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GE Nuclear Energy

ABWR

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Subject Chapter 14

Message Chet-
Please pass a copy of this
along to Tim Polich.

Thanks

Jack

Follow-up on Chapter 14 Open Items

Page / Section	Issue	Response
14.2-3 / 14.2.3.1	Incorporation of last paragraph of SRP 14.2, Section II.8	Done, see revised Insert C
14.2-5.1 / 14.2.10.1	Change should to shall in last sentence	Done, see revised text
14.2-7 / 14.2.12.1	Change last sentence in Insert F	Done, see revised Insert F
14.2-9 / 14.2.12.1.3	Change "will likely" or better define meaning [item (3), first paragraph]	Done, see revised text
14.2-13 / 14.2.12.1.8 [DSER Item 132]	Incorporation of RG 1.139	Done, see revised text for items (3)(b) and (i) to directly reference RG 1.139
14.2-13 / 14.2.12.1.8 [DSER Item 133]	Incorporation of ASME testing of RHR relief valves [per RG 1.139]	Done, see revised text for item (3)(c) to address subject testing, including direct reference of RG 1.139
14.2-31 / 14.2.12.1.34	Incorporation of RG 1.95 [Item (3)(k)]	Done, reference to RG 1.95 added
14.2-33 / 14.2.12.1.42	Need more specific cross reference to location of testing information	Done, see revised subsection 14.2.12.1.42 for more detailed explanation regarding testing of containment isolation valve function and closure timing
14.2-64.2 / 14.2.12.2.37	Change should to shall [Item (4)]	Use of should is intentional and appropriate for issues involving performance expectations as opposed to those related to design basis analyses, safety limits or regulations where shall is utilized
14.2-64.3 / 14.2.12.2.38	Change should to shall [Item (4)]	Use of should is intentional and appropriate for issues involving performance expectations as opposed to those related to design basis analyses, safety limits or regulations where shall is utilized
14.2-65.1 / 14.2.13 [DSER Item 122]	Change wording to comply with RG 1.68 but without double negative	Done, see revised text
14.2-66 / Table 14.2-1	Define checkmarks	Done, see revised table with modified legend to define checkmarks
14.2-67 / Figure 14.2-1	Label 60% rod line D	Done, see revised figure
Various [DSER Item 124]	Trail from subsection 1A.2.4 (Item I.G.1 of NUREG 0737) to Chapter 14 - Appendix E of BWROG response dated 2/4/81 committed to additional testing	Done, see revised text in subsection 1A.2.4 - operator training and initial testing issues have been more specifically delineated and a more specific cross reference has been provided to Chapter 14; cross references back to 1A.2.4 have also been added to the referenced subsections in Ch. 14
Various [DSER Item 125]	Incorporation of RG 1.56 into subsections 14.2.12.1.19, 14.2.12.1.54 and 14.2.12.2.21	The referenced subsections describe testing of systems that help control reactor water chemistry whereas RG 1.56 is concerned with the ability to monitor and verify acceptability of reactor water chemistry. Therefore, subsections 14.2.12.1.22 and 14.2.12.2.1, which describe testing of the equipment used for such monitoring and verification, have been revised instead to make specific reference to RG 1.56 requirements.

14.2.2.3 General Electric Company

INSERT A

for equipment and systems within the GE scope of supply;

INSERT B

[Note: The official designation of this group may differ for the plant owner/operator referencing the ABWR Standard Plant design and SCG is used throughout this discussion for illustrative p. poses only]

14.2.3 Test Procedures

INSERT C

Specifically, GE will provide the plant owner/operator referencing the ABWR Standard Plant design with scoping documents (i.e. preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to its scope of design responsibility. Such documents shall also include, as appropriate, delineation of specific plant operational conditions at which tests are to be conducted, testing methodologies to be utilized, specific data to be collected, and acceptable data reduction techniques,

as well as any reconciliation methods needed to account for test conditions, methods or results where testing is performed at conditions other than representative design operating conditions.

INSERT D

for preoperational tests and 60 days prior to scheduled fuel loading for power ascension tests.

14.2.10.1 Pre-Fuel Load Checks

Once the plant has been declared ready to load fuel, there are a number of specific checks that ~~should~~ be made prior to proceeding. These include a final review of the preoperational test results and the status of any design changes, work packages, and/or retests that were initiated as a result of exceptions noted during this phase. Also, the technical specifications surveillance program requirements, as described in Chapter 16, shall be instituted at this time to assure the operability of systems required for fuel loading. Just prior to the initiation of fuel loading the proper vessel water level and chemistry ~~should~~ be verified and the calibration and response of nuclear instruments ~~should~~ be checked.

shall

14.2.10.2 Initial Fuel Loading

Fuel loading requires the movement of the full core complement of assemblies from the fuel

Specific testing to be performed and the applicable acceptance criteria for each preoperational test are in accordance with the detailed system specifications and equipment specifications for equipment in those systems. The tests demonstrate that the installed equipment and systems perform within the limits of these specifications.

INSERT F

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

(a) verification that all sensing devices respond to actual process variables and provide alarms and trips at specified values (including proper tracking of RPV level instruments in response to actual changes in reactor water level - see Subsection 1A 2 4);

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

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

(d) verification of SRV and MSIV accumulator capacity;

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

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

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

Other checks ~~should~~ 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 ~~should~~ shall be verified from certification or bench tests to be consistent with applicable requirements. Additionally, proper installation and setting of supports and restraints for SRV discharge piping will be verified as part of the testing described in 14.2.12.1.51.

14.2.12.1.2 Reactor Recirculation System Preoperational Test

(1) Purpose

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

14.2.12.1 Preoperational Test Procedures

INSERT F

Specific testing to be performed and the applicable acceptance criteria for each preoperational test ~~are~~ will be documanted 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 ~~insure that the tests are conducted~~ in accordance with established methods and appropriate acceptance criteria, the plant and system preoperational test specifications will also be made available to the NRC.

allow for verification that that the detailed test procedures were developed

14.2.7.01

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

14.2.12.1.3 Recirculation Flow Control System Preoperational Test

(1) Purpose

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

(2) Prerequisites

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

(3) General Test Methods and Acceptance Criteria

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

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

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

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

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

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

(e) proper operation of the adjustable speed drives;

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

(g) proper control of pump motor start sequence;

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

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

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

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

14.2.12.1.4 Feedwater Control System Preoperational Test

(1) Purpose

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

(2) Prerequisites

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

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

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

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

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

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

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

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

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

14.2.12.1.6 Control Rod Drive System Preoperational Test

(1) Purpose

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

(2) Prerequisites

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

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

(3) General Test Methods and Acceptance Criteria

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

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

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

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

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

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

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

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

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

(3) General Test Methods and Acceptance Criteria

Performance ~~should~~ 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: (per Reg Guide 1.139)

(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, [Annotation: including that intended to alert operators when high pressure- low pressure interface valves are not full closed with the reactor coolant system at high pressure;]

(c) proper operation of system valves, including timing, under expected operating conditions; [Annotation: (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 modes including verfication that spray nozzles, headers and piping are free of debris; (per Reg Guide 1.139)

(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, [Annotation: including valve interlocks and controls designed to protect low pressure portions of the system from the reactor coolant system at high pressure;]

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

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

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

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

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

14.2.12.1.9 Reactor Core Isolation Cooling System Preoperational Test

(1) Purpose

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

(2) Prerequisites

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

(3) General Test Methods and Acceptance Criteria

The RCIC turbine should first be tested while disconnected from and then while coupled to the pump. [Annotation: The intent of this preoperational test is to test the RCIC system to the extent possible. However,] Since preoperational testing is performed utilizing a temporary steam supply the attainable RCIC pump flow may be limited. [Annotation: Should this prevent any specified testing from being completed successfully, such cases will be documented and scheduled for completion during the power ascension test phase.]

Performance ~~should~~ 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 turbine and pump in all design operating modes;

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

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

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

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

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

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

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

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

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

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

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

14.2.12.1.10 High Pressure Core Flooder System Preoperational Test

(1) Purpose

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

(2) Prerequisites

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

(3) General Test Methods and Acceptance Criteria

Performance should 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 integrated system tests to demonstrate the following:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

14.2.12.1.22 Plant Process Sampling System Preoperational Test

(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 of indvidual 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 ~~should~~ shall be observed and recorded during a series of tests to demonstrate the following:

(a) proper operation of ~~on-line~~ required sampling and monitoring equipment, considering calibration, indication and alarm/functions, including reactor water conductivity instrumentation and other equipment or instrumentation required to show compliance with Reg Guide 1.56;

~~calibration, indication, and alarms;~~

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

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

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

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

14.2.12.1.23 Process Radiation Monitoring System Preoperational Test

(1) Purpose

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

(2) Prerequisites

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

(3) General Test Methods and Acceptance Criteria

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

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

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

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

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

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

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

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

14.2.12.1.24 Area Radiation Monitoring System Preoperational Test

(1) Purpose

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

(2) Prerequisites

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

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 speci ied 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 should 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 should be observed and recorded during a series of individual component and integrated system tests to demonstrate the following:

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

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

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

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

(e) proper system flow paths and flow rates including individual component and total system capacities and overall system flow balancing;

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

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

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

(i) the ability to maintain the specified positive or negative pressure(s) in the designated rooms and areas and to direct local and total air flow, including any potential leakage, relative to the anticipated contamination levels;

(j) the ability of exhaust, supply, and recirculation filter units to maintain the specified dust and contamination free environment(s);

(k) the ability of the control room habitability function to detect the presence of smoke and/or toxic gas and to remove or prevent in-leakage of such;

(l) proper operation of HEPA filters and charcoal adsorber sections, if applicable, 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 tightness of charcoal adsorber section per Regulatory Guide 1.5;

(f) proper system and component flow paths and flow rates including overall system flow balance;

(g) ability to maintain the specified negative pressure in the secondary containment;

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

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

(j) proper operation of heaters, demister, and moisture seperator equipment; and

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

Refer also to Subsection 6.5.1.4.1.

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

14.2.12.1.37 Containment Isolation Valve Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment isolation valves are given in Subsection 6.2.6.3.

14.2.12.1.38 Containment Penetration Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment penetrations are given in Subsection 6.2.6.2.

14.2.12.1.39 Containment Airlock Leakage Rate Tests

Description of and criteria for preoperational leakage rate tests of containment airlocks are given in Subsection 6.2.6.2.

14.2.12.1.40.1 Containment Integrated Leakage Rate Test

Description of and criteria for containment integrated leakage rate tests are given in Subsection 6.2.6.1.

14.2.12.1.40.2 Containment Structural Integrity Test

Description of and criteria for the required containment structural integrity test is given in Subsection 3.8.1.7.1.

14.2.12.1.41 Pressure Suppression Containment Bypass Leakage Tests

Test procedures are identical to those used for other penetrations under isolation conditions as discussed in Subsection 6.2.6.2.

14.2.12.1.42 Containment Isolation Valve Functional and Closure Timing Tests

~~Preoperational functional and closure timing tests of containment isolation valves is discussed in Subsection 6.2.4.~~

INSERT G (attached)

14.2.12.1.43 Wetwell-to-Drywell Vacuum Breaker System Preoperational Test

(1) Purpose

To verify proper functioning of the wetwell-to-drywell vacuum breakers.

(2) Prerequisites

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

(3) General Test Methods and Acceptance Criteria

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

(a) proper operation of vacuum breaker valves and system logic including verification of opening and closing setpoints and timing;

.42 Containment Isolation Valve nction and Closure Timing Tests

INSERT G

The containment isolation system is discussed in Subsection 6.2.4 with characteristics of and requirements for individual valves listed in Table 6.2-7. Preoperational functional and closure timing tests ~~of containment isolation valves is discussed in Subsection 6.2.4~~ of valves performing containment isolation functions will be done as part of the testing of the systems to which such valves belong (see Table 6.2-7 for system affiliation of individual valves). Overall containment isolation and isolation initiation logic is a function of the leak detection and isolation system, the testing of which is described in Subsection 14.2.12.1.13.

14.2.12.1.42 Containment Isolation Valve Function and Closure Timing Tests

INSERT G

The containment isolation system is discussed in Subsection 6.2.4 with characteristics of and requirements for individual valves listed in Table 6.2-7. Preoperational functional and closure timing tests ~~of containment isolation valves is discussed in Subsection 6.2.4~~ of valves performing containment isolation functions will be done as part of the testing of the systems to which such valves belong (see Table 6.2-7 for system affiliation of individual valves). Overall containment isolation initiation logic is a function of the leak detection and isolation system, the testing of which is described in Subsection 14.2.12.1.13.

power conditions

(c) proper functioning of valve positive closure devices including verification of adequate valve leak tightness; and

(d) proper functioning of vacuum breaker test features.

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

14.2.12.1.44 Primary Containment Monitoring Instrumentation Preoperational Test

(1) Purpose

To verify the proper operation of instrumentation used for long term monitoring of the drywell and wetwell atmospheres and suppression pool temperature and level during both normal operations and accident conditions in the primary containment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The suppression pool shall be filled and expected to undergo measurable level and temperature changes at some point during the scheduled testing. The required interfacing systems and components are available, as needed, to support the specified testing. Additionally, any parallel testing to be performed in conjunction with the testing of this subsection is appropriately scheduled.

(3) General Test Methods and Acceptance Criteria

A description of the instrumentation required for containment monitoring is presented in Subsection 6.2.1.7. Preoperational testing of these instruments will be performed in conjunction with the testing of the applicable systems. Only that instrumentation requiring special considerations is discussed below.

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

(a) proper tracking of drywell pressure by all instrument channels during containment integrated leak rate testing (see subsection 14.2.4);

(b) ~~proper response of all suppression pool level instrumentation during actual changes in pool level;~~

(c) proper tracking by all suppression pool temperature instrument channels of an actual change in pool temperature;

(d) proper functioning of associated indicators, recorders, annunciators, and alarms including those monitoring instrumentation status; and

(e) proper system trips in response to the appropriate high and/or low setpoints and inoperative conditions.

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

14.2.12.1.45 Electrical Systems Preoperational Test

The total plant electrical distribution network is described in Chapter 8 and is comprised of the following systems:

(1) unit auxiliary AC power system;
(2) unit Class 1E AC power system;
(3) safety system logic and control system power system;
(4) instrument power system;
(5) uninterruptible power system;
(6) unit auxillary DC power system; and
(7) unit class 1E DC power system.

Because of the similarities in their design and function, the testing requirements for these systems, and their respective components, can be divided into the four general categories as described below. The specific testing required for each system is described in the applicable design and testing specifications.

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

14.2.12.2.1 Chemical and Radiochemical Measurements

(1) Purpose

To secure information on the chemistry and radiochemistry of the reactor coolant while verifying that the sampling equipment, procedures and analytic techniques are adequate to supply the data required to demonstrate that the chemistry of all parts of the entire reactor system meet specifications and process requirements, including the requirements of Reg Guide 1.56.

(2) Prerequisites

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

(3) Description

Specific objectives of the test program include evaluation of fuel performance, evaluations of demineralizer operations by direct and indirect methods, measurements of filter performance, confirmation of condenser integrity, demonstration of proper steam separator-dryer operation, measurement and calibration of the offgas system, and evaluation and calibration of certain process instrumentation (including that used to monitor Condensate and reactor water conductivity). An additional objective of this test is the demonstration, and adjustment if necessary, of the proper functioning of the hydrogen water chemistry system, the oxygen injection system, the zinc injection passivation system and the iron ion injection system as required by Reg Guide 1.56. Data for these purposes is secured from a variety of sources such as plant operating records, regular routine coolant analysis, radiochemical measurements of specific nuclides, and special chemical tests.

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

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

(4) Criteria

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

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

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

(3) Description

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

(4) Criteria

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

14.2.12.2.38 Radioactive Waste Systems Performance

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

14.2.13 Interfaces (continuation)

The applicant referencing the ABWR Standard Plant shall also provide a list of those tests to be performed as part of the power ascension test phase that are proposed to be exempt from operating license conditions requiring NRC prior approval for major test changes. ~~Such tests are those which are not essential to the demonstration of conformance with design requirements for structures, systems, components, and design features which meet any of the following criteria:~~

~~a. Those that will be used for safe shutdown and cooldown of the reactor under normal~~

Reg Guide 1.68 specifies criteria (see Regulatory Position C.1) for determining what structures, systems, components and design features are required to be tested during the power ascension test phase in accordance with the requirements therein. Testing of such structures, systems, components and design features is then subject to license conditions requiring NRC prior approval for major test changes. For completeness, the testing described in 14.2.12.2 includes testing of a limited number of ABWR structures, systems, components and design features that do not meet the referenced Reg Guide 1.68 criteria, and are thus exempt from such license conditions.

~~d. Those that are classified as engineered safety features or will be used to support or ensure the operation of engineered safety features within design limits;~~

~~e. Those that are assumed to function or for which credit is taken in the accident analysis for the facility, as described in the FSAR; or~~

~~f. Those that will be used to process, store, control, or limit the release of radioactive materials.~~

Of the tests described in Section 14.2.12.2 for the ABWR Standard Plant the following tests, or designated portions thereof, ~~meet the above criteria:~~ are thus candidates for proposed exemptions from operating license conditions requiring NRC prior approval for major test changes;

1) 14.2.12.2.13 Recirculation Flow Control - <u>except</u> for those features intended to limit maximum core flow;

2) 14.2.12.2.21 Reactor Water Cleanup System Performance;

3) 14.2.12.2.23 Plant Cooling/Service Water System Performance - those portions pertaining to the turbine building cooling and service water systems;

4) 14.2.12.2.24 HVAC System Performance - those portions pertaining to the Normal HVAC system and its associated nonessential chilled water system;

5) 14.2.12.2.29 Feedwater Pump Trip; and

6) 14.2.12.2.39 Steam and Power Conversion Systems Performance.

The COL applicant shall provide the final list of tests proposed to be exempt from such license conditions, including adoption or augmentation of the above list, as appropriate.

Table 14.2-1 POWER ASCENSION TEST MATRIX

POWER ASCENSION TEST	TESTING PLATEAU					NOTES
	OV	HU	LP	MP	HP	
Chemical and Radiochemical Measurements						
Sampling System Functioning		✔	✔	✔	✔	
Process Rad Monitoring Functioning	✔	✔	✔	✔	✔	
Steady State Performance Measurements	✔	✔	✔	✔	✔	Includes verification of water quality
Steam Separator/Dryer Performance				✔		At low power, high flow corner of power-flow map
Radiation Measurements						
Steady State Measurements	✔	✔	✔	✔	✔	
Shielding Adequacy Assessment				✔	✔	
Fuel Loading						
Core Loading	✔					
Partial Core S/D Margin	✔					
Full Core Verification	✔					
Full Core Shutdown Margin Demonstration	✔					
Rod Control System Performance						
CRD Functional Testing	✔	✔				
Friction Testing	✔	✔				
Rod Pair Scram Testing	✔	✔				
Full Core Scram			✓	✓	✓	With planned scrams
SCRRI Functioning					✓	At low power end of rated rod line prior to planned RIP trips and when actuated following RIP trips
Alternate Rod Run-in Functioning			✓	✓	✓	Post scram verification following planned trips

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

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

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

Table 14.2-1 POWER ASCENSION TEST MATRIX

POWER ASCENSION TEST	TESTING PLATEAU					NOTES
	OV	HU	LP	MP	HP	
Neutron Monitoring System Performance						
SRNM Calibration/Response	✓	✓				
LPRM Calibration/Response		✓	✓	✓	✓	
APRM Calibration/Response		✓	✓	✓	✓	
TIP System Alignment/Response	✓	✓	✓			Only as needed to complete tests subsequent to HU
Process Computer System Operation						
NSS/BOP Monitoring Programs		✓	✓	✓	✓	
Automation Programs		✓	✓	✓	✓	
RWM/RC&IS Functioning		✓	✓		✓	
Core Performance		✓	✓	✓	✓	
Nuclear Boiler Process Monitoring						
Reactor Coolant Temperature Measurement		✓		✓	✓	At MP & HP during steady state and RIP trip testing
Reactor Water Level Measurement	✓	✓	✓	✓	✓	
Core Flow Calibration/Measurement		✓	✓	✓	✓	
System Expansion						
Support Inspection/Interference Check		✓	✓	✓	✓	Only as needed upon return to cold setting conditions after planned shutdowns subsequent to HU
Displacement Measurements		✓	✓	✓	✓	
System Vibration						
Steady State Measurements		✓	✓	✓	✓	
Transient Response			✓	✓	✓	
Reactor Internals Vibration (If Required)		✓	✓	✓	✓	Cold, zero power, test, if required, will be done with RPV head on during HU

⇒ [INSERT EXPANDED LEGEND (see Page 1)]

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

POWER ASCENSION TEST	TESTING PLATEAU					NOTES
	OV	HU	LP	MP	HP	
Recirculation Flow Control						
Control System Adjustment/Confirmation			✔	✔	✔	
Feedwater Control						
Control System Adjustment/Confirmation		✔	✔	✔	✔	
Pressure Control						
Control System Adjustment/Confirmation		✔	✔	✔	✔	
Plant Automation and Control						
Plant Startup/ Shutdown		✔	✔	✔	✔	
Load Following					✔	
Reactor Recirculation System Performance						
Steady State Performance		✔	✔	✔	✔	
RIPs Out of Service				✔	✔	
Pump Restarts				✔	✔	
Feedwater System Performance						
Steady State Performance		✔	✔	✔	✔	
Maximum Runout Flow Determination					✔	
Main Steam System Performance						
Steady State Performance		✔	✔	✔	✔	
Residual Heat Removal System Performance						
Suppression Pool Cooling		✔ ✓			✔	After testing which adds heat to the suppression pool. May not be sufficient heat at lower power levels
Shutdown Cooling		✔ ✓			✔	May not be sufficient reactor decay heat at lower power levels to demonstrate Hx heat removal capability

⇒ [INSERT EXPANDED LEGEND (see Page 1)]

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

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Table 14.2-1 POWER ASCENSION TEST MATRIX

POWER ASCENSION TEST	TESTING PLATEAU OV	HU	LP	MP	HP	NOTES
Reactor Water Cleanup System Performance						
Steady State Performance		✓			✓	
Inventory Rejection Mode		✓				
F/D Performance					✓	May be accomplished during earlier testing plateaus
RCIC System Performance						
Low Reactor Pressure		✓				
High Reactor Pressure		✓				
Hot/Cold Quick Starts		✓	✓			As needed to complete required quick starts subsequent to TC-HU
Plant Cooling/Service Water System Performance						
Steady State Power Operations		✓	✓	✓	✓	
Off-Normal Operations		✓	✓		✓	During RHR Hx operation, as practicable
HVAC System Performance						
Steady State Power Operations		✓	✓	✓	✓	
Off-Normal Operations		✓	✓	✓	✓	In individual spaces as conditions allow (i.e. as pertinent equipment is operated)
Turbine Valve Performance		✓	✓	✓	✓	Only bypass valves need be tested at HU
MSIV Performance						
Individual MSIV Closure/ Timing		✓	✓		✓	Fast closure not req'd at High Power
Branch Line Closure/ Timing		✓	✓			
SRV Performance						
Individual Valve Functioning		✓	✓			
Automatic Opening Verification			✓	✓	✓	During planned trips, as applicable

⟹ [Insert Expanded Legend (see Page 1)]

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

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Table 14.2-1

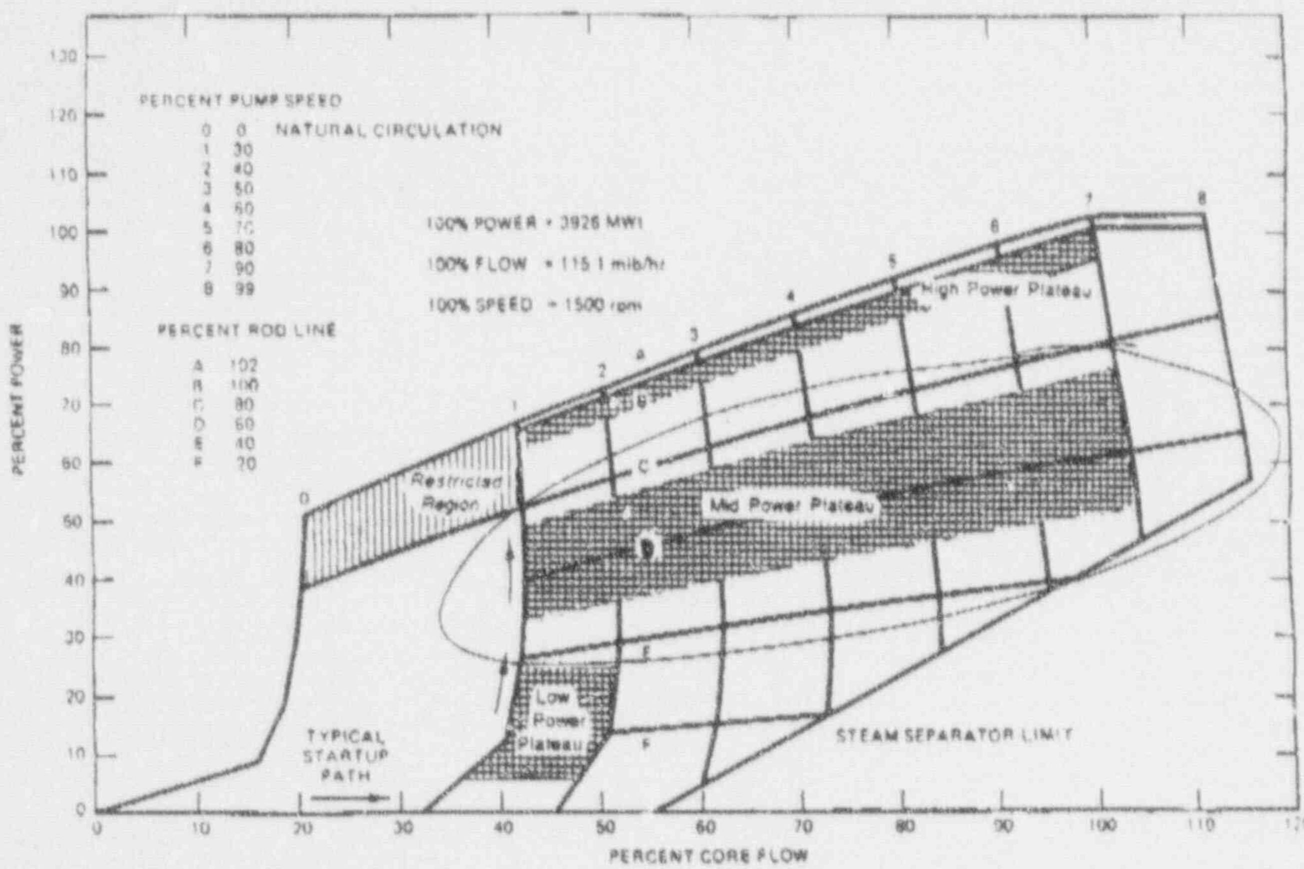
POWER ASCENSION TEST MATRIX

POWER ASCENSION TEST	TESTING PLATEAU					NOTES
	OV	HU	LP	MP	HP	
Loss of Feedwater Heating					✓	At 80-90% CTP, 100% Flow during HP
Feedwater Pump Trip					✓	
Recirculation Pump Trip						
One RIP Trip				✓	✓	At near rated flow
Two RIP Trip				✓	✓	At near rated flow
Three RIP Trip				✓	✓	At near rated flow
Shutdown from Outside the Control Room			✓			At >10% Generator Load
Loss of Turbine Generator and Offsite Power			✓			At 10-20% rated power
Turbine Trip and Generator Load Rejection						
Load Rejection within Bypass Capacity			✓			
Turbine Trip				✓		
Full Power Load Rejection					✓	
Reactor Full Isolation					✓	
Offgas System Performance		✓	✓	✓	✓	
Power Conversion Equipment Performance		✓	✓	✓	✓	
Loose Parts Monitoring System Baseline Data		✓	✓	✓	✓	
Liquid RadWaste Systems Performance			✓		✓	

⇒ [Insert Expanded Legend (see Page 1)]

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

Figure 14.2-1
Power-Flow Operating Map and Testing Plateau Definitions



Testing Plateau	Description (1)
Open Vessel (OV)	With the RPV head removed, from initiation of fuel loading to cold conditions with a fully loaded core
Nuclear Heat-Up (HU)	During nuclear heat-up, from ambient conditions and 0 psig to rated temperature and pressure within the RPV, with reactor power typically less than 5% of rated
Low Power (LP)	Between 5% and 25% rated thermal power, with the reactor internal pumps (RIPs) within 10% of minimum speed
Mid Power (MP)	Between approximately the 50% and 75% power rod lines, with the RIPs operating between minimum and rated speeds, with the lower power corner within the capacity of the bypass valves.
High Power (HP)	Along and just below (+0,-5%) the 100% power rod line, from minimum RIP speed to rated core flow

(1) Descriptions of testing plateaus are offered for illustrative purposes and general guidance only, as some tests are intended to be conducted outside the general testing plateaus described. Neither the above descriptions, nor the corresponding boundary lines on the power-flow map, are meant to be absolute limits. Any operating limits will be specified in the plant license. Any other testing restrictions will be specified either within the plant administrative procedures covering the power ascension test program or within the individual test procedure for a given test.

TABLE 1.8-20

RGs Applicable to ABWR (Continued)

RG No.	Regulatory Guide Title	Appl. Rev.	Issued Date	ABWR Appli-cable?	Comments
1.60	Design Response Spectra for Seismic Design of Nuclear Power Plants.	1	12/73	Yes	
1.61	Damping Values for Seismic Design of Nuclear Power Plants.	0	10/73	Yes	
1.62	Manual Initiation of Protective Actions.	0	10/73	Yes	
1.63	Electric Penetration Assemblies in Containment Structures of Nuclear Power Plants.	3	2/87	Yes	
1.64	Quality Assurance Requirements for the Design of Nuclear Power Plants.		Superceded		See Table 17.0-1
1.65	Materials and Inspections for Reactor Vessel Closure Studs.	0	10/73	Yes	
1.68	Initial Test Programs for Water-Cooled Reactor Power Plants.	2	8/78	Yes	
1.68.1	Preoperational and Initial Startup Testing of Feedwater and Condensate Systems for Boiling Water Reactor Power Plants.	1	1/77	Yes	
1.68.2	Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants.	1	7/78	Yes	
1.68.3	Preoperational Testing of Instrument and Control Air Systems.	~~1~~ 0	~~7/78~~ 4/82	Yes	
1.69	Concrete Radiation Shields for Nuclear Power Plants.	0	12/73	Yes	
1.70	Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants.	3	11/78	Yes	
1.71	Welder Qualifications for Areas of Limited Accessibility.	0	12/73	—	Interface
1.72	Spray Pond Piping Made From Fiberglass-Reinforced Thermosetting Resin.	2	11/78	Yes	

The submittals described in (1) above have been discussed and reviewed extensively among the BWR Owners' Group, the General Electric Company, and the NRC Staff.

The NRC has extensively reviewed the latest revision (Revision 4) of the emergency Procedures Guidelines and issued a SER, *Safety Evaluation of BWR Owners' Group Emergency Procedure Guidelines, Revision 4, NEDO-31331, March 1987,* letter from A. C. Thadani, NRC Office of Nuclear Reactor Regulation, to D. Grace, Chairman of BWR Owners' Group, dated September 12, 1988. The SER concludes that this document is acceptable for implementation. It further states that the SER closes all the open items carried from the previous revisions of the EPG.

GE believes that in view of these findings, no further detailed justification of the analyse. .r guidelines is necessary at this time. Interface requirements pertaining to emergency procedures are discussed in Subsection 1A.3.1.

1A.2.2 Control Room Design Reviews - Guidelines and Requirements [I.D.1(1)]

NRC Position

In accordance with task Action Plan I.D.1.(1), all licensees and applicants for operating licenses will be required to conduct a detailed control-room design review to identify and correct design deficiencies. This detailed control-room design review is expected to take about a year. Therefore, the Office of Nuclear Reactor Regulation (NRR) requires that those applicants for operating licenses who are unable to complete this review prior to issuance of a license make preliminary assessments of their control rooms to identify significant human factors and instrumentation problems and establish a schedule approved by NRC for correcting deficiencies. These applicants will be required to complete the more detailed control room reviews on the same schedule as licensees with operating .ants.

Response

The design of the main control room will utilize accepted human factors engineering principles, incorporating the results of a full systems analysis similar to that described in Appendix B of NUREG-0700. A DCRDR specified in NUREG-0737 is not required by SRP Section 18.1.

1A.2.3 Control Room Design - Plant Safety Parameter Display Console [I.D.2]

NRC Position

In accordance with Task Action Plan I.D.2, each applicant and licensee shall install a safety parameter display system (SPDS) that will display to operating personnel a minimum set of parameters which define the safety status of the plant. This can be attained through continuous indication of direct and der' ed variables as necessary to assess plant safety status.

Response

The functions of the SPDS will be integrated into the overall control room design, as permitted by SRP Section 18.2.

1A.2.4 Scope of Test Program - Preoperational and Lower Power Testing [I.G.1]

NRC Position

Supplement operator training by completing the special low-power test program. Tests may be observed by other shifts or repeated on other shifts to provide training to the operators.

Response

The initial test program presents an excellent opportunity for licensed operators and other plant staff members to gain valuable experience and training and in fact theses benefits are objectives of the program (see Subsection 14.2.1). The degree to which the potential benefit is realized will depend on such plant specific factors as the organizational makeup of the startup g: up and overall plant staff (see Subsections 14.2.2 and 13.1), as well as how the test program is conducted (see Subsection 14.2.4).

~~The test program described in Chapter 14 is consistent with~~ The BWR Owners' Group response to Item I.G.1 of NUREG-0737 is documented in a letter of February 4, 1981 from D. B. Waters to D. G. Eisenhut.

For the most part, this issue concerns operator training requirements, although in the context of the initial test program. Thus, the BWROG response primarily deals likewise with operator training issues. The exception is Appendix E of the BWROG response which describes additional tests to be conducted during the preoperational and/or startup phase.

The specific training requirements for reactor operators are discussed in Section 13.2 of the SRP which is outside the scope of the ABWR Standard Plant. See Table 1.9-1 for interface requirements.

The additional tests specified in Appendix E of the BWROG response are contained within the initial test program described in Chapter 14. See specifically subsections 14.2.12.1.1(3)(a), 14.2.12.1.9(3)(j) and 14.2.12.1.44(3)(a) for the relevant testing.

1A.2.5 Reactor Coolant System Vents [II.B.1]

NRC Position

Each applicant and licensee shall install reactor coolant system (RCS) and reactor vessel head high point vents remotely operated from the control room. Although the purpose of the system is to vent noncondensible gases from the RCS which may inhibit core cooling during natural circulation, the vents must not lead to an unacceptable increase in the probability of a loss-of- coolant accident (LOCA) or a challenge to containment integrity. Since these vents form a part of the reactor coolant pressure boundary, the design of the vents shall conform to the requirements of Appendix A to 10 CFR Part 50, *General Design Criteria*. The vent system shall be designed with sufficient redundancy that assures a low probability of inadvertent or irreversible actuation.

Each license shall provide the following information concerning the design and operation of the high point vent system:

(1) Submit a description of the design, location, size, and power supply for the vent system along with results of analyses for loss-of-coolant accidents initiated by a break in the vent pipe. The results of the analyses should demonstrate compliance with the acceptance criteria of 10 CFR 50.46.

(2) Submit procedures and supporting analysis for operator use of the vents that also include the information available to the operator for initiating or terminating vent usage.

Response

The capability to vent the ABWR reactor coolant system is provided by the safety relief valves and reactor coolant vent line as well as other systems. The capability of these systems and their satisfaction of Item II.B.1 is discussed below.

The ABWR design is provided with eighteen power-operated relief valves which can be manually operated form the control room to vent the reactor pressure vessel. The point of connection to the main steam lines which exits near the top of the vessel to these valves is such that accumulation of gases above that point in the vessel will not affect removal of gases from the reactor core region.

These power-operated relief valves satisfy the intent of the NRC position. Information regarding the design, qualification, power source, etc., of these valves is provided in Subsection 5.2.2.

The BWR Owners' Group position is that the requirement of single-failure criteria for prevention of inadvertent actuation of these valves, and the requirement that power be removed during normal operation, are not applicable to BWR's. These dual-purpose safety/relief valves serve an important pressure relief function in mitigating the effects of transients and concurrently provide ASME code overpressure protection via their independent safety mode of operation. Therefore, the addition of a second "block" valve to the vent lines would result in a less safe design and a violation of the code. Moreover, the inadvertent opening of a relief valve in a BWR is a design-basis event and results in a controllable transient.

In addition to these automatic (or manual) relief valves, the ABWR design includes various other means of high-point venting. Among these are:

(1) Normally closed reactor vessel head vent valves, operable from the control room, which discharge to the drywell. The reactor coolant vent line is located at the very top of the reactor vessel as shown in the nuclear boiler system P&ID (Figure 5.1-3a). This 2-inch line contains two safety-related Class 1E motor-operated valves that are operated from the control room. The location of this line permits it to vent the entire reactor core system normally connected to the reactor pressure vessel. In addition, since this vent line is part of the original design, it has already been considered in all the design-basis accident analyses contained elsewhere in this document.

(2) Normally open reactor head vent line, which discharges to a main steamline;

(3) The main steam-driven reactor core isolation