



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

April 13, 1993

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 - **Modifications to Section 14.2**

Dear Chet:

Enclosed is a markup of showing proposed modifications to our February 12, 1993 submittal of Section 14.2 which responded to Open items 14.2.12.3-1 and 14.2.12.3-2. These modifications are indicated as "per this change, dated March 17, 1993" on the enclosed pages. These modifications are the result of a recent GE review of Section 14.2 based on ITAAC and available design documents.

Please provide a copy of this transmittal to Frank Talbot.

Sincerely,

Jack Fox
Advanced Reactor Programs

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

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Specific testing to be performed and the applicable acceptance criteria for each pre-operational 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 the 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, *(Setpoint value, position transmits)*

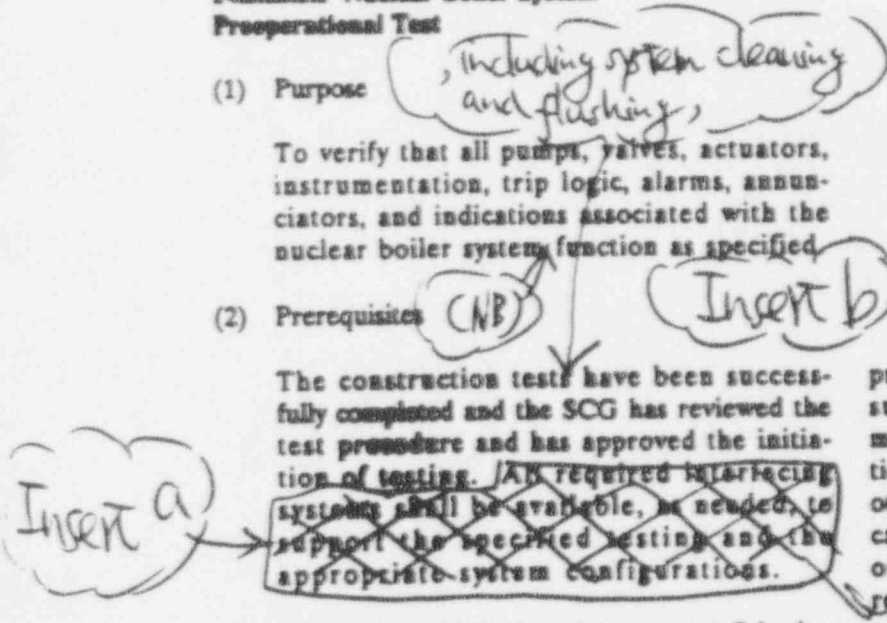
(e) proper operation of SRV air piston actuators and discharge line vacuum breakers;

(f) verification of the acceptable leak tightness and overall integrity of the reactor coolant pressure boundary via the leakage rate and/or hydrostatic 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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- (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.

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- (l) that MSIVs will stroke to the fully closed position upon the loss of pneumatic pressure to the MSIV actuators.
- (m) that the main steam line drain valves will open when pneumatic pressure to the valve is removed or electric power to the valve actuating solenoid is lost.
- (n) that the main steam line drain valves will close upon receipt of a simulated containment isolation initiation signal.

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.

(RFC)

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing.

Fault-tolerant capability of the redundant RFC digital controller as simulated single processor channel failure.

Performance shall be available, as needed, to support the specified testing and the corresponding system configurations.

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(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 ~~control~~ 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);

control

Stability control and protection (SCP) alternate reduction (ARI), reactor trip (RT), flow back

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

including calibration of process sensors, operator displays and alarm annunciation configuration of signal continuity, scaling and validation logic and operator/technician interfaces and set

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

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

recirculation pump and pump meter component

(e) proper operation of the adjustable speed drives;

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

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(g) ~~proper operation of interlocks and~~

stop logic and all control functions.

(h) ~~proper operation of permissive prohibit and bypass functions, and~~

(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.~~

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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.

14.2.12.1.4 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.

proper steady-state and shutdown performance of M-G sets.

(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-

(a) proper operation of the technician interface used in the various operational modes.

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(k) capabilities of cold and warm start features, ie, 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



(l) proper operation of the RIP₂ trip function by verifying that RIP₂ trip in response to simulated high dome pressure, low water level and both signals as specified by the appropriate RFC system design specification.

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* this change, dated 3/17/93



such as, service air system, purified makeup water system, electrical instrumentation and communication equipment.

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.

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

14.2.12.1.5 Standby Liquid Control System Preoperational Test

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.

(1) Purpose

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

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

(2) Prerequisites

A sufficient quantity of chemically acceptable water is available to conduct the test.

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.

- (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.

(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, ~~uninspected operating conditions~~, and position indicators;
- (d) proper operation of pumps and motors in all design operating modes;

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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.
- (n) 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.

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dated 3/17/93

- (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).

- (p) adequate NPSH verification by injecting demineralized water using both SLC S pumps and flow path from the storage tank to the RPV with conditions in the storage tank of low level (down to pump trip level) and temperature greater than or equal to 43°C

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- (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.

ciated 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; *(Rod Action and Position Information Subsystem)*
 - (c) proper functioning of ~~CRD system~~ 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; *(rod selection and verification logic)*
 - (d) proper operation of RC&IS software including verification of gang ~~and~~ ~~rod worth~~ and ~~banked position~~ ~~functions~~; and *(minimize)*
- (rod withdraw sequence)*

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

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 asso-

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operation and
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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, shutdowns 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

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- (f) proper operation of automated thermal limit monitor (ATLM) to generate a red block signal based on LPRM and control rod position input data that simulate a condition of fuel operating thermal limits violation.
 - (g) capability of RC&IS continued operation under the condition with different subsystems of RC&IS being bypassed.
 - (h) proper functioning of the RC&IS bypass interlock logic to preclude a bypass state that could render RC&IS inoperational as specified in the appropriate design documents.
 - (i) proper operation of single-failure design feature of RC&IS by verifying that RC&IS is capable of continued operation with one channel disabled, that one channel can cause a red block, and that two channels must be in agreement to cause normal RC&IS functioning of control rod movements.

(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 relief 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 documentation 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 ~~mode~~ including verification 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.

14.1.12.1.9 Reactor Core Isolation Cooling System Preoperational Test

(1) Purpose

The temporary strainer shall also be installed in the pump suction. 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

Such as reactor pressure vessel, suppression pool, condensate storage pool, instrument air system, condensate makeup water system, reactor building cooling water system and communication equipment

including alarm initiation at the established value and reset when operating signal is removed.

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RCIC turbine accessories

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

(b) proper functioning of instrumentation and alarms ~~under most operating conditions and availability~~

(c) proper operation of ~~valves~~ valves, including timing ~~under expected operating conditions~~ operability, position indicator, and ~~air operated~~ call motor operated and air operated

(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 start flow,~~

(n) 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

(o) 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:

(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;

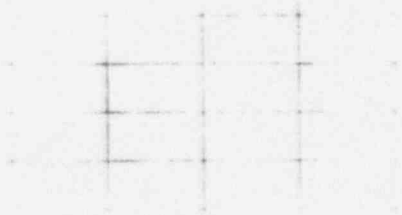
(a) proper operation of instrumentation and equipment in all combinations of logic

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- (a) correct implementation and operation of the RCIC 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).

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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 steam 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.~~

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(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 operability. The SSLC, therefore, should be adequately tested during the preoperational phase testing of the associated systems including the integrated LOP/LOCA test. Since the construction testing and the associated system preoperational testing has been successfully completed, as it relates to proper operation of the SSLC, no specific additional testing should be necessary.

shall operate include Provi associ

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

will

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 module

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SSLC

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~~The verification and validation testing for the SSLC software-based controls and instrumentation systems 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.

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* of the SSLC functional logic
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SSLC
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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 (RMU 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 scratch test (RPS), by actuating manual scratch switches.
- * MSIV test close, by manually operating test close switch.
- * Divisional MSIV isolation test, by manually actuating divisional 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 SBU, using input simulation and automatic self-test feature.
- * Equipment operation, using input simulation or manual.

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SSLC

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acceptability of the SSLC bypass functions, including
division-of-server bypass and division-out-of-service
bypass as specified by the appropriate SSLC system
design specifications.

Capability of the automatic self-test feature in
verifying proper operation of the functional logic
of each SSLC logic processor.

proper operation of fail-safe (de-energize-co-operate)
design feature of SSLC upon loss of AC or DC
power as described by the appropriate design specifications.

correct functioning of the digital trap module (DTM),
trap logic unit (TLU) or safety system logic unit
(SBU) in SSLC signal processing as described by
the appropriate design specifications.

proper annunciator action for trap of any channel,
including announcement display and reset functions.

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(2) Prerequisites

System construction testing has been successfully completed.

drywell sumps.

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

(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.

~~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;

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

Open/close cycling, position indicators, verification and crawl

(d) proper response of related system valves, including timing, ~~edges reported~~ ~~operating, and security;~~

(1) Purpose

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

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

(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.~~

(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.

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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.

(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

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.

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- (h) proper operation of the LDS functions such as equipment area leak detection for RHR and RCC systems and area leak detection for main steamline tunnel in reactor building and turbine building and CW system.
- (i) proper operation of drywell cooler condensate flow monitoring including flow indicator and alarm activation.
- (j) correct function of flow transmitter and differential flow switch on the CW flow leak detection system.
- (k) correct function of RCC steamline high flow and main steamline high flow detection and the associated trip initiations.

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- (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.

- (n) that loss of electrical power to the LD&IS diversion logic channel will initiate a channel trip
- (o) that logic circuitry can be reset manually from the main control room.

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(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 Method 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.

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simulated RPS multiplexed input signals shall be provided for each of the four RPS divisions. Special test instrumentation for simulated inputs data reduction, and analysis shall be available for use. Systems which may be checked by the input process variables that are not intended to function during a specified test shall be blocked out before the test.

(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.

Prerequisites 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 *proper operation of each RPS input signals from RPS and RPS backup signal initiations at the pre-actuation*

(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;

(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) availability of bypass switches including related logic;
- ~~(f) proper operation of permissive and prohibit interlocks;~~

- (a) 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
- (b) 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

(f) proper operation of manual trip mode switch functions.

This test shall also include signal error checking and signal conditioning functions.

** per div change dated 7/17/93*

This test shall include verification of RPS fail-safe function - failure - insert

a

Insert a

41
RPS

- (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 operations.

dated: 3/17/93

(k) acceptability of the time period established within which manual reset is automatically inhibited following a full reactor scram initiation condition



* per this change, dated 3/17/93

- (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; *(Scaling, interface mating)*
- (b) proper operation of data logging and plotting features; *(alarm monitoring and print)*
- (c) verification of computer priorities and CRT displays; *(including the capability of setting setpoint scaling)*
- (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 pre-operational 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. *(and BOP/MS performance calculations)*

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

- (a) proper operation of redundant controller functions in response to a simulated controller failure.
- (b) proper operation of system self-checking function.

Amendment 21

* per this change dated 7/17/93

* dated 3/17/98 (Insert 9)

Insert a

(j) capability of the PGCS to automatically decouple from the plant control circuitry and revert the plant operation to manual mode upon receipt of a simulated failure signal.

→ *

* per this change, dated 3/17/93



- (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

Steam bypass and pressure control system

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

(c) verification of the dynamic characteristics of load rate limiter and reactor power compensator for correct functioning.

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

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 systems 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;

** per this change dated 3/17/93*

dated 7/17/93

Amendment 21

Insert a

Insert a

- (f) capability of the APR system to identify and isolate failure of process input signals
- (g) proper operation of the redundant controller function upon a simulated controller failure.
- (h) proper operation of the APR system upon loss of any one power supply.

→ *

* per this change related
7/17/93

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- (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 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-

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Standard Plant**

Instrument air system, makeup water system and electrical power system shall be in operation and available for use during this test

ried 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.

Confirm that all components subject to interlocking signals in this system operate properly

(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;

(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.

Filling water to the reactor well using the suppression pool as water source.

~~(j) proper system operation while providing the specified inter-system test capabilities; and~~

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

Inset a

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

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

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.

** per this change dated 3/17/93*

(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 opening, closing, and operation in all design operation modes;~~

Water operated and air operated

operability, position indication, verification and isolation function

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

(e) acceptable pump NPSH under the most limiting design flow 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 required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

dated: 3/17/93

(3) General Test Methods and Acceptance Criteria

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

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

proper system operating conditions during rated flow operation through filter/demineralizer and while manually adjusting filter/demineralizer by flow rate operation.

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 prep 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 compliance 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 a 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

of plant process sampling system (PASS)

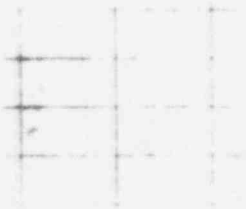
(Insert)

Insert a (cont'd)

(K) capability of opening the PASS isolation valve under simulated LCCA conditions.

→ *

* per this change, dated 3/17/93



(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:

Amendment 21

The CAMS system valve liners are completed. All applicable ~~test~~ power sources to supply electric power to control circuits and instrumentation are available for use. Appropriate simulation of sensor and CAM system response is provided prior to the test.

- (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:

Insert A

- (g) proper operation of the heat tracing used in each H_2/O_2 sample line to maintain prescribed temperature.
- (h) proper operation of all remote-operated subacid operated valves.
- (i) proper operation of oxygen and hydrogen analyzers as specified by the manufacturer's technical instruction manual.

(j) proper operation of the CAM system containment isolation valve ~~and~~ automated closure function upon receipt of a simulated containment violation initiation signal.

dated:
3/17/93

*

* per this change, dated 3/17/93

including alarm activation and test, alarm set value, alarm indication and operating logic. REV B

modes for which the system is expected to remain operational;

as needed, to support the specified system testing.

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

(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:

(l) the ability of the air to meet end use cleanliness requirements with respect to oil, water, and particulate matter content;

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

(m) continued operability of supplied loads in response to credible failures that result in an increase in the supply system pressure;

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

(n) proper "failure" (open, close, or ~~as ill~~) of supplied components to both instantaneous (pipe break) and slow (plugging or freezing) simulated air losses (per Regulatory Guide 1.68.3); and

all motor operated and air operated valves including valve function

proper operation of ~~valves~~, including timing ~~and approved operating conditions~~;

valve operability, indicator lighting

(o) the ability of the service air system to act as backup to the instrument air system.

(d) ability to maintain receiver(s) at specified pressure(s) under design loading conditions;

* per this change, dated 2/17/93

~~proper system flow paths and acceptable flow rates to individual loads at specified temperatures and pressures under design loading conditions;~~

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

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

14.2.12.1.25 High Pressure Nitrogen Gas Supply System Preoperational Test

(1) Purpose

including operation of all components subject to interlocking, interlocking set value and operating logic

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.

(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;

(2) Prerequisites

including pressure proof test

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.

(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

Instrument air system, electrical instrument equipment and communication equipment are available for use.

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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 ~~alarms~~ in all combinations of logic and instrument channel trip;
- (b) proper functioning of instrumentation and ~~alarms~~ in ~~all~~ ~~design~~ ~~operating~~ ~~modes~~;
- (c) proper operation of ~~valves~~ valves, including ~~testing~~ ~~motor~~ ~~operation~~ ~~opening~~ ~~and~~ ~~closing~~ ~~cycles~~ ~~and~~ ~~timing~~;
- (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 ~~protective devices~~ in pump and valve control;~~

(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

(2) Purpose

proper operating conditions (flow, vibration, bearing temperature) of the RCW pumps during continuous pump run test in design operating modes.

* per this change dated 7/7

... increasing opening of all pumps subject to interlocking. This test can be performed by using simulated signal, of actual critical temperature practical.

Insert a

makeup water - partial distribution system

during system operation P.T.

and vice

RCW capability

control

all motor operated and air operated

and vibration function

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control, including pressurizer, surge tank level controller, and chilled water temperature controller functions.

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- (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.

*delete * per this change, dated 7/17/97*

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 event status~~; *meter operated level air upvote*
- (c) proper operation of system valves, including ~~operating conditions~~ *operability position indic*
- (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;~~ *Info*

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.

including alarm activation and reset, alarm set value, alarm indication and operating logic.

14.2.12.1.33 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.

Cooling
including confirmation that all components are operated in conformity with IPD and drawings.

Cooling

- (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;

(2) Prerequisites

The construction tests have been successfully completed and the SOG has reviewed the test procedures 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.

instrument air, makeup water piping

- (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

and nu!

- (l) ~~proper functioning of system surge tank and manual addition features.~~

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded

System operation is considered acceptable when the observed/measured performance

*instrument air system, 2nd building cooling water system
makeup water-purified distribution system*

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

**14.2.12.1.38 HVAC Normal Chilled Water System
Preoperational Test**

Cooling

(1) Purpose

Cooling

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

** per this change*

Control, including surge tank level controller, chilled water temperature controller, and chilled water flow switch function

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, ~~and instrument air~~, 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

Insert

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

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

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

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 equipment and systems.

(2) Prerequisites

The construction tests, including initial flow balancing, have been successfully

operability, position indicator and

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

(c) proper operation of system valves, including isolation functions, and associated operating conditions;

motor operated and air operated

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

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

including confirmation that all components are operated in conformity with IBD and Sequence Diagram

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(l) proper operation of the standby chiller and pump auto start feature upon loss of an operating chiller or pump.

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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 systems 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 equipment 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; *humidifiers, heaters, and air conditioners*
- (e) ~~proper system flow paths and flow rates, including individual component and total system capacities and overall system flow balancing;~~ *Insert C*
- (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

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operating times and

This test shall demonstrate that the HVAC system operates as specified by Subsection 9.4 and applicable manufacturer's technical instructions manuals through the following test:

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

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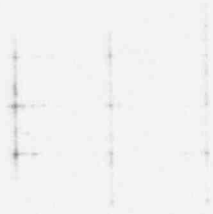
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spent fuel pool area ventilation system, service building ventilation system, radwaste building HVAC system, auxiliary area ventilation system, diesel-generator area ventilation system, reactor building ventilation system, control building HVAC system, turbine island ventilation system, drywell cooling system and control room habitability area HVAC system.



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(c) ability of the standby refrigerator and pump units to automatically start upon receipt of a simulated high cooling water temperature or operating pump failure signal.

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(p) ability of the standby control room habitability area HVAC division to automatically start in the emergency mode upon receipt of a simulated low flow signal from the operating control room habitability area HVAC division.

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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

14.2.12.1.35

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Control power, instrument air system, HVAC system, high pressure nitrogen gas supply system, and standby gas treatment system are operational and available for use.

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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.

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.

(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:

(2) Prerequisites

for nitrogen gas supply equipment, electric heater and PCV monitoring system

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.

Control

(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;~~ *and isolation function*

Inert a

(d) proper nitrogen air flow paths and flow rates both into and out of the primary containment;

(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: *function and all components subject to interlocking.*

(e) proper operation of interlocks and ~~other protective devices;~~

(f) proper operation of permissive, prohibitive, 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.

(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 the PCV during containment structural integrity test (Subsection 14.2.12.1.40.2) and integrated leakage rate test (Subsection 14.2.12.1

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the PCV during containment structural integrity test (Subsection 14.2.12.1.40.2) and integrated leakage rate test (Subsection 14.2.12.1

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(i) Capability of opening the AC system drywell purge exhaust bypass valve, wetwell purge exhaust bypass valves and the exhaust isolation valves under a simulated primary containment isolation condition.

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14.2.12.1.01 DC Power Supply System
Preoperational Test

trical independence for its particular application;

(1) Purpose

To verify the ability of DC power supply systems to supply highly reliable, uninterrupted power for instrumentation, logic, control, lighting and other normal and emergency loads that must remain operational during and after a loss of AC power.

(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 prohibitive interlocks;

(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.

(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.

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14.2.12.1.02 Emergency AC Power Distribution System Preoperational Test

(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, ~~as specified in the following:~~

Capability of each Class 1E DC bus system to provide the rated load as specified by Subsection 5.3.2, 2 hours

(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.

essential loads & how the bus associated with RCLC

This test shall demonstrate that the DC power system operates properly as specified by Subsection 5.3.2 through the following testing:

(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;

(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

proper load sizing and rated capacity verification by performing a discharge test. The individual voltage and specific gravity of each cell shall be within the prescribed limits following the performance of discharge test.

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(i) that the battery charger interlocks will prevent paralleling AC or DC dividers for the 125VDC safety-related DC power distribution system, paralleling AC load groups or DC batteries for the 125VDC non-safety-related DC power distribution system and paralleling AC load groups or battery chargers for the 250VDC non-safety-related DC power distribution system.

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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, uninterrupted 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 full/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 elec-

trical 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 (Moved to 14.2.12.1.45.4)~~

~~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 buses, the switchgear and motor control required for the individual loads served, and the coordinated system protective relaying. Performance shall be observed and recorded during~~

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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.

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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. Additionally, 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

**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.,

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Appropriate 125VDC control power source 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 480V 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~~ ^{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 oil, lubrication and combustion air intake and exhaust)~~ shall be available for this test.

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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;

(b) 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;

* per this change dated 3/17/93

(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 the 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.

Electrical

14.2.12.1.4.5.4 Normal AC Power Distribution System Preparational Test

(1) Purpose *essential and electrical*

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 configuration.~~

(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 system operates properly as specified by Subsection F.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.

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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to provide power to
plant loads

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The capabilities of the non-safety-related and the Class 1E power system portion of the on-site power system under various plant operating conditions will be demonstrated. The system components to be tested include the medium and low voltage power distribution system, power centers, motor control centers, vital AC power supply system, and instrumentation and control power supply system as appropriate to each portion of the on-site power system. The system performance capability, including actual loading of the EDG, is demonstrated in the EDG system preoperational test (Subsection 14.2.12.1.45.3). The ability of the DC power supply system to supply DC power to system loads is demonstrated in the DC power supply system preoperational test (Subsection 14.2.12.1.45.1).

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(i) the ability of the 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.

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(j) the adequacy of the plant emergency and essential lighting systems.

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- (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
- (b) 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 systems and components 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 internal 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 Main Condenser Evacuation 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.

Main Condenser Evacuation System

of the main condenser evacuation system (MCEES)

vacuum gland seal

Maintenance shall be on the turning gear. Instrument Air system, turbine building cooling water system, make water-purified system, off-gas system, Condensate system and electrical power systems shall be available for use

Invert adated
3/17/93

- (i) proper operation of the mechanic vacuum pump trip function and its discharge valve closure upon receipt of a simulated main steam high-high radiation signal.
- (j) proper operation of the isolation valve closure for the off-gas system upon receipt of a simulated low steam flow signal.

→ *

* per this change, dated 3/17/93

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This test shall demonstrate that the MCEs operate as specified by Subsection 10.4.2 and applicable manufacturer technical instruction manual through the following testing:

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(3) General Test Methods and Acceptance Criteria

(2) Prerequisites

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

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.

control

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

(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 activation and set, alarm indication and operating logic.

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

all remote-operated

(c) proper operation of valves, including ~~remote-operated~~ *operation remote indication* expected operating conditions;

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

(d) proper operation of the mechanical vacuum pumps including the ability to establish the required vacuum within the design time frame;

condition in the main condenser

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

(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);

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

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

(d) proper operation of components in all design operating modes;

(g) proper operation of interlocks and equipment protective devices in ~~proper~~ *including operation of all components subject to interlocking in this test*

(e) proper system and component flow paths and flow rates;

(h) proper operation of permissive, prohibitive, and bypass functions;

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

(g) proper operation of permissive, prohibitive, 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.

** per this change, dated 3/17/97*

Insert A

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.

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

* per this change
dated 3/17/93

Makeup water - Condensate (MUWC)

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

Makeup water - Condensate

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.

14.2.12.1.69 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

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/ measured 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.

**14.3.12.1.61 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

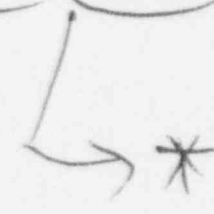
Performance shall be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

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:

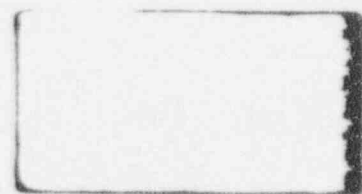
Insert b

(Q) acceptable performance capability of RSW heat exchangers to the extent practical. otherwise, RSW heat exchanger test can be performed in startup test stage.

dated 7/17/93 (M) proper operation of the standby heat exchanger inlet and outlet valve opening upon receipt of a simulated LOCA signal.



* per this change, dated 3/17/93



ABWR Standard Plant

All system instrumentation will be in accordance with the instrument data sheets and certified per instrument suppliers' instructions. All services, including water, electricity and communications shall be available and performing at their rated design level (voltage, pressure, etc.).

generator hydrogen system and its associated seal oil and cooling systems);

during a series of individual component and integrated system tests to demonstrate the following:

- (e) proper operation of interlocks and equipment protective devices in the various generator and auxiliary system controls; *including alarm actuation, reset, alarm set value, alarm indication*
- (f) proper operation of permissive, prohibit, and bypass functions; *and operating logic*
- (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; *timing and velocity functions*
- (h) proper generator alignment, including acceptability of clearance and vibration levels, if possible, during both transient and steady state operation;

- (a) proper operation of instrumentation and equipment in all combinations of logic;
- (b) proper functioning of instrumentation and alarms; *including a complete system operation and availability*
- (c) proper operation of ~~pressure~~ *pressure* valves, including ~~testing~~ *testing* under ~~normal~~ *normal* operating conditions; *all meter operation on air checked values*
- (d) proper system flow paths and flow indicators both into and out of the primary containment; *operability using value opening closing switches at the control panel*
- (e) proper operation of interlocks and equipment protective devices; *Insert a*

* per this change, dated 3/17/93

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).

- (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.

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.

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

(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.

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.

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

and instrumentation
Additionally, the LPMS channel checks shall have been completed with acceptable results. 10-2-00-13

including system double alarm (low alarm) set verification and sensitivity measurements.

(3) General Test Methods and Acceptance Criteria

simulated seismic event.

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

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

- (a) proper operation of instrumentation and alarms; and

14.2.12.1.75 Liquid and Solid Radwaste Systems Preoperational Tests

- (b) the adequacy of alert level setpoints based on preliminary data.

(1) Purpose

System operation is considered acceptable when the observed/measured performance characteristics meet the applicable design specifications.

To verify the proper operation of the various equipment and processes which make up the liquid and solid radwaste systems.

(2) Prerequisites

14.2.12.1.74 Seismic Monitoring System Preoperational Test

(1) Purpose

including automatic data acquisition function upon receipt of alert level signal

To verify that the seismic monitoring system will operate as designed in response to a seismic event.

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.

(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

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.

(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:

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 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

- (a) proper operation of equipment controls and logic including prohibitive and permissive interlocks;
- (b) proper operation of equipment protective features and automatic isolation functions including those for ventilation systems and liquid effluent pathways;

This test shall demonstrate that the LPTS operates properly as described in section 4.4.3 during the following testing

** per this change, dated 7/17/93*

**ABWR
Standard Plant**

Service air, reactor building cooling water, heating system, makeup water purifier, and process sampling systems shall be operational and available for use. 2306100247 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**

(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;

to collect, decant, and hold liquid/liquid-solid solutions in accordance with design.

(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;~~

(b) proper operation of filter and demineralizer units and their associated support facilities;

(i) proper functioning of drains and pumps including those dedicated for handling of specific agents such as detergents; and

~~(h) proper calibration and operation of radiation detectors and monitors.~~

(d) acceptable operation of the low conductivity waste (LCW) subsystem, high conductivity waste (HCW) subsystem and detergent waste (DW) subsystem as well as liquid waste system for correct process flow rates and flow paths, including discharge flow control and sampling techniques as specified by subsection 11.4.

(g) acceptable ~~operation~~ ^{functioning} of the thin film dryer, pelletizer, pellet filling machine, mixing tank, drum conveyor and incinerator during integral solid radioactive system operation in solidifying, packaging, compacting, and incinerating processes as specified by subsection 11.4.

Regeneration cycles of the liquid radioactive system.

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

14.2.12.1.77 Ultimate Heat Sink Preoperational Test

14.2.12.1.76 (moved to 14.2.12.2.36) solid radioactive waste

(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

(j) capability of the system to receive, process and transfer waste between designated locations using simulated waste variations

in accordance with the process control program (PCP)

(k) proper operation of automatic isolation function of RW system CUVs upon receipt of a simulated initiation signal.

*for this change, dated 3/17/93

*dated 7/17/93

*

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

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

reactor trip ~~should~~ also be verified. Overspeed of the main turbine ~~should~~ also be evaluated since the generator is unloaded prior to complete shutoff of steam to the turbine.

14.2.12.2.33 Turbine Trip and Generator Load Rejection

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

shall

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

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

(4) Criteria

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

Insert FY

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

Insert 11.11

typically, this trip is initiated by opening of the generator output breaker

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

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

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

* per this change,
dated 3/17/93

*



If any SRVs open, the response times of ~~one~~ actuated SRVs shall be within the limits specified in SSAR Subsection 5.2.2.4.1 and applicable nuclear boiler system design specifications.

14.2.12.2.34 Reactor Full Isolation

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

(4) Criteria

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

private design and testing specifications

14.2.12.2.35 Offgas System

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

shall

(4) Criteria

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

Testing of the offgas system is also discussed in 11.3.9.

Insert VV

Insert VI (Cont'd)

3 of 3

The positive changes in vessel dome pressure and simulated fuel surface heat flux occurring within the first 30 seconds after the closure of all MSIV valves must not exceed the predicted values referenced to actual test conditions of initial power level and dome pressure and corrected for the measured control rod insertion speed and insertion time.

The predicted values are provided in the applicable transient safety analysis design report (TSADR) based on the beginning-of-cycle design basis and shall be used as the basis to which the actual transient is compared.

If any SRVs open, the response times of actuated SRVs shall be within the limits specified in SSAR subsection 5.2.2.4.1 and applicable nuclear boiler system design specifications.

* per this change, dated 3/17/93