GE Nuclear Energy

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

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Docket No. STN 52-001

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

Subject: **Submittal Supporting Accelerated ABWR Review Schedule**

Dear Chet:

Enclosed is a markup of ABWR SSAR Section 14.2 which addresses open items 14.2.12.3-1 and 14.2.12.3-2.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

cc: H. J. Yang (GE)
Norman Fletcher (DOE)

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Specific testing to be performed and the applicable acceptance criteria for each preoperational test will be documented in detailed test procedures to be made available to the NRC approximately 60 days prior to their intended use. Preoperational testing will be in accordance with the detailed system specifications and associated equipment specifications for equipment in those systems (provided as part of scoping documents to be supplied by GE and others as described in Subsection 14.2.3). The tests demonstrate that he installed equipment and systems perform within the limits of these specifications. To allow verification that the detailed test procedures were developed in accordance with established methods and appropriate acceptance criteria, the plant and system preoperational test specifications will also be made available to the NRC.

The preoperational tests anticipated for the ABWR Standard Plant are listed and described in the following paragraphs. Testing of systems outside the scope of the ABWR Standard Plant, but that may have related design and therefore testing requirements, are discussed in Subsection 14.2.13, along with other interface requirements related to the initial test program.

14.2.12.1.1 Nuclear Boiler System Preoperational Test

(1) Purpose

To verify that all pumps, valves, actuators, instrumentation, trip logic, alarms, annunciators, and indications associated with the nuclear boiler system function as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

(3) General Test Methods and Acceptance Criteria

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

(a) verification that all sensing devices respond to actual process variables and provide alarms and trips at specified values (including proper tracking of RPV level instruments in response to actual changes in reactor water level - see Subsection 1A.2.4);

(b) proper operation of system instrumentation and any associated logic, including that of the automatic depressurization system (ADS);

(c) proper operation of MSIVs and main steamline drain valves, including verification of closure time in the isolation mode, and test mode, if applicable;

(d) verification of SRV and MSIV accumulator capacity;

(e) proper operation of SRV air piston actuators and discharge line vacuum breakers;

(f) verification of the acceptable leak tightness and overall integrity of the reactor coolant pressure boundary via the leakage rate and/or hydrstatic testing as described in Section 5.2.4.6.1 and 5.2.4.6.2 respectively; and

(g) proper system instrumentation and equipment operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system and/or components are expected to remain operational.

Other checks shall be performed, as appropriate, to demonstrate that design requirements, such as those for sizing or installation, are met via as built calculations, visual inspections, review of qualification documentation or other methods. For instance, SRV setpoints and capacities shall be verified from certification or bench tests to be consistent with applicable requirements. Additionally, proper installation and setting of supports and restraints for SRV discharge piping will be verified as part of the testing described in 14.2.12.1.51.

14.2.12.1.2 Reactor Recirculation System Preoperational Test

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Prerequisites of all required interfacing systems, as needed, must be completed to the extent sufficient to support the specified testing and the appropriate system configuration. This prerequisite completion, includes, but is not limited to the following:

(a) All services, including air, nitrogen, water, electricity and communication shall be available and performing at rated design loads (flow, pressure, voltage, cleanliness, etc.)

(b) All system instrumentation and valve position sensors are in accordance with the applicable nuclear boiler system instrument data sheet, and calibrated per instrument supplier's instructions.

(c) The reactor pressure vessel and main steam lines are ready to accept water.

(d) On reactor water level instrumentation, careful inspections have been made on the installation of condensing chambers and piping from the chambers to the instruments to assure compliance with applicable Process Instrumentation Specification and the P&ID.

(e) On differential pressure-sensing devices, installation has been checked against vendor drawings to assure that hot and cold leg errors due to installations are well within the limits specified in the applicable design document.

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2 of 2

(f) Special high accuracy RTDs in the feedwater and steam lines have been verified to meet the accuracy requirements of applicable design document as installed, including effects of noise pick up due to plant and panel wiring.

(g) All system valve packings have been properly adjusted in accordance with applicable vendor instructions.

(h) The nuclear boiler hydrostatic test has been performed on the entire system and leaks have been corrected prior to the operation tests of the safety/relief valves.

(i) During MSIV time response testing, all MSIVs have been closed and disabled since there will be no MSIV actuations during this testing.

(j) Prior to SRV solenoid valve operation testing, flow restrictors have been installed in the pneumatic cylinder exhaust to prevent rapid closure of the SRV and the resulting seat and disc damage during this testing.

(k) Prior to MSIV operations when cold with no fluid in the steam lines, guide surfaces shall have been wetted by flooding the steam lines with water and draining to avoid excessive wear and resultant valve overload.

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NB

(h) Run all power-operated valves full stroke for verifying operability, proper torque switch settings, limit switch settings, and position switch settings.

(i) During the system flow test and the primary vessel leakage test, verify that the feedwater check valve disc swings open and close freely.

(j) Proper operation of the feedwater positive acting check valve by verifying that the solenoid valve, pneumatic cylinder piston and piston rod assembly, spring and limit switch function as designed.

(k) Proper operation of the feedwater manual operated gate valve, including limit switch function and handwheel rotation.

Specific testing to be performed and the applicable acceptance criteria for each preoperational test will be documented in detailed test procedures to be made available to the NRC approximately 60 days prior to their intended use. Preoperational testing will be in accordance with the detailed system specifications and associated equipment specifications for equipment in those systems (provided as part of scoping documents to be supplied by GE and others as described in Subsection 14.2.3). The tests demonstrate that he installed equipment and systems perform within the limits of these specifications. To allow verification that the detailed test procedures were developed in accordance with established methods and appropriate acceptance criteria, the plant and system preoperational test specifications will also be made available to the NRC.

The preoperational tests anticipated for the ABWR Standard Plant are listed and described in the following paragraphs. Testing of systems outside the scope of the ABWR Standard Plant, but that may have related design and therefore testing requirements, are discussed in Subsection 14.2.13, along with other interface requirements related to the initial test program.

14.2.12.1.1 Nuclear Boiler System Preoperational Test

(1) Purpose

To verify that all pumps, valves, actuators, instrumentation, trip logic, alarms, annunciators, and indications associated with the nuclear boiler system function as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

(3) General Test Methods and Acceptance Criteria

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

(a) verification that all sensing devices respond to actual process variables and provide alarms and trips at specified values (including proper tracking of RPV level instruments in response to actual changes in reactor water level - see Subsection 1A.2.4);

(b) proper operation of system instrumentation and any associated logic, including that of the automatic depressurization system (ADS);

(c) proper operation of MSIVs and main steamline drain valves, including verification of closure time in the isolation mode, and test mode, if applicable;

(d) verification of SRV and MSIV accumulator capacity;

(e) proper operation of SRV air piston actuators and discharge line vacuum breakers;

(f) verification of the acceptable leak tightness and overall integrity of the reactor coolant pressure boundary via the leakage rate and/or hydrstatic testing as described in Section 5.2.4.6.1 and 5.2.4.6.2 respectively; and

(g) proper system instrumentation and equipment operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system and/or components are expected to remain operational.

Other checks shall be performed, as appropriate, to demonstrate that design requirements, such as those for sizing or installation, are met via as built calculations, visual inspections, review of qualification documentation or other methods. For instance, SRV setpoints and capacities shall be verified from certification or bench tests to be consistent with applicable requirements. Additionally, proper installation and setting of supports and restraints for SRV discharge piping will be verified as part of the testing described in 14.2.12.1.51.

14.2.12.1.2 Reactor Recirculation System Preoperational Test

(1) Pupose

To verify the proper operation of the reactor recirculation system at conditions approaching rated volumetric flow, including the reactor internal pumps (RIPs) and motors, and the equipment associated with the motor cooling, seal purge, and inflatable shaft seal subsystems.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Cooling water from the reactor building cooling water system and seal purge flow from the CRD hydraulic system shall be available. The recirculation flow control system shall be sufficiently tested

to support RIP operation. Other interfacing systems shall be available, as needed, to support the specified testing and the corresponding system configurations. Reactor vessel internals shall be capable of being subjected to rated volumetric core flow.

(3) General Test Methods and Acceptance Criteria

Testing of the recirculation system shall be coordinated closely with that of the recirculation flow control system (Subsection 14.2.12.1.3) in order to adequately demonstrate proper integrated system response and operation. Also, the preoperational phase of the reactor internals vibration assessment program (Subsection 14.2.12.1.52) involves extended operation of the recirculation system and should be scheduled accordingly so as to optimize overall plant integrated testing.

The scope and intensity of the preoperational testing of the recirculation system and associated support subsystems will be limited by the unavailability of nuclear heating. Comprehensive testing of the system at rated temperature and pressure will be performed during the startup phase.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves ~~under expected operating conditions~~;

(d) proper operation of pumps and motors in all normal design operating modes as well as any specified special testing configurations;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow rates including individual pump capacity and discharge head;

(g) proper manual and automatic system operation and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and motor controls;

(i) proper operation of permissive, prohibit and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) proper operation of the recirculation motor seal purge subsystem over the full range of RPV pressures including the proper functioning of the main header pressure control valve and proper distribution of seal purge flow to individual pumps and motors;

(l) proper functioning of the recirculation motor cooling subsystem ~~and its ability to remove design heat loads from each RIP motor via the dedicated heat exchangers~~;

(m) ~~proper functioning of the recirculation motor inflatable shaft seal subsystem and its ability to provide a temporary backup sealing mechanism for each pump motor shaft during recirc motor maintenance or removal~~;

(n) acceptable pump/motor vibration levels and system piping movements during both transient and steady state operation;

(o) acceptable reactor vessel internals flow induced vibration levels per the requirements of Subsection 14.2.12.1.52.

System operation is considered acceptable when the observed/measured performance charac-

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RR

(m) Monitor and record RIP steady-state performance data at several intermediate speed steps and the maximum permissible speed while RIPs are at separate - ed ganged mode of operation prior to fuel loading. This same set of RIP performance data will also be recorded after fuel loading and prior to initial reactor startup with RIPs at separate mode of operation.

at the maximum permissible speed

Insert b

RR

(p) Verify proper operation of reactor recirculation system at various flow steps under rated temperature and pressure conditions during the scheduled RRS/RPV internal hot functional test prior to fuel loading.

(q) Demonstrate proper operation of reactor recirculation system in response to the designed Recirculation Pump Trips (RPTs) required during integrated ECCS/LOPA testing prior to fuel loading.

(Subsection 14.2.12.1.46)

teristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.3 Recirculation Flow Control System Preoperational Test

(1) Purpose

To verify that the operation of the recirculation flow control system, including that of the adjustable speed drives, RIP trip and runback logic, and the core flow measurement subsystem, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing and the corresponding system configurations.

(3) General Test Methods and Acceptance Criteria

Some portions of the recirculation flow control system testing described below may be performed in conjunction with that of the recirculation system, as described in Subsection 14.2.12.1.2. In any case, close coordination of the testing specified for the two systems is required in order to demonstrate the proper integrated system response and operation.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip including recirculation pump trip (RPT) and runback circuitry, (RPT testing will specifically include its related ATWS function);

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper functioning of the core flow measurement subsystem;

(d) proper operation of control systems in all design operating modes and all levels of controls;

(e) proper operation of the adjustable speed drives;

(f) ability of the control system to communicate properly with equipment and controllers in other systems;

(g) proper control of pump motor start sequence;

(h) proper operation of interlocks and equipment protective devices;

(i) proper operation of permissive, prohibit and bypass functions; and

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.4 Feedwater Control System Preoperational Test

(1) Purpose

To verify proper operation of the feedwater control system (FDWC) including individual components such as controllers, indicators, and controller software settings such as gains and function generator curves.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedures and has approved the initiation of testing. Preoperational tests must be completed on lower level controllers that do not strictly belong to the feedwater control system but that may affect system response. All feedwater control system com-

teristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.3 Recirculation Flow Control System Preoperational Test

(1) Purpose

To verify that the operation of the recirculation flow control system, including that of the adjustable speed drives, RIP trip and runback logic, and the core flow measurement subsystem, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing and the corresponding system configurations.

(3) General Test Methods and Acceptance Criteria

Some portions of the recirculation flow control system testing described below may be performed in conjunction with that of the recirculation system, as described in Subsection 14.2.12.1.2. In any case, close coordination of the testing specified for the two systems is required in order to demonstrate the proper integrated system response and operation.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip including recirculation pump trip (RPT) and runback circuitry, (RPT testing will specifically include its related ATWS function);

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper functioning of the core flow measurement subsystem;

(d) proper operation of control systems in all design operating modes and all levels of controls;

(e) proper operation of the adjustable speed drives;

(f) ability of the control system to communicate properly with equipment and controllers in other systems;

(g) proper response of the system to power supply transients;

(h) proper operation of interlocks and equipment protective devices;

(i) proper operation of permissive, prohibit and bypass functions; and

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.4 Feedwater Control System Preoperational Test

(1) Purpose

To verify proper operation of the feedwater control system, including individual components such as controllers, indicators, and controller software settings such as gains and function generator curves.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedures and has approved the initiation of testing. Preoperational tests must be completed on lower level controllers that do not strictly belong to the feedwater control system but that may affect system response. All feedwater control system com-

RFC

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Reactor recirculation system, feedwater control system, steam bypass and pressure control system, electric power distribution system / instrumentation and control power supply, process computer system, reactor water Cleanup system, CRD system, RC&IS, neutron monitoring system, automatic power regulation system, condensate and feedwater system and reactor protection system

RFC

Insert b

(g) capability of the self-test and on-line diagnostic features in identifying the presence of a fault and determine the location of a failure

RFC

Insert C

(k) capabilities of cold and warm start features, i.e., self-starting following a power interruption to the full system and bringing a processing channel on line with the other channels in operation, without the need for operator or technician action.

ponents shall have an initial calibration in accordance with vendor instructions. All required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

(3) General Test Methods and Acceptance Criteria

Testing of the feedwater control system during the preoperational phase may be limited by the absence of an acceptable feedwater recirculation flow path. Comprehensive flow testing will be conducted during startup phase.

Performance shall be observed and recorded during a series of individual component and overall system response tests to demonstrate the following:

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trips including verification of setpoints;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing and stroke, in response to control demands (including the reactor water cleanup system dump valve response to the low flow controller);

(d) proper operation of interlocks and equipment protective devices in pump and valve controls;

(e) proper operation of permissive, prohibit, and bypass functions;

(f) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(g) proper communication and interface with other control systems and related equipment.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.5 Standby Liquid Control System Preoperational Test

(1) Purpose

To verify that the operation of the standby liquid control (SLC) system, including pumps, tanks, control, logic, and instrumentation, is as specified.

(2) Prerequisites

The construction tests have been successfully completed, operating procedures are fully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Valves should be previously bench tested and other precautions relative to positive displacement pumps taken. The reactor vessel shall be available for injecting demineralized water. All required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

FDWC

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Appropriate instrumentation and control power supply, turbine control system, reactor recirculation flow control system, condensate and feedwater system, process computer system, reactor water cleanup system, RCIC, nuclear boiler system and multiplexing system

FDWC

Insert b

(f) Capability of the self-test and on-line diagnostic features in identifying the presence of a fault and determine the location of the failure.

(g) Capabilities of cold and warm start features, i.e., self starting following a power interruption to the full system and bringing a processing channel on line with the other channels in operation, without the need for operator or technician action.

(h) proper operation of the technician interface unit in the various ~~[illegible]~~ operational modes.

(i) correct functions of all control logic and FDWC system services provided to other systems as specified by the appropriate feedwater control system design specification.

(j) proper operation of redundant controller upon simulated single channel controller failures.

(k) proper operation of level setpoint step test functions ~~for Item (e) above~~.

ponen's shall have an initial calibration in accordance with vendor instructions. All required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

(3) General Test Methods and Acceptance Criteria

Testing of the feedwater control system during the preoperational phase may be limited by the absence of an acceptable feedwater recirculation flow path. Comprehensive flow testing will be conducted during startup phase.

Performance shall be observed and recorded during a series of individual component and overall system response tests to demonstrate the following:

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trips including verification of setpoints;

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

(c) proper operation of system valves, including timing and stroke, in response to control demands (including the reactor water cleanup system dump valve response to the low flow controller);

(d) proper operation of interlocks and equipment protective devices in pump and valve controls;

(e) proper operation of permissive, prohibit, and bypass functions;

(f) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(g) proper communication and interface with other control systems and related equipment.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.5 Standby Liquid Control System Preoperational Test

(1) Purpose

To verify that the operation of the standby liquid control (SLC) system, including pumps, tanks, control, logic, and instrumentation, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Valves should be previously bench tested and other precautions relative to positive displacement pumps taken. The reactor vessel shall be available for injecting demineralized water. All required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing ~~under unexpected operating conditions;~~

(d) proper operation of pumps and motors in all design operating modes;

(e) proper operation of the tank heaters and proper mixing of the neutron absorber solution;

(f) proper system flow paths and flow rates including pump capacity and discharge head (with demineralized water substituted for the neutron absorber mixture);

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.6 Control Rod Drive System Preoperational Test

(1) Purpose

To verify that the control rod (CRD) system, including the CRD hydraulic and fine motion control subsystems, functions as designed.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The control blades shall be installed and ready to be stroked and scrammed. Reactor building cooling water, instrument air, and other required interfacing systems shall be available, as needed, to support the specified testing and the corresponding system configurations.

Additionally, the rod control and information system shall be functional when needed, with the applicable portion of its specified preoperational testing complete.

(3) General Test Methods and Acceptance Criteria

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

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

(b) proper communication with, and response to demands from, the rod control and information system and the reactor protection system, including that associated with alternate rod insertion (ATWS), alternate rod-in (post-scram), and select control rod run-in functions;

(c) proper functioning of system valves, including purge water pressure control valves, under expected operating conditions;

(d) proper operation of CRD hydraulic subsystem pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper pump motor start sequence and mar- gin to actuation of protective devices;

(g) proper system flow paths and flow rates including sufficient pump capacity and discharge head;

(h) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;

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(l) Operate the lubricant pump continuously at the defined pumping pressure on the flow path between the lubricant pump and the SLC injection pump for verifying normal operating conditions.

(m) Operate the SLC injection pump continuously with designed flow rate and pumping pressure on the flow path between the SLC test tank and the SLC injection pump for verifying normal operating conditions.

(y) With the SLC injection pump operating to circulate from test tank to test tank, close the test return valve gradually for verifying correct operating points (i.e., opening and reclosing pressure) of the relief valve at pump discharge line.

(o) Operate the SLC system by the below listed flow paths for verifying normal operating conditions under each mode of operation:

* Test mode (test tank to test tank)
* Accident mode (SLC tank to RPV)
* Injection test mode (test Tank to RPV).

(e) proper operation of the tank heaters and proper mixing of the neutron absorber solution;

(f) proper system flow paths and flow rates including pump capacity and discharge head (with demineralized water substituted for the neutron absorber mixture);

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.6 Control Rod Drive System Preoperational Test

(1) Purpose

To verify that the control rod (CRD) system, including the CRD hydraulic and fine motion control subsystems, functions as designed.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The control blades shall be installed and ready to be stroked and scrammed. Reactor building cooling water, instrument air, and other required interfacing systems shall be available, as needed, to support the specified testing and the corresponding system configurations.

Additionally, the rod control and information system shall be functional when needed, with the applicable portion of its specified preoperational testing complete.

(3) General Test Methods and Acceptance Criteria

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

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

(b) proper communication with, and response to demands from, the rod control and information system and the reactor protection system, including that associated with alternate rod insertion (ATWS), alternate rod-in (post-scram), and select control rod run-in functions;

(c) proper functioning of system valves, including purge water pressure control valves, under expected operating conditions;

(d) proper operation of CRD hydraulic subsystem pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper pump motor start sequence and mar- gin to actuation of protective devices;

(g) proper system flow paths and flow rates including sufficient pump capacity and discharge head;

(h) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) proper operation of fine motion motors and drives and associated control units, including verification of acceptable normal insert and withdraw timing;

(m) proper operation of hydraulic control units and associated valves including CRD scram timing demonstrations against atmospheric pressure.

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System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.7 Rod Control and Information System Preoperational Test

(1) Purpose

To verify that the rod control and information system (RC&IS) functions as designed.

(2) Prerequisites

The construction tests, including initial check-out of RC&IS software, have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of tests to demonstrate the following:

(a) proper operation of rod blocks and associated alarms and annunciators in all combinations of logic and instrument channel trip including all positions of the reactor mode switch;

(b) proper operation of control rod run-in logic including that associated with ARI (ATWS), SCRRI and normal post-SCRAM follow-in;

(c) proper functioning of instrumentation used to monitor CRD system status such as rod position indication instrumentation and that used to monitor continuous full-in and rod/drive separation status;

(d) proper operation of RC&IS software including verification of gang and group assignments and predictor-comparator, rod worth limiter, and banked position withdrawal sequence functions; and

(e) proper communication with interfacing systems such as the power generation control system, the automatic power regulator, and the automatic rod block monitor.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.8 Residual Heat Removal System Preoperational Test

(1) Purpose

To verify the proper operation of the residual heat removal (RHR) system under its various modes of operation: core cooling, shutdown cooling, wetwell and drywell spray, suppression pool cooling, and supplemental fuel pool cooling.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The reactor vessel shall be intact and capable of receiving injection flow from the various modes of RHR. The

Insert A

(1) each FMCRD satisfies the insert/withdraw performance requirements at various RC&IS operating modes (i.e., Step driving, notch driving and continuous driving).

(2) satisfactory performance of the FMCRD separation switch probes at the overtravel position and the integrity of the coupling between the control blade and the FMCRD hollow piston confirmed.

(3) satisfactory scram system functional performance, including the requirements of scram timing, automatic scram follow function, scram accumulator charging pressure, scram solenoid pilot valve and scram valve operations, FMCRD failed buffer detection and backup scram function.

(4) proper operation of alternate rod insertion (ARI) function.

(5) Capability of the FMCRD brake to hold the FMCRD in position.

(6) proper actuation of the ball check valve in the drive housing flange when subject to a reverse flow through the scram insert line.

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) proper operation of fine motion motors and drives and associated control units, including verification of acceptable normal insert and withdraw timing;

(m) proper operation of hydraulic control units and associated valves including CRD scram timing demonstrations against atmospheric pressure.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.7 Rod Control and Information System Preoperational Test

(1) Purpose

To verify that the rod control and information system (RC&IS) functions as designed.

(2) Prerequisites

The construction tests, including initial check-out of RC&IS software, have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of tests to demonstrate the following:

(a) proper operation of rod blocks and associated alarms and annunciators in all combinations of logic and instrument channel trip including all positions of the reactor mode switch;

(b) proper operation of control rod run-in logic including that associated with ARI (ATWS), SCRRI and normal post-SCRAM follow-in;

(c) proper functioning of instrumentation used to monitor CRD system status such as rod position indication instrumentation and that used to monitor continuous full-in and rod/drive separation status;

(d) proper operation of RC&IS software including verification of gang and group assignments and operator comparator rod worth limits and banked position withdrawal sequence functions; and

(e) proper communication with interfacing systems such as the power generation control system, the automatic power regulator, and the automatic rod block monitor.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.8 Residual Heat Removal System Preoperational Test

(1) Purpose

To verify the proper operation of the residual heat removal (RHR) system under its various modes of operation: core cooling, shutdown cooling, wetwell and drywell spray, suppression pool cooling, and supplemental fuel pool cooling.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The reactor vessel shall be intact and capable of receiving injection flow from the various modes of RHR. The

RCIS

Insert C

Additionally, mandatory requirements and prerequisites, includes but is not limited to the following, must be completed prior to the test:

(a) All electrical connections have been completed and verified in accordance with the Rod Control & Information System IED and IBD.

(b) All RC&IS cabinet power is available and system power supplies calibrated.

(c) All site-installed interconnecting cables associated with the RC&IS have been properly installed for the performance of this test.

(d) A control rod synchro simulator for both RC&IS channels has been fabricated to facilitate verification testing of rod position displays and alarms.

(e) Simulated inputs shall be provided as required, for the following interfacing systems associated with the RC&IS functions:

* Feedwater control system
* Recirculation flow control system
* Reactor Protection system
* Performance monitoring and control system
* Automatic power regulator system
* Refueling platform control computer system
* Scram Time recording and analysis panel.
* Neutron monitoring system
* Control rod drive system

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) proper operation of fine motion motors and drives and associated control units, including verification of acceptable normal insert and withdraw timing;

(m) proper operation of hydraulic control units and associated valves including CRD scram timing demonstrations against atmospheric pressure.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.7 Rod Control and Information System Preoperational Test

(1) Purpose

To verify that the rod control and information system (RC&IS) functions as designed.

(2) Prerequisites

The construction tests, including initial check-out of RC&IS software, have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of tests to demonstrate the following:

(a) proper operation of rod blocks and associated alarms and annunciators in all combinations of logic and instrument channel trip including all positions of the reactor mode switch;

(b) proper operation of control rod run-in logic including that associated with ARI (ATWS), SCRRI and normal post-SCRAM follow-in;

(c) proper functioning of instrumentation used to monitor CRD system status such as rod position indication instrumentation and that used to monitor continuous full-in and rod/drive separation status;

(d) proper operation of RC&IS software including verification of gang and group assignments and predictor-comparator, rod worth limiter, and banked position withdrawal sequence functions; and

(e) proper communication with interfacing systems such as the power generation control system, the automatic power regulator, and the automatic rod block monitor.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.8 Residual Heat Removal System Preoperational Test

(1) Purpose

To verify the proper operation of the residual heat removal (RHR) system under its various modes of operation: core cooling, shutdown cooling, wetwell and drywell spray, suppression pool cooling, and supplemental fuel pool cooling.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The reactor vessel shall be intact and capable of receiving injection flow from the various modes of RHR. The

reactor building cooling water system and other required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

, instrument air system, fuel pool cooling and [redacted] cleanup system, leak detection system, RCIC system, suppression pool water system, nuclear boiler system, process computer system, electric power distribution system, process computer system

Additionally, RHR pump suction line shall be installed with a 50% plugged temporary strainer throughout the ~~prior to this~~ test. Also, the suppression pool water shall be of a quality acceptable prior to injection testing with flow from the suppression pool to the reactor.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated system tests that includes all modes of RHR system operation in order to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of system instrumentation and alarms used to monitor system operation and availability including that intended to alert when high pressure- low pressure interface valves are not full closed with the reactor coolant system at high pressure (per Reg. Guide 1.139);

(c) proper operation of system valves, including timing, ~~under expected operating conditions~~ verification of proper setpoint of system releif valves per ASME Code requirements, including those intended to meet the requirements of Reg Guide 1.139, may use the results of vendor tests and the appropriate documemtation of such);

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head and time to rated flow;

(g) proper operation of containment spray modes including verfication that spray nozzles, headers and piping are free of debris;

(h) proper pump motor start sequence and margin to actuation of protective devices;

(i) proper operation of interlocks and equipment protective devices in pump and valve controls including valve interlocks and controls including valve interlocks and controls designed to protect low pressure portions of the system from the reactor coolant system at high pressure (per Reg Guide 1.139);

(j) proper operation of permissive, prohibit, and bypass functions;

(k) proper system operation while powered from primary and alternate sources, including transfers; and ~~in degraded modes for which the system is expected to remain operational~~;

(l) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(m) proper operation of pump discharge line keep fill system(s) and its ability to prevent damaging water hammer during system transients.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.9 Reactor Core Isolation Cooling System Preoperational Test

(1) Purpose

Verify that the operation of the reactor core isolation cooling (RCIC) system, including the turbine, pump, valves, instrumentation, and control, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. A temporary steam supply shall be available for driving the RCIC turbine. The turbine instruction manual shall be reviewed in detail in order that precautions relative to turbine operation are followed. All required interfacing systems shall be available, as needed, to support the specified testing and the corresponding system configurations.

(3) General Test Methods and Acceptance Criteria

RHR

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(f) that ~~the~~ the RHR system can be operated normally and satisfy the NPSH requirement by combining all components, piping and instruments constituting this system in each mode of operation. The modes to be tested are test line mode, shutdown cooling mode, PCV cooling mode, suppression pool cooling mode, LPFL mode, and fuel pool cooling mode.

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(N) that [redacted] the flow path is normal by way of pump operation from RHR to the following radwaste treatment system collector pool and tank.

* Low Conductivity waste collector pool
* High Conductivity waste collector tank.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated system tests that includes all modes of RHR system operation in order to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of system instrumentation and alarms used to monitor system operation and availability including that intended to alert when high pressure- low pressure interface valves are not full closed with the reactor coolant system at high pressure (per Reg. Guide 1.139);

(c) proper operation of system valves, including timing, under expected operating conditions verification of proper setpoint of system releif valves per ASME Code requirements, including those intended to meet the requirements of Reg Guide 1.139, may use the results of vendor tests and the appropriate documemtation of such);

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head and time to rated flow;

(g) proper operation of containment spray modes including verfication that spray nozzle, headers and piping are free of debris;

(h) proper pump motor start sequence and margin to actuation of protective devices;

(i) proper operation of interlocks and equipment protective devices in pump and valve controls including valve interlocks and controls including valve interlocks and controls designed to protect low pressure portions of the system from the reactor coolant system at high pressure (per Reg Guide 1.139);

(j) proper operation of permissive, prohibit, and bypass functions;

(k) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(l) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(m) proper operation of pump discharge line keep fill system(s) and its ability to prevent damaging water hammer during system transients.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.9 Reactor Core Isolation Cooling System Preoperational Test

(1) Purpose

Verify that the operation of the reactor core isolation cooling (RCIC) system, including the turbine, pump, valves, instrumentation, and control, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. A temporary steam supply shall be available for driving the RCIC turbine. The turbine instruction manual shall be reviewed in detail in order that precautions relative to turbine operation are followed. All required interfacing systems shall be available, as needed, to support the specified testing and the corresponding system configurations.

(3) General Test Methods and Acceptance Criteria

The RCIC turbine shall be tested in accordance with the manufacturere's recommendations. Usually this involves the turbine first being tested while disconnected from and then while coupled to the pump. The intent of this preoperational test is to test the RCIC system to the extent possible. However, since preoperational testing is performed utilizing a temporary steam supply, the attainable RCIC pump flow may be limited. Should this prevent any specified testing from being completed sucessfully, such cases will be documented and scheduled for completion during the power ascension test phase.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms ~~required to monitor system operation and availability~~;

(c) proper operation of system valves, including timing ~~under expected operating conditions~~;

(d) proper operation of turbine and pump in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) ~~proper system flow paths and flow rates including pump capacity, discharge head and time to rated flow~~;

(g) proper manual and automatic system operation and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in turbine, pump, and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational. Included shall be a demonstration of RCIC system ability to start without the aid of AC power, except for RCIC DC/AC inverters; an evaluation of RCIC operation beyond its design basis during an extended loss of AC power to it and its support systems and verification of RCIC DC component operability when the non-RCIC station batteries are disconnected See Subsection 1A.2.4);

(k) acceptability of pump/turbine vibration levels and system piping movements during both transient and steady state operation;

(l) proper operation of the barometric condenser condensate pump and vacuum pump;

(m) the ability of the system to swap pump suction source from the condensate storage pool to the suppression pool without interrupting system operation; and

(n) proper operation of the pump discharge line keep fill system and its ability to prevent damaging water hammer during system transients.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications (while accounting for the limitations imposed by the temporary steam supply).

14.2.12.1.10 High Pressure Core Flooder System Preoperational Test

(1) Purpose

To verify the operation of the high pressure core flooder (HPCF) system, including related auxiliary equipment, pumps, valves, instrumentation and control, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The suppression pool and condensate storage tank shall be available as HPCF pump suction sources and the reactor vessel shall be sufficiently intact to receive HPCF injection flow. The required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic

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Additionally, appropriate measures shall be taken so that other systems will not be affected when signals involving other system are used throughout the test. The signals to automatically startup this system at low reactor water level or high drywell pressure and the signal for automatic isolation of this system at low pressure of the steam supply shall be blocked prior to the test.

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(f) ~~Demonstrate~~ RCIC system performs properly during various modes of operation. This test shall be performed using temporary steam supply, equipment, piping and instrumentation as necessary for the test,

(1) RCIC shall be operated properly at minimum flow rate through the minimum flow line with suction from the suppression pool or from the condensate storage pool and return to the suppression pool.

(2) Operate the RCIC system continuously at test mode ~~at~~ with required pump flow rate and head and through the system test line with suction from the suppression pool and return to the suppression pool

(3) Operate the RCIC system to take suction from the condensate storage pool and inject water into the reactor through the reactor feedwater line with the reactor at atmospheric pressure condition.

(4) Turbine quick start in response to the simulated automatic initiation signal with suction from the condensate storage pool and discharge via test return line to the condensate storage pool. Proper system flow rate and ~~startup time~~ time to rated flow and no malfunction in the system shall be confirmed.

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of turbine and pump in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity, discharge head and time to rated flow;

(g) proper manual and automatic system operation and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in turbine, pump, and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational. Included shall be a demonstration of RCIC system ability to start without the aid of AC power, except for RCIC DC/AC inverters; an evaluation of RCIC operation beyond its design basis during an extended loss of AC power to it and its support systems and verification of RCIC DC component operability when the non-RCIC station batteries are disconnected See Subsection 1A.2.4);

(k) acceptability of pump/turbine vibration levels and system piping movements during both transient and steady state operation;

(l) proper operation of the barometric condenser condensate pump and vacuum pump;

(m) the ability of the system to swap pump suction source from the condensate storage pool to the suppression pool without interrupting system operation; and

(n) proper operation of the pump discharge line keep fill system and its ability to prevent damaging water hammer during system transients.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications (while accounting for the limitations imposed by the temporary steam supply).

14.2.12.1.10 High Pressure Core Flooder System Preoperational Test

(1) Purpose

To verify the operation of the high pressure core flooder (HPCF) system, including related auxiliary equipment, pumps, valves, instrumentation and control, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The suppression pool and condensate storage tank shall be available as HPCF pump suction sources and the reactor vessel shall be sufficiently intact to receive HPCF injection flow. The required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic

Insert A

including alarm actuation by practically operating the detector of the alarm generating source or using its simulated signal and alarm reset. 23A6100AN REV B

and instrument channel trips;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head and time to rated flow;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) the ability of the system to swap pump suction source from the condensate storage pool to the suppression pool without interrupting system operation;

(m) acceptability of the HPCF sparger flooding pattern; and

(n) proper operation of the pump discharge line keep fill system and its ability to prevent damaging water hammer during system transients.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

all motor-operated

14.2.12.1.11 Safety System Logic and Control Preoperational Test

opening and closing with the operating switch, valve status indication and travel timing.

(1) Purpose

To verify proper operation of the plant safety system logic and control (SSLC).

including operation of all components subject to interlocking.

(2) Prerequisites

The applicable construction tests have been successfully completed.

(3) General Test Methods and Acceptance Criteria

The SSLC integrates the automatic decision making and trip logic functions associated with the safety action of several of the plants' safety-related systems. Such systems include the RPS, HPCF, RHR, RCIC, LDIS, and ADS. The SSLC is not so much a system itself, but is instead an assembly of the above mentioned safety-related systems signal processors designed and grouped for optimum reliability, availability and oper- ability. The SSLC, therefore, should be adequately tested during the preoperational phase testing of the associated systems in- cluding the integrated LOP/LOCA test. Pro- vided the construction testing and the asso- ciated system preoperational testing has been successfully completed, as it relates to proper operation of the SSLC, no specific additional testing should be necessary.

SSLC performance would then be considered acceptable provided all design and testing specifications are met.

14.2.12.1.12 Multiplexing System Preoperational Test

(1) Purpose

To verify proper functioning of the plant multiplexing system including both essential and nonessential subsystems.

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(a) correct implementation and operation of the HPCF system software-based controls and instrumentation. This test shall check the system behaviour against the functional, performance and interface requirements as specified by the appropriate design documents and the hardware/software system specification (HSSS).

Insert b

(f) that the HPCF system can be operated normally at each mode and satisfy the NPSH requirement by combining all components, piping and instruments constituting this system during the following test items:

(1) minimum flow operational test — operate the HPCF pump manually using flow path from suppression pool to suppression pool through the minimum flow line until the temperature of each pump and motor bearing is stabilized.

(2) rated core flooding ~~test~~ operational test — operate the HPCF system at rated core flooding mode using test line for flooding the suppression pool. This test shall be performed continuously from the pump motor start sequence and the minimum flow operating condition.

(3) high pressure flooding operational test — operate the HPCF system at the high pressure flooding mode using test lines from suppression pool or condensate storage pool to suppression pool. This test shall also be performed continuously from the pump motor start sequence and the minimum flow condition.

(4) Reactor injection test —
operate the HPCF system using core flooding line to confirm that the core flooding manual operation can be performed normally.

(5) Alternate source verification test —
Confirm that water source can be transferred satisfactorily from the condensate storage pool to the suppression pool.

(6) automatic starting test —
confirm that the HPCF system starting time is within the safety requirement and water hammer does not occur.

and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head and time to rated flow;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration le- vels and system piping movements during both transient and steady state operation;

(l) the ability of the system to swap pump suction source from the condensate storage pool to the suppression pool without interrupting system operation;

(m) acceptability of the HPCF sparger flooding pattern; and

(n) proper operation of the pump discharge line keep fill system and its ability to prevent damaging water hammer during system transients.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.11 Safety System Logic and Control Preoperational Test

(1) Purpose

To verify proper operation of the plant safety system logic and control (SSLC).

(2) Prerequisites

Insert d

~~The applicable construction tests have been successfully completed.~~

(3) General Test Methods and Acceptance Criteria

The SSLC integrates the automatic decision making and trip logic functions associated with the safety action of several of the plants' safety-related systems. Such systems include the RPS, HPCF, RHR, RCIC, LDIS, and ADS. The SSLC is not so much a system itself, but is instead an assembly of the above mentioned safety-related systems signal processors designed and grouped for optimum reliability, availability and ~~[illegible]~~ The SSLC, therefore, should be adequately tested during the preoperational phase testing of the associated systems ~~including~~ the integrated LOP/LOCA test. ~~Provided the~~ construction testing and the ~~[illegible]~~ system preoperational testing has been successfully completed, as it relates to proper operation of the SSLC, no specific additional testing should be necessary.

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SSLC performance ~~would~~ then be considered acceptable provided all design and testing specifications are met.

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14.2.12.1.12 Multiplexing System Preoperational Test

(1) Purpose

To verify proper functioning of the plant multiplexing system including both essential and nonessential subsystems.

associated with the self-test system and signal processing modules

Insert d

The verification and validation testing for the SSLC software-based control and instrumentation system shall have been successfully completed. The required 120VAC and 125VDC electrical power systems shall be in operation and available to the SSLC cabinets as required. The control logic associated with these systems resident in the SSLC cabinets shall have been verified to be operable. Annunciators, indicators, and displays as part of the SSLC cabinets are operable. All instrumentation (including bypasses where applicable) associated with the SSLC shall have been installed with permanent wiring connections made and adjusted to the values specified in the plant Technical Specifications. The process computer shall be available for displaying and logging, as required, the SSLC supplied parameters and fault identification and bypass status signals. Additionally, a dedicated diagnostic instrument, surveillance test controller (STC), shall be available and used as an aid in performing SSLC functional logic testing, including trip, initiation, and interlock logic.

SSLC
1 of 1

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Operability from sensor input to driven equipment actuation shall be demonstrated during a series of overlap testing as following:

(a) Reactor Protection System (RPS)/MSIV Tests

* Setpoint validation (CRMU to DTM), using input simulation and automatic self-test feature.
* Trip logic test of TLU, using input simulation and automatic self-test feature
* Divisional RPS trip test, by manually actuating divisional trip test switch.
* Manual scram test (RPS), by actuating manual scram switches.
* MSIV test close, by manually operating test close switches
* Divisional MSIV isolation test, by manually actuating division isolation test switches.

(b) Engineered Safety Features (ESF) Actuation System Tests

* Setpoint validation, using input simulation and automatic self-test feature.
* Trip logic test of SLU, using input simulation and automatic self-test feature.
* Equipment operation, using input simulation or manual.

and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head and time to rated flow;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) the ability of the system to swap pump suction source from the condensate storage pool to the suppression pool without interrupting system operation;

(m) acceptability of the HPCF sparger flooding pattern; and

(n) proper operation of the pump discharge line keep fill system and its ability to prevent damaging water hammer during system transients.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.11 Safety System Logic and Control Preoperational Test

(1) Purpose

To verify proper operation of the plant safety system logic and control (SSLC).

(2) Prerequisites

The applicable construction tests have been successfully completed.

(3) General Test Methods and Acceptance Criteria

The SSLC integrates the automatic decision making and trip logic functions associated with the safety action of several of the plants' safety-related systems. Such systems include the RPS, HPCF, RHR, RCIC, LDIS, and ADS. The SSLC is not so much a system itself, but is instead an assembly of the above mentioned safety-related systems signal processors designed and grouped for optimum reliability, availability and oper- ability. The SSLC, therefore, should be adequately tested during the preoperational phase testing of the associated systems in- cluding the integrated LOP/LOCA test. Pro- vided the construction testing and the asso- ciated system preoperational testing has been successfully completed, as it relates to proper operation of the SSLC, no specific additional testing should be necessary.

SSLC performance would then be considered acceptable provided all design and testing specifications are met.

14.2.12.1.12 Multiplexing System Preoperational Test

(1) Purpose

To verify proper functioning of the plant multiplexing system including both essential and nonessential subsystems.

(EMS and NEMS)

(2) Prerequisites

Insert f

System construction testing has been successfully completed.

(3) General Test Method and Acceptance Criteria

Since this system is the primary communication interface between the various plant systems it should be adequately tested during the preoperational phase testing performed on those interconnected systems. Provided the construction testing and the associated system testing has been successfully completed as it relates to proper operation of the multiplexing system, no specific additional testing should be necessary.

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System performance would then be considered acceptable provided all design specifications are met.

14.2.12.1.13 Leak Detection and Isolation System Preoperational Test

(1) Purpose

To verify proper response and operation of the leak detection and isolation system (LDS) logic.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedures and has approved the initiation of testing. The required AC and DC electrical power sources shall be operational and the appropriate interfacing systems shall be available as required to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Since the leak detection and isolation system is comprised mostly of logic, the checks of valve response and timing and the testing of sensors will be performed as part of, or in conjunction with, the various systems with which they are associated. These systems include RHR, RCIC, RWCU, main steam, feedwater, recirculation, radiation monitoring, nuclear boiler, drywell cooling and the drywell sumps.

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

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip;

(b) proper functioning of indicators, annunciators, and alarms used to monitor system operation and status;

(c) proper operation of leakoff and drainage measurement functions such as those associated with the reactor vessel head flange, drywell cooler condensate, and various primary system valves;

(d) proper response of related system valves, including timing, under expected operating conditions;

(e) proper interface with related systems in regards to the input and output of leak detection indications and isolation initiation commands;

(f) proper operation of bypass switches and related logic; and

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.14 Reactor Protection System Preoperational Test

(1) Purpose

To verify proper operation of the reactor protection system (RPS) including complete channel logic and response time.

MUX

Insert f

The power supply, logic units (SSLC), and other component (MCU, RMU, CMU) associated with the essential and non-essential multiplexing system shall be operable. The interfacing systems' actuators, alarms, and displays which receive the processed control signals from the essential and non-essential multiplexing systems shall be operational. The data acquisition and communication software required to support the essential and non-essential multiplexing system functions shall be available. Simulated sensor input signals shall be provided for the performance of this test. Additionally, special test instrumentation for simulated inputs, data reductions and analysis shall be available.

MAX

Insert 9

The integrated hardware/software testing shall check the system functional performance and interface requirements as specified in the non-essential multiplexing system (NEMS) and essential multiplexing system (EMS) design specifications. The verification and validation testing are performed to check the input signal coming from appropriately assigned input point and the output signal to the appropriately assigned signal points. This testing shall also check the function of the redundant multiplexing system and the fail-safe function of both systems. The capability of both warm and cold starts upon power interruption and automatic self-test function of the systems shall also be demonstrated to meet the design requirements. Additionally, after the above verification the validated essential multiplexing system shall be checked for final validation during integrated essential multiplexing system/SSLC testing as part of the SSLC preoperational test (SSAR Section 14.2.12.1.11). Testing shall include confirmation of every multiplexed sensor signal for accuracy, and functional requirements of control, interlock or display as specified in the documents of the systems integrated within the SSLC.

(2) Prerequisites

System construction testing has been successfully completed.

(3) General Test Method and Acceptance Criteria

Since this system is the primary communication interface between the various plant systems it should be adequately tested during the preoperational phase testing performed on those interconnected systems. Provided the construction testing and the associated system testing has been successfully completed as it relates to proper operation of the multiplexing system, no specific additional testing should be necessary.

System performance would then be considered acceptable provided all design specifications are met.

14.2.12.1.13 Leak Detection and Isolation System Preoperational Test

(1) Purpose

To verify proper response and operation of the leak detection and isolation system (LDS) logic.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedures and has approved the initiation of testing. The required AC and DC electrical power sources shall be operational and the appropriate interfacing systems shall be available as required to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Since the leak detection and isolation system is comprised mostly of logic, the checks of valve response and timing and the testing of sensors will be performed as part of, or in conjunction with, the various systems with which they are associated. These systems include RHR, RCIC, RWCU, main steam, feedwater, recirculation, radiation monitoring, nuclear boiler, drywell cooling and the drywell sumps.

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

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip;

(b) proper functioning of indicators, annunciators, and alarms used to monitor system operation and status;

(c) proper operation of leakoff and drainage measurement functions such as those associated with the reactor vessel head flange, drywell cooler condensate, and various primary system valves;

(d) proper response of related system valves, including timing, under expected operating conditions;

(e) proper interface with related systems in regards to the input and output of leak detection indications and isolation initiation commands;

(f) proper operation of bypass switches and related logic; and

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.14 Reactor Protection System Preoperational Test

(1) Purpose

To verify proper operation of the reactor protection system (RPS) including complete channel logic and response time.

LDS

Insert A

All system instrumentation shall have been properly calibrated per instrument supplier's instructions. Appropriate simulation of LDS response and sensors shall be provided for each of the LDS division. Special test instrumentation for simulated test inputs, data reduction and analysis shall be available for use. Systems which may be tripped by the input process variables that are not intended to function during a specified test shall be blocked out before the test. Applicable power sources to supply electrical power to motors, control circuits, and instrumentation shall be available and operational. Auxiliary calibration sources shall be provided to support the specified calibration tests. Additionally, the following nuclear and plant auxiliary systems shall be operational for verifying the leak detection and isolation functions as indicated in the parenthesis,

(1) Neutron monitoring system (ATIP isolation)
(2) Containment system (Drywell coolant leakage)
(3) Standby gas treatment system (system initiation)
(4) Reactor protection system (isolation bypass)
(5) Standby liquid control system (system initiation)
(6) Nuclear boiler system (MSIV, MSL drain valves)
(7) RHR system (shutdown cooling suction isolation)
(8) CUW system (containment isolation valve)
(9) RCIC system (system isolation)
(10) SSLC (LDS logic processing)
(11) Other auxiliary systems (e.g., PRM, RD, RCW, HNCW, HVAC, ACS, FCS, SPCU, etc.,) associated with the LDS functions.

Insert b

(a) correct implementation and operation of the LDS system software-based controls and instrumentation. This test shall check the system behavior against the functional, performance and interface requirements as specified by the appropriate design documents and hardware/software system specification (HSSS). (the)

Insert C

(h) proper operation of the LDS functions such as equipment-area leak detection for RHR and RCIC systems and area leak detection for main steamline tunnel in reactor building and turbine building and CUW system.

(i) proper operation of drywell coolers condensate flow monitoring, including flow indicator and alarm actuation.

(j) correct function of flow transmitter and differential flow switch on the CUW flow leak detection system.

(k) correct function of RCIC steamline high flow and main steamline high flow detection and the associated trip initiations.

(l) proper operation of the fission product monitoring system, including calibration of each detector and control functions of all associated equipment.

(m) capability of the LDS to perform MSIV isolation function as designed with diverse manual isolation switches from the main control room.

(2) Prerequisites

System construction testing has been successfully completed.

(3) General Test Method and Acceptance Criteria

Since this system is the primary communication interface between the various plant systems it should be adequately tested during the preoperational phase testing performed on those interconnected systems. Provided the construction testing and the associated system testing has been successfully completed as it relates to proper operation of the multiplexing system, no specific additional testing should be necessary.

System performance would then be considered acceptable provided all design specifications are met.

14.2.12.1.13 Leak Detection and Isolation System Preoperational Test

(1) Purpose

To verify proper response and operation of the leak detection and isolation system (LDS) logic.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedures and has approved the initiation of testing. The required AC and DC electrical power sources shall be operational and the appropriate interfacing systems shall be available as required to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Since the leak detection and isolation system is comprised mostly of logic, the checks of valve response and timing and the testing of sensors will be performed as part of, or in conjunction with, the various systems with which they are associated. These systems include RHR, RCIC, RWCU, main steam, feedwater, recirculation, radiation monitoring, nuclear boiler, drywell cooling and the drywell sumps.

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

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip;

(b) proper functioning of indicators, annunciators, and alarms used to monitor system operation and status;

(c) proper operation of leakoff and drainage measurement functions such as those associated with the reactor vessel head flange, drywell cooler condensate, and various primary system valves;

(d) proper response of related system valves, including timing, under expected operating conditions;

(e) proper interface with related systems in regards to the input and output of leak detection indications and isolation initiation commands;

(f) proper operation of bypass switches and related logic; and

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.14 Reactor Protection System Preoperational Test

(1) Purpose

To verify proper operation of the reactor protection system (RPS) including complete channel logic and response time.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedures and has approved the initiation of testing. The rod control system, instrument air system, and the required AC and DC electrical power sources are operational. All other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip including those associated with all positions of the reactor mode switch;

(b) proper functioning of instrumentation and alarms used to monitor sensor and channel operation and availability;

(c) proper calibration of primary sensors;

(d) proper trip and alarm settings;

(e) ability of bypass switches including ated logic;

(f) proper operation of permissive and prohibit interlocks;

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(h) acceptability of instrument channel response times, as measured from each applicable process variable (except for neutron sensors) to the de-energization of the scram pilot valve solenoids.

System operation is considered acceptable when the observed/measured performance characteristics from the testing described above, meet the applicable design specifications.

The ability of the system to scram the reactor within a specified time must be demonstrated in conjunction with the CRD system preoperational test (Subsection 14.2.12.1.6).

14.2.12.1.15 Neutron Monitoring System Preoperational Test

(1) Purpose

To verify the proper operation of the neutron monitoring system (NMS) including fixed incore startup and power range detectors, traversing incore probes (TIPs) and related hardware and software.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All startup range neutron monitor subsystem components and power range neutron monitor subsystem components have been calibrated per vendor instructions. Additionally, all required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip including rod block and scram signals feeding the rod control system and the reactor trip system, respectively;

(b) proper functioning of instrumentation, displays, alarms, and annunciators used to monitor system operation and status;

(c) proper operation of detectors and associated cabling, preamplifiers, and power supplies;

Insert a

(i) Correct functioning of test and calibration hardware/software.

(j) Correct functioning of all RPS isolated output signals during individual or combinations of input conditions such as automatic system trip initiation, manual trip initiation, and channel sensor bypass operating.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedures and has approved the initiation of testing. The rod control system, instrument air system, and the required AC and DC electrical power sources are operational. All other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip including those associated with all positions of the reactor mode switch;

(b) proper functioning of instrumentation and alarms used to monitor sensor and channel operation and availability;

(c) proper calibration of primary sensors;

(d) proper trip and alarm settings;

(e) [illegible]rability of bypass switches including [illegible]ated logic;

(f) proper operation of permissive and prohibit interlocks;

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected [illegible] remain operational; and

(h) acceptability of instrument cha[illegible]el response times, as measured from each applicable process variable (except for neutron sensors) to the de-energization of the scram pilot valve solenoids.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the appli[illegible]ie design specifications.

The ability of the system to scram the reactor within a specified time must be demonstrated in conjunction with the CRD system preoperational test (Subsection 14.2.12.1.6).

neutron monitoring subsystems

14.2.12.1.15 Neutron Monitoring System Preoperational Test

(1) Purpose

ATIP

To verify the proper operation of the neutron monitoring system (NMS) including fixed incore startup and power range detectors, traversing incore probes (TIPs) and related hardware and software.

automated

and multi-channel rod block monitoring subsystem

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All startup range neutron monitor subsystem components and power range neutron monitor subsystem components have been calibrated per vendor instructions. Additionally, all required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip including rod block and scram signals feeding the rod control system and the reactor trip system, respectively;

(b) proper functioning of instrumentation, displays, alarms, and annunciators used to monitor system operation and status;

(c) proper operation of detectors and associated cabling, preamplifiers, and power supplies;

and signal conditioning equipment

instrument air, electrical power system, and rod control and information system are operational and all other

(d) proper operation of TIP drive mechanisms and indexers;

(e) proper operation of interlocks and equipment protective devices including those associated with the TIP indexers and drive control units;

(f) proper operation of permissive, prohibit and bypass functions;

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(h) proper operation of system and subsystem self-test diagnostic and calibration functions;

(i) the ability to communicate and interface with appropriate plant systems and between NMS subsystems; and

(j) the ability to generate core flow trip signals from core plate differential pressure measurements.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.16 Process Computer System Preoperational Test

(1) Purpose

To verify the proper operation of the process computer system (PCS) including the performance monitoring and control system (PMCS) and the power generation control system (PGCS) and their related functions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All programming shall be complete and initial software diagnostic checks determined acceptable. The required input and output devices and various system interfaces shall be connected and available, as needed, for supporting the specified testing configurations.

(3) General Test Methods and Acceptance Criteria

Proper performance of system hardware and software will be verified by a series of individual and integral tests that include the following demonstrations:

(a) proper connection and calibration of all analog and digital signals;

(b) proper operation of data logging and plotting features;

(c) verification of computer printouts and CRT displays;

(d) proper communication and interface with other plant equipment, computers and control systems;

(e) verification of proper data flow and processing and of calculational accuracy;

(f) proper operation of calibration and surveillance support functions; and

(g) proper operation of operator guidance and prompting functions, including alarms and status messages, in all operating modes for plant startup, shutdown and power maneuvering iterations.

Much of the testing performed during the preoperational phase is done utilizing simulated conditions and inputs via system hardware and software. Final system performance during live conditions will be evaluated during the startup phase.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.17 Automatic Power Regulator Preoperational Test

(1) Purpose

(d) proper operation of TIP drive mechanisms and indexers;

(e) proper operation of interlocks and equipment protective devices including those associated with the TIP indexers and drive control units;

(f) proper operation of permissive, prohibit, and bypass functions;

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(h) proper operation of system and subsystem self-test diagnostic and calibration functions;

(i) the ability to communicate and interface with appropriate plant systems and between NMS subsystems; and

(j) the ability to generate core flow biased trip setpoints from core plate differential pressure measurements.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.16 Process Computer System Preoperational Test

(1) Purpose

To verify the proper operation of the process computer system (PCS) including the performance monitoring and control system (PMCS) and the power generation control system (PGCS) and their related functions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All programming shall be complete and initial software diagnostic checks determined acceptable. The required input and output devices and various system interfaces shall be connected and available, as needed, for supporting the specified testing configurations.

(3) General Test Methods and Acceptance Criteria

Proper performance of system hardware and software will be verified by a series of individual and integral tests that include the following demonstrations:

(a) proper connection and calibration of all analog and digital signals;

(b) proper operation of data logging and plotting features;

(c) verification of computer printouts and CRT displays;

(d) proper communication and interface with other plant equipment, computers and control systems;

(e) verification of proper data flow and processing and of calculational accuracy;

(f) proper operation of calibration and surveillance support functions; and

(g) proper operation of operator guidance and prompting functions, including alarms and status messages, in all operating modes for plant startup, shutdown and power maneuvering iterations.

Much of the testing performed during the preoperational phase is done utilizing simulated conditions and inputs via system hardware and software. Final system performance during live conditions will be evaluated during the startup phase.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.17 Automatic Power Regulator Preoperational Test

(1) Purpose

(d) proper operation of TIP drive mechanisms and indexers;

(e) proper operation of interlocks and equipment protective devices including those associated with the TIP indexers and drive control units;

(f) proper operation of permissive, prohibit, and bypass functions;

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(h) proper operation of system and subsystem self-test diagnostic and calibration functions;

(i) the ability to communicate and interface with appropriate plant systems and between NMS subsystems; and

(j) the ability to generate core flow biased trip setpoints from core plate differential pressure measurements.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.16 Process Computer System Preoperational Test

(1) Purpose

To verify the proper operation of the process computer system (PCS) including the performance monitoring and control system (PMCS) and the power generation control system (PGCS) and their related functions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All programming shall be complete and initial software diagnostic checks determined acceptable. The required input and output devices and various system interfaces shall be connected and available, as needed, for supporting the specified testing configurations.

(3) General Test Methods and Acceptance Criteria

Proper performance of system hardware and software will be verified by a series of individual and integral tests that include the following demonstrations:

(a) proper connection and calibration of all analog and digital signals;

(b) proper operation of data logging and plotting features;

(c) verification of computer printouts and CRT displays;

(d) proper communication and interface with other plant equipment, computers and control systems;

(e) verification of proper data flow and processing and of calculational accuracy;

(f) proper operation of calibration and surveillance support functions; and

(g) proper operation of operator guidance and prompting functions, including alarms and status messages, in all operating modes for plant startup, shutdown and power maneuvering iterations.

Much of the testing performed during the preoperational phase is done utilizing simulated conditions and inputs via system hardware and software. Final system performance during live conditions will be evaluated during the startup phase.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.17 Automatic Power Regulator Preoperational Test

(1) Purpose

To verify proper operation of the automatic power regulator (APR) over the range of required operating modes.

(2) Prerequisites

The software programming and initial diagnostic testing has been completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The process computer system, rod control and information system, recirc flow control system, turbine control system, and other required system interfaces shall be available to support the specified system testing.

(3) General Test Methods and Acceptance Criteria

The APR is a top level controller that interfaces with various lower level controllers and systems. APR testing, therefore, shall be closely coordinated with testing of related interfacing and affected systems. Such testing shall include the following demonstrations:

(a) proper operation of instrumentation and controls in all combinations of logic for all modes of operation including transfers;

(b) proper functioning of annunciators, alarms, and displays used to monitor system operation or status;

(c) verification of proper data flow and processing including the accuracy of calculations and control algorithms; and

(d) proper communication and interface with other control systems and related supporting and monitoring functions.

System operation is considered acceptable when the observed performance meets the applicable design specifications.

14.2.12.1.18 Remote Shutdown System Preoperational Test

(1) Purpose

Verify the feasibility and operability of intended remote shutdown functions from the remote shutdown panel and other local and remote locations outside the main control room which will be utilized during the remote shutdown scenario.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Additionally, control power shall be supplied to the remote shutdown panel and the required system and component interfaces shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The remote shutdown system (RSS) consists of the control and instrumentation available at the dedicated remote shutdown panel(s) and other local and remote locations intended to be used during the remote shutdown scenario.

Much of the specified testing can be accomplished in conjunction with, or as part of, the individual system and component preoperational testing. However, the successful results of such testing shall be documented as part of this test, as applicable. Performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper functioning of the control and instrumentation associated with the RSS;

(b) proper operation of pumps and valves including establishment of system flow paths using RSS control;

(c) proper functioning of RSS transfer switches including verification of proper override of main control room functions;

(d) proper operation of prohibit and permissive interlocks and bypass functions after transfer of control;

To verify proper operation of the automatic power regulator (APR) over the range of required operating modes.

(2) Prerequisites

The software programming and initial diagnostic testing has been completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The process computer system, rod control and information system, recirc flow control system, turbine control system, and other required system interfaces shall be available to support the specified system testing.

(3) General Test Methods and Acceptance Criteria

The APR is a top level controller that interfaces with various lower level controllers and systems. APR testing, therefore, shall be closely coordinated with testing of related interfacing and affected systems. Such testing shall include the following demonstrations:

(a) proper operation of instrumentation and controls in all combinations of logic for all modes of operation including transfers;

(b) proper functioning of annunciators, alarms, and displays used to monitor system operation or status;

(c) verification of proper data flow and processing including the accuracy of calculations and control algorithms; and

(d) proper communication and interface with other control systems and related supporting and monitoring functions.

System operation is considered acceptable when the observed performance meets the applicable design specifications.

14.2.12.1.18 Remote Shutdown System Preoperational Test

(1) Purpose

Verify the feasibility and operability of intended remote shutdown functions from the remote shutdown panel and other local and remote locations outside the main control room which will be utilized during the remote shutdown scenario.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Additionally, control power shall be supplied to the remote shutdown panel, and the required system and component interfaces shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The remote shutdown system (RSS) consists of the control and instrumentation available at the dedicated remote shutdown panel(s) and other local and remote locations intended to be used during the remote shutdown scenario.

Much of the specified testing can be accomplished in conjunction with, or as part of, the individual system and component preoperational testing. However, the successful results of such testing shall be documented as part of this test, as applicable. Performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper functioning of the control and instrumentation associated with the RSS;

(b) proper operation of pumps and valves including establishment of system flow paths using RSS control;

(c) proper functioning of RSS transfer switches including verification of proper override of main control room functions;

(d) proper operation of prohibit and permissive interlocks and bypass functions after transfer of control;

(e) proper system operation while powered from primary and alternate electrical sources; and

(f) the ability to establish and maintain communication among personnel stationed throughout the plant who would be performing the remote shutdown operation.

RSS operation is considered acceptable when the observed and measured performance meets the applicable design specifications.

14.2.12.1.19 Reactor Water Cleanup System Preoperational Test

(1) Purpose

To verify that the operation of the reactor water cleanup system (CUW), including pumps, valves, and filter/demineralizer equipment, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Filter aid and resin material shall be available. Reactor building cooling water, instrument air, CRD purge supply, and other required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations. Special provisions may be required for testing the CUW system in the vessel head spray mode.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip including those associated with the leak detection and isolation system;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(l) proper operation of the reactor water cleanup filter/demineralizers and associated support facilities.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. Proper operation of sampling stations and displays will be demonstrated per Subsection 14.2.12.1.22.

14.2.12.1.20 Suppression Pool Cleanup System Preoperational Test

(1) Purpose

To verify that the operation of the suppression pool cleanup system (SPCU) is as speci-

(e) proper system operation while powered from primary and alternate electrical sources; and

(f) the ability to establish and maintain communication among personnel stationed throughout the plant who would be performing the remote shutdown operation.

RSS operation is considered acceptable when the observed and measured performance meets the applicable design specifications.

14.2.12.1.19 Reactor Water Cleanup System Preoperational Test

(1) Purpose

To verify that the operation of the reactor water cleanup system (CUW), including pumps, valves, and filter/demineralizer equipment, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Filter aid and resin material shall be available. Reactor building cooling water, instrument air, CRD purge supply, and other required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations. Special provisions may be required for testing the CUW system in the vessel head spray mode.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip including those associated with the leak detection and isolation system;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, ~~under expected operating conditions~~;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(l) proper operation of the reactor water cleanup filter/demineralizers and associated support facilities.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. Proper operation of sampling stations and displays will be demonstrated per Subsection 14.2.12.1.22.

14.2.12.1.20 Suppression Pool Cleanup System Preoperational Test

(1) Purpose

To verify that the operation of the suppression pool cleanup system (SPCU) is as speci-

CMW

Insert A

(f) System performance capability based on ambient reactor pressure and temperature with all components, piping and instruments that constitute the entire system in the below listed mode of operation:

(1) Rated operation (with 2 pumps and 2 filter-demineralizers)

(2) 50% flow rate operation (with 1 pump and 1 filter-demineralizer)

(3) RPV head spray operation

(4) pump runout operation (with 1 pump in operation until operating conditions stabilized by using filter-demineralizer bypass line and setting flow rate to the established runout flow rate)

Additionally, the RPV bottom drain flow rate shall be adjusted if necessary to the established value during rated operation.

(e) proper system operation while powered from primary and alternate electrical sources; and

(f) the ability to establish and maintain communication among personnel stationed throughout the plant who would be performing the remote shutdown operation.

RSS operation is considered acceptable when the observed and measured performance meets the applicable design specifications.

14.2.12.1.19 Reactor Water Cleanup System Preoperational Test

(1) Purpose

To verify that the operation of the reactor water cleanup system (CUW), including pumps, valves, and filter/demineralizer equipment, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Filter aid and resin material shall be available. Reactor building cooling water, instrument air, CRD purge supply, and other required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations. Special provisions may be required for testing the CUW system in the vessel head spray mode.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip including those associated with the leak detection and isolation system;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(l) proper operation of the reactor water cleanup filter/demineralizers and associated support facilities.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. Proper operation of sampling stations and displays will be demonstrated per Subsection 14.2.12.1.22.

14.2.12.1.20 Suppression Pool Cleanup System Preoperational Test

(1) Purpose

To verify that the operation of the suppression pool cleanup system (SPCU) is as speci-

fied in all required operating modes.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The fuel pool and suppression pool shall be adequately filled and the appropriate filter/demineralizer support facilities and other system interfaces available, as needed, to support the specified testing.

(3) General Test Method and Acceptance Criteria

The suppression pool and fuel pool share common water treatment facilities. The suppression pool cleanup system has a dedicated pump for circulating water to and from the suppression pool and through the common filter/demineralizer. However, the shared filter/demineralizer facilities are considered part of the fuel pool cooling and cleanup system. Therefore, this preoperational test shall be closely coordinated with that of Subsection 14.2.12.1.21.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing under expected operating conditions;

(d) proper operation of pump and motor in all design operation modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while providing the specified intersystem relief capabilities and

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.21 Fuel Pool Cooling and Cleanup System Preoperational Test

(1) Purpose

To verify that the operation of the fuel pool cooling and cleanup (FPC) system, including the pumps, heat exchangers, controls, valves, and instrumentation, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and

SPCU

Insert A

(l) proper system operation while supplying water to the RCW surge tanks and fuel pool (for FPC system) using the condensate storage tank and suppression pool (backup) as the water source.

fied in all required operating modes.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The fuel pool and suppression pool shall be adequately filled and the appropriate filter/demineralizer support facilities and other system interfaces available, as needed, to support the specified testing.

(3) General Test Method and Acceptance Criteria

The suppression pool and fuel pool share common water treatment facilities. The suppression pool cleanup system has a dedicated pump for circulating water to and from the suppression pool and through the common filter/demineralizer. However, the shared filter/demineralizer facilities are considered part of the fuel pool cooling and cleanup system. Therefore, this preoperational test shall be closely coordinated with that of Subsection 14.2.12.1.21.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pump and motor in all design operation modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while providing the specified intersystem refill capabilities; and

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.21 Fuel Pool Cooling and Cleanup System Preoperational Test

(1) Purpose

To verify that the operation of the fuel pool cooling and cleanup (FPC) system, including the pumps, heat exchangers, controls, valves, and instrumentation, is as specified.

(2) Prerequisites

Insert a

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and

integrated system tests to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip, including isolation and bypass of the nonsafety related fuel pool cleanup filter/demineralizers;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability, including those associated with pool water level;

(c) proper operation of ~~system valves~~, including timing ~~under expected operating conditions~~;

(d) ~~proper operation of pumps and motors for all design operating modes;~~

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) ~~proper system flow paths and flow rates including pump capacity and discharge head;~~

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) proper functioning of pool antisiphon devices and acceptable nonleakage from pool drains, sectionalizing devices, and gaskets or bellows;

(m) proper functioning of the system in conjunction with the RHR system in the supplemental fuel pool cooling mode; and

(n) proper operation of filter/demineralizer units and their associated support facilities.

Integrated system testing with flow to and from the fuel pool cleanup subsystem will be performed in conjunction with the appropriate portions of the suppression pool cleanup system preop described in Subsection 14.2.12.1.20.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.22 Plant Process Sampling System Preoperational Test

(1) Purpose

To verify the proper operation and the accuracy of equipment and techniques to be used for on-line and periodic sampling and analysis of overall reactor water chemistry (including that required to show compilance with Reg Guide 1.56) as well as that individual plant process streams, including the post accident sampling system (PASS).

(2) Prerequisites

Construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Adequate laboratory facilities and appropriate analytical procedures shall be in place.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during as series of tests to demonstrate the following:

(a) proper operation of on-line sampling and monitoring equipment, considering required calibration, indication, and alarm/functions, including reactor water

FPC

Insert A

A sufficiat quantity of chemically acceptable water is available for the performance of this test. All applicable electrical power to motors, control circuits, and instrumentation shall be available for use during this test. The spent fuel storage pool and dryer/separator storage pool are filled with demineralized water prior to the test. The portions of RHR and SPCU system required by the performance of this test shall be available. Instrument air system, makeup water-condensate system and reactor building cooling water system shall be in operation and available for use throughout this test. Additionally, all other

FPC

Insert b

(f) proper system operating conditions on various flow paths and operation modes in accordance with the applicable system design specification,

(1)* Normal heat load mode: with one system and two systems in parallel and with the filter demineralizer in-line or bypassed on the flow path between the skimmer surge tanks and the fuel pool by way of the filter demineralizers.

(2)* Earthquake cooling operating mode: with the pumps in cleanup bypassing mode of operation on the flow path begin with the skimmer surge tanks, through FPC pump, heat exchanger and supply water to fuel pool.

(3)* Draining operating mode (LCW collector pool): operate the system to drain water directly between reactor well pool/dryer-separator storage pool and LCW collector pool through installed draining piping

(4)* Draining operating mode (suppression pool): operate the system to drain water directly between reactor well pool/dryer-separator storage pool and suppression pool through using FPC pumps, filter demineralizers and the SPCU returning piping to the suppression pool.

integrated system tests to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip, including isolation and bypass of the nonsafety related fuel pool cleanup filter/demineralizers;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability, including those associated with pool water level;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) proper functioning of pool antisiphon devices and acceptable nonleakage from pool drains, sectionalizing devices, and gaskets or bellows;

(m) proper functioning of the system in conjunction with the RHR system in the supplemental fuel pool cooling mode; and

(n) proper operation of filter/demineralizer units and their associated support facilities.

Integrated system testing with flow to and from the fuel pool cleanup subsystem will be performed in conjunction with the appropriate portions of the suppression pool cleanup system preop described in Subsection 14.2.12.1.20.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.22 Plant Process Sampling System Preoperational Test

of plant process sampling system (PSS)

(1) Purpose

To verify the proper operation and the accuracy of equipment and techniques to be used for on-line and periodic sampling and analysis of overall reactor water chemistry (including that required to show compilance with Reg Guide 1.56) as well as that individual plant process streams, including the post accident sampling system (PASS).

(2) Prerequisites

Construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Adequate laboratory facilities and appropriate analytical procedures shall be in place.

(Insert b)

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during as series of tests to demonstrate the following:

(a) proper operation of on-line sampling and monitoring equipment, considering required calibration, indication, and alarm/functions, including reactor water

conductivity instrumentation and other equipment or instrumentation required to show compliance with Reg Guide 1.56;

(b) the capability of obtaining grab samples of designated process streams at the desired locations;

(c) proper functioning of personnel protective devices at local sampling stations; and

(d) the adequacy and accuracy of sample analysis methods.

Insert a

The above tests should be performed using actual process streams where practicable. System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.23 Process Radiation Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the process radiation monitoring system (PRMS) to indicate and alarm normal and abnormal radiation levels, and to initiate, if appropriate, isolation and/or cleanup systems upon detection of high radiation levels in any of the process streams that are monitored.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The various process radiation moni- toring subsystems, including preamplifiers, power supplies, indicator and trip units, and sensors and converters, have been calibrated according to vendor instructions. The re- quired interfacing systems shall be avail- able, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The PRMS consists of a number of subsystems that monitor various liquid and gaseous process streams, building and area ventilation exhausts, and plant and process effluents. The offgas system and the main steam lines are also monitored.

Performance shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(a) proper calibration of detector assemblies and associated equipment using a standard radiation source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms;

(c) proper system trips in response to high radiation and downscale/inoperative conditions;

(d) proper operation of permissive, prohibit, interlock, and bypass functions; and

(e) proper operation of primary and backup sampling functions.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.24 Area Radiation Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the area radiation monitoring (ARM) system to indicate and alarm normal and abnormal general area radiation levels throughout the plant.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Indicator and trip units, power supplies, and sensor/converters have been calibrated according to vendor instructions.

PSS

Insert b

Additionally, prerequisites, including but not limited to the following, must be completed prior to the test:

(a) All instrumentation provided for alarm, recording and analyzing functions shall be available and operational and properly calibrated

(b) All applicable power sources to supply electric power to motors, control circuits, and instrumentation shall be available, as required, for test use.

(c) The system valve and electrical lineups shall be completed in accordance with the applicable plant operation procedures prior to the test.

(d) The following sampling panels shall be available and operational:
* Reactor building sample station (RWCU, CRD, PASS)
* Feedwater corrosion product monitoring system panel.
* RHR, fuel pool and suppression pool sampling station
* Turbine building condensate system sampling.
* Radwaste system sampling station.

Instrument air system, makeup water-purified distribution system,

(e) All sample lines and components are operable.

(f) The turbine and reactor building cooling (TCW & RCW) systems are available to support testing.

Insert C1

(e) proper operation of all motor operated valves and air operated valves, including operability from local control panel, open/closure indicators and timing.

(f) proper operative conditions and operative/stop indicators of all equipments except for valves from PASS local panel.

(g) proper operation of main interlock functions in conformity with IBD by detector practical operation or simulated signal operation.

~~proper operation of pump during~~

(h) proper operating condition without any abnormalities in the pump during continuous operation.

(i) ~~automatic~~ functions ~~proper operation system operation in automatic mode~~

proper equipment ~~operations~~ in automatic mode of system operation during sampling, sample transportation and flushing of PASS.

(j). Correct operation of temperature baths, relief, sensors, and indicators specified by the P&ID.

This test shall demonstrate that the PRMS operates as specified by Subsection 11.5 and the appropriate manufacturer's technical instruction manuals through the preoperational testing.

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conductivity instrumentation and other equipment or instrumentation required to show compliance with Reg Guide 1.56;

(b) the capability of obtaining grab samples of designated process streams at the desired locations;

(c) proper functioning of personnel protective devices at local sampling stations; and

(d) the adequacy and accuracy of sample analysis methods.

The above tests should be performed using actual process streams where practicable. System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.23 Process Radiation Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the process radiation monitoring system (PRMS) to indicate and alarm normal and abnormal radiation levels, and to initiate, if appropriate, isolation and/or cleanup systems upon detection of high radiation levels in any of the process streams that are monitored.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The various process radiation moni- toring subsystems, including preamplifiers, power supplies, indicator and trip units, and sensors and converters, have been calibrated according to vendor instructions. The re- quired interfacing systems shall be avail- able, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The PRMS consists of a number of subsystems that monitor various liquid and gaseous process streams, building and area ventilation exhausts, and plant and process effluents. The offgas system and the main steam lines are also monitored.

Performance shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(a) proper calibration of detector assemblies and associated equipment using a standard radiation source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms;

(c) proper system trips in response to high radiation and downscale/inoperative conditions;

(d) proper operation of permissive, prohibit, interlock, and bypass functions; and

(e) proper operation of primary and backup sampling functions.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.24 Area Radiation Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the area radiation monitoring (ARM) system to indicate and alarm normal and abnormal general area radiation levels throughout the plant.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Indicator and trip units, power supplies, and sensor/converters have been calibrated according to vendor instructions.

Check sources shall be in place where required and all radiation monitors shall be tested using a check source. Upscale and downscale annunciator setpoints shall be set as calculated based on the radiation levels of release limits prior to this test.

Insert a

Additionally, appropriate simulation of sensors and PRMS response shall be available for use. System which may be tripped by the input process variables that are not intended to function during a prescribed test shall be blocked out befor the test specified.

Insert b

(f) proper operation of all process sample racks in accordance with manufacturer's technical instruction manuals.

(g) correct implementation and operation of the PRM system software-based controls and instrumentation. This test shall check the system behavior against the functional, performance and interface requirements as specified by the appropriate design documents and the hardware/software system specification (HSSS).

High radiation alarm setpoints shall be properly established based on sensor location, background radiation level, expected radiation level and low occupation dose goal of the test.

conductivity instrumentation and other equipment or instrumentation required to show compliance with Reg Guide 1.56;

(b) the capability of obtaining grab samples of designated process streams at the desired locations;

(c) proper functioning of personnel protective devices at local sampling stations; and

(d) the adequacy and accuracy of sample analysis methods.

The above tests should be performed using actual process streams where practicable. System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.23 Process Radiation Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the process radiation monitoring system (PRMS) to indicate and alarm normal and abnormal radiation levels, and to initiate, if appropriate, isolation and/or cleanup systems upon detection of high radiation levels in any of the process streams that are monitored.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The various process radiation moni- toring subsystems, including preamplifiers, power supplies, indicator and trip units, and sensors and converters, have been calibrated according to vendor instructions. The re- quired interfacing systems shall be avail- able, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The PRMS consists of a number of subsystems that monitor various liquid and gaseous process streams, building and area ventilation exhausts, and plant and process effluents. The offgas system and the main steam lines are also monitored.

Performance shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(a) proper calibration of detector assemblies and associated equipment using a standard radiation source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms;

(c) proper system trips in response to high radiation and downscale/inoperative conditions;

(d) proper operation of permissive, prohibit, interlock, and bypass functions; and

(e) proper operation of primary and backup sampling functions.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.24 Area Radiation Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the area radiation monitoring (ARM) system to indicate and alarm normal and abnormal general area radiation levels throughout the plant.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Indicator and trip units, power supplies, and sensor/converters have been calibrated according to vendor instructions.

, including reactor building, control building, service building, radwaste building and turbine building.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(a) proper calibration of detector assemblies and associated equipment using a standard radiation source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms;

(c) proper system trips in response to high radiation and downscale/inoperative conditions; and

(d) proper operation of permissive, prohibit, interlock, and bypass functions.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.25 Dust Radiation Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the dust radiation monitoring system to indicate and alarm normal and abnormal airborne radiation levels throughout the plant.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Additionally, indicator and trip units, power supplies, and sensor/converters have been calibrated according to vendor instructions.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(a) proper calibration of detector assemblies and associated equipment using a standard radiation source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms;

(c) proper system trips in response to high radiation and downscale/inoperative conditions;

(d) proper operation of permissive, prohibit, interlock, and bypass functions; and

(e) proper operation of filtering and sampling equipment.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.26 Containment Atmospheric Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the containment atmospheric monitoring system (CAMS) to monitor oxygen, hydrogen, and gross gamma radiation levels in the wetwell and drywell airspace regions of the primary containment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Initial system and component setup has been accomplished per vendor instructions.

(3) General Test Methods and Acceptance Criteria

The containment atmosphere monitoring system consists of radiation, orygen, and hydrogen monitoring subsystems. Performance of each of these subsystems shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(a) proper calibration of detector assemblies and associated equipment using a standard radiation source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms;

(c) proper system trips in response to high radiation and downscale/inoperative conditions; and

(d) proper operation of permissive, prohibit, interlock, and bypass functions.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.25 Dust Radiation Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the dust radiation monitoring system to indicate and alarm normal and abnormal airborne radiation levels throughout the plant.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Additionally, indicator and trip units, power supplies, and sensor/converters have been calibrated according to vendor instructions.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(a) proper calibration of detector assemblies and associated equipment using a standard radiation source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms;

(c) proper system trips in response to high radiation and downscale/inoperative conditions;

(d) proper operation of permissive, prohibit, interlock, and bypass functions; and

(e) proper operation of filtering and sampling equipment.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.26 Containment Atmospheric Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the containment atmospheric monitoring system (CAMS) to monitor oxygen, hydrogen, and gross gamma radiation levels in the wetwell and drywell airspace regions of the primary containment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Initial system and component setup has been accomplished per vendor instructions.

(3) General Test Methods and Acceptance Criteria

The containment atmosphere monitoring system consists of radiation, oxygen, and hydrogen monitoring subsystems. Performance of each of these subsystems shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(a) proper calibration of detector assemblies and associated equipment using a standard radiation source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms;

(c) proper system trips in response to high radiation and downscale/inoperative conditions; and

(d) proper operation of permissive, prohibit, interlock, and bypass functions.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.25 Dust Radiation Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the dust radiation monitoring system to indicate and alarm normal and abnormal airborne radiation levels throughout the plant.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Additionally, indicator and trip units, power supplies, and sensor/converters have been calibrated according to vendor instructions.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

(a) proper calibration of detector assemblies and associated equipment using a standard radiation source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms;

(c) proper system trips in response to high radiation and downscale/inoperative conditions;

(d) proper operation of permissive, prohibit, interlock, and bypass functions; and

(e) proper operation of filtering and sampling equipment.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.26 Containment Atmospheric Monitoring System Preoperational Test

(1) Purpose

To verify the ability of the containment atmospheric monitoring system (CAMS) to monitor oxygen, hydrogen, and gross gamma radiation levels in the wetwell and drywell airspace regions of the primary containment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Initial system and component setup has been accomplished per vendor instructions.

(3) General Test Methods and Acceptance Criteria

The containment atmosphere monitoring system consists of radiation, oxygen, and hydrogen monitoring subsystems. Performance of each of these subsystems shall be observed and recorded during a series of individual component and integrated subsystem tests to demonstrate the following:

The CAMS system valve lineups are completed. All applicable power sources to supply electric power to control circuits and instrumentation are available for use. Appropriate simulation of sensors and CAMS system responses is provided prior to the test.

(a) proper calibration of detector assemblies and associated equipment using a standard source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms including those monitoring system availability;

(c) proper system trips in response to high setpoint and downscale/inoperative conditions;

(d) proper operation of permissive, prohibit, interlock, and bypass functions;

(e) proper initiation and operation of detection and sampling functions including pump start and valve sequencing, if appropriate, in response to a LOCA signal; and

(f) proper operation of calibration gas supply systems and self calibration functions.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.27 Instrument Air and Station Service Air Systems Preoperational Tests

(1) Purpose

To verify the ab. ity of the instrument air and service air systems (IA and SA) to provide the design quantities of clean dry compressed air to user systems and components.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup electrical power, the supplied system and components loads, and other required system interfaces are available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The instrument air system and the service air system are specified as separate systems. However, since they are so closely related the preop test requirements are essentially the same.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of compressors and motors in all design operating modes;

(e) ability of compressor(s) to maintain receiver at specified pressure(s) and to recharge within specified time under design loading conditions;

(f) proper system flow paths and acceptable flow rates to individual loads at specified temperatures and pressures under design loading conditions, including leakage for the system, is in accordance with design;

(g) proper compressor start sequence (including load and unload) and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in compressor and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded

Insert A

(g) proper operation of the heat tracing used in such H_2/O_2 sample line to maintain prescribed temperature.

(h) proper operation of all remote-operated solenoid operated valves.

(i) proper operation of oxygen and hydrogen analyzers as specified by the manufacturer's technical instruction manual.

(a) proper calibration of detector assemblies and associated equipment using a standard source or portable calibration unit;

(b) proper functioning of indicators, recorders, annunciators, and alarms including those monitoring system availability;

(c) proper system trips in response to high setpoint and downscale/inoperative conditions;

(d) proper operation of permissive, prohibit, interlock, and bypass functions;

(e) proper initiation and operation of detection and sampling functions including pump start and valve sequencing, if appropriate, in response to a LOCA signal; and

(f) proper operation of calibration gas supply systems and self calibration functions.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.27 Instrument Air and Station Service Air Systems Preoperational Tests

(1) Purpose

To verify the ability of the instrument air and service air systems (IA and SA) to provide the design quantities of clean dry compressed air to user systems and components.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup electrical power, the supplied system and components loads, and other required system interfaces are available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The instrument air system and the service air system are specified as separate systems. However, since they are so closely related the preop test requirements are essentially the same.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of compressors and dryers in all design operating modes;

(e) ability of compressor(s) to maintain receiver at specified pressure(s) and to recharge within specified time under design loading conditi...

(f) proper system flow paths and acceptable flow rates to individual loads at specified temperatures and pressures under design loading conditions, including leakage for the system, is in accordance with design;

(g) proper compressor start sequence (including load and unload) and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in compressor and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded

This test shall demonstrate that the IA and SA systems operate as specified by Subsection 9.3.6 and Subsection 9.3.7 respectively and applicable manufacturer's technical instruction manuals through the following testing:

control

for air compressors, dryer units, air receiver and filters

and isolation function.)

after cooler and moisture separator, air receiver, dryer units and filters

Insert b

reactor building cooling water system, HVAC system, high pressure nitrogen gas supply system, atmosphere control system

and the operation of air compressors, dryer units, air receiver and filters associated with the system.

additionally, valves in other systems that are required for the loss of instrument air pressure tests shall be available.

modes for which the system is expected to remain operational;

(k) acceptability of compressor/motor vibration levels and system piping movements during both transient and steady state operation;

(l) the ability of the air to meet end use cleanliness requirements with respect to oil, water, and particulate matter content;

(m) continued operability of supplied loads in response to credible failures that result in an increase in the supply system pressure;

(n) proper "failure" (open, close, or as is) of supplied components to both instantaneous (pipe break) and slow (plugging or freezing) simulated air losses (per Regulatory Guide 1.68.3); and

(o) the ability of the service air system to act as backup to the instrument air system.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.28 High Pressure Nitrogen Gas Supply System Preoperational Test

(1) Purpose

To verify the ability of the high pressure nitrogen gas supply system (HPIN) to furnish compressed nitrogen gas to user systems at design quantity and quality.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. User system loads and other required system interfaces shall be available, as needed, to support the specified system testing.

(3) Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) ability to maintain receiver(s) at specified pressure(s) under design loading conditions;

(e) proper system flow paths and acceptable flow rates to individual loads at specified temperatures and pressures under design loading conditions;

(f) proper operation of interlocks and equipment protective devices;

(g) proper operation of permissive, prohibit, and bypass functions;

(h) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(i) acceptability of vibration levels and system piping movements during both transient and steady state operation;

(j) the ability of the nitrogen gas to meet end use cleanliness requirements with respect to oil, water, and particulate matter content; and

IA/SA

Insert b

(f) proper operating conditions (capacity, pressure, temperature and quality of air from the system) and system performance capability of the IA system during various mode of operations (normal operation mode, backup operation mode, refueling outage mode) in accordance with the appropriate IA system design specification.

(k) proper operating conditions (capacity, pressure, temperature, and quality of air from the system) and the system performance capability of the SA system during various mode of operations (normal operating mode and IA system backup operation mode).

IA/SA

Insert a

(c) proper operation of the instrument air system in accordance with the design specification during a loss of instrument air testing. This test is done on lines which service safety related equipment.

modes for which the system is expected to remain operational;

(k) acceptability of compressor/motor vibration levels and system piping movements during both transient and steady state operation;

(l) the ability of the air to meet end use cleanliness requirements with respect to oil, water, and particulate matter content;

(m) continued operability of supplied loads in response to credible failures that result in an increase in the supply system pressure;

(n) proper "failure" (open, close, or as is) of supplied components to both instantaneous (pipe break) and slow (plugging or freezing) simulated air losses (per Regulatory Guide 1.68.3); and

(o) the ability of the service air system to act as backup to the instrument air system.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.28 High Pressure Nitrogen Gas Supply System Preoperational Test

(1) Purpose

To verify the ability of the high pressure nitrogen gas supply system (HPIN) to furnish compressed nitrogen gas to user systems at design quantity and quality.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. User system loads and other required system interfaces shall be available, as needed, to support the specified system testing.

(3) Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms ~~need to monitor system operating and availability~~;

(c) proper operation of ~~system valves~~, including timing ~~under expected operating conditions~~;

(d) ability to maintain receiver(s) at specified pressure(s) under design loading conditions;

(e) proper system flow paths and acceptable flow rates to individual loads at specified temperatures and pressures under design loading conditions;

(f) proper operation of interlocks and equipment protective devices;

(g) proper operation of permissive, prohibit, and bypass functions;

(h) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(i) acceptability of vibration levels and system piping movements during both transient and steady state operation;

(j) the ability of the nitrogen gas to meet end use cleanliness requirements with respect to oil, water, and particulate matter content; and

(k) proper "failure" (open, close, or as is) of supplied components to both instantaneous (pipe break) and slow (plugging or freezing) simulated nitrogen gas supply losses (per Regulatory Guide 1.68.3).

System operation is considered acceptable

Insert A

(e) proper system operation and capability (performance) at the following operating conditions:

(1) nitrogen gas supplies to SRV accumulators with the pressure control valves maintaining specified value of supply pressure.

(2) supply pressure to the SRV accumulators meets the specified value described in the appropriate HPIN system design specification.

(3) HPIN system is operated with normal operation lineup in the following test cases:

* atmospheric control system is used as nitrogen source.
* nitrogen gas bottles are used as nitrogen source.

when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.29 Reactor Building Cooling Water System Preoperational Test

(1) Purpose

To verify proper operation of the reactor building cooling water system (RCW) including its ability to supply design quantities of cooling water, at the required temperatures, to essential and nonessential loads, as appropriate, during normal, abnormal, and accident conditions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup power, reactor building service water, instrument air, and other required supporting systems shall be available, as needed, for the specified testing configurations. The cooled components shall be operational and operating to the extent practicable during heat exchanger performance evaluation.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system and component flow paths, flow rates, and pressure drops, including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational. This includes isolation/shedding of nonessential loads and divisional interties when a LOCA signal is present;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) proper operation of system surge tanks and chemical addition tanks and their associated functions; and

(m) acceptable performance of heat exchangers, to the extent practical.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. Due to the possibility of insufficient heat loads during the preop phase, the final system flow balancing and heat exchanger performance evaluation may need to be performed during the startup phase.

14.2.12.1.30 Plant Makeup Water System(s) Preoperational Test

(1) Purpose

RCW

Insert A

(f) proper operating conditions and system performance capability during the following system operational tests:

(1) system operation tests at various operating modes (normal, shutdown cooling, hot standby without off-site power source, LOCA, and refueling outage)

switching capability

(2) test of RCW pumps and heat exchangers between 1-unit and 2-units operating.

operation mode

(3) transfer test from normal mode to LOCA mode by LOCA signal.

(4) transferability test to the hot standby mode operation upon loss of off-site power.

(5) system operation capability from the remote shutdown panel.

(6) flow balancing for all modes of operation.

when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.29 Reactor Building Cooling Water System Preoperational Test

(1) Purpose

To verify proper operation of the reactor building cooling water system (RCW) including its ability to supply design quantities of cooling water, at the specified temperatures, to essential and nonessential loads, as appropriate, during normal, abnormal, and accident conditions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup power, reactor building service water, instrument air, and other required supporting systems shall be available, as needed, for the specified testing configurations. The cooled components shall be operational and operating to the extent practicable during heat exchanger performance evaluation.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system and component flow paths, flow rates, and pressure drops, including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational. This includes isolation/shedding of nonessential loads and divisional interties when a LOCA signal is present;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) proper operation of system surge tanks and chemical addition tanks and their associated functions; and

(m) acceptable performance of heat exchangers, to the extent practical.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. Due to the possibility of insufficient heat loads during the preop phase, the final system flow balancing and heat exchanger performance evaluation may need to be performed during the startup phase.

14.2.12.1.30 ~~Plant Makeup Water System (T)~~ Makeup Water-Purified Distribution System
Preoperational Test

(1) Purpose

makeup water-purified (MUWP) distribution system to supply purified water for makeup to the reactor coolant system and plant auxiliary systems and services

To verify the ability of the plant make-up water system(s) to resupply the designated plant systems with water of the designed quantity and quality for each such system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Final interconnection with the supplied systems is complete and those systems are ready to accept transfer of design quantities of makeup water.

(3) General Test Methods and Acceptance Criteria

System performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic;

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

(c) proper operation of pumps, motors, and valves under expected operating conditions;

(d) proper functioning of interlocks and equipment protective devices in pump, motor, and valve controls;

(e) the adequacy of system flow paths and flow rates including pump and tank capacities;

(f) proper functioning of chemical addition and water treatment facilities and equipment;

(g) proper functioning of freeze protection devices, if applicable; and

(h) acceptability of pump and motor vibration levels and system piping movements during both transient and steady state operations.

System operation is considered acceptable if the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.31 Hot Water Heating System Preoperational Test

(1) Purpose

Verify the ability of the hot water heating system to provide hot water to the appropriate HVAC systems in order to maintain the specified design temperatures within the various building rooms and areas.

(2) Prerequisites

The construction tests have been completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Electrical power, the appropriate heating source(s), the various HVAC systems heating coils, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation;

(c) proper operation of system valves under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

MWP

Insert 8 1 of 1

Additionally, prerequisite, include but is not limited to the following, must be completed prior to the test:

(a) All system instrumentation shall be in accordance with the P&ID and Instrument Data Sheets and have been calibrated per instrument supplier's instructions.

(b) The applicable power source to supply electric power to motors, control circuits, and instrumentation shall be available, as required, to support testing.

(c) The system valve lineups shall have been completed in accordance with the applicable system's operation procedures prior to the test.

(d) The following system and/or equipment shall be available for use in support of this test.

* Instrument air system (IA)
* Electrical instrument equipment
* Communication equipments

(e) A sufficient quantity of chemically acceptable water shall be available for performing this test.

(f) Simulated sensor input signals shall be provided, if desired to be used for the test.

Insert 1

MWP

1 of 2

(a) alarm test: (and reset) (functions) (the MWP)

Proper operation of the alarm associated with system by actually operating the detector of the alarm generating source or using the simulated signal.

(b) Proper operation of all components subject to interlocking signals associated with this system by practically operating the detector or using the simulated signal.

(c) Proper operation of the combination of the logic circuit by generating the signal to each detector terminal and actuating auxiliary relays that constitute the logic circuit.

(d) System operation test:

Proper operation of all components, piping and instruments that constitute the entire system during each of the following mode of operation test:

* System operation test: to confirm pump performance including stable operation condition and pump discharge pressure against the pump characteristic curve.
* Pump minimum flow test to confirm a stable pump operation and ability to operate continuously with pump discharge valve in the closed position.

MWP

Insert Y (cont'd)

2 of 2

* Standby pump automatic start test to confirm the auto start feature of a standby pump upon the trip of a running pump through observing the sequential operation and outlet pressure change.

To verify the ability of the plant make-up water system(s) to resupply the designated plant systems with water of the design quantity and quality for each such system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Final interconnection with the supplied systems is complete and those systems are ready to accept transfer of design quantities of makeup water.

(3) General Test Methods and Acceptance Criteria

System performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic;

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

(c) proper operation of pumps, motors, and valves under expected operating conditions;

(d) proper functioning of interlocks and equipment protective devices in pump, motor, and valve controls;

(e) the adequacy of system flow paths and flow rates including pump and tank capacities;

(f) proper functioning of chemical addition and water treatment facilities and equipment;

(g) proper functioning of freeze protection devices, if applicable; and

(h) acceptability of pump and motor vibration levels and system piping movements during both transient and steady state operations.

System operation is considered acceptable if the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.31 Hot Water Heating System Preoperational Test

(1) Purpose

Verify the ability of the hot water heating system to provide hot water to the appropriate HVAC systems in order to maintain the specified design temperatures within the various building rooms and areas.

(2) Prerequisites

The construction tests have been completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Electrical power, the appropriate heating source(s), the various HVAC systems hearing coils, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation;

(c) proper operation of system valves under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions; and

(j) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. It may not be possible to fully evaluate heat exchanger and heating coil performance during the preoperational test phase because of process temperature limitations.

14.2.12.1.32 HVAC Emergency Chilled Water System Preoperational Test

(1) Purpose

To verify the ability of the HVAC emergency chilled water system (HECW) to supply the design quantities of chilled water at the specified temperatures to the various cooling coils of the HVAC systems serving rooms and areas containing essential systems and equipment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Normal and auxiliary electrical power, reactor building cooling water, applicable HVAC system cooling coils, and other required system interfaces shall be available, as needed, to support the specified system testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including isolation functions, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates to all supplied loads including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(l) proper functioning of system surge tank and chemical addition features.

System operation is considered acceptable when the observed/measured performance

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions; and

(j) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. It may not be possible to fully evaluate heat exchanger and heating coil performance during the preoperational test phase because of process temperature limitations.

14.2.12.1.32 HVAC Emergency Chilled Water System Preoperational Test

(1) Purpose

To verify the ability of the HVAC emergency chilled water system (HECW) to supply the design quantities of chilled water at the specified temperatures to the various cooling coils of the HVAC systems serving rooms and areas containing essential systems and equipment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Normal and auxiliary electrical power, reactor building cooling water, applicable HVAC system cooling coils, and other required system interfaces shall be available, as needed, to support the specified system testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and components in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including isolation functions, remote manual and operating mechanisms;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates to all supplied loads including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(l) proper functioning of system surge tank and chemical addition features.

System operation is considered acceptable when the observed/measured performance

Insert A

(f) proper operating conditions (flow rate, pressure, and temperature) and system performance capability in conformity with the design during the following system operational tests:

(1) system flow rate test to confirm that system flow rate is prescribed value under the system design operating conditions.

(2) single operational test of HECW pumps to verify that each HECW pump can be individually operated continuously at rated flow rate without any abnormalities.

(3) Operational test of all HECW pumps to confirm that all HECW pumps can be continuously operated without any problems in HECW system.

(4) flow rate to each load shall be verified and adjusted (if necessary) to be consistent with the prescribed value. This test shall also confirm that each coil in supply units has adequate cooling capacity and each room temperature is under the design temperature.

(5) chemical addition test to confirm that the concentration of inhibitor in circulating water in HECW system is within prescribed limits.

characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.33 HVAC Normal ~~Chilled~~ Water System Preoperational Test

(1) Purpose

To verify the ability of the HVAC normal ~~chilled~~ water system (HNCW) to supply the design quantities of chilled water at the specified temperatures to the various cooling coils of the HVAC systems serving rooms and areas containing nonessential equipment and systems.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and auxiliary electrical power, ~~the associated cooling water systems~~, the applicable HVAC system cooling coils, and other required system interfaces shall be available, as needed, to support the specified system testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms ~~used to monitor system operation and availability~~;

(c) proper operation of system valves, including isolation functions, ~~under expected operating conditions~~;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) ~~proper system flow paths and flow rates to all supplied loads including pump capacity and discharge head~~;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(l) ~~proper functioning of system surge tank and chemical addition features~~.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.34 Heating, Ventilation, and Air Conditioning Systems Preoperational Test

(1) Purpose

To verify the ability of the various HVAC systems to establish and maintain the specified environment, with regards to temperature, pressure, and airborne particulate level, in the applicable rooms, areas, and buildings throughout the plant, supporting essential and nonessential equip- ment and systems.

(2) Prerequisites

The construction tests, including initial flow balancing, have been successfully

HNCW

Insert A

(f) proper operating conditions (flow rate, pressure, and temperature) and system performance capability in conformity with the design during the following system operational tests:

(1) system flow rate test to confirm that ~~the~~ system flow rate is prescribed value under the system design operating conditions.

(2) single operational test of HNCW pumps to verify that each HNCW pump can be individually operated continuously at rated flow rate without any abnormalities.

(3) operational test of all HNCW pumps to confirm that all HNCW pumps can be continuously operated without any problems in HNCW system.

(4) flow rate to each load shall be verified and adjusted (if necessary) to be consistent with the ~~[redacted]~~ prescribed value. This test shall also confirm that each coil in supply units has adequate cooling capacity and each return temperature is under the design temperature.

(5) chemical addition test to confirm that the concentration of inhibitor in circulating water in HNCW system is within prescribed limits.

characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.33 HVAC Normal Chilled Water System Preoperational Test

(1) Purpose

To verify the ability of the HVAC normal chilled water system (HNCW) to supply the design quantities of chilled water at the specified temperatures to the various cooling coils of the HVAC systems serving rooms and areas containing nonessential equipment and systems.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and auxiliary electrical power, the associated cooling water system(s), the applicable HVAC system cooling coils, and other required system interfaces shall be available, as needed, to support the specified system testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including isolation functions, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates to all supplied loads including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(l) proper functioning of system surge tank and chemical addition features.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.34 Heating, Ventilation, and Air Conditioning Systems Preoperational Test

(1) Purpose

To verify the ability of the various HVAC systems to establish and maintain the specified environment, with regards to temperature, pressure, and airborne particulate level, in the applicable rooms, areas, and buildings throughout the plant, supporting essential and nonessential equip- ment and systems.

(2) Prerequisites

The construction tests, including initial flow balancing, have been successfully

completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. Additionally, the normal and backup electrical power sources, the applicable heating, cooling, and chilled water systems, and any other required system interfaces shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

There are numerous HVAC systems in the plant, located throughout the various buildings. Each system typically consists of some combination of supply and exhaust air handling units and local cooling units, and the associated fans, dampers, valves, filters, heating and cooling coils, and control and instrumentation. The HVAC systems to be tested shall include the following: those supporting the reactor building rooms containing the emergency diesel generators and the ECCS pumps and heat exchangers; those serving the electrical equipment rooms of the control building; those supporting the divisional cooling water rooms; those supporting the turbine/generator auxiliaries, those serving the secondary containment and the general areas of the control building, reactor building and turbine building; and the dedicated systems of the drywell and the main control room (including the control room habitability function).

Since the various HVAC systems are similar in design of equipment and function, they are subject to the same basic testing requirements.

Performance shall be observed and recorded during a series of individual component and integrated system tests, to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves and dampers, including isolation functions, under expected operating conditions;

(d) proper operation of fans and motors in all design operating modes;

(e) proper system flow paths and flow rates including individual component and total system capacities and overall system flow balancing;

(f) proper operation of interlocks and equipment protective devices;

(g) proper operation of permissive, prohibit, and bypass functions;

(h) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(i) the ability to maintain the specified positive or negative pressure(s) in the designated rooms and areas and to direct local and total air flow, including any potential leakage, relative to the anticipated contamination levels;

(j) the ability of exhaust, supply, and recirculation filter units to maintain the specified dust and contamination free environment(s);

(k) the ability of the control room habitability function to detect the presence of smoke and\or toxic gas and to remove or prevent in-leakage of such (in accordance with Reg Guide 1.95);

(l) proper operation of HEPA filters and charcoal adsorber sections, where utilized, including relative to the in-place testing requirements of Regulatory Guide 1.140 regarding visual inspections and airflow distribution, DOP penetration and bypass leakage testing;

(m) the ability of the heating and cooling coils to maintain the specified thermal environment(s) while considering the heat loads present during the preop test phase; and

(n) the ability of primary and secondary containment HVAC systems to provide

sufficient purge, exhaust, and recirculation flows in support of drywell inerting and deinerting operations.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.35 Atmospheric Control System Preoperational Test

(1) Purpose

sufficient purge, exhaust, and recirculation flows in support of drywell inerting and deinerting operations.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.35 Atmospheric Control System Preoperational Test

(1) Purpose

Insert a

proper system operating conditions and
System performance capability ~~shall be demonstrated~~ during
~~system~~ the following ~~test items~~ system operational tests:

* Capability of system operation at normal-run mode and emergency-run mode.
* Capability of automatic switch-over to the standby ~~system~~ supply/exhaust fan in response to the overload trip signal of the operating equipment.
* Start/Stop sequence of the supply/exhaust fans in ~~each~~ either manual or automatic modes of operations.
* Overall system flow balancing for all modes of operation.

sufficient purge, exhaust, and recirculation flows in support of drywell inerting and deinerting operations.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.35 Atmospheric Control System Preoperational Test

(1) Purpose

Electric power, instrument air system, HVAC system, high pressure nitrogen gas supply system, and standby gas treatment system are operational and available for use.

To verify the ability of the atmospheric control system (ACS) to establish and maintain the specified inert atmosphere in the primary containment during all expected plant conditions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The primary and secondary containments are intact, their HVAC systems operational, and all other required interfaces available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, ~~under expected operating conditions~~;

(d) proper nitrogen/air flow paths and flow rates both into and out of the primary containment;

(e) proper operation of interlocks and equipment protective devices;

(f) proper operation of permissive, prohibit, and bypass functions; and

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.36 Standby Gas Treatment System Preoperational Test

(1) Purpose

To verify the ability of the standby gas treatment system (SGTS) to establish and maintain a negative pressure within the secondary containment and to adequately filter the resultant exhaust air flow.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The primary and secondary containments are intact and the appropriate interfacing systems are available as required to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves and dampers, including timing, under expected operating conditions;

(d) proper operation of exhaust fans in all design operating modes;

(e) efficiency of HEPA filters and leak

(h) proper operation of the ACS system in providing nitrogen gas to pressurize through inlet line the PCV during containment structural integrity test (Subsection 14.2.12.1.40.2) and integrated leakage rate test (Subsection 14.2.12.1.40.

Insert A

(d) proper operating conditions and system performance capability during various modes of operations (inerting, makeup operation, venting, and de-inerting) in accordance with the appropriate ACS design specification.

To verify the ability of the atmospheric control system (ACS) to establish and maintain the specified inert atmosphere in the primary containment during all expected plant conditions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The primary and secondary containments are intact, their HVAC systems operational, and all other required interfaces available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper nitrogen/air flow paths and flow rates both into and out of the primary containment;

(e) proper operation of interlocks and equipment protective devices;

(f) proper operation of permissive, prohibit, and bypass functions; and

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.36 Standby Gas Treatment System Preoperational Test

(1) Purpose

To verify the ability of the standby gas treatment system (SGTS) to establish and maintain a negative pressure within the secondary containment and to adequately filter the resultant exhaust air flow.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The primary and secondary containments are intact and ~~the appropriate~~ interfacing systems are available as required to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms ~~used to monitor system operation and availability~~;

(c) proper operation of ~~system~~ valves and dampers, including timing, ~~under expected operating conditions~~;

(d) proper operation of exhaust fans in all design operating modes;

(e) efficiency of HEPA filters and leak

including operation of all components subject to interlocking, interlocking set value and operating logic.

tightness of charcoal adsorber section per Regulatory Guide 1.5;

(f) proper system and component flow paths and flow rates including overall system flow balance;

Insert a

(g) ability to maintain the specified negative pressure in the secondary containment;

Insert b

(h) proper operation of interlocks and equipment protective devices;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper operation of heaters, demister, and moisture seperator equipment; and

(k) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

Refer also to Subsection 6.5.1.4.1.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.37 Containment Isolation Valve Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment isolation valves are given in Subsection 6.2.6.3.

14.2.12.1.38 Containment Penetration Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment penetrations are given in Subsection 6.2.6.2.

14.2.12.1.39 Containment Airlock Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment airlocks are given in Subsection 6.2.6.2.

14.2.12.1.40.1 Containment Integrated Leakage Rate Test

Description of and criteria for containment integrated leakage rate tests are given in Subsection 6.2.6.1.

14.2.12.1.40.2 Containment Structural Integrity Test

Description of and criteria for the required containment structural inetgrity test is given in Suibsection 3.8.1.7.1.

14.2.12.1.41 Pressure Suppression Containment Bypass Leakage Tests

Test procedures are indentical to those used for other penetrations under isolation conditions as discussed in Subsection 6.2.6.2.

14.2.12.1.42 Containment Isolation Valve Functional and Closure Timing Tests

The containment isolation system is discussed in Subsection 6.2.4 with characteristics of and requirements for individual valves listed in Table 6.2-7. Preoperational functional and closure timing tests of valves performing containment isolation functions will be done as part of the testing of the systems to which such valves belong (see Table 6.2-7 for system affiliation of individual valves). Overall containment isolation initiation logic is a function of the leak detection and isolation system, the testing of which is described in Subsection 14.2.12.1.13.

14.2.12.1.43 Wetwell-to-Drywell Vacuum Breaker System Preoperational Test

(1) Purpose

To verify proper functioning of the wetwell-to-drywell vacuum breakers.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing.

Proper operation of the system in response to an automatic startup signal while on standby condition. By this test, it shall be confirmed that the system is practically operable in accordance with IBD and sequence diagram and that there are no difficulties in the system operat

Insert a

proper operating conditions and performance capability during following system operational tests :

(a) emergency operating mode test : the system shall be brought to the rated flow operating condition by starting SGTS exhaust fan and adjusting dryer train inlet valve in single loop and parallel loops operating. By this test, it shall be confirmed that stabilized continuous system operation is possible and that performance of SGTS exhaust fan and heating coil, as well as differential pressure of each filter meet appropriate SGTS equipment requirement specification.

(b) primary containment exhaust operating mode test: the system shall be operated to exhaust from primary containment by operating SGTS under the conditions where primary containment is not isolated. The items to be confirmed by this test is shall be the same as the emergency operating mode test.

SGTS

Insert b

ability to maintain air tightness of building structures forming reactor secondary containment and the openings and penetrations provided in those structures. This secondary containment leak rate test shall be performed by operating the SGTS with negative pressure maintained inside the building under reactor auxiliary building HVAC system isolated and idling. In addition, this test shall confirm that SGTS is operable without generating the alarm for high differential pressure between building and open air.

tightness of charcoal adsorber section per Regulatory Guide 1.5;

(f) proper system and component flow paths and flow rates including overall system flow balance;

(g) ability to maintain the specified negative pressure in the secondary containment;

(h) proper operation of interlocks and equipment protective devices;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper operation of heaters, demister, and moisture seperator equipment; and

(k) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

Refer also to Subsection 6.5.1.4.1.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.37 Containment Isolation Valve Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment isolation valves are given in Subsection 6.2.6.3.

14.2.12.1.38 Containment Penetration Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment penetrations are given in Subsection 6.2.6.2.

14.2.12.1.39 Containment Airlock Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment airlocks are given in Subsection 6.2.6.2.

14.2.12.1.40.1 Containment Integrated Leakage Rate Test

Description of and criteria for containment integrated leakage rate tests are given in Subsection 6.2.6.1.

14.2.12.1.40.2 Containment Structural Integrity Test

Description of and criteria for the required containment structural inetgrity test is given in Suibsection 3.8.1.7.1.

14.2.12.1.41 Pressure Suppression Containment Bypass Leakage Tests

Test procedures are indentical to those used for other penetrations under isolation conditions as discussed in Subsection 6.2.6.2.

14.2.12.1.42 Containment Isolation Valve Functional and Closure Timing Tests

The containment isolation system is discussed in Subsection 6.2.4 with characteristics of and requirements for individual valves listed in Table 6.2-7. Preoperational functional and closure timing tests of valves performing containment isolation functions will be done as part of the testing of the systems to which such valves belong (see Table 6.2-7 for system affiliation of individual valves). Overall containment isolation initiation logic is a function of the leak detection and isolation system, the testing of which is described in Subsection 14.2.12.1.13.

14.2.12.1.43 Wetwell-to-Drywell Vacuum Breaker System Preoperational Test

(1) Purpose

To verify proper functioning of the wetwell-to-drywell vacuum breakers.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing.

Insert A

14.2.12.1.42.2 Safety-related Motor-operated Valves Baseline Pre-service Tests.

The motor-operated valve (MOV) testing under various differential pressure and flow up to maximum achievable conditions is discussed in Subsection 3.9.6.2.2. This type of testing is to determine the torque and thrust requirements of the valves at design conditions. Baseline pre-service testing (see Subsection 3.9.7.3) of the safety-related MOVs will be done as part of the system operational tests of the systems to which such valves belong during the pre-operational test stage.

tightness of charcoal adsorber section per Regulatory Guide 1.5;

(f) proper system and component flow paths and flow rates including overall system flow balance;

(g) ability to maintain the specified negative pressure in the secondary containment;

(h) proper operation of interlocks and equipment protective devices;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper operation of heaters, demister, and moisture seperator equipment; and

(k) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

Refer also to Subsection 6.5.1.4.1.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.37 Containment Isolation Valve Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment isolation valves are given in Subsection 6.2.6.3.

14.2.12.1.38 Containment Penetration Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment penetrations are given in Subsection 6.2.6.2.

14.2.12.1.39 Containment Airlock Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment airlocks are given in Subsection 6.2.6.2.

14.2.12.1.40.1 Containment Integrated Leakage Rate Test

Description of and criteria for containment integrated leakage rate tests are given in Subsection 6.2.6.1.

14.2.12.1.40.2 Containment Structural Integrity Test

Description of and criteria for the required containment structural inetgrity test is given in Suibsection 3.8.1.7.1.

14.2.12.1.41 Pressure Suppression Containment Bypass Leakage Tests

Test procedures are indentical to those used for other penetrations under isolation conditions as discussed in Subsection 6.2.6.2.

14.2.12.1.42 Containment Isolation Valve Functional and Closure Timing Tests

The containment isolation system is discussed in Subsection 6.2.4 with characteristics of and requirements for individual valves listed in Table 6.2-7. Preoperational functional and closure timing tests of valves performing containment isolation functions will be done as part of the testing of the systems to which such valves belong (see Table 6.2-7 for system affiliation of individual valves). Overall containment isolation initiation logic is a function of the leak detection and isolation system, the testing of which is described in Subsection 14.2.12.1.13.

14.2.12.1.43 Wetwell-to-Drywell Vacuum Breaker System Preoperational Test

(1) Purpose

To verify proper functioning of the wetwell-to-drywell vacuum breakers.

(2) Prerequisites

The ~~construction tests~~ have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing.

system (WDVBS)

Insert I

inspection of major mechanical component associated with the WDVBS

Insert 1

Additionally, prerequisites, include but is not limited to the following, must be completed prior to the test:

(a) All permanently installed instrumentation have been calibrated and adjusted to the values specified in the applicable design documents.

(b) Facilities are provided in the support chamber airspace to facilitate removal and servicing of the WDVBS valve internals, if required.

(c) Pneumatic sources are available for performing the valve leak tightness test.

(d) Interfacing system such as Flammability Control System (FCS) is available and operational to support testing, as required.

(e) Appropriate power sources to supply electrical power to all instrumentation are available for use.

power conditions

(c) proper functioning of valve positive closure devices including verification of adequate valve leak tightness; and

(d) proper functioning of vacuum breaker test features.

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.44 Primary Containment Monitoring Instrumentation Preoperational Test

(1) Purpose

To verify the proper operation of instrumentation used for long term monitoring of the drywell and wetwell atmospheres and suppression pool temperature and level during both normal operations and accident conditions in the primary containment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The suppression pool shall be filled and expected to undergo measurable level and temperature changes at some point during the scheduled testing. The required interfacing systems and components are available, as needed, to support the specified testing. Additionally, any parallel testing to be performed in conjunction with the testing of this subsection is appropriately scheduled.

(3) General Test Methods and Acceptance Criteria

A description of the instrumentation required for containment monitoring is presented in Subsection 6.2.1.7. Preoperational testing of these instruments will be performed in conjunction with the testing of the applic- able systems. Only that instrumentation requiring special considerations is discus- sed below.

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

(a) proper tracking of drywell pressure by all instrument channels during containment integrated leak rate testing (see Subsection 1A.2.4);

(b) proper response of all suppression pool level instrumentation during actual changes in pool level;

(c) proper tracking by all suppression pool temperature instrument channels of an actual change in pool temperature;

(d) proper functioning of associated indicators, recorders, annunciators, and alarms including those monitoring instrumentation status; and

(e) proper system trips in response to the appropriate high and/or low setpoints and inoperative conditions.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.45 Electrical Systems Preoperational Test

The total plant electrical distribution network is described in Chapter 8 and is comprised of the following systems:

(1) unit auxillary AC power system;
(2) unit Class 1E AC power system;
(3) safety system logic and control system power system;
(4) instrument power system;
(5) uninterruptible power system;
(6) unit auxillary DC power system; and
(7) unit class 1E DC power system.

Because of the similarities in their design and function, the testing requirements for these systems, and their respective components, can be divided into the four general categories as described below. The specific testing required for each system is described in the applicable design and testing specifications.

Insert a

(e) proper outputs to all system components that are required to function upon receiving inputs from the PAMS instruments at the prescribed high/low setpoints and inoperative conditions.

(f) proper signal processing of the PAMS related instrumentation by the microprocessor as specified by the appropriate design specification.

(g) proper operation of drywell and wetwell air temperature and pressure monitoring subsystem instrumentation.

14.2.12.1.45.1 DC Power Supply System Preoperational Test

(1) Purpose

To verify the ability of DC power supply systems to supply highly reliable, uninterruptable power for instrumentation, logic, control, lighting and other normal and emergency loads that must remain operational during and after a loss of AC power.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedures and has approved the initiation of testing. All interfacing systems and equipment required to support system operation shall be available, as needed, for the specified testing configurations.

(3) General Test Methods and Acceptance Criteria

The DC power supply systems consist of essential and nonessential equipment, including batteries, battery chargers, inverters, static transfer switches, and associated instrumentation and alarms, that is used to supply both normal and emergency loads. Performance shall be observed and recorded during a series of individual component and integrated systems tests to demonstrate the following:

(a) capability of each battery bank to supply its design load for the specified time without the voltage dropping below minimum battery or cell limits;

(b) capability of each battery charger to fully recharge its associated battery (or bank), from the discharged state, within the specified time while simultaneously supplying the specified loads;

(c) verification that actual loading of each DC bus is consistent with battery sizing assumptions;

(d) verification that each DC bus meets the specified level of redundancy and electrical independence for its particular application;

(e) proper functioning of transfer devices, breakers, cables and inverters (including load capability);

(f) proper calibration and trip settings of protective devices, including relaying, and proper operation of permissive and prohibit interlocks;

(g) proper operation of instrumentation and alarms associated with under voltage, over voltage, and ground conditions; and

(h) proper operation of emergency DC lighting, including capacity of self contained batteries.

14.2.12.1.45.2 Emergency AC Power Distribution System Preoperational Test

(1) Purpose

To verify the ability of the Class 1E AC power distribution system to provide both manual and fully automatic means for supplying and regulating AC power to safety equipment, from both offsite and onsite sources, via independent distribution subsystems for each redundant Class 1E load group.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All interfacing systems and equipment required to support system operation shall be available, as needed, for the specified testing configurations.

(3) General Test Methods and Acceptance Criteria

The Class 1E AC power distribution system is comprised of the equipment required for transformation, conversion, and regulation of voltage to the essential busses, the switchgear and motor control required for the individual loads served, and the coordinated system protective relaying. Performance shall be observed and recorded during

Insert h

All the permanently installed instrumentation shall have been properly calibrated and operational. The fire protection system shall be available. Adequate ventilation shall be available for the battery rooms. All DC emergency lighting shall be available. DC to AC inverters shall be available and operational. The 480VAC system shall be in operation and supply power to the battery chargers for the 125VDC safety related loads. Additionally a load shall be available for the performance of battery capacity check tests.

14.2.12.1.45.1 DC Power Supply System Preoperational Test

(1) Purpose

To verify the ability of DC power supply systems to supply highly reliable, uninterruptable power for instrumentation, logic, control, lighting and other normal and emergency loads that must remain operational during and after a loss of AC power.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedures and has approved the initiation of testing. All interfacing systems and equipment required to support system operation shall be available, as needed, for the specified testing configurations.

(3) General Test Methods and Acceptance Criteria

The DC power supply systems consist of essential and nonessential equipment, including batteries, battery chargers, inverters, static transfer switches, and associated instrumentation and alarms, that is used to supply both normal and emergency loads. Performance shall be observed and recorded during a series of individual component and integrated systems tests to demonstrate the following:

(a) capability of each battery bank to supply its design load for the specified time without the voltage dropping below minimum battery or cell limits;

(b) capability of each battery charger to fully recharge its associated battery (or bank), from the discharged state, within the specified time while simultaneously supplying the specified loads;

(c) verification that actual loading of each DC bus is consistent with battery sizing assumptions;

(d) verification that each DC bus meets the specified level of redundancy and electrical independence for its particular application;

(e) proper functioning of transfer devices, breakers, cables and inverters (including load capability);

(f) proper calibration and trip settings of protective devices, including relaying, and proper operation of permissive and prohibit interlocks;

(g) proper operation of instrumentation and alarms associated with under voltage, over voltage, and ground conditions; and

(h) proper operation of emergency DC lighting, including capacity of self contained batteries.

14.2.12.1.45.2 Emergency AC Power Distribution System Preoperational Test

(1) Purpose

To verify the ability of the Class 1E AC power distribution system to provide both manual and fully automatic means for supplying and regulating AC power to safety equipment, from both offsite and onsite sources, via independent distribution subsystems for each redundant Class 1E load group.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All interfacing systems and equipment required to support system operation shall be available, as needed, for the specified testing configurations.

Insert a

(3) General Test Methods and Acceptance Criteria

The Class 1E AC power distribution system is comprised of the equipment required for transformation, conversion, and regulation of voltage to the essential busses, the switchgear and motor control required for the individual loads served, and the coordinated system protective relaying. Performance shall be observed and recorded during

a series of individual component and integrated system tests to demonstrate the following:

(a) proper operation of initiating, transfer, and trip devices;

(b) proper operation of relaying and logic, including load shedding features;

(c) proper operation of equipment protective devices, including permissive and prohibit interlocks;

(d) proper operation of instrumentation and alarms used to monitor system and equipment status (including availability);

(e) proper operation and load carrying capability of breakers, motor controllers, switchgear, transformers, and cables;

(f) that a sufficient level of redundancy and electrical independence exists as specified for each application;

(g) the capability to transfer between onsite and offsite power sources as per design;

(h) the ability of emergency and vital loads to start in the proper sequence and to operate properly under simulated accident conditions, while powered from either preferred or standby sources, and over the specified range of available bus voltage; and

(i) the adequacy of the plant emergency and essential lighting systems.

14.2.12.1.45.3 Emergency Diesel Generator Preoperational Test

(1) Purpose

To demonstrate the capability of the emergency diesel generators to provide highly reliable emergency electrical power during normal and simulated accident conditions when normal offsite power sources are unavailable, and to demonstrate the operability of the diesel generator auxiliary systems, e.g., diesel fuel oil transfer, diesel-generator starting air supply, jacket water, and lube oil.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All interfacing systems and equipment required to support system operation shall be available, as needed, for the specified testing configuration. Additionaly, sufficient diesel fuel shall be available, on site or readily accessible, site to perform the scheduled tests.

(3) General Test Methods and Acceptance Criteria

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

(a) proper automatic startup and operation of the diesel generators upon simulated loss of a-c voltage and attainment of the required frequency and voltage within the specified time limits;

(b) proper response and operation for design-basis accident loading sequence to design-basis load requirements, and verification that voltage and frequency are maintained within specified limits;

(c) proper operation of the diesel generators during load shedding, load sequencing, and load rejection, including a test of the loss of the largest single load and of the complete loss of load, verifying that voltage and frequency are maintained within design limits and that overspeed limits are not exceeded;

(d) that a LOCA signal will block generator breaker or field tripping by all protective relays except for the generator phase differential current and engine overspeed relays;

(e) that a LOCA signal will initiate termination of parallel operations (test or manual transfer) and that the diesel

EAC

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Appropriate 125 VDC control power sources shall be available and supply power to all local and control room controls and protective devices related to this test. 6.9 kV class 1E buses shall be available to energize the 480 V class 1E load centers and 27 kV power shall also be available for use. All loads that can not be cycled shall be removed and supplied with temporary power prior to this test. Adequate ventilation shall be available for switchgear and battery rooms and diesel-generator area. The portion of fire protection system covering the emergency areas AC power distribution system shall be available and operational. Additionally, emergency diesel-generators with their auxiliary systems (i.e., fuel oil storage and transfer, jacket cooling water, starting air, lubrication and combustion air intake and exhaust) shall be available for this test.

a series of individual component and integrated system tests to demonstrate the following:

(a) proper operation of initiating, transfer, and trip devices;

(b) proper operation of relaying and logic, including load shedding features;

(c) proper operation of equipment protective devices, including permissive and prohibit interlocks;

(d) proper operation of instrumentation and alarms used to monitor system and equipment status (including availability);

(e) proper operation and load carrying capability of breakers, motor controllers, switchgear, transformers, and cables;

(f) that a sufficient level of redundancy and electrical independence exists as specified for each application;

(g) the capability to transfer between onsite and offsite power sources as per design;

(h) the ability of emergency and vital loads to start in the proper sequence and to operate properly under simulated accident conditions, while powered from either preferred or standby sources, and over the specified range of available bus voltage; and

(i) the adequacy of the plant emergency and essential lighting systems.

14.2.12.1.45.3 Emergency Diesel Generator Preoperational Test

(1) Purpose

To demonstrate the capability of the emergency diesel generators to provide highly reliable emergency electrical power during normal and simulated accident conditions when normal offsite power sources are unavailable, and to demonstrate the operability of the diesel generator auxiliary systems, e.g., diesel fuel oil transfer, diesel-generator starting air supply, jacket water, and lube oil.

(2) Prerequisites

Invert a)

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All interfacing systems and equipment required to support system operation shall be available, as needed, for the specified testing configuration. Additionaly, sufficient diesel fuel shall be available, on site or readily accessible, site to perform the scheduled tests.

(3) General Test Methods and Acceptance Criteria

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

(a) proper automatic startup and operation of the diesel generators upon simulated loss of a-c voltage and attainment of the required frequency and voltage within the specified time limits;

(b) proper response and operation for design-basis accident loading sequence to design-basis load requirements, and verification that voltage and frequency are maintained within specified limits;

(c) proper operation of the diesel generators during load shedding, load sequencing, and load rejection, including a test of the loss of the largest single load and of the complete loss of load, verifying that voltage and frequency are maintained within design limits and that overspeed limits are not exceeded;

(d) that a LOCA signal will block generator breaker or field tripping by all protective relays except for the generator phase differential current and engine overspeed relays;

(e) that a LOCA signal will initiate termination of parallel operations (test or manual transfer) and that the diesel

generator will continue to run unloaded and available;

(f) that the engine speed governor and the generator voltage regulator automatically return to an isochronous (constant speed) mode of operation upon initiation of a LOCA signal;

(g) full-load carrying capability of the diesel generators for a period of not less than 24 hours, of which 22 hours are at a load equivalent to the continuous rating of the diesel generator and 2 hours are at the 2-hour load rating as described in Reg Guide 1.108 including verification that the diesel cooling systems function within design limits, and the diesel generator HVAC system maintains the diesel generator room within design limits;

(h) functional capability at operating temperature conditions by reperforming the tests in (a) and (b) above immediately after completion of the 24-hour load test per (g) above;

(i) the ability to synchronize the diesel generators with offsite power while connected to the emergency load, transfer the load from the diesel generators to the offsite power, isolate the diesel generators, and restore them to standby status;

(j) that the rate of fuel consumption and the operation of any fuel oil supply pumping or transfer devices, while operating at the design-basis accident load, are such that the requirements for 7-day storage inventory are met for each diesel generator;

(k) that all permissive and prohibit interlocks, controls, and alarms (both local and remote) operate in accordance with design specifications;

(l) acceptable diesel generator reliability during starting and loading sequences as described in Reg. Guide 1.108;

(m) proper operation and correct setpoints for initiating and trip devices and verification of system logic not tested otherwise; and

(n) proper operation of auxiliary systems such as those used for starting, cooling, heating, ventilating, lubricating, and fueling the diesel generators.

14.2.12.1.45.4 Normal AC Power Distribution System Preoperational Test

(1) Purpose

To verify the ability of the normal AC power distribution system to provide a means for supplying AC power to nonessential equipment, from both onsite and offsite sources, via the appropriate distribution network(s).

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All interfacing systems and equipment required to support system operation shall be available, as needed, for the specified testing configurations.

(3) General Test Methods and Acceptance Criteria

The normal AC power distribution system is comprised of the equipment used for transformation, conversion, regulation, and distribution of voltage to plant nonessential equipment during normal operation. Performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper operation of initiating, transfer, and trip devices;

(b) proper operation of relaying and logic, including load shedding features;

(c) proper operation of equipment protective devices, including permissive and prohibit interlocks;

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All the necessary permanently installed instrumentation shall have been properly calibrated and operational. Appropriate electrical power sources, reactor building cooling water system, pneumatic sources, diesel-generator area ventilation system, and the portion of fire protection system covering the diesel-generator area shall be available for use. The ECC systems shall be available for operation as applicable to the diesel-generator under test.

EDG.

Insert b

(n) that the diesel-generator fuel oil transfer pumps start and stop automatically in response to a day tank low level and high level signal respectively.

(o) that the ~~the~~ diesel-generator can be started from minimum design starting air pressure and the air starting system has sufficient capacity for cranking the engine for prescribed number of automatic or manual starts without recharging as specified by Subsection 9.5.6.

(p) that the diesel-generator jacket cooling water system functions properly to maintain engine temperatures within design limits in both standby mode and normal mode of operation as specified by Subsection 9.5.5.

(q) that the diesel-generator lubrication system functions properly to supply clean, filtered oil to the engine and generator bearing surfaces at controlled pressure and temperature during normal operation and maintain sufficient circulation of warm oil at prescribed temperature when engine is in a standby condition as specified by Subsection 9.5.7.

for the individual component associated with the normal AC power distribution system

generator will continue to run unloaded and available;

(f) that the engine speed governor and the generator voltage regulator automatically return to an isochronous (constant speed) mode of operation upon initiation of a LOCA signal;

(g) full-load carrying capability of the diesel generators for a period of not less than 24 hours, of which 22 hours are at a load equivalent to the continuous rating of the diesel generator and 2 hours are at the 2-hour load rating as described in Reg Guide 1.108 including verification that the diesel cooling systems function within design limits, and the diesel generator HVAC system maintains the diesel generator room within design limits;

(h) functional capability at operating temperature conditions by reperforming the tests in (a) and (b) above immediately after completion of the 24-hour load test per (g) above;

(i) the ability to synchronize the diesel generators with offsite power while connected to the emergency load, transfer the load from the diesel generators to the offsite power, isolate the diesel generators, and restore them to standby status;

(j) that the rate of fuel consumption and the operation of any fuel oil supply pumping or transfer devices, while operating at the design-basis accident load, are such that the requirements for 7-day storage inventory are met for each diesel generator;

(k) that all permissive and prohibit interlocks, controls, and alarms (both local and remote) operate in accordance with design specifications;

(l) acceptable diesel generator reliability during starting and loading sequences as described in Reg. Guide 1.108;

(m) proper operation and correct setpoints for initiating and trip devices and verification of system logic not tested otherwise; and

(n) proper operation of auxiliary systems such as those used for starting, cooling, heating, ventilating, lubricating, and fueling the diesel generators.

14.2.12.1.45.4 Normal AC Power Distribution System Preoperational Test

(1) Purpose

To verify the ability of the normal AC power distribution system to provide a means for supplying AC power to nonessential equipment, from both onsite and offsite sources, via the appropriate distribution network(s).

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All interfacing systems and equipment required to support system operation shall be available, as needed, for the specified testing configurations.

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(3) General Test Methods and Acceptance Criteria

The normal AC power distribution system is comprised of the equipment used for transformation, conversion, regulation, and distribution of voltage to plant nonessential equipment during normal operation. Performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper operation of initiating, transfer, and trip devices;

(b) proper operation of relaying and logic, including load shedding features;

(c) proper operation of equipment protective devices, including permissive and prohibit interlocks;

This test shall demonstrate that the normal AC power systems operate properly as specified by Subsection 8.3.1.

(h) that bus voltage fluctuation shall not exceed the value specified by plant design specification for electrical equipment

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

(e) proper operation and load carrying capability of breakers, motor controllers, switchgear, transformers, and cables;

(f) sufficient level of redundancy and electrical independence as specified for each application; and

(g) the capability to transfer between onsite and offsite power sources as per design.

Performance of each of the various plant electrical systems is considered acceptable when the testing described above demonstrates that the requirements of the applicable design and testing specifications have been met.

14.2.12.1.46 Integrated ECCS Loss of Offsite Power (LOP)/LOCA Preoperational Test

(1) Purpose

To verify the proper integrated ECCS and plant electrical system response to a simulated LOP/LOCA condition and to verify the independence of the redundant onsite divisional power sources and their associated load groups.

(2) Prerequisites

The preoperational tests of the plant electrical system, including diesel generators, and the ECCS and related auxiliary systems, have been successfully completed. The reactor vessel shall be ready to accept design ECCS injection flow, all ECCS pumps shall have an adequate suction source, the diesel generators shall have sufficient fuel available, and essential DC power shall be available. All other required systems shall also be available, as needed, to support the specified integrated testing.

(3) General Test Methods and Acceptance Criteria

For each combination of divisional load groups, two at a time (A and B, B and C, A and C), with the other divisional load group completely isolated from both onsite and offsite power sources (including DC sources), simulate a divisional bus under-voltage condition (LOP) followed immediately by a LOCA signal and verify the following:

(a) that the appropriate divisional diesel generators automatically start, reach rated speed and voltage, and connect to their respective divisional buses according to design and within the specified time;

(b) that all relaying and interlocks related to the LOP/LOCA condition operate properly including the specified shedding and sequencing of sources and loads;

(c) that all divisional loads operate as designed in response to the LOP/LOCA condition, including establishment of the appropriate divisional ECCS flow to the vessel within the specified time; and

(d) that all loads and electrical busses associated with the isolated divisional load group remain deenergized.

The test of each combination shall be of sufficient duration to allow establishment of stable operating conditions such that any adverse conditions which might result from improper load group assignment (e.g., lack of forced cooling of a vital component or system) would be detected.

After the proper response of each divisional combination has been separately demonstrated the integrated response of all ECCS and electrical divisions shall be demonstrated by simulating a complete loss of offsite power and LOCA condition and then verifying items (a) through (d) above for all three diesel generators and load groups as they respond and operate simultaneously.

Performance is acceptable when the above testing demonstrates that the applicable design specifications have been met.

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All the necessary permanently installed instrumentation shall have been properly calibrated and operational. Appropriate electrical power sources shall be available for remote control, parameter information and annunciators associated with the normal AC power distribution system. Adequate ventilation to both switchgear and battery rooms shall be available and operational. The portion of ~~the~~ fire protection ~~s~~ system covering the normal AC power distribution system areas shall be available for use. Additionally, the plant AC power distribution system (27 KV, 6.9 KV, 480 V and 120 V power) shall be loaded prior to this test.

RHR system, HPCF system, diesel generator area ventilation system, switchgear and battery room ventilation systems, reactor building cooling water system and fire protection system shall be available for use.

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

(e) proper operation and load carrying capability of breakers, motor controllers, switchgear, transformers, and cables;

(f) sufficient level of redundancy and electrical independence as specified for each application; and

(g) the capability to transfer between onsite and offsite power sources as per design.

Performance of each of the various plant electrical systems is considered acceptable when the testing described above demonstrates that the requirements of the applicable design and testing specifications have been met.

14.2.12.1.46 Integrated ECCS Loss of Offsite Power (LOP)/LOCA Preoperational Test

(1) Purpose

To verify the proper integrated ECCS and plant electrical system response to a simulated LOP/LOCA condition and to verify the independence of the redundant onsite divisional power sources and their associated load groups.

Plant Class 1E buses loaded with their normal plant demands.

(2) Prerequisites

The preoperational tests of the plant electrical system, including diesel generators, and the ECCS and related auxiliary systems, have been successfully completed. The reactor vessel shall be ready to accept design ECCS injection flow, all ECCS pumps shall have an adequate suction source, the diesel generators shall have sufficient fuel available, and essential DC power shall be available. All other required systems shall also be available, as needed, to support the specified integrated testing.

(3) General Test Methods and Acceptance Criteria

For each combination of divisional load groups, two at a time (A and B, B and C, A and C), with the other divisional load group completely isolated from both onsite and offsite power sources (including DC sources), simulate a divisional bus under-voltage condition (LOP) followed immediately by a LOCA signal and verify the following:

(a) that the appropriate divisional diesel generators automatically start, reach rated speed and voltage, and connect to their respective divisional buses according to design and within the specified time; source transfer and reenergization operation

(b) that all relaying and interlocks related to the LOP/LOCA condition operate properly including the specified shedding and sequencing of ~~buses and~~ loads;

(c) that all divisional loads operate as designed in response to the LOP/LOCA condition, including establishment of the appropriate divisional ECCS flow to the vessel within the specified time; and

(d) ~~that all loads and electrical busses associated with the isolated divisional load group remain deenergized.~~

The test of each combination shall be of sufficient duration to allow establishment of stable operating conditions such that any adverse conditions which might result from improper load group assignment (e.g., lack of forced cooling of a vital component or system) would be detected.

After the proper response of each divisional combination has been separately demonstrated the integrated response of all ECCS and electrical divisions shall be demonstrated by simulating a complete loss of offsite power and LOCA condition and then verifying items (a) through (d) above for all three diesel generators and load groups as they respond and operate simultaneously.

Performance is acceptable when the above testing demonstrates that the applicable design specifications have been met.

Additionally, all permanently installed instrumentation shall have been properly calibrated and operable. All test instrumentation shall also be available and properly calibrated.

that independance of redundant Class 1E power sources and load groups exists.

14.2.12.1.47 Plant Communications System Preoperational Test

(1) Purpose

To verify the proper operation and adequacy of all plant communications systems and methods that will be used during normal and abnormal operations including those needed to carry out the plant emergency plan.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Initial system and component settings (gains, volumes, etc.) shall be consistent with expectations of the acoustic environment and background noise levels for each location and for all modes of operation.

(3) General Test Methods and Acceptance Criteria

The communications systems to be tested include the plant PA system, all hardwired systems within the plant, portable radio systems to be used within the plant boundary, normal and dedicated communications links to outside agencies, and the plant emergency alarms. Performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper functioning of all transmitters and receivers without excessive interference levels;

(b) proper operation of all controls, switches, and interfaces including silencing and muting features;

(c) proper isolation and independence of various channels and systems;

(d) proper operation of systems under multiple user and fully loaded conditions as per design;

(e) proper operation of plant emergency alarms;

(f) audibility of speakers and receivers under anticipated background noise levels;

(g) the ability to establish the required communications with outside agencies, and

(h) proper functioning of dedicated use systems and of those systems expected to function under abnormal conditions such as loss of electrical power or shutdown from outside the control room scenarios.

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.48 Fire Protection System Preoperational Test

(1) Purpose

To verify the ability of the fire protection system to detect and alarm the presence of combustion, smoke or fire within the plant and to initiate the appropriate suppression systems or devices.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The required electrical power and make-up water sources, and other appropriate interfaces and support systems, are available as needed for the specified testing.

(3) General Test Methods and Acceptance Criteria

The fire protection system is but one part of the overall fire protection program. This program is the integrated effort involving components, procedures, and personnel utilized in carrying out all activities of fire protection, in accordance with Criterion 3 of 10CFR50, Appendix A. It includes systems and components, facility design, fire prevention, detection, annunciation, confinement, suppression, adminis-

14.2.12.1.47 Plant Communications System Preoperational Test

(1) Purpose

To verify the proper operation and adequacy of all plant communications systems and methods that will be used during normal and abnormal operations including those needed to carry out the plant emergency plan.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Initial system and component settings (gains, volumes, etc.) shall be consistent with expectations of the acoustic environment and background noise levels for each location and for all modes of operation.

(3) General Test Methods and Acceptance Criteria

The communications systems to be tested include the plant PA system, all hardwired systems within the plant, portable radio systems to be used within the plant boundary, normal and dedicated communications links to outside agencies, and the plant emergency alarms. Performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper functioning of all transmitters and receivers without excessive interference levels;

(b) proper operation of all controls, switches, and interfaces including silencing and muting features;

(c) proper isolation and independence of various channels and systems;

(d) proper operation of systems under multiple user and fully loaded conditions as per design;

(e) proper operation of plant emergency alarms;

(f) audibility of speakers and receivers under anticipated background noise levels;

(g) the ability to establish the required communications with outside agencies; and

(h) proper functioning of dedicated use systems and of those systems expected to function under abnormal conditions such as loss of electrical power or shutdown from outside the control room scenarios.

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.48 Fire Protection System Preoperational Test

(1) Purpose

To verify the ability of the fire protection system to detect and alarm the presence of combustion, smoke or fire within the plant and to initiate the appropriate suppression systems or devices.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The required electrical power and make-up water sources, and other appropriate interfaces and support systems, are available as needed for the specified testing.

(3) General Test Methods and Acceptance Criteria

The fire protection system is but one part of the overall fire protection program. This program is the integrated effort involving components, procedures, and personnel utilized in carrying out all activities of fire protection, in accordance with Criterion 3 of 10CFR50, Appendix A. It includes systems and components, facility design, fire prevention, detection, annunciation, confinement, suppression, adminis-

trative controls, fire brigade organization, training, quality assurance, inspection, testing, and maintenance. The fire protection program begins with the initial design of all plant systems and equipment and of the buildings and structures in which they are located. A detailed analysis is then performed on this design to identify, qualify, and quantify all potential fire hazards, and their consequences, within the plant. Specific fire protection equipment is then added, where needed, when individual component design and features such as physical separation, walls, doors, and other barriers and passive devices, do not completely fulfill the requirements of the fire protection program.

The majority of the effort involved in demonstrating that the requirements of the overall fire protection program are met will be through analysis and documentation. Preoperational testing of the fire protection system will mainly be limited to the equipment and facilities designed for the detection, annunciation, and suppression of fires. This testing shall include the following demonstrations:

(a) proper operation of instrumentation and equipment in all combinations of logic and control;

(b) proper functioning of prohibit and permissive interlocks and equipment protective devices;

(c) proper operation of system valves, pumps, and motors under expected operating conditions;

(d) proper system and component flow paths, flow rates and capacities;

(e) proper operation of water based suppression systems such as spray, sprinkler, deluge, and hose devices and of other suppression systems such as those utilizing halon, carbon dioxide, dry chemical, and foam, including both manually and automatically actuated systems;

proper operation of freeze protection devices, if applicable;

(g) proper functioning of smoke, heat and flame detection devices;

(b) proper operation of both local and remote alarms including those interfacing with outside agencies; and

(i) proper operation of primary and secondary electrical power sources including fire protection system diesel generators.

System operation is considered acceptable when the observed and measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.49 Radioactive Liquid Drainage and Transfer Systems Preoperational Tests

(1) Purpose

To verify the proper operation of the various equipment and pathways which make up the radioactive liquid drainage and transfer system within the Nuclear Island.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. An adequate supply of demineralized water, the necessary electrical power, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The testing described below consists of that of the equipment and pathways for the drainage and transfer of radioactive and potentially radioactive liquids within the plant. Also included are dedicated systems for the handling of liquids that require special collection and disposal considerations such as detergents.

Performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the

trative controls, fire brigade organization, training, quality assurance, inspection, testing, and maintenance. The fire protection program begins with the initial design of all plant systems and equipment and of the buildings and structures in which they are located. A detailed analysis is then performed on this design to identify, qualify, and quantify all potential fire hazards, and their consequences, within the plant. Specific fire protection equipment is then added, where needed, when individual component design and features such as physical separation, walls, doors, and other barriers and passive devices, do not completely fulfill the requirements of the fire protection program.

The majority of the effort involved in demonstrating that the requirements of the overall fire protection program are met will be through analysis and documentation. Preoperational testing of the fire protection system will mainly be limited to the equipment and facilities designed for the detection, annunciation, and suppression of fires. This testing shall include the following demonstrations:

(a) proper operation of instrumentation and equipment in all combinations of logic and control;

(b) proper functioning of prohibit and permissive interlocks and equipment protective devices;

(c) proper operation of system valves, pumps, and motors under expected operating conditions;

(d) proper system and component flow paths, flow rates and capacities;

(e) proper operation of water based suppression systems such as spray, sprinkler, deluge, and hose devices and of other suppression systems such as those utilizing halon, carbon dioxide, foams and dry chemicals, including both manually and automatically actuated systems;

(f) proper operation of freeze protection devices, if applicable;

(g) proper functioning of smoke, heat and flame detection devices;

(h) proper operation of both local and remote alarms including those interfacing with outside agencies; and

(i) proper operation of primary and secondary electrical power sources including fire protection system diesel generators.

System operation is considered acceptable when the observed and measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.49 Radioactive Liquid Drainage and Transfer Systems Preoperational Tests

(1) Purpose

To verify the proper operation of the various equipment and pathways which make up the radioactive liquid drainage and transfer system within the Nuclear Island.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. An adequate supply of demineralized water, the necessary electrical power, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The testing described below consists of that of the equipment and pathways for the drainage and transfer of radioactive and potentially radioactive liquids within the plant. Also included are dedicated systems for the handling of liquids that require special collection and disposal considerations such as detergents.

Performance shall be observed and recorded during a series of individual component and integrated system tests, to demonstrate

(a) proper operation of equipment controls, and logic including prohibit and permissive interlocks;

(b) proper operation of equipment protective features and automatic isolation functions;

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

(d) acceptable system and component flow paths and flow rates including pump capacities and sump or tank volumes;

(e) proper operation of system pumps, valves, and motors under expected operating conditions;

(f) proper functioning of drains and sumps including those dedicated for handling of specific agents such as detergents; and

(g) proper calibration and operation of radiation detectors and monitors.

System operation is considered acceptable when the observed and measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.50 Fuel-Handling and Reactor Component Servicing Equipment Preoperational Test

(1) Purpose

To verify proper operation of the fuel handling and reactor component servicing equipment. This includes cranes, hoists, grapples, trolleys, platforms, hand tools, viewing aids, and other equipment used to lift, transport, or otherwise manipulate fuel, control rods, neutron instrumentation, and other in-vessel, under-vessel, and drywell components. Also included is equipment needed to lift and relocate structures and components necessary to provide access to fuel, vessel internals, and reactor components during the refueling and servicing operations.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The required electrical power sources and sufficient lighting shall be available under-vessel, in the drywell, and on the refueling floor. The refueling floor (including the upper pools and reactor cavity) and drywell and under-vessel areas shall be capable of supporting load and travel testing of the various cranes, bridges, and hoists. Other interfacing systems shall be available as required to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Fuel handling and reactor component servicing equipment testing described herein includes that of the reactor building crane, refueling bridge, auxiliary platform, and the associated hoists and grapples, as well as other lifting and rigging devices. Also included are specialized hand tools and viewing aids. Fuel pool cooling and cleanup functions are tested as described in Subsection 14.2.12.1.21. The HVAC systems serving the refueling floor and drywell are tested as described in Subsection 14.2.12.1.34.

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

(a) proper operation for each crane, bridge, trolley, or platform through its full travel and at up to its maximum speed including verification of braking action and overspeed or overtravel protection devices;

(b) proper operation of the various cables, grapples, and hoists including brakes, limit switches, load cells, and other equipment protective devices;

following:

(a) proper operation of equipment controls and logic including prohibit and permissive interlocks;

(b) proper operation of equipment protective features and automatic isolation functions;

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

(d) acceptable system and component flow paths and flow rates including pump capacities and sump or tank volumes;

(e) proper operation of system pumps, valves, and motors under expected operating conditions;

(f) proper functioning of drains and sumps including those dedicated for handling of specific agents such as detergents; and

(g) proper calibration and operation of radiation detectors and monitors.

System operation is considered acceptable when the observed and measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.50 Fuel-Handling and Reactor Component Servicing Equipment Preoperational Test

(1) Purpose

To verify proper operation of the fuel handling and reactor component servicing equipment. This includes cranes, hoists, grapples, trolleys, platforms, hand tools, viewing aids, and other equipment used to lift, transport, or otherwise manipulate fuel, control rods, neutron instrumentation, and other in-vessel, under-vessel, and dry-well components. Also included is equipment needed to lift and relocate structures and components necessary to provide access to fuel, vessel internals, and reactor components during the refueling and servicing operations.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The required electrical power sources and sufficient lighting shall be available under-vessel, in the drywell, and on the refueling floor. The refueling floor (including the upper pools and reactor cavity) and drywell and under-vessel areas shall be capable of supporting load and travel testing of the various cranes, bridges, and hoists. Other interfacing systems shall be available as required to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Fuel handling and reactor component servicing equipment testing described herein includes that of the reactor building crane, refueling bridge, auxiliary platform, and the associated hoists and grapples, as well as other lifting and rigging devices. Also included are specialized hand tools and viewing aids. Fuel pool cooling and cleanup functions are tested as described in Subsection 14.2.12.1.21. The HVAC systems serving the refueling floor and drywell are tested as described in Subsection 14.2.12.1.34.

Performance shall be observed and recorded during a series of individual component and integrated system tests ~~to demonstrate the following:~~

(a) ~~proper operation for each crane, bridge, trolley, or platform through its full travel and at up to its maximum speed including verification of braking action and overspeed or overtravel protection devices;~~

(b) proper operation of the various cables, grapples, and hoists including brakes, limit switches, load cells, and other equipment protective devices;

associated with the refueling platform and service platform

(c) proper functioning of all control, instrumentation, logic, interlocks and alarms;

(d) proper functioning of other fuel handling and reactor component servicing equipment such as that used for cell disassembly, channel replacement, instrument handling, CRD handling, RIP servicing, SRV and MSIV maintenance, pool and vessel vacuum cleaning, and for underwater lighting and viewing.

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(e) proficiency in fuel movement operations using dummy fuel (prior to actual fuel loading); and

(f) dynamic and static load testing of all cranes, hoists, and associated lifting and rigging equipment including static load testing at 125% of rated load and full operational testing at 100% of rated load.

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System and component operation is considered acceptable when observed and measured performance characteristics from the testing described above meet the applicable design specifications.

14.2.12.1.51 Expansion, Vibration and Dynamic Effects Preoperational Test

(1) Purpose

To verify that critical components and piping runs are properly designed and supported such that expected steady state and transient vibration and movement due to thermal expansion does not result in excessive stress or fatigue to safety related plant systems and equipment.

(2) Prerequisites

All piping and components and their associated supports and restraints have been inspected and determined to be installed per design. Additionally, support devices such as snubbers and spring cans have been verified to be in their expected cold, static positions and temporary restraining devices such as hanger locking pins have been observed to be removed.

(3) General Test Method and Acceptance Criteria

Vibration and thermal expansion testing will be conducted on plant systems and components of the following classifications:

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

(b) high energy piping systems inside Seismic Category 1 structures;

(c) high energy portions of systems whose failure could reduce the functioning of any Seismic Category 1 plant features to an unacceptable level; and

(d) Seismic Category 1 portions of moderate energy piping systems located outside containment.

Thermal expansion testing during the preoperational phase will be limited to those systems that are expected to be heated up significantly above their normal ambient temperatures. The testing will be in conformance with ANSI/ASME-OM7 as discussed in Subsection 3.9.2.1.2, and will consist of a combination of visual inspections and local and remote displacement measurements. This testing, as well as that performed during the power ascension phase per Subsection 14.2.12.2.10, includes the inspection and testing of RCPB component supports as described in Subsection 5.4.14.4. Visual inspections are performed to identify actual or potential constraints to free thermal growth. Displacement measurements will be made utilizing specially installed instrumentations and also using the position of supports such as snubbers. Results of the thermal expansion testing are acceptable when all systems move as predicted and there are no observed restraints to free thermal growth or when additional analysis shows that any unexpected results will not produce unacceptable stress values.

Vibration testing will be performed on system components and piping during preoperational function and flow testing. This testing will be in accordance with ANSI/ASME-OM3 as discussed in Subsection 3.9.2.1.1 and will include visual observation and local and remote monitioring in critical steady state operating modes and during transients such as pump starts and stops, valve stroking, and significant process flow changes.

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(d) proper assembly and operation of reactor vessel servicing equipment, including reactor vessel servicing tools, main steam line plug, shroud head stud wrench, head holding pedestal, head stud rack, dryer/separator strongback, and head strongback carousel.

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(g) correct assembly and operation of in-vessel servicing equipment, such as in-core instrument servicing, FMCRD assembly servicing, and in-vessel fuel assembly servicing.

(h) proper installation and operation of fuel servicing equipment, such as fuel preparation machine, new fuel inspection stand, channel bolt wrenches and handling tools, general purpose grapples and fuel pool vacuum sipper.

(i) correct installation and operation of under-reactor vessel servicing equipment, including FMCRD servicing tools and handling equipment, in-core flange seal test plug, RIP handling equipment and thermal sleeve installation tool.

(j) proper assembly and operation of various servicing aids, such as underwater lights and viewing tube, viewing aids, underwater TV monitoring system, underwater vacuum cleaner, and pool tool accessories.

consist of displacement measurements on the NSSS portion of piping during the HCRS/RPV internal hot functional test (Subsection 14.2.12.1.2) and visual inspections at ambient temperature on the NSSS and BOP portions of piping.

(c) proper functioning of all control, instrumentation, logic, interlocks and alarms;

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(d) proper functioning of other fuel handling and reactor component servicing equipment such as that used for cell disassembly, channel replacement, instrument handling, CRD handling, RIP servicing, SRV and MSIV maintenance, pool and vessel vacuum cleaning, and for underwater lighting and viewing.

(e) proficiency in fuel movement operations using dummy fuel (prior to actual fuel loading); and

(f) dynamic and static load testing of all cranes, hoists, and associated lifting and rigging equipment including static load testing at 125% of rated load and full operational testing at 100% of rated load.

System and component operation is considered acceptable when observed and measured performance characteristics from the testing described above meet the applicable design specifications.

14.2.12.1.51 Expansion, Vibration and Dynamic Effects Preoperational Test

(1) Purpose

prior to or between tests

To verify that critical components and piping runs are properly designed and supported such that expected steady state and transient vibration and movement due to thermal expansion does not result in excessive stress or fatigue to safety related plant systems and equipment.

(2) Prerequisites

Hydro testing and flushing of the piping systems shall have been completed.

All piping and components and their associated supports and restraints have been inspected and determined to be installed per design. Additionally, support devices such as snubbers and spring cans have been verified to be in their expected cold, static positions and temporary restraining devices such as hanger locking pins have been observed to be removed.

(3) General Test Method and Acceptance Criteria

(Preoperational phase of)

Vibration and thermal expansion testing will be conducted on plant systems and components of the following ~~systems~~:

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

(b) high energy piping systems inside Seismic Category 1 structures;

(c) high energy portions of systems whose failure could reduce the functioning of any Seismic Category 1 plant features to an unacceptable level; and

(d) Seismic Category 1 portions of moderate energy piping systems ~~located outside containment~~.

Thermal expansion testing during the preoperational phase will be limited to those systems that are expected to be heated up significantly above their normal ambient temperatures. The testing will be in conformance with ANSI/ASME-OM7 as discussed in Subsection 3.9.2.1.2, and will consist of a combination of visual inspections and local and remote displacement measurements. This testing, as well as that performed during the power ascension phase per Subsection 14.2.12.2.10, includes the inspection and testing of RCPB component supports as described in Subsection 5.4.14.4. Visual inspections are performed to identify actual or potential constraints to free thermal growth. Displacement measurements will be made utilizing specially installed instrumentations and also using the position of supports such as snubbers. Results of the thermal expansion testing are acceptable when all systems move as predicted and there are no observed restraints to free thermal growth or when additional analysis shows that any unexpected results will not produce unacceptable stress values.

Vibration testing will be performed on system components and piping during preoperational function and flow testing. This testing will be in accordance with ANSI/ASME-OM3 as discussed in Subsection 3.9.2.1.1 and will include visual observation and local and remote monitoring in critical steady state operating modes and during transients such as pump starts and stops, valve stroking, and significant process flow changes.

The instrumentation system required by the remote measurements shall have been completely installed and the as-built locations and orientation of measurement instruments documented in the test records.

Results are acceptable when visual observations show no signs of excessive vibration and when measured vibration amplitudes are within acceptable levels to assure no failures from fatigue over the life of the plant as calculated based on expected steady state and transient operation.

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(9) The piping systems considered to be within the NSSS scope of testing are as following:

(1) Main steam piping bounded by the reactor vessel nozzles and the MSIV outside containment.

(2) SRV discharge piping attached to the main steam lines and bounded by the [redacted] SRV discharge flange and the quencher in the wetwell.

(3) Feedwater piping bounded by the RPV and the isolation check valves outside containment.

(4) Recirculation motor cooling piping, including RIPs.

(5) Small branch piping attached to the portions of the piping defined in Item (1), (2), and (3); are bounded by the large pipe branch connection and the first downstream anchor. Small branch pipes that can not be monitored due to limited access are excluded.

[redacted]

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(b) The BOP scope of piping systems are listed as following:

(1) Main steam piping downstream of the MSIV outside containment.

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

(3). RPV head vent piping.

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

(5) RHR suction and discharge piping in shutdown cooling mode and LPFL mode (and injection)

(6) RCIC turbine steam supply and exhaust piping

(7) RCIC pump suction and discharge piping

(8) SLC system piping (pump suction/discharge)

(9) RSW suction and discharge piping

(10) RBCCW suction and discharge piping

(11) HPCF suction and injection piping

(12) Diesel generator fuel, cooling, intake and exhaust piping.

(13) CGCS hydrogen recombiner piping

(14) CRD system piping (pump suction/discharge)

These inspection shall detect wear, cracking, loosening of bolts, failures and the presence of debris and loose parts on lower surfaces such as the lower head and the core support plate.

14.2.12.1.52 Reactor Vessel Flow-Induced Vibration Preoperational Test

(1) Purpose

To collect information needed to verify the adequacy of the reactor internals design, manufacture, and assembly with respect to the potential effects of flow induced vibration. Instrumentation of major components and the flow tests and inspections will provide assurance that excessive vibration amplitudes, if they exist, will be detected at the earliest possible time. The data collected will also help establish the margin to safety associated with steady state and anticipated transient conditions and will help confirm the pretest analytical vibration calculations. This testing will fulfill the preoperational requirements of Regulatory Guide 1.20 for a vibration measurement and inspection program for prototype reactor internals,and applies only to the ABWR designated for testing of "prototype" reactor internals. Subsequent ABWRs, whose internals qualify as non-prototype, are subject to a reduced set of testing requirements in accordance with Regulatory Guide 1.20 as discussed in Subsections 3.9.2.4 and 3.9.7.1.

(2) Prerequisites

and the associated inspection activities

The initial vibration analysis computations and specification of acceptance criteria shall be complete. These results shall be utilized to define final inspection and measurement programs. Preoperational testing of the recirculation system shall be sufficiently complete to ensure safe operation of the reactor internal pumps at rated volumetric flow for the duration of the scheduled flow testing. This includes all required auxiliary systems. All reactor vessel components and structures shall be installed and secured as designed in expectation of being subjected to rated volumetric core flow. This includes the steam separator assembly and reactor vessel head but excludes the steam dryer. Also, during the flow testing, the control blades shall either be removed or be fully withdrawn and motion inhibited. The assembly and disassembly of vessel internals shall be choreographed such that structures and components requiring inspection are accessible at the proper times. The required sensors shall be installed and calibrated prior to the flow testing. All other systems, components, and structures shall be available, as required, to support the reactor vessel internals vibration assessment program.

at rated temperature and pressure

(3) General Test Methods and Acceptance Criteria

The reactor internals vibration assessment program consists of three parts: a vibration analysis program, a vibration measurement program, and an inspection program. The vibration analysis portion is performed on the final design, prior to the preoperational test, and the results are used to develop the measurement and inspection portions of the program. The preoperational test therefore consists of an instrumented flow test and pre-and post-test inspections as described in the following paragraphs:

(a) Pre-flow Vessel Inspection

The preflow inspection is performed primarily to establish and document the status of vessel internal structures and components. Some of the inspection requirements may be met by normal visual fabrication inspections. The majority of the inspection requirements will be met by visual and remote observations of the installed reactor internals in a flushed and drained vessel. The following types of structures and components shall be included in the vessel internals inspection program:

(1) major load bearing elements including lateral, vertical and torsional supports;

(2) locking and bolting components whose failure could adversely affect structural integrity;

(3) known or potential contact surfaces;

(4) critical locations as identified by the vibration analysis program; and

(5) interior surfaces for evidence of loose parts or foreign material

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all temporary hardware devices, such as blade guides, must be removed.

no in-core instruments or neutron sources shall be installed and

(b) Flow testing

The preoperational flow test will be performed at rated volumetric core flow

at rated temperature and pressure conditions

during the RRS/RPV internal hot functional test (Subsection 14.2.12.1.2)

with the vessel internals completely intact with the exception of the fuel bundles, the control blades (unless fully withdrawn), and the steam dryer assembly. A post fuel load, subcritical flow test will be performed later on the complete reactor assembly unless it is shown analytically or experimentally that the preoperational results are already conservatively bounding. Additionally internals vibration will be measured during individual component or system preoperational testing where operation my result in significant vibrational excitation of reactor internals, such as HPCF testing.

The duration of preoperational testing at the various flow configurations shall ensure that each critical component is subjected to at least 10^6 cycles of vibration, as calculated using the lowest frequency for which the component is expected to experience a significant structural response.

(c) Post Flow Vessel Inspection

The post flow inspection shall be performed after the resultant vibrational excitation from the preoperational flow testing described above. The structures and components inspected shall be the same as specified for the preflow inspection. Visual and remote observations are performed after the vessel has been depressurized and drained. Inspection of critical surfaces and components shall be performed prior to any disassembly required for access to other internal structures.

(d) Acceptance Criteria

The acceptance criteria are generated as part of the analytical portion of the program in terms of maximum vibrational response levels of overall structures and components and translated to specific sensor locations.

Reactor vessel internals vibration is considered acceptable when results of the measurement program correlate and compare favorably with those of the analysis program, and, when the results of the inspections show no signs of defects, loose parts, extraneous material, or excessive wear due to flow testing, and are consistent with the results obtained from the analysis and measurement programs.

14.2.12.1.53 Condensate and Feedwater Systems Preoperational Test

(1) Purpose

To verify proper operation of the various components that comprise the condensate and feedwater systems and their capability to deliver the required flow from the condenser hotwell to the nuclear boiler system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. The required interfacing systems shall be available as needed, to support the specified testing. For all flow testing their shall be an adequate suction source available and an appropriate flow path established.

(3) General Test Methods and Acceptance Criteria

Preoperational testing of the condensate and feedwater systems will include the piping, components, and instrumentation between the condenser and the nuclear boiler but not the condensate filters or demineralizers nor the feedwater heaters, which will be tested separately per the specific discussions provided for those features.

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

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(1) Lower plenum surfaces for debris and loose or failed parts by removal of the center Control Rod Guide Tube and scanning with a TV camera.

(2) Core plate for debris and loose or failed parts.

(3) All peripheral control rod drive and in-core housings, and their weld joints to the vessel by removal of eight control rod guide tubes [redacted] and scanning with a TV camera.

(4) Peripheral in-core guide tube stabilizer connections and stabilizer bars. [redacted]

(5) RIP and core differential pressure lines and bracket welds; [redacted]

(6) The shroud-to-shroud support weld.

(7) Fuel support castings (for evidence of lifting) and peripheral orifices.

(8) Reactor vessel surveillance program specimen holders, specimens and mounting brackets.

(9) Top guide to shroud holddown nuts, keepers, pins and associated welds.

(10) Top guide and shroud head flange locating pins and bolts for evidence of deleterious motion marks other than those caused from normal installation.

(11) Core plate to shroud holddown nuts, keepers and associated welds.

(12) Steam separator, tie bar welds, outer rows of standpipes, stiffener bar welds, shroud head bolt support ring brackets and supports, and associated welds.

(13) Feedwater and LPCF sparger structure and end bracket attachments.

(14) HPCF coupling and HPCF spargers.

(15) Shroud head bolts at guide rings for wear.

(16) Steam dryer hoods, end plates, tie bars, skirt, drain channels, and associated welds.

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(flow-induced RPV internal)

The preoperational test operating conditions for vibration measurements shall include: (1) all pumps in operation at minimum, 50% of maximum flow, 75% of maximum flow, and maximum flow conditions. (2) With all pumps at maximum flow, perform single pump trips. (3) With seven pumps in operation at minimum, 50% of maximum flow, 75% of maximum flow and maximum flow conditions. (4) With seven pumps at maximum flow and the other three pumps at minimum flow, 50% of maximum flow, and 75% of maximum flow. (5) From maximum flow, trip all pumps simultaneously. (6) Complete the requirement for total operating time specified in the test specification.

with the vessel internals completely intact with the exception of the fuel bundles, the control blades (unless fully withdrawn), and the steam dryer assembly. A post fuel load, subcritical flow test will be performed later on the complete reactor assembly unless it is shown analytically or experimentally that the preoperational results are already conservatively bounding. Additionally internals vibration will be measured during individual component or system preoperational testing where operation my result in significant vibrational excitation of reactor internals, such as HPCF testing.

The duration of preoperational testing at the various flow configurations shall ensure that each critical component is subjected to at least 10^6 cycles of vibration, as calculated using the lowest frequency for which the component is expected to experience a significant structural response.

(c) Post Flow Vessel Inspection

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The post flow inspection shall be performed after the resultant vibrational excitation from the preoperational flow testing described above. The structures and components inspected shall be the same as specified for the preflow inspection. Visual and remote observations are performed after the vessel has been depressurized and drained. Inspection of critical surfaces and components shall be performed prior to any disassembly required for access to other internal structures.

(d) Acceptance Criteria

The acceptance criteria are generated as part of the analytical portion of the program in terms of maximum vibrational response levels of overall structures and components and translated to specific sensor locations.

Reactor vessel internals vibration is considered acceptable when results of the measurement program correlate and compare favorably with those of the analysis program, and, when the results of the inspections show no signs of defects, loose parts, extraneous material, or excessive wear due to flow testing, and are consistent with the results obtained from the analysis and measurement programs.

14.2.12.1.53 Condensate and Feedwater Systems Preoperational Test

(1) Purpose

(CFS)

To verify proper operation of the various components that comprise the condensate and feedwater systems and their capability to deliver the required flow from the condenser hotwell to the nuclear boiler system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. The required interfacing systems shall be available as needed, to support the specified testing. For all flow testing their shall be an adequate suction source available and an appropriate flow path established.

(3) General Test Methods and Acceptance Criteria

Preoperational testing of the condensate and feedwater systems will include the piping, components, and instrumentation between the condenser and the nuclear boiler but not the condensate filters or demineralizers nor the feedwater heaters, which will be tested separately per the specific discussions provided for those features.

Performance shall be observed and recorded during a series of individual component and integrated system tests to ~~demonstrate the following:~~

This test shall demonstrate that the CFS operates as specified by Subsection 10.4.7 and applicable manufacturer's technical instruction manuals through the following testing:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms ~~used to monitor system operation and availability~~, including alarm actuation and reset, alarm indication and operation logic;

(c) proper operation of system valves, including timing, ~~under expected operating conditions~~, operability, position indication and

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which system components are expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(l) proper operation of controllers for pump drivers and flow control valves including those in minimum flow recirculation lines.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.54 Condensate Cleanup System Preoperational Test

(1) Purpose

To verify proper operation of the condensate filters and demineralizers and the associated support facilities.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The condensate system shall be operational with an established flow path capable of supporting full condensate filter and demineralizer flow. Adequate supplies of ion exchange resin should be available and the radwaste system shall be capable of processing the expected quantities of water and spent resins. Other required interfacing systems shall also be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper individual vessel and overall system flow rates and pressure drops including bypass capabilities (for both filter and demineralizer units);

(e) proper operation of interlocks and equipment protective devices;

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Prerequisites, includes but not necessarily limited to the following, must be completed prior to the test:

(a) All elements of feedwater control system control algorithm have been implemented and adjusted if necessary to the values specified by the vendor's instructions or the results of preoperational testing, as appropriate.

(b) All other system instrumentation associated with the condensate and feedwater system shall be in accordance with the P&ID, IED, and Instrument Data Sheets and have been properly calibrated per instrument supplier's instructions.

(c) Appropriate power sources to supply electric power to motors, control circuits and instrumentation shall be available, as required, to support testing.

(d) The system valve and electric lineups have been completed in accordance with the appropriate plant operation procedures prior to the test.

(e) A sufficient quantity of chemically acceptable demineralized water shall be available for test use

(f) The following system/equipment shall be available and operational: ~~Prior to the test~~

* Instrument air system
* Turbine building cooling water system

* Makeup water–condensate system (storing and transferring demineralized water)

(g) The main condenser is available as a water source and discharge point for the reactor feedwater pumps during this test.

(h) The condensate system shall be available to provide a flow path and the required NPSH for the reactor feedwater pumps testing.

(i) The feedwater pump adjustable speed drives shall have been functionally checked against the respective vendor operating and maintenance manual to ensure correct remote operation prior to pump operation.

(j) Signals from the FDWC system affect other systems such as feedwater pump ASD, recirculation system and main turbine. Therefore, prior to the control logic and interlock testing, care must be taken to ensure that the input process variable signal from the FDWC system can be accept by those affected systems without harm to personnel or equipment.

Instrument air and service air systems, turbine building cooling water system, process sampling system, makeup water purification distribution system, and appropriate electrical power sources shall be available for use.

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which system components are expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation; and

(l) proper operation of controllers for pump drivers and flow control valves including those in minimum flow recirculation lines.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.54 Condensate Cleanup System Preoperational Test

(1) Purpose (cleanup system (CCS))

To verify proper operation of the condensate ~~filters and demineralizers~~ and the associated support facilities.

(2) Prerequisites (all other) (and feedwater)

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The condensate system shall be operational with an established flow path capable of supporting full condensate filter and ~~demineralizer~~ flow. Adequate supplies of ion exchange resin ~~should~~ be available and the radwaste system shall be capable of processing the expected quantities of water and spent resins. Other required interfacing systems shall also be available, as needed, to support the specified testing.

(shall)

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated system tests ~~to demonstrate the following~~:

(a) proper operation of instrumentation and ~~equipment~~ in all combinations of logic and instrument channel trip; (control)

(b) proper functioning of instrumentation and alarms ~~used to monitor system operation and status~~; (including alarm actuation/reset, alarm indication and operating logic)

(c) proper ~~operation of system valves, including timing, under expected operating conditions~~; (open/close cycling, remote indication and)

(d) ~~proper individual vessel and overall system flow rates and pressure drops including bypass capabilities (for both filter and demineralizer units)~~;

(e) proper operation of interlocks and equipment protective devices;

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This test shall demonstrate that the CCS operates as specified by Subsection 10.4.6 and the applicable manufacturer's technical instruction manuals through the following testing:

(f) proper operation of permissive, prohibit, and bypass functions;

(g) the ability to perform on-line exchange of standby and spent filter units and demineralizer vessels; and

(h) proper operation of filter and demineralizer support facilities such as those used for regeneration of resins or for handling of wastes.

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.55 Reactor Water Chemistry Control Systems Preoperational Test

(1) Purpose

To verify proper operation of the various chemical addition systems designed for actively controlling the reactor water chemistry, including the oxygen injection system, the zinc injection passivation system, the iron ion injection system, and the hydrogen water chemistry system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. The required interfacing systems shall be available, as needed, to support the specified testing. The appropriate vendor precautions shall be followed with regards to the operation of the affected sytems and componenets and for the actual reactor water chemistry given the existing reactor operating state.

(3) General Test Methods and Acceptance Criteria

Preoperational testing of these systems will concentrate on verifying proper operation of the equipment skids and the various individual components. Actual chemical injection demonstrations and/or simulations shall be limited to only those cases where it is deemed practicable or appropriate with regards to the aforementioned precautions.

Performance shall be observed and recorded during a series of individual component and integrated system tests (to the extent possible) to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing and sequencing, under expected operating conditions;

(d) proper system flow paths, flow rates and pressures;

(e) proper operation of system interlocks and equipment protective devices; and,

(f) proper operation of permissive, prohibit, and bypass functions;

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.56 Condenser Air Removal System Preoperational Test

(1) Purpose

To verify the ability for the mechanical vacuum pumps and the steam jet air ejectors to establish and maintain a vacuum in the main condenser as per design.

(2) Prerequisites

Construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The main condenser shall be intact and steam shall be available from the auxiliary boiler or some other temporary source. Other required interfacing systems shall be available, as needed, to support the specified testing.

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(d) proper operating conditions and performance capability during the following system operational tests:

(1) placing a standby polisher unit into service.

(2) transferring the resin inventory of any polisher vessel into the resin receiver tank.

(3) removing operating filter from service, backwashing and restoring to service.

(4) transferring the resin storage tank resins to any polisher vessel.

(5) Transferring resin from receiver tank to the radwaste system.

(6) operating the system at full condensate flow with four filters and five polisher vessels.

(f) proper operation of permissive, prohibit, and bypass functions;

(g) the ability to perform on-line exchange of standby and spent filter units and demineralizer vessels; and

(h) proper operation of filter and demineralizer support facilities such as those used for regeneration of resins or for handling of wastes.

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.55 Reactor Water Chemistry Control Systems Preoperational Test

(1) Purpose

To verify proper operation of the various chemical addition systems designed for actively controlling the reactor water chemistry, including the oxygen injection system, the zinc injection passivation system, the iron ion injection system, and the hydrogen water chemistry system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. The required interfacing systems shall be available, as needed, to support the specified testing. The appropriate vendor precautions shall be followed with regards to the operation of the affected sytems and componenets and for the actual reactor water chemistry given the existing reactor operating state.

(3) General Test Methods and Acceptance Criteria

Preoperational testing of these systems will concentrate on verifying proper operation of the equipment skids and the various individual components. Actual chemical injection demonstrations and/or simulations shall be limited to only those cases where it is deemed practicable or appropriate with regards to the aforementioned precautions.

This test shall demonstrate that the specified reactor water chemistry control system (if installed during the construction stage) operate as described by Subsections 9.3.9, 9.3.10, 9.3.11 and applicable manufacturer's technical instruction manuals. Tier 1 Rev B

Performance shall be observed and recorded during a series of individual component and integrated system tests (to the extent possible), to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing and sequencing, under expected operating conditions;

(d) proper system flow paths, flow rates and pressures;

(e) proper operation of system interlocks and equipment protective devices; and,

(f) proper operation of permissive, prohibit, and bypass functions;

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System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.56 Condenser Air Removal System Preoperational Test

(1) Purpose

To verify the ability for the mechanical vacuum pumps and the steam jet air ejectors to establish and maintain a vacuum in the main condenser as per design.

(2) Prerequisites

Construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The main condenser shall be intact and steam shall be available from the auxiliary boiler or some other temporary source. Other required interfacing systems shall be available, as needed, to support the specified testing.

Feedwater and condensate system, offgas system, appropriate electrical power, and other

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(a) proper operation of control, trips, interlocks, and alarm functions for the appropriate system as specified by the elementary diagrams, IDs, and IBDs.

(b) performance capability of the hydrogen water chemistry system, including automatic shutdown and isolation features, as specified by Subsection 9.3.9 and the manufacturer's technical instruction manual. This test shall be done with all components, valves, piping and instruments that constitute the entire system as an integrated unit during automatic mode of operation.

(c) operability of the oxygen injection system as specified by Subsection 9.3.10 and the manufacturer's technical instruction manual with the integrated operation of condensate oxygen injection module and the gas flow regulating valve in manual mode of control from the main control room.

(d) operability of the zinc injection system, including automatic shutdown feature, as specified by Subsection 9.3.11 and the manufacturer's technical instruction manual.

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(e) operability of the iran injection system as specified by the manufacturer's technical instruction manual,

(f) proper operation of permissive, prohibit, and bypass functions;

(g) the ability to perform on-line exchange of standby and spent filter units and demineralizer vessels; and

(h) proper operation of filter and demineralizer support facilities such as those used for regeneration of resins or for handling of wastes.

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.55 Reactor Water Chemistry Control Systems Preoperational Test

(1) Purpose

To verify proper operation of the various chemical addition systems designed for actively controlling the reactor water chemistry, including the oxygen injection system, the zinc injection passivation system, the iron ion injection system, and the hydrogen water chemistry system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. The required interfacing systems shall be available, as needed, to support the specified testing. The appropriate vendor precautions shall be followed with regards to the operation of the affected sytems and componenets and for the actual reactor water chemistry given the existing reactor operating state.

(3) General Test Methods and Acceptance Criteria

Preoperational testing of these systems will concentrate on verifying proper operation of the equipment skids and the various individual components. Actual chemical injection demonstrations and/or simulations shall be limited to only those cases where it is deemed practicable or appropriate with regards to the aforementioned precautions.

Performance shall be observed and recorded during a series of individual component and integrated system tests (to the extent possible) to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing and sequencing, under expected operating conditions;

(d) proper system flow paths, flow rates and pressures;

(e) proper operation of system interlocks and equipment protective devices; and,

(f) proper operation of permissive, prohibit, and bypass functions;

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.56 Condenser Air Removal System Preoperational Test

(1) Purpose

To verify the ability of the mechanical vacuum pumps and the steam jet air ejectors to establish and maintain a vacuum in the main condenser as per design.

(2) Prerequisites

Construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The main condenser shall be intact and steam shall be available from the auxiliary boiler or some other temporary source. Other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and diagnosis;

(c) proper operation of system valves, including operation under expected operating conditions;

(d) proper operation of the mechanical vacuum pumps including the ability to establish the required vacuum within the design time frame;

(e) proper operation of the steamjet air ejectors including their ability to maintain the specified vacuum in the main condenser (while accounting for the source of the driving steam used);

(f) proper pump motor start sequence and margin to actuation of protective devices;

(g) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls; and

(h) proper operation of permissive, prohibit, and bypass functions;

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

14.2.12.1.57 Offgas System Preoperational Test

(1) Purpose

To verify proper operation of the offgas system including valves, recombiner, condensers, coolers, filters, and hydrogen analyzers.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Additionally, instrument air, electrical power, cooling water, and other required system interfaces shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including isolation features, under expected operating conditions;

(d) proper operation of components in all design operating modes;

(e) proper system and component flow paths and flow rates;

(f) proper operation of interlocks and equipment protective devices;

(g) proper operation of permissive, prohibit, and bypass functions; and

(h) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of the mechanical vacuum pumps including the ability to establish the required vacuum within the design time frame;

(e) proper operation of the steamjet air ejectors including their ability to maintain the specified vacuum in the main condenser (while accounting for the source of the driving steam used);

(f) proper pump motor start sequence and margin to actuation of protective devices;

(g) proper operation of interlocks and equipment protective devices in pump, motor, and valve controls; and

(h) proper operation of permissive, prohibit, and bypass functions;

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

14.2.12.1.57 Offgas System Preoperational Test

(1) Purpose

To verify proper operation of the offgas system including valves, recombiner, condensers, coolers, filters, and hydrogen analyzers.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Additionally, instrument air, electrical power, cooling water, and other required system interfaces shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including isolation features, under expected operating conditions;

(d) proper operation of components in all design operating modes;

(e) proper system and component flow paths and flow rates;

(f) proper operation of interlocks and equipment protective devices;

(g) proper operation of permissive, prohibit, and bypass functions; and

(h) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.58 Hotwell Level Control System Preoperational Test

(1) Purpose

To verify design level control capability in the main condenser hotwell.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The condenser, condensate storage tank, condensate pumps, and associated valves and piping shall be operational and the other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of system components in all combinations of logic and in response to all expected controller demands;

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

(c) proper operation of system valves including stroke and timing; and

(d) the ability to maintain the desired hotwell condensate inventory in conjunction with the condensate storage and transfer system.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.59 Condensate Storage and Transfer System Preoperational Test

(1) Purpose

To verify the ability of the condensate storage and transfer system to provide an adequate reserve of condensate quality water for make-up to the condensate system, as a preferred suction source for the RCIC and HPCS systems, and for other uses as designed.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic;

(b) proper functioning of permissive and prohibit interlocks;

(c) proper functioning of instrumentation and alarms used to monitor system operation and status including CST volume and/or level;

(d) proper operation of freeze protection devices, if applicable; and

(e) the ability of the system to provide desired flow rates and volumes to the applicable systems and/or components.

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

14.2.12.1.60 Circulating Water System Preoperational Test

(1) Purpose

To verify the proper operation of the circulating water system and its ability to circulate cooling water from the ultimate heat

14.2.12.1.58 Hotwell Level Control System Preoperational Test

(1) Purpose

To verify design level control capability in the main condenser hotwell.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The condenser, condensate storage tank, condensate pumps, and associated valves and piping shall be operational and the other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of system components in all combinations of logic and in response to all expected controller demands;

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

(c) proper operation of system valves including stroke and timing; and

(d) the ability to maintain the desired hotwell condensate inventory in conjunction with the condensate storage and transfer system.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.59 Condensate Storage and Transfer System Preoperational Test

(1) Purpose

To verify the ability of the condensate storage and transfer system to provide an adequate reserve of condensate quality water for make-up to the condensate system, as a preferred suction source for the RCIC and HPCS systems, and for other uses as designed.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic;

(b) proper functioning of permissive and prohibit interlocks;

(c) proper functioning of instrumentation and alarms used to monitor system operation and status including CST volume and/or level;

(d) proper operation of freeze protection devices, if applicable; and

(e) the ability of the system to provide desired flow rates and volumes to the applicable systems and/or components.

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

14.2.12.1.60 Circulating Water System Preoperational Test

(1) Purpose

To verify the proper operation of the circulating water system and its ability to circulate cooling water from the ultimate heat

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Prerequisites, includes but not necessarily limited to the following, must be completed prior to the test:

(a) All system instrumentation shall be in accordance with the P&ID and Instrument Data Sheets and have been properly calibrated per instrument supplier's instructions.

(b) The applicable power sources to supply electric power to motors, control circuits and instrumentation shall be available, as required, to support the performance of this testing.

(c) The system valve line-ups shall have been completed in accordance with applicable system's operation procedures prior to the test.

(d). The following system and/or equipment shall be available for use in support of this test, as required:

* Instrument air system (IA)
* Electrical instrument equipment
* Communication equipments
* Makeup water- purified (MUWP) distribution system

(e) A sufficient quantity of chemically acceptable water shall be available for performing this test.

14.2.12.1.58 Hotwell Level Control System Preoperational Test

(1) Purpose

To verify design level control capability in the main condenser hotwell.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The condenser, condensate storage tank, condensate pumps, and associated valves and piping shall be operational and the other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of system components in all combinations of logic and in response to all expected controller demands;

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

(c) proper operation of system valves including stroke and timing; and

(d) the ability to maintain the desired hotwell condensate inventory in conjunction with the condensate storage and transfer system.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.59 Condensate Storage and Transfer System Preoperational Test

(1) Purpose

To verify the ability of the condensate storage and transfer system to provide an adequate reserve of condensate quality water for make-up to the condensate system, as a preferred suction source for the RCIC and HPCS systems, and for other uses as designed.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic;

(b) proper functioning of permissive and prohibit interlocks;

(c) proper functioning of instrumentation and alarms used to monitor system operation and status including CST volume and/or level;

(d) proper operation of freeze protection devices, if applicable; and

(e) the ability of the system to provide desired flow rates and volumes to the applicable systems and/or components.

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

14.2.12.1.60 Circulating Water System Preoperational Test

(CWS)

(1) Purpose

To verify the proper operation of the circulating water system and its ability to circulate cooling water from the ultimate heat

bearing lubricating and shaft sealing water, vacuum priming and chemical additive subsystems, makeup water-condensate system;

sink through the tubes of the main condenser in sufficient quantities to condense the steam exhausted from the main turbine under all expected operating conditions.

(2) Prerequisites

function when recirculate water from discharge side of the condenser back to the screen house intake.

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The main condenser, ultimate heat sink, appropriate electrical power source(s) and other required interfacing systems shall be available, as needed, to support the specified testing.

This test shall demonstrate that the CWS operates as specified by subsection 10.4.5 during the following testing:

(3) General Test Methods and Acceptance Criteria

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

including alarm actuation/reset and operating logic.

(a) proper operation of instrumentation and control in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

all major system valves which control flow path

(c) proper operation of system valves, including timing, under expected operating conditions;

open/closure cycling and position indication verification

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper operation of freeze protection devices if applicable;

(k) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(l) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/ easured performance characteristics, from the testing described above, meet the applicable design specifications. However, due to the lack of significant heat loads during the preoperational test phase, condenser and ultimate heat sink performance evaluation will be performed during the startup phase with the turbine-generator on line.

14.2.12.1.61 Reactor Service Water System Preoperational Test

(1) Purpose

To verify proper operation of the reactor service water (RSW) system and its ability to supply design quantities of cooling water to the RCW system heat exchangers.

(2) Prerequisites

including operation of all components subject to interlocking

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup electrical power, the RCW system (including heat exchangers), instrument air, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

proper operating conditions (flow, pressure, vibration) and performance capability during integrated operation of circulating water, water box fill and drain, traveling screens, and chemical additive subsystems.

sink through the tubes of the main condenser in sufficient quantities to condense the steam exhausted from the main turbine under all expected operating conditions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The main condenser, ultimate heat sink, appropriate electrical power source(s) and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper operation of freeze protection devices, if applicable;

(k) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(l) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/ easured performance characteristics, from the testing described above, meet the applicable design specifications. However, due to the lack of significant heat loads during the preoperational test phase, condenser and ultimate heat sink performance evaluation will be performed during the startup phase with the turbine-generator on line.

14.2.12.1.61 Reactor Service Water System Preoperational Test

(1) Purpose

To verify proper operation of the reactor service water (RSW) system and its ability to supply design quantities of cooling water to the RCW system heat exchangers.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup electrical power, the RCW system (including heat exchangers), instrument air, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated system tests ~~to demonstrate the following~~:

This test shall demonstrate that the RSW system operates as specified by Subsection 9.2.15 and the applicable manufacturer's technical instruction manual through the following testing:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper operation of freeze protection devices, if applicable;

(k) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(l) acceptability of pump/motor vibration levels and system piping movements during both transient and steady-state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. The heat exchangers which serve as the interface with the RCW system are considered part of that system and will be tested as such. However, due to the probability of insufficient heat loads during the preoperational test phase, it is likely that heat exchanger performance verification will be delayed until the startup phase.

14.2.12.1.62 Turbine Building Cooling Water System Preoperational Test

(1) Purpose

To verify proper operation of the turbine building cooling water (TCW) system and its ability to supply design quantities of cooling water, at the specified temperatures, to designated plant loads.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup power, turbine service water (TSW), instrument air, and other required supporting systems shall be available, as needed, for the specified testing configurations. The cooled components should be operational and operating to the extent possible during heat exchanger performance evaluation.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

RSW

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(f) proper operating conditions and system performance capability during the following system operational tests:

(1) system operation tests at various operating modes (normal, shutdown cooling, hot standby without off-site power source, LOCA and refueling outage)

(2) switch-over test of RSW pumps and heat exchangers between 1-unit and 2-units operations.

(3) transfer test from normal operation mode to LOCA mode by LOCA signal

(4) transferability test to the hot standby mode operation upon loss of off-site power.

(5) system operation capability ~~from~~ the remote shutdown panel.

(6) adequacy of orifice ~~[redacted]~~ confirmation.

RSW

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(l) acceptable performance capability of RSW heat exchangers to the extent practical. Otherwise, RSW heat exchanger test can be performed in startup test stage.

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump, motor and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper operation of freeze protection devices, if applicable;

(k) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(l) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. The heat exchangers which serve as the interface with the RCW system are considered part of that system and will be tested as such. However, due to the probability of insufficient heat loads during the preoperational test phase, it is likely that heat exchanger performance verification will be delayed until the startup phase.

14.2.12.1.62 Turbine Building Cooling Water System Preoperational Test

(1) Purpose

To verify proper operation of the turbine building cooling water (TCW) system and its ability to supply design quantities of cooling water, at the specified temperatures, to designated plant loads.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup power, turbine service water (TSW), instrument air, and other required supporting systems shall be available, as needed, for the specified testing configurations. The cooled components should be operational and operating to the extent possible during heat exchanger performance evaluation.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system and component flow paths, flow rates, and pressure drops, including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) proper operation of system surge tanks and chemical addition tanks and their associated functions; and

(m) acceptable performance of TCW system heat exchangers, to the extent practical.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. Due to the possibility of insufficient heat loads during the preop phase, the final system flow balancing and heat exchanger performance evaluation may have to be performed during the startup phase.

14.2.12.1.63 Turbine Service Water System Preoperational Test

(1) Purpose

To verify the ability of the turbine service water (TSW) system to supply design quantities of cooling water to the TCW heat exchangers.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup electrical power, TCW system heat exchangers, instrument air, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper operation of freeze protection devices, if applicable;

(k) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(f) proper system and component flow paths, flow rates, and pressure drops, including pump capacity and discharge head;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational;

(k) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation;

(l) proper operation of system surge tanks and chemical addition tanks and their associated functions; and

acceptable performance of TCW system heat exchangers, to the extent practical.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. Due to the possibility of insufficient heat loads during the preop phase, the final system flow balancing and heat exchanger performance evaluation may have to be performed during the startup phase.

14.2.12.1.63 Turbine Service Water System Preoperational Test

(1) Purpose

To verify the ability of the turbine service water (TSW) system to supply design quantities of cooling water to the TCW heat exchangers.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup electrical power, TCW system heat exchangers, instrument air, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated system tests ~~to demonstrate the following~~:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms ~~used to monitor system operation and availability~~;

(c) proper operation of ~~system~~ valves, including ~~timing under expected operating conditions~~;

(d) proper operation of pumps and motors in all design operating modes;

(e) acceptable pump NPSH under the most limiting design flow conditions;

(f) proper system flow paths and flow rates ~~including pump capacity and discharge head~~;

(g) proper pump motor start sequence and margin to actuation of protective devices;

(h) proper operation of interlocks and equipment protective devices in pump and valve controls;

(i) proper operation of permissive, prohibit, and bypass functions;

(j) proper operation of freeze protection devices, if applicable;

(k) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

acceptable performance capability of TSW heat exchangers to the extent practical. Otherwise, TSW heat exchanger tests can be performed in startup test stage

(l) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. The heat exchangers which serve as the interface with the TCW system are considered part of that system and will be tested as such. However, due to the probability of insufficient heat loads during the preoperational test phase, it is likely that heat exchanger performance verification will be delayed until the startup phase.

14.2.12.1.64 Main Turbine Control System Preoperational Test

(1) Purpose

To verify proper operation of the turbine control system which includes the turbine stop valves, control valves, intermediate stop and intercept valves, and their associated actuators and hydraulic control.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The steam bypass and pressure control system shall be operational and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper functioning of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of main stop and control valves and intermediate stop and intercept valves in normal control, trip and test modes (including timing);

(d) proper operation of valve auxiliaries such as hydraulic fluid systems, including pumps and accumulators, and power supplies; and

(e) proper interface with (i.e. response and feedback to) the steam bypass and pressure control system.

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

14.2.12.1.65 Main Turbine Bypass System Preoperational Test

(1) Purpose

To verify proper operation of the turbine bypass system which includes the main turbine bypass valves and their associated actuators and hydraulic control.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The steam bypass and pressure control system shall be operational and other required interfacing system shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper functioning of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of main turbine bypass valves in normal control, trip and test modes (including timing);

(l) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. The heat exchangers which serve as the interface with the TBCWS are considered part of that system and will be tested as such. However, due to the probability of insufficient heat loads during the preoperational test phase, it is likely that heat exchanger performance verification will be delayed until the startup phase.

14.2.12.1.64 Main Turbine Control System Preoperational Test

(1) Purpose

To verify proper operation of the turbine control system which includes the turbine stop valves, control valves, intermediate stop and intercept valves, and their associated actuators and hydraulic control.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The steam bypass and pressure control system shall be operational and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper functioning of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of main stop valves and intermediate stop a

valves in normal control, trip and test modes (including timing);

(d) proper operation of valve auxiliaries such as hydraulic fluid systems, including pumps and accumulators, and power supplies; and

(e) proper interface with (i.e., response and feedback to) the steam bypass and pressure control system.

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

14.2.12.1.65 Main Turbine Bypass System Preoperational Test

(1) Purpose

To verify proper operation of the turbine bypass system which includes the main turbine bypass valves and their associated actuators and hydraulic control.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The steam bypass and pressure control system shall be operational and other required interfacing system shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper functioning of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of main turbine bypass valves in normal control, trip and test mo (including timing);

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(c) correct operation of main stop and control valves and combined intermediate values in response to simulated signals related to turbine speed, load, and reactor pressure as specified in Subsection 10.2.2.

(d) proper operation of the hydraulic control subsystem, including hydraulic fluid pumps and accumulators, and power supplies.

(e) proper operation of main stop and control valves upon loss of control system electrical power or hydraulic system pressure.

(f) capability of manual operation of main stop and control valves and CIVs, including verification of position indications and a stroke rate adjustments.

(l) acceptability of pump/motor vibration levels and system piping movements during both transient and steady state operation.

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. The heat exchangers which serve as the interface with the TBCWS are considered part of that system and will be tested as such. However, due to the probability of insufficient heat loads during the preoperational test phase, it is likely that heat exchanger performance verification will be delayed until the startup phase.

14.2.12.1.64 Main Turbine Control System Preoperational Test

(1) Purpose

To verify proper operation of the turbine control system which includes the turbine stop valves, control valves, intermediate stop and intercept valves, and their associated actuators and hydraulic control.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The steam bypass and pressure control system shall be operational and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper functioning of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of main stop and control valves and intermediate stop and intercept valves in normal control, trip and test modes (including timing);

(d) proper operation of valve auxiliaries such as hydraulic fluid systems, including pumps and accumulators, and power supplies; and

(e) proper interface with (i.e. response and feedback to) the steam bypass and pressure control system.

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

14.2.12.1.65 Main Turbine Bypass System Preoperational Test

(1) Purpose

To verify proper operation of the turbine bypass system which includes the main turbine bypass valves and their associated actuators and hydraulic control.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The steam bypass and pressure control system shall be operational and other required interfacing system shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of component and system tests.

(a) proper functioning of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of main turbine bypass valves in normal control, trip and test modes (including timing);

integrated

chest assembly and hydraulic fluid power unit, including hydraulic accumulators, high pressure fluid pumps, filters, and heat exchangers,

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(d) proper operation of valve auxiliaries such as hydraulic fluid systems, including pumps and accumulators, and power supplies; and

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(e) proper interface with (i.e. response and feedback to) the steam bypass and pressure control system.

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

14.2.12.1.66 Steam Bypass and Pressure Control System Preoperational Test

(1) Purpose

To verify proper operation of the steam bypass and pressure control system (SBPCS) including, as appropriate, higher level control of the turbine bypass system, the turbine control system, and the recirc flow control sys

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The preoperational tests have been completed on the turbine bypass and control systems (including the EHC system) to extent necessary to support integrated system testing and all SBPCS components have been initially calibrated in accordance with vendor instructions. The required supporting systems and equipment shall be available, as needed, for the specified testing configurations.

(3) General Test Methods and Acceptance Criteria

The SBPCS is primarily an electronic control system. It does not include any large mechanical equipment (i.e. turbine stop, control and bypass valves) nor any associated hydrauiic actuators, but does provide for their integrated control. System preoperational testing will be limited to demonstrations without (or with significantly reduced, from a temporary source) turbine steam flow. Comprehensive steam flow testing will be conducted during the startup phase.

Performance shall be observed and recorded during a series of individual component and integrated system test to demonstrate the following:

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip, including verification of setpoints;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of associated valves, including timing and stroke, in response to control system demands;

(d) proper operation of interlocks and equipment protective devices;

(e) proper operation of permissive, prohibit, and bypass functions;

(f) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(g) proper communication and interface with other equipment and control systems.

System operation is considered acceptable when the observed/ measured performance characteristics, from the testing described above, meet the applicable design specifications

14.2.12.1.67 Feedwater Heater and Drain System Preoperational Test

(1) Purpose

To verify proper operation of the feedwater heaters and their associated drains including heater level control capabilities.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of

Insert A

(e) proper operation of bypass valve closure in response to a simulated loss of condenser vacuum signal at the prescribed setpoint.

(f) proper operation of bypass valve opening inhibit feature upon a simulated MSIV closure condition, including annunciation in the main control room and the alarm reset function.

(g) proper bypass valve response following a simulated turbine and generator trip initiation signal, including the fast opening timing requirements per Technical Specifications.

(h) The deadband from bypass steam flow demand to bypass valve motion is within the design limits.

(d) proper operation of valve auxiliaries such as hydraulic fluid systems, including pumps and accumulators, and power supplies; and

(e) proper interface with (i.e. response and feedback to) the steam bypass and pressure control system.

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

14.2.12.1.66 Steam Bypass and Pressure Control System Preoperational Test

(1) Purpose

To verify proper operation of the steam bypass and pressure control system (SBPCS) including, as appropriate, higher level control of the turbine bypass system, the turbine control system, and the recirc flow control sys

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The preoperational tests have been completed on the turbine bypass and control systems (including the EHC system) to extent necessary to support integrated system testing and all SBPCS components have been initially calibrated in accordance with vendor instructions. The required supporting systems and equipment shall be available, as needed, for the specified testing configurations.

(3) General Test Methods and Acceptance Criteria

The SBPCS is primarily an electronic control system. It does not include any large mechanical equipment (i.e. turbine stop, control and bypass valves) nor any associated hydraulic actuators, but does provide for their integrated control. System preoperational testing will be limited to demonstrations without (or with significantly reduced, from a temporary source) turbine steam flow. Comprehensive steam flow testing will be conducted during the startup phase.

(Subsection 14.2.12.2.15)

Performance shall be observed and recorded during a series of individual component and integrated system test to demonstrate the following:

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip, including verification of setpoints;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of associated valves, including timing and stroke, in response to control system demands;

(d) proper operation of interlocks and equipment protective devices;

(e) proper operation of permissive, prohibit, and bypass functions;

(f) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(g) proper communication and interface with other equipment and control systems.

System operation is considered acceptable when the observed/ measured performance characteristics, from the testing described above, meet the applicable design specifications

14.2.12.1.67 Feedwater Heater and Drain System Preoperational Test

(1) Purpose

To verify proper operation of the feedwater heaters and their associated drains including heater level control capabilities.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of

SBPCS

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Verification of the

(a) dynamic characteristics of pressure controller, steamline resonance compensator, pressure compensator for governor free operation and rate limiter of turbine control valve demand signal for correct functions.

(b) preliminary adjustments of controllers for prescribed open-loop frequency response or step response.

(c) verification of signal continuity, scaling, interface mating, sensor calibration and limiter setpoints.

(d) proper operation of redundant controller upon simulated operating controller failure.

(e) proper operation of pressure setpoint and load demand step test functions. ~~for Item (b) above~~

(f) verification of the calibration of redundant pressure sensors to within the prescribed limits as specified by the appropriate ~~PD~~ SB&PC design specification.

(g) capability of the self-test and on-line diagnostic features in identifying the presence of a fault and determine the location of the failure.

(h) capabilities of cold and warm start features, i.e., self-starting following a power interruption to the full system and bringing a processing channel on-line with the other channels in operation, without the need for operator or technician action.

(i) proper operation of the technician interface unit in the various operational modes.

(d) proper operation of valve auxiliaries such as hydraulic fluid systems, including pumps and accumulators, and power supplies; and

(e) proper interface with (i.e. response and feedback to) the steam bypass and pressure control system.

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

14.2.12.1.66 Steam Bypass and Pressure Control System Preoperational Test

(1) Purpose

To verify proper operation of the steam bypass and pressure control system (SBPCS) including, as appropriate, higher level control of the turbine bypass system, the turbine control system, and the recirc flow control sys ..

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The preoperational tests have been completed on the turbine bypass and control systems (including the EHC system) to extent necessary to support integrated system testing and all SBPCS components have been initially calibrated in accordance with vendor instructions. The required supporting systems and equipment shall be available, as needed, for the specified testing configurations.

(3) General Test Methods and Acceptance Criteria

The SBPCS is primarily an electronic control system. It does not include any large mechanical equipment (i.e. turbine stop, control and bypass valves) nor any associated hydraulic actuators, but does provide for their integrated control. System preoperational testing will be limited to demonstrations without (or with significantly reduced, from a temporary source) turbine steam flow. Comprehensive steam flow testing will be conducted during the startup phase.

Performance shall be observed and recorded during a series of individual component and integrated system test to demonstrate the following:

(a) proper operation of instrumentation and controls in all combinations of logic and instrument channel trip, including verification of setpoints;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of associated valves, including timing and stroke, in response to control system demands;

(d) proper operation of interlocks and equipment protective devices;

(e) proper operation of permissive, prohibit, and bypass functions;

(f) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational; and

(g) proper communication and interface with other equipment and control systems.

System operation is considered acceptable when the observed/ measured performance characteristics, from the testing described above, meet the applicable design specifications

14.2.12.1.67 Feedwater Heater and Drain System Preoperational Test

(1) Purpose

To verify proper operation of the feedwater heaters and their associated drains including heater level control capabilities.

(2) Prerequisites

All applicable preliminary component tests

~~The construction tests~~ have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of

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testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Method and Acceptance Criteria

The feedwater heater and drain system includes the feedwater heaters, internal and external drain coolers, normal and emergency dump valves, shell and tube side isolation valves, shell side vents and safety relief valves, and associated instrumentation, control and logic.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of system valves and actuators under expected operating conditions;

(d) proper operation of interlocks and equipment protective devices;

(e) proper operation of permissive, prohibit, and bypass functions; and

(f) proper operation of heater level controls including response of the associated drain/dump valves.

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

14.2.12.1.68 Extraction Steam System Preoperational Test

(1) Purpose

To verify proper operation of the components which comprise the extraction steam system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Comprehensive testing of the extraction steam system will require the turbine generator to be on line with a substantial amount of steam flow available. Since significant steam flow conditions are dependent on nuclear heating, the preoperational phase testing that is possible will be limited. Performance shall be observed and recorded during a series of component and system tests to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of system valves under expected operating conditions including response of air assisted nonreturn check valves to a turbine trip signal;

(d) proper operation of interlocks and equipment protective devices; and

(e) proper operation of permissive, prohibit, and bypass functions.

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

14.2.12.1.69 Moisture Seperator/Reheater System Preoperational Test

(1) Purpose

To verify proper operation of the turbine moisture sperator/ reheaters (MSRs) and their

This test shall demonstrate that the feedwater heater and drain system operates as specified by Subsection 10.4.7 and the applicable manufacturer's technical instruction manuals through the following testing:

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All applicable instrument calibration and loop checks have been completed in accordance with the instrument supplier's instructions. Appropriate AC power sources that supply electric power to motors, control circuits and instrumentation are available to support testing. The system valve and electric lineups shall have been completed per the applicable plant operating procedures. The following systems/equipment are available and operational for test use:

* Instrument air system
* Communication equipment
* Electrical instrument equipment

Additionally, a simulated input signals for feedwater heater level transients shall be provided during the performance of heater level control testing.

testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Method and Acceptance Criteria

The feedwater heater and drain system includes the feedwater heaters, internal and external drain coolers, normal and emergency dump valves, shell and tube side isolation valves, shell side vents and safety relief valves, and associated instrumentation, control and logic.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of system valves and actuators under expected operating conditions;

(d) proper operation of interlocks and equipment protective devices;

(e) proper operation of permissive, prohibit, and bypass functions; and

(f) proper operation of heater level controls including response of the associated drain/dump valves.

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

14.2.12.1.68 Extraction Steam System Preoperational Test

(1) Purpose

To verify proper operation of the components which comprise the extraction steam system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Comprehensive testing of the extraction steam system will require the turbine generator to be on line with a substantial amount of steam flow available. Since significant steam flow conditions are dependent on nuclear heating, the preoperational phase testing that is possible will be limited. Performance shall be observed and recorded during a series of component and system tests to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and status, including response to pressure variable to provide alarm at the prescribed value.

(c) proper operation of system valves under expected operating conditions including response of air assisted nonreturn check valves to a turbine trip signal;

(d) proper operation of interlocks and equipment protective devices; and

(e) proper operation of permissive, prohibit, and bypass functions.

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

14.2.12.1.69 Moisture Seperator/Reheater System Preoperational Test

(1) Purpose

To verify proper operation of the turbine moisture sperator/ reheaters (MSRs) and their

This test shall demonstrate that the extraction steam system operates as specified by the applicable manufacturer's technical instruction manuals through the following testing:

Insert V

All permanently installed instrumentation have been properly calibrated and loop checks completed in accordance with the instrument suppliers instructions. Applicable power sources to supply electric power to motors, control circuits, and instrumentation are available. The system valve and electric lineups have been completed per the applicable plant operation procedures. The following systems/equipment are available and operational for test use:

* Instrument air system
* Communication equipment
* Electrical instrument equipment.

testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Method and Acceptance Criteria

The feedwater heater and drain system includes the feedwater heaters, internal and external drain coolers, normal and emergency dump valves, shell and tube side isolation valves, shell side vents and safety relief valves, and associated instrumentation, control and logic.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of system valves and actuators under expected operating conditions;

(d) proper operation of interlocks and equipment protective devices;

(e) proper operation of permissive, prohibit, and bypass functions; and

(f) proper operation of heater level controls including response of the associated drain/dump valves.

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

14.2.12.1.68 Extraction Steam System Preoperational Test

(1) Purpose

To verify proper operation of the components which comprise the extraction steam system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Comprehensive testing of the extraction steam system will require the turbine generator to be on line with a substantial amount of steam flow available. Since significant steam flow conditions are dependent on nuclear heating,the preoperational phase testing that is possible will be limited. Performance shall be observed and recorded during a series of component and system tests to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of system valves under expected operating conditions including response of air assisted nonreturn check valves to a turbine trip signal;

(d) proper operation of interlocks and equipment protective devices; and

(e) proper operation of permissive, prohibit, and bypass functions.

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

14.2.12.1.69 Moisture Seperator/Reheater System Preoperational Test

(1) Purpose

To verify proper operation of the turbine moisture sperator/ reheaters (MSRs) and their

associated drain pathways, steam extraction lines, and isolation and non-return check valves.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The MSRs include both a moisture seperator and reheater compartment each with their owndrains, shell and tube side isolation valves, shell side vents and safety relief valves, and associated instrumentation, control and logic.

Comprehensive testing of the extraction steam system will require the turbine generator to be on line with a substantial amount of steam flow available. Since significant steam flow conditions are dependent on nuclear heating, the preoperational phase testing that is possible will be limited.

Performance shall be observed and recorded during a series of individual component and integrated system tests, to demonstrate the following:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of system valves and actuators (including isolation and non-return check valves) under expected operating conditions;

(d) proper operation of interlocks and equipment protective devices;

(e) proper operation of permissive, prohibit, and bypass functions; and

(f) proper operation of moisture seperator and reheater compartment drain pathways.

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

14.2.12.1.70 Main Turbine and Auxiliaries Preoperational Test

(1) Purpose

To verify that the operation of the main turbine and its auxiliariy systems, including the gland sealing system, lube oil system, turning gear, supervisory instrumentation, and turbine protection system (including overspeedprotection), is as specified. Testing of the turbine valves and associated control systems is specified separately (elsewhere).

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. To the extent practicable, a temporary steam supply shall be available for driving the turbine. The turbine instruction manual shall be reviewed in detail in order that precautions relative to turbine operation are followed. All required interfacing systems shall be available, as needed, to support the specified testing and the corresponding system configurations.

(3) General Test Methods and Acceptance Criteria

Since preoperational testing is performed utilizing a temporary steam supply, the extent to which the turbine itself can be tested may be limited. Therefore, the testing effort at this stage will concentrate on assuring that the necessary turbine auxiliaries are functioning properly.

Performance shall be observed and recorded during a series of individual component, subsystem and integrated system tests (to the extent possible) to demonstrate the following, with regrads to both the turbine and its auxiliaries:

Insert W

This test shall demonstrate that the MSR and its associated instrumentation and control operate as specified by the manufacturer's technical instruction manual and Subsection 10.2.3.4.2.11 through the following testing:

Insert W

MSR

1 of 1

Prerequisites, includes but not necessarily limited to the following, must be completed prior to the test:

(a) All instrumentation and devices associated with the MSR have been installed and permanent wiring connections made, and shall have been adjusted to the values specified by the vendor's instructions.

(b) The applicable power sources to supply electrical power to motors, control circuits, and instrumentation shall be available as required to support testing.

(c) The system valve and electrical lineups have been completed in accordance with the applicable system's operation procedures prior to the test.

(d) The following system and/or equipment shall be available for test use:

* Instrument air system
* Test pressure sources and pressure test gauges
* Communication equipments

associated drain pathways, steam extraction lines, and isolation and non-return check valves.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. All required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The MSRs include both a moisture seperator and reheater compartment each with their owndrains, shell and tube side isolation valves, shell side vents and safety relief valves, and associated instrumentation, control and logic.

Comprehensive testing of the extraction steam system will require the turbine generator to be on line with a substantial amount of steam flow available. Since significant steam flow conditions are dependent on nuclear heating, the preoperational phase testing that is possible will be limited.

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

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

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

(c) proper operation of system valves and actuators (including isolation and non-return check valves) under expected operating conditions;

(d) proper operation of interlocks and equipment protective devices;

(e) proper operation of permissive, prohibit, and bypass functions; and

(f) proper operation of moisture seperator and reheater compartment drain pathways.

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

14.2.12.1.70 Main Turbine and Auxiliaries Preoperational Test

(1) Purpose

To verify that the operation of the main turbine and its auxiliary systems, including the gland sealing system, lube oil system, turning gear, supervisory instrumentation, and turbine protection system (including overspeedprotection), is as specified. Testing of the turbine valves and associated control systems is specified separately (elsewhere).

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. To the extent practicable, a temporary steam supply shall be available for driving the turbine. The turbine instruction manual shall be reviewed in detail in order that precautions relative to turbine operation are followed. All required interfacing systems shall be available, as needed, to support the specified testing and the corresponding system configurations.

(3) General Test Methods and Acceptance Criteria

Since preoperational testing is performed utilizing a temporary steam supply, the extent to which the turbine itself can be tested may be limited. Therefore, the testing effort at this stage will concentrate on assuring that the necessary turbine auxiliaries are functioning properly.

Performance shall be observed and recorded during a series of individual component, subsystem and integrated system tests (to the extent possible) to demonstrate the following with regrads to both the turbine and its auxiliaries:

This test shall demonstrate that the turbine and its auxiliaries operate as specified by Subsection 10.2 and the applicable manufacturer's technical instruction manuals through the following testing:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability, including the turbine supervisory instrumentation;

(c) proper operation of system pumps and valves in all design operating modes;

(d) proper system flow paths, flow rates and pressures (particularly with regards to the lube oil and gland sealing steam systems);

(e) proper operation of interlocks and equipment protective devices in the turbine, pump, and valve controls (including the various primary and backup turbine overspeed protection devices);

(f) proper operation of permissive, prohibit and bypass functions;

(g) proper operation while powered from both primary and alternate sources, including transfers, and in degraded modes for which the system, subsystem or component is expected to remain operational;

(h) proper turbine alignment, including acceptability of displacement and vibration levels, if possible, during both transient and steady state operation;

System operation is considered acceptable when the observed/ measured performance characteristics, from the testing described above, meet the applicable design specifications (while accounting for the testing limitations imposed).

14.2.12.1.71 Main Generator and Auxiliary Systems Preoperational Test

(1) Purpose

Verify that the operation of the main generator and its auxiliariy systems, including the generator hydrogen system and its associated seal oil and cooling systems, those subsystems and/or components that provide cooling to the generator exciter, stator, circuit breakers and isophase bus duct, and the generator protection system, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. To the extent practicable, and in conjunction with the turbine preoperational testing, a temporary steam supply shall be available for driving the turbine/generator. The generator instruction manual shall be reviewed in detail in order that precautions relative to generator operation are followed. All required interfacing systems shall be available, as needed, to support the specifiedtesting and the corresponding system configurations.

(3) General Test Methods and Acceptance Criteria

Since preoperational testing in part is performed utilizing a temporary steam supply, the extent to which the turbine, and therefore the generator, can be tested may be limited. Therefore, the testing effort at this stage will concentrate on assuring that the necessary individual generator components and auxiliaries are functioning properly.

Performance shall be observed and recorded during a series of individual component, subsystem and integrated system tests (to the extent possible) to demonstrate the following, with regrads to both the generator and its auxiliaries:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system pumps, valves, fans, and piping or ducting in all design operating modes;

(d) proper system flow paths, flow rates and pressures (particularly with regards to the

VB & clerk.

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Main turbine and condenser shall be ready to receive gland sealing steam. Main condenser evacuation system shall be available and operational to draw vacuum and maintained on the main condenser. Applicable electrical power sources and pneumatic sources shall also be available for use. The turbine control system and the SB&PC system shall be available and operational.

T/B & aux.

Insert b

(c) proper operating condition of the turbine lube oil pumps and turning-gear oil pump during continuous pump run tests.

(d) proper operation of turbine lube oil system to ~~provide~~ provide lube oil to bearing surfaces and turning-gear. This test shall also verify the automatic starting features of all motor-driven lube oil pumps and the alarm functions of lube oil level gages.

(e) proper operating conditions and performance capability of the TGSS and exhaust blower to maintain a prescribed steam pressure in the seal steam header. This test shall also verify correct steam sealing regulating valve functions.

(f) proper turbine operation during continuous turning-gear run test. This test shall also verify correct turning-gear engagement and dis-engagement functions as specified by the manufacturer's technical instruction manual.

T/B & aux.

(g) proper performance capability of the emergency trip system (ETS) in shutting down the turbine and closing the main stop and control valves and CIVs. This test shall also verify the instrumentation associated with the ETS for correct functions and setpoints.

(h) proper operation of the turbine overspeed protection system to provide mechanical overspeed trip and electrical backup overspeed trip as specified by Subsection 10.2.2.4 and the manufacturer's technical instruction manual. This test shall also verify the trip value for correct functions.

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability, including the turbine supervisory instrumentation;

(c) proper operation of system pumps and valves in all design operating modes;

(d) proper system flow paths, flow rates and pressures (particularly with regards to the lube oil and gland sealing steam systems);

(e) proper operation of interlocks and equipment protective devices in variousturbine, pump, and valve controls (including the various primary and backup turbine overspeed protection devices);

(f) proper operation of permissive, prohibit, and bypass functions;

(g) proper operation while powered from both primary and alternate sources, including transfers, and in degraded modes for which the system, subsystem or component is expected to remain operational;

(h) proper turbine alignment, including acceptability of displacement and vibration levels,if possible, during both transient and steady state operation;

System operation is considered acceptable when the observed/ measured performance characteristics, from the testing described above, meet the applicable design specifications (while accounting for the testing limitations imposed).

14.2.12.1.71 Main Generator and Auxiliary Systems Preoperational Test

(1) Purpose

Verify that the operation of the main generator and its auxiliariy systems, including the generator hydrogen system and its associated seal oil and cooling systems, those subsystems and/or components that provide cooling to the generator exciter, stator, circuit breakers and isophase bus duct, and the generator protection system, is as specified.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. To the extent practicable, and in conjunction with the turbine preoperational testing, a temporary steam supply shall be available for driving the turbine/generator. The generator instruction manual shall be reviewed in detail in order that precautions relative to generator operation are followed. All required interfacing systems shall be available, as needed, to support the specifiedtesting and the corresponding system configurations.

(3) General Test Methods and Acceptance Criteria

Since preoperational testing in part is performed utilizing a temporary steam supply, the extent to which the turbine, and therefore the generator, can be tested may be limited. Therefore, the testing effort at this stage will concentrate on assuring that the necessary individual generator components and auxiliaries are functioning properly.

Performance shall be observed and recorded during a series of individual component, subsystem and integrated system tests (to the extent possible) to demonstrate the following with regards to both the generator and its auxiliaries:

(a) proper operation of instrumentation and equipment in all combinations of logic and instrument channel trip;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system pumps, valves, fans, and piping or ducting in all design operating modes;

(d) proper system flow paths, flow rates and pressures (particularly with regards to the

Insert a

generator hydrogen system and its associated seal oil and cooling systems);

(e) proper operation of interlocks and equipment protective devices in the various generator and auxiliary system controls;

(f) proper operation of permissive, prohibit, and bypass functions;

(g) proper operation while powered from primary and any alternate sources, including transfers, and in degraded modes for which the system, subsystem or component is expected to remain operational;

(h) proper generator alignment, including acceptability of clearance and vibration levels, if possible, during both transient and steady state operation;

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications (while accounting for the testing limitations imposed).

14.2.12.1.72 Flammability Control System Preoperational Test

(1) Purpose

To verify the ability of the flammability control system (FCS) to recombine hydrogen and oxygen and therefore maintain the specified inert atmosphere in the primary containment during long term post accident conditions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The wetwell and drywell airspace regions of the primary containment shall be intact, and all other required interfaces available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper system flow paths and flow rates both into and out of the primary containment;

(e) proper operation of interlocks and equipment protective devices in valve and recombiner skid controls;

(f) proper operation of permissive, prohibit, and bypass functions; and

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/ measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.73 Loose Parts Monitoring System Preoperational Test

(1) Purpose

To verify proper functioning of loose parts monitoring equipment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Reactor internals shall be in place with all system sensors connected.

Insert A

(c) proper operating conditions of the seal oil pumps and stator cooling water pumps during continuous pump run tests.

(d) proper operating conditions and performance capability of the gas control system in removing air from and filling generator with hydrogen and providing gas pressure and temperature control during normal mode of operation as specified by the manufacturer's technical instruction manual.

(e) proper operation of the stator cooling system to provide adequate stator cooling water flow at prescribed flow rate and maintain inlet temperature and conductivity control as specified by the manufacturer's technical instruction manual.

(f) ~~proper operation~~ correct function of the generator runback circuitry in response to simulated high stator cooling water outlet temperature and low stator cooling water pressure signals as specified by the appropriate design specification and manufacturer's technical instruction manual.

generator hydrogen system and its associated seal oil and cooling systems);

(e) proper operation of interlocks and equipment protective devices in the various generator and auxiliary system controls;

(f) proper operation of permissive, prohibit, and bypass functions;

(g) proper operation while powered from primary and any alternate sources, including transfers, and in degraded modes for which the system, subsystem or component is expected to remain operational;

(h) proper generator alignment, including acceptability of clearance and vibration levels, if possible, during both transient and steady state operation;

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications (while accounting for the testing limitations imposed).

14.2.12.1.72 Flammability Control System Preoperational Test

(1) Purpose

To verify the ability of the flammability control system (FCS) to recombine hydrogen and oxygen and therefore maintain the specified inert atmosphere in the primary containment during long term post accident conditions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The wetwell and drywell airspace regions of the primary containment shall be intact, and all other required interfaces available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic;

(b) proper functioning of instrumentation and alarms ~~to monitor system operation and availability~~;

(c) proper operation of ~~system valves~~, including timing; ~~under expected operating conditions~~;

(d) ~~proper system flow paths and flow~~ both into and out of the primary containment;

(e) proper operation of interlocks ~~and equipment protective devices~~ and permissive and controls;

(f) proper operation of permissive, prohibit, and bypass functions; and

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/ measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.73 Loose Parts Monitoring System Preoperational Test

(1) Purpose

To verify proper functioning of loose parts monitoring equipment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Reactor internals shall be in place with all system sensors connected.

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proper system operating conditions as described in the following test cases:

(a) Trickle heater test for inside heater box temperature during steady state operation.

(b) Blower running test for blower flow rate, flow control valve position and each line's gas flow rate.

(c) Reaction chamber heat up test for blower flow rate, flow control valve position, each line's gas flow rate and the time for heating up the reaction chamber.

(d) In these tests, the system shall be operated normally without any abnormalities, vibration, or leakage in components, valves, and piping within the FCS.

generator hydrogen system and its associated seal oil and cooling systems);

(e) proper operation of interlocks and equipment protective devices in the various generator and auxiliary system controls;

(f) proper operation of permissive, prohibit, and bypass functions;

(g) proper operation while powered from primary and any alternate sources, including transfers, and in degraded modes for which the system, subsystem or component is expected to remain operational;

(h) proper generator alignment, including acceptability of clearance and vibration levels, if possible, during both transient and steady state operation;

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications (while accounting for the testing limitations imposed).

14.2.12.1.72 Flammability Control System Preoperational Test

(1) Purpose

To verify the ability of the flammability control system (FCS) to recombine hydrogen and oxygen and therefore maintain the specified inert atmosphere in the primary containment during long term post accident conditions.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The wetwell and drywell airspace regions of the primary containment shall be intact, and all other required interfaces available, as needed, to support the specified test.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and equipment in all combinations of logic;

(b) proper functioning of instrumentation and alarms used to monitor system operation and availability;

(c) proper operation of system valves, including timing, under expected operating conditions;

(d) proper system flow paths and flow rates both into and out of the primary containment;

(e) proper operation of interlocks and equipment protective devices in valve and recombiner skid controls;

(f) proper operation of permissive, prohibit, and bypass functions; and

(g) proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational.

System operation is considered acceptable when the observed/ measured performance characteristics, from the testing described above, meet the applicable design specifications.

14.2.12.1.73 Loose Parts Monitoring System Preoperational Test

(1) Purpose

To verify proper functioning of loose parts monitoring equipment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Reactor internals shall be in place with all system sensors connected.

including system trouble alarm (low alarm), set values, sensor verification and sensitivity measurements.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and alarms; and

(b) the adequacy of alert level setpoints based on preliminary data.

(high alarm)

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.74 Seismic Monitoring System Preoperational Test

including automatic data acquisition function upon receipt of alert level signal

(1) Purpose

To verify that the seismic monitoring system will operate as designed in response to a seismic event.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The required electrical power shall be available and all system recording devices shall have sufficient storage medium available, based on the expected duration of the testing scheduled.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of tests, as recommended by the manufacturer, to demonstrate the following:

(a) proper calibration and response of seismic instrumentation including verification of alarm and initiation setpoints;

(b) proper operation of internal calibration or test features;

(c) proper operation of recording and playback devices; and

(d) proper integrated system response to a simulated seismic event.

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.75 Liquid and Solid Radwaste Systems Preoperational Tests

(1) Purpose

To verify the proper operation of the various equipment and processes which make up the liquid and solid radwaste systems.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. There shall be access to appropriate laboratory facilities and an acceptable effluent discharge path shall be established. Additionally, an adequate supply of demineralized water, the necessary electrical power, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The testing described below consists of that of the equipment and processes for the handling, treating, storing, and preparation for the disposal or discharge of liquid and solid radwaste. Gaseous effluents are treated and released by the offgas system or the standby gas treatment system, the testing of which is specifically described elsewhere.

For the liquid and solid radwaste systems performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper operation of equipment controls and logic including prohibit and permissive interlocks;

(b) proper operation of equipment protective features and automatic isolation functions including those for ventilation systems and liquid effluent pathways;

by displacing the seismic switches and triggers of the system Rev B

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and alarms; and

(b) the adequacy of alert level setpoints based on preliminary data.

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.74 Seismic Monitoring System Preoperational Test

Additionally, instrument calibration and instrument loop checks shall have been completed.

(1) Purpose

To verify that the seismic monitoring system will operate as designed in response to a seismic event.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The required electrical power shall be available and all system recording devices shall have sufficient storage medium available, based on the expected duration of the testing scheduled. (AC and VC)

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of tests, as recommended by the manufacturer, to demonstrate the following:

(a) proper calibration and response of seismic instrumentation including verification of alarm and initiation setpoints;

(b) proper operation of internal calibration or test features;

(c) proper operation of recording and playback devices; and

(d) proper integrated system response to a simulated seismic event.

(including annunciations)

the seismic monitoring system functions in the test, record, and playback modes

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.75 Liquid and Solid Radwaste Systems Preoperational Tests

(1) Purpose

To verify the proper operation of the various equipment and processes which make up the liquid and solid radwaste systems.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. There shall be access to appropriate laboratory facilities and an acceptable effluent discharge path shall be established. Additionally, an adequate supply of demineralized water, the necessary electrical power, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The testing described below consists of that of the equipment and processes for the handling, treating, storing, and preparation for the disposal or discharge of liquid and solid radwaste. Gaseous effluents are treated and released by the offgas system or the standby gas treatment system, the testing of which is specifically described elsewhere.

For the liquid and solid radwaste systems performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper operation of equipment controls and logic including prohibit and permissive interlocks;

(b) proper operation of equipment protective features and automatic isolation functions including those for ventilation systems and liquid effluent pathways;

Service air, reactor building cooling water, heating steam, makeup water purified, and process sampling systems shall be operational and available for use.

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of instrumentation and alarms; and

(b) the adequacy of alert level setpoints based on preliminary data.

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.74 Seismic Monitoring System Preoperational Test

(1) Purpose

To verify that the seismic monitoring system will operate as designed in response to a seismic event.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The required electrical power shall be available and all system recording devices shall have sufficient storage medium available, based on the expected duration of the testing scheduled.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of tests, as recommended by the manufacturer, to demonstrate the following:

(a) proper calibration and response of seismic instrumentation including verification of alarm and initiation setpoints;

(b) proper operation of internal calibration or test features;

(c) proper operation of recording and playback devices; and

(d) proper integrated system response to a simulated seismic event.

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

14.2.12.1.75 Liquid and Solid Radwaste Systems Preoperational Tests

(1) Purpose

To verify the proper operation of the various equipment and processes which make up the liquid and solid radwaste systems.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. There shall be access to appropriate laboratory facilities and an acceptable effluent discharge path shall be established. Additionally, an adequate supply of demineralized water, the necessary electrical power, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The testing described below consists of that of the equipment and processes for the handling, treating, storing, and preparation for the disposal or discharge of liquid and solid radwaste. Gaseous effluents are treated and released by the offgas system or the standby gas treatment system, the testing of which is specifically described elsewhere.

For the liquid and solid radwaste systems performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

(a) proper operation of equipment controls and logic including prohibit and permissive interlocks and automatic operation functions;

(b) proper operation of equipment protective features and automatic isolation functions including those for ventilation systems and liquid effluent pathways;

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

(d) acceptable system and component flow paths and flow rates including pump capacities and tank volumes;

(e) proper operation of system pumps, valves, and motors under expected operating conditions;

(f) proper operation of phase separators and waste evaporators;

(g) proper operation of concentrating, solidifying, and packaging functions including verification of the absence of free liquids in packaged waste;

(h) proper operation of filter and demineralizer vessels and their associated support facilities;

(i) proper functioning of drains and sumps including those dedicated for handling of specific agents such as detergents; and

(j) proper calibration and operation of radiation detectors and monitors.

System operation is considered acceptable when the observed and measured performance characteristics, from the testing described above, meet the applicable design specifications

14.2.12.1.76 (Moved to 14.2.12.2.35)

14.2.12.1.77 Ultimate Heat Sink Preoperational Test

(1) Purpose

To verify that the ultimate heat sink is capable of supplying design quantities of make-up and/or return water to the circulating water system and the reactor turbine service water systems.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The circulating water system and the reactor and turbine

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

(d) acceptable system and component flow paths and flow rates including pump capacities and tank volumes;

(e) proper operation of system pumps, valves, and motors under expected operating conditions;

(f) proper operation of phase separators and waste evaporators;

(g) proper operation of concentrating, solidifying, and packaging functions including verification of the absence of free liquids in packaged waste;

(h) proper operation of filter and demineralizer units and their associated support facilities;

(i) proper functioning of drains and sumps including those dedicated for handling of specific agents such as detergents; and

(j) proper calibration and operation of radiation detectors and monitors.

System operation is considered acceptable when the observed and measured performance characteristics, from the testing described above, meet the applicable design specifications

14.2.12.1.76 (Moved to 14.2.12.2.35)

14.2.12.1.77 Ultimate Heat Sink Preoperational Test

(1) Purpose

(UHS)

To verify that the ultimate heat sink is capable of supplying design quantities of ~~make-up and/or return water to the circulating water system and the reactor turbine service water systems.~~ cooling water to the reactor service water (RSW) system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. ~~The circulating water system and the reactor and turbine~~

All instrumentation and devices associated with the UHS have been properly calibrated.
The HVAC system within spray pond pump structure is operational and available.
The reactor service water system is operational and available for all anticipated modes of RSW system operation.
Sufficient quantity of water are available in the spray pond for use.

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

(3) General Test Methods and Acceptance Criteria

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

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

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

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

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

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

14.2.12.2 General Discussion of Startup Tests

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

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

Where applicable, the relevant acceptance criteria for the test are discussed. Some of the criteria relate to the value of process variables assigned in the design or analysis of the plant,

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(b) proper operating conditions and performance capability of the UHS spray networks during all anticipated modes of the RSW system operations as specified by Subsection 9.2.5.4.1.

(c) proper operating conditions and performance capability of the UHS in cold weather mode of operation through the bypass line as specified by Subsection 9.2.5.4.e.

(d) proper operation of the makeup water valve to maintain proper water level in the UHS spray pond through makeup line and maintain water quality in conjunction with the blowdown operation

(e) proper operation of blowdown from the UHS spray pond to remove excess water through the blowdown line.

and maintain water quality control