May 20, 1991

MFN No. 058-91
Docket No. STN 50-605
EEN-9142

Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Charles L. Miller, Director
Standardization and Non-Power Reactor Project Directorate

Subject: **GE Responses to GE/NRC May 7, 1991 Meeting on Performance & Quality Evaluation Branch Open Items on ABWR SSAR Chapter 14**

Enclosed are thirty-four (34) copies of the subject responses. Responses are provided for all the open items with the exception of open items numbered 2.1.4, 2.1.6, 2.1.7, 2.1.9 and the additional test abstracts that are required to address comments on positions 4.k, 5.n, 5.w and 5.c.c, requested under open item 2.1.8, pertaining to Regulatory Guide 1.68. Responses to these outstanding open items will be transmitted by the end of June.

It is intended that GE will amend the SSAR, as appropriate, with the enclosed responses in a future amendment.

Sincerely,

R C Mitchell

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ITEM BY ITEM RESPONSES TO STAFF COMMENTS ON CHAPTER 14
PRESENTED IN 5/7/91 REVIEW MEETING
(Responses in Boldface)

Based on a review of the ABWR ITP, the staff prepared a list of questions and comments to be responded to by the applicant, and errata information which should be used by the applicant in making corrections to it's ITP. These are as follows:

2.1 Staff Questions and Comments Regarding Applicant's ITP.

2.1.1 Section 14.2.4, "Conduct of Test Program," and Section 14.2.5, "Review, Evaluation, and Approval of Test Results," should be modified to specify whose approval must be obtained before increasing power to the next higher test plateau.

Response- Such specifics will be a function of the plant owner/operator's unique organizational structure and detailed plant administrative procedures and are thus left to the applicant referencing the ABWR design.

2.1.2 Section 14.2.7, "Conformance of Test Program With Regulatory Guides," should be modified to address the following items:

a. Include Regulatory Guide 1.95, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release," in accordance with SRP Section 14.2.

Response- To be incorporated

b. Include Regulatory Guide 1.139, "Guidance for Residual Heat Removal," in accordance with SRP Section 14.2.

Response- To be incorporated

c. Either document the applicable revision number of each regulatory guide listed in Section 14.2.7 or reference Table 1.8-20 of the FSAR

Response- Section 14.2.7 will be revised to reference Table 1.8-20 for the applicable revision numbers of the listed Reg Guides

d. Correct the reference to Regulatory Guide 1.68.3, "Preoperational Testing of Instrument and Control Air Systems," contained in Table 1.8-20 of the FSAR or Section 14.2.7, as appropriate, to Revision 0, issue date of April 1982.

Response- To be incorporated

2.1.3 Section 14.2.10, "Initial Fuel Loading and Initial Criticality," should be modified to state that completion of preoperational testing (including the review and approval of the test results) is required prior to fuel loading. If portions of any preoperational tests are intended to be conducted, or their results approved, after fuel loading: (1) list each test: (2) state which portions of each test will be delayed until after fuel loading: (3) provide technical justification for delaying these portions; and (4) state when each test will be completed (key to test conditions defined in Chapter 14).

Response- It is intended that all preoperational tests shall be completed, and the results obtained approved, prior to commencement of fuel loading. However, there may be unforeseen circumstances that arise that would prevent this from occurring but that would not necessarily justify the delay of fuel loading. Section 14.2.10 of the SSAR will be revised accordingly to require that the above stated conditions be appropriately documented should the applicant referencing the ABWR design decide to request permission from the NRC to proceed with fuel loading under such circumstances.

2.1.4 Section 14.2.11, "Test Program Schedule," should be modified to include the following:

a. A figure which illustrates the power-flow operating map.

Response- See Figure 4.4-1

b. A table which lists the startup tests and states at which test condition(s) each test is to be conducted.

Response- To be determined

2.1.5 Section 14.2.12.1, Preoperational Test Procedures," states that testing of systems outside the scope of the ABWR Standard Plant are discussed in Subsection 14.2.12.3. Either this subsection should be included in the ABWR FSAR or Section 14.2.12.1 should be modified accordingly.

Response- The material that was to be included in Section 14.2.12.3 can be found in Section 14.2.13

2.1.6 Section 14.2.12 test abstracts should be modified to address the following concerns:

a. Several preoperational and startup test prerequisites include the requirement that interfacing support systems shall be available. Identify which support systems are required for each test and specify which individuals or groups are authorized to make this determination.

Response- Interfacing support system requirements will be specified in the detailed test procedures (and operating and maintenance procedures, if appropriate) which are required by Reg Guide 1.68 to be made available to NRC I&E personnel at least 60 days prior to their intended use. Additionally, the startup manual and applicable plant administrative procedures shall delineate how such determinations of operability and availability will be authorized. Thus, these details are the responsibility of the applicant referencing the ABWR design.

b. The use of the word "should" in most, if not all test abstracts is not a commitment by the applicant to perform certain tasks. It should, therefore, be reevaluated and revised accordingly (i.e. "will", "must").

Response- Such a reevaluation shall be performed.

c. Several preoperational and startup test abstracts include imprecise acceptance criteria (e.g., applicable intervals, applicable design specifications, specified amounts, specified tolerances, perform as specified, function properly). Modify individual test abstracts to specify the bases for determining acceptable system and component performance. Acceptable criteria includes specific references to regulatory guides, Technical Specifications, assumptions used in the safety analysis, other ABWR FSAR sections, and applicable codes and standards.

Response- To be determined. (Note: Chapter 14 of the SSAR was written primarily to document the appropriate testing commitments contained in Reg Guide 1.68. It was anticipated that precise acceptance criteria would be provided as part of the ITAAC effort)

d. Section 14.2.12.2 states that failure to satisfy some acceptance criteria (e.g., those related to values of process variables important to plant design) will result in the plant placed in a suitable hold position until resolution is obtained, while failure to satisfy other acceptance criteria (e.g., expectations relating to system performance) may only result in the need for further data analysis. The distinction between these types of acceptance criteria is unclear. Modify Section 14.2.12.2 and individual startup test abstracts to differentiate between various types of acceptance criteria and the resultant actions for each type if unsatisfactory test results are obtained.

Response- As stated in Section 14.2.12.2, "Specific actions for dealing with criteria failures and other testing exceptions or anomalies will be described in the startup administrative manual." (To be supplied by the applicant referencing the ABWR design)

2.1.7 Startup test abstracts listed in Section 14.2.12.2 that 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 should be provided:

a. Those that will be used for safe shutdown and cooldown of the reactor under normal plant conditions and for maintaining the reactor in a safe condition for an extended shutdown period: or

b. Those that will be used for safe shutdown and cooldown of the reactor under transient (infrequent or moderately frequent events) conditions and postulated accident conditions and for maintaining the reactor in a safe condition for an extended shutdown period following such conditions: or

c. Those that will be used for establishing conformance with safety limits or limiting conditions for operation that will be included in the facility technical specifications; or

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; or

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.

Response- The tests abstracts contained in Section 14.2.12.2 of the ABWR SSAR are intended to meet the requirements of Reg Guide 1.68, updated and/or modified as necessary to reflect the actual ABWR design. A screening will be performed to identify and document any testing that is currently specified for systems that are not essential for demonstrating conformance with the aforementioned criteria.

2.1.8 Review of the preoperational and startup test phase descriptions disclosed that the operability of several of the systems and components listed in Regulatory Guide 1.68, "Initial Test Programs for Water-Cooled Nuclear Power Plants," Revision 2, Appendix A, may not be demonstrated. Either expand your test descriptions to address the following items, insert cross- references in Section 14.2.12 if complete test descriptions for the following items are provided elsewhere in the ABWR FSAR, or modify Section 14.2.7 or Table 1.8-20 of the FSAR as appropriate to provide technical justification for any exception to Regulatory Guide 1.68 Rev. 2, for the following items:

2.1.8.1 Preoperational Testing

1.a.(2)(d) Supports and restraints for discharge piping of SRVs

Response- A statement has been added to section 14.2.12.1.1 indicating that testing of SRV discharge piping supports and restraints is specifically covered by that testing described in 14.2.12.1.51. Section 14.2.12.1.51 will be modified to specifically cross reference the applicable testing requirements given in sections 3.9.2.1 and 5.4.14.4.

1.a.(4) Pressure boundary integrity tests.

Response- Integrity tests of the reactor coolant pressure boundary are specified in Section 5.2.4.6.2. Section 14.2.12.1.1 has been revised accordingly to cross-reference the applicable testing requirements.

1.c Protection of facility for anticipated transients without a scram (ATWS).

Response-

ATWS protection functions are tested as part of the respective systems which perform such functions (i.e. SLCS, RC&IS, FMCRD, RFCS). However, for the purpose of more explicitly demonstrating compliance with Reg Guide 1.68, the appropriate subsections of Section 14.2.12.1 will be revised to more specifically indicate where ATWS related testing requirements are being fulfilled, particularly those related to the ARI function.

14.2.12.1.3(3)(a) Recirc Flow Control, 14.2.12.1.6(3)(b) CRD System, 14.2.12.1.7(3)(b) RC&IS

1.h.(4) Demonstration that containment hydrogen monitoring is functional without the operation of the hydrogen recombiner.

Response- In the ABWR design, containment hydrogen monitoring is accomplished separately from the hydrogen recombiners. Therefore, the specific test described in Reg Guide 1.68 is not applicable. Proper functioning of containment hydrogen monitors is verified by the testing described in Section 14.2.12.1.26.

1.h.(9) Demonstration the containment recirculation fans can operate in accordance with design requirements at the containment design peak accident pressure.

Response- The ABWR design does not utilize containment recirculation fans during normal operation or accident conditions. Therefore, the specific test described in Reg Guide 1.68 is not applicable.

1.i.(1) Containment design over pressure structural tests (and vacuum tests).

Response- Containment structural integrity testing requirements are specified in Section 3.8.1.7.1. Accordingly, Section 14.2.12.1.40.2 has been added to cross-reference the applicable testing requirements.

1.j.(12) Failed fuel detection system.

Response- In the ABWR design the failed fuel detection function is performed by the leak detection and isolation system and the process radiation monitoring system. In particular, gross fuel failure would be detected first by the main steam line radiation monitors and secondarily by the offgas pre-treatment

radiation monitors. In addition, the normal reactor water sampling system will allow for identification of trends indicative of possible fuel failure. Testing of the applicable features of the associated systems, as described in subsections 14.2.12.1.13 and 14.2.12.1.23, will assure proper operation of the failed fuel detection function.

1.j.(15) Automatic dispatcher control systems.

Response- Automatic load following is performed by the Automatic Power Regulator whose testing is described in Section 14.2.12.1.17. This system will have the capability, if enabled, to accept external demand signals (e.g. from the load dispatcher). Should the applicant referencing the ABWR design decide to seek approval for utilization of this capability, designation of the appropriate testing will have to be included in the application for such. Section 14.2.13 will be revised accordingly to document this potential interface requirement.

1.k.(2) Personnel monitors and radiation survey instruments.

Response- Traditional "Preoperational testing" of personnel monitors and radiation survey instruments is not appropriate as these instruments are subject to very specific calibration programs. It is the responsibility of the plant operator to verify and maintain the proper calibration and operation of such devices. Therefore, any required testing shall be the responsibility of the applicant referencing the ABWR design. Section 14.2.13 will be revised accordingly to document this as an interface requirement.

1.n.(14)(f) Control room habitability systems. Demonstrate proper operation of smoke and toxic chemical detection systems and ventilation shutdown devices, including leaktightness of ducts and flow rates, proper direction of air flows, and proper control of space temperatures.

Response- The test description in Section 14.2.12.1.34 has been revised to make it clear that the control room habitability function is to be included in the testing specified for the dedicated HVAC system of the main

control room. Additionally, a specific requirement to demonstrate the system capability to detect smoke and/or toxic chemicals and to remove and/or prevent in-leakage of such has been added.

2.1.8.2 Initial Fuel Loading and Precritical Tests

2.c Final functional testing of the reactor protection system to demonstrate proper trip points, logic, and operability of scram breakers and valves. Demonstrate the operability of manual scram functions.

Response- Such testing will have been completed as part of the preoperational testing described in Subsection 14.2.12.1.14. Additionally, these tests are part of the plant Technical Specification surveillance program which is required to be instituted prior to commencement of fuel loading as specified in Section 14.2.10.1. However, subsection 14.2.12.2.3 has been revised to specifically require that the demonstrations required by position 2.c above be completed as prerequisites to fuel loading.

2.d Final reactor coolant system leak rate test to verify that system leak rates are within specified limits.

Response- Such testing will have been completed as part of the preoperational testing described in revised Subsection 14.2.12.1.1, which references the required reactor coolant leak rate tests specified in Subsection 5.2.4.6.1. However, subsection 14.2.12.2.3 has been revised to specifically require that the demonstrations required by position 2.d above be completed as prerequisites to fuel loading.

2.1.8.3 Low Power Testing

4.k Steam driven plant auxiliaries and power conversion equipment.

Response- Section 14.2.12.2 will be revised accordingly

4.l Branch steamline valves and bypass valves used for protective isolation functions at rated temperature and pressure conditions.

Response- For ABWR the only branch steamline valves used for protective isolation functions are those on the RCIC steamline and the common drainline from the main steamlines. Accordingly, the description of RCIC system testing in Subsection 14.2.12.2.22 has been

revised to include specific testing of the RCIC steamline isolation valves and Subsection 14.2.12.2.26 has been revised to include specific testing of the main steamline branch drain line isolation valves in addition to the MSIV testing already specified.

2.1.8.4 Power Ascension Tests

5.j Plant performance is as expected for rod runback and partial scram.

Response- The ABWR design has no partial scram function. Rod-runback is accomplished by the select control rod run-in (SCRRI) function. Subsection 14.2.12.2.6 has been revised to assure that appropriate testing is performed to demonstrate proper functioning of SCRRI logic and hardware. Also, Subsection 14.2.12.2.30 has been revised to assure that proper plant response is demonstrated during the event that will result in initiation of SCRRI.

5.n Reactor coolant system loose parts monitoring system.

Response- An appropriate test description will be added to Section 14.2.12.2.

5.o Reactor coolant leak detection systems.

Response- It is expected that testing of reactor coolant leak detection systems will be completed during the preoperational stage.

5.q Proper operation of failed fuel detection systems.

Response- In the ABWR design the failed fuel detection function is performed by the process radiation monitoring system, the testing of which is described in Subsection 14.2.12.2.1. This test description has been revised to require the appropriate demonstration of the related failed fuel detection function.

Also see response to item 1.j.(12) above.

5.u Branch steamline isolation valve operability and response times.

Response- The applicable test descriptions have been revised accordingly. See response to item 4.1 above.

5.w Demonstration that concrete temperatures surrounding hot penetrations do not exceed design limits with the minimum design capability of cooling system components available.

Response- An appropriate test description will be added to Section 14.2.12.2.

5.x Auxiliary systems required to support operation of engineered safety features.

Response- Auxiliary systems required to support operation of engineered safety features include the cooling water and HVAC systems whose testing is described in Subsections 14.2.12.2.23 and 14.2.12.2.24, respectively. These subsections have been revised to assure that the testing performed, and results obtained, will ultimately demonstrate the adequacy of a particular auxiliary system's performance under limiting accident conditions.

5.z Demonstration that process and effluent radiation monitoring systems are responding correctly by performing independent laboratory or other analyses.

Response- This testing is part of that described in Section 14.2.12.2.1(3), which has been revised to specifically address position 5.z above.

5.c.c Demonstration that gaseous and liquid radioactive waste processing, storage, and release systems operate in accordance with design.

Response- An appropriate test description will be added to Section 14.2.12.2.

5.g.g Demonstration of design features to prevent or mitigate anticipated transients without scram (ATWS), [if not previously done].

Response- ATWS design features are comprised primarily of dedicated logic, and some hardware, which will be thoroughly checked out as part of the preoperational test program (See response to item 1(c) of 2.1.8.1 above). Most hardware design features that perform ATWS related functions do so in their normal mode, only initiated by dedicated ATWS logic. Therefore, the

functioning of these features is adequately verified via the testing already conducted for such. Thus, no dedicated testing of ATWS related features is planned during the power ascension test phase.

5.h.h Demonstration that the dynamic response of the plant to load swings for the facility, including step and ramp changes, is in accordance with design.

Response- This testing is intended to be a part of that described in Section 14.2.12.2.16, which has been revised to specifically address position 5.h.h above.

2.1.9 Section IA 2.4 of the FSAR states that testing described in Chapter 14 is consistent with the BWR Owner's Group response to Item I.G.1 of NUREG-0737 as documented in a letter of February 4, 1981 from D. B. Waters to D. G. Eisenhut. Section 14.2.12 test abstracts that describe testing outlined in Appendix E of this letter should be identified or modified accordingly.

Response- Testing outlined in Appendix E of the referenced document is specified in the following test abstracts: 14.2.12.1.1(3)(a), 14.2.12.1.9(3)(j) & 14.2.12.1.44(3)(a). A more detailed review and comparison will be performed of the requirements of Item I.G.1 of NUREG-0737 versus the response given in Section 1A 2.4 of the SSAR and the correspondence referenced therein, and the SSAR test abstracts listed above.

2.1.10 Section 14.2.12.1.19, "Reactor Water Cleanup System Preoperational Test," Section 14.2.12.1.54, "Condensate Cleanup System Preoperational Test," and Section 14.2.12.2.21, "Reactor Water Cleanup System Performance," should be modified to address the concerns of Regulatory Guide 1.56, "Maintenance of Water Purity in Boiling Water Reactors."

Response- Regulatory Guide 1.56 deals mainly with design related issues, specifically the equipment and instrumentation needed to assure proper BWR reactor water chemistry. Subsections 14.2.12.1.19, 14.2.12.1.54 and 14.2.12.2.21 describe preoperational and power ascension testing that is adequate to demonstrate proper performance of the reactor water clean-up system and the condensate filter/demineralizer system in assuring that acceptable reactor water chemistry is maintained. Subsection 14.2.12.1.22 describes the preoperational testing intended to demonstrate the proper functioning of the instrumentation required by Reg Guide 1.56. However, this

section has been revised to more specifically address functioning of conductivity meters, which are a major focus of Reg Guide 1.56. Likewise, Subsection 14.2.12.2.1 verifies that a proper reactor water chemistry monitoring program is in place. However, this subsection has also been revised to more specifically address the required demonstration of the proper functioning of related instrumentation (i.e. conductivity meters).

2.1.11 Section 14.2.12.2.14, "Feedwater Control," should be revised to address the following items in accordance with Regulatory Guide 1.68.1, "Preoperational and Initial Startup Testing of Feedwater and Condensate Systems for Boiling Water Reactor Power Plants:"

a. Modify the test description to provide for demonstration of the operability of the feedwater system at low reactor power (15% reactor power) (R.G.1.68.1.C.2.a).

Response- Such testing is already specified in the current description. A more specific commitment to the Reg Guide position will be evident in the test matrix to be supplied in response to comment 2.1.4.b.

b. Modify or clarify the test acceptance criteria to provide assurance that vibration levels for system components and piping are within predetermined limits (R.G.1.68.1.C.2.f); piping movement during heatup and steady state and transient operation are within predetermined limits (R.G.1.68.1.C.2.g); and adequate margins exist between system variables and setpoints of instruments monitoring these variables to prevent spurious actuations or loss of system pumps and motor-operated valves (R.G.1.68.1.C.2.h).

Response- The testing called for by positions C.2.f and C.2.g is included in the test abstracts of subsections 14.2.12.1.51, 14.2.12.1.53(b)&(k), 14.2.12.2.10, 14.2.12.2.11, and 14.2.12.2.18. Subsection 14.2.12.2.18 has been revised to more specifically address position C.2.h.

2.1.12 Section 14.2.12.1.27, "Instrument Air and Station Service Air System Preoperational Test," should be revised to address the following items in accordance with Regulatory Guide 1.68.3, "Preoperational Testing of Instrument and Control Air Systems:"

a. Determination that the total air demand at normal steady state conditions, including leakage for the system, is in accordance with design (R.G.1.68.3.C.5).

Response- This determination is part of the testing specified in 14.2.12.1.27(3)(f) which has been revised to more directly address the issue of total demand, including leakage.

b. Demonstration that the plant equipment designated by design to be supplied by the instrument and control air system is not being supplied by other compressed air supplies (such as service air) that may have less restrictive air quality requirements (R.G.1.68.3.C.9).

Response- Although the service air system acts as a back-up to instrument air, it does so upstream of the instrument air filters. Furthermore, although totally separate (except for the manual back-up cross-tie) the design of the two systems is essentially identical. Thus, the air supplied to the inlet of the instrument air filters is of the same quality, whether it is sourced from the instrument or service air system; therefore, the outlet air will be of the same quality. Since the design precludes occurrence of the conditions hypothesized, no specific test demonstration is needed beyond the construction verification and preoperational testing already planned.

c. Demonstration that functional testing of instrument and control air systems important to safety is performed to ensure that credible failures resulting in an increase in the supply system pressure will not cause loss of operability (R.G.1.68.3.C.11).

Response- The test description will be revised accordingly.

2.1.13 Section 14.2.12.1.34, "Heating, Ventilation, and Air Conditioning Systems Preoperational Test," should be revised to address the concerns of Regulatory Guide 1.95, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release."

Response- See response to comment on position 1.n.(14)(f).

2.1.14 Section 14.2.12.1.8, "Residual Heat Removal System Preoperational Test," should be revised to address the following items in accordance with Regulatory Guide 1.139, "Guidance for Residual Heat Removal:"

a. RHR system isolation (R.G.1.139.C.2).

Response- The applicable demonstrations were intended to be a part of the testing described in subsection 14.2.12.1.8(3)(i). However, the testing description has been revised to specifically address testing of features designed to assure isolation of low pressure portions of the RHR system from RCS at high pressure.

b. RHR system pressure relief (R.G.1.139.C.3).

Response- The design of the RHR system includes the relief capability and capacity required by the above referenced position, in accordance with the applicable ASME code. The verification of the proper setting of relief valves is a vendor bench test required per the same ASME code, and thus no specific additional preoperational test is needed.

2.1.15 Section 14.2.12.1.34, "Heating, Ventilation, and Air Conditioning Systems Preoperational Test," or other appropriate preoperational tests, should be revised to address the concerns of Position C.5 of Regulatory Guide 1.140, "Design, Maintenance, and Testing Criteria for Normal Ventilation Exhaust System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants."

Response- The testing requirements specified by Reg Guide 1.140, and by the industry standards referenced therein, will be reviewed for their potential applicability to potentially effected filtration and adsorption units. Section 14.2.12.1.34 will then be revised accordingly.

2.2 Staff prepared ERRATA information which should be used by the applicant to correct the FSAR Chapter 14 submittal.

Section	Page	Comment
14.2.12.1.1(1)	14.2-7	"and indication" should be "and indications"
14.2.12.1.28(3)	14.2-26	Title of the subsection on "General Test Methods and Acceptance Criteria" is simply titled "Test Methods and Acceptance Criteria". This should be consistent throughout the chapter.

14.2.12.1.31(3)	14.2-28	Same comment as above.
14.2.12.1.32(3)	14.2-29	Same comment as above.
14.2.12.1.33(3)	14.2-30	Same comment as above.
14.2.12.1.44(3)	14.2-34	Same comment as above.
14.2.12.1.45(3)	14.2-35	Same comment as above.
14.2.12.22.76	14.2-44.15	The Offgas System Startup Test is misnumbered and listed in the preoperational test section. Move this test to the appropriate section.
14.2.12.1.4(3)(a)	14.2-10	"Channel Trip" should be "Channel Trips"
14.2.12.1.4(3)(f)	14.2-10	"foe which" should be "for which"
14.2.12.1.34(1)	14.2-30	"nonessential equip-ment" should be "Nonessential equipment"
14.2.1.71.(3)(f),(g),(h)	14.2-44.13	(f), (g), and (h) margins are out of alignment
Section	Page	Comment
14.2.12.2	14.2-44.16	Top of column B "equip-ment" should be "equipment"
14.2.12.2.1.3	14.2-45	"perfor mance" should be "performance"
14.2.12.2.3.2	14.2-46	"liscense" should be "license"
14.2.12.2.8.2	14.2-49	"interation" should be "iteration"
14.2.12.2.8.4	14.2-49	"liscense" should be "license"
14.2.12.2.14.2	14.2-53	"interation" should be "iteration"

14.2.12.2.17.2	14.2-55	"interation" should be "iteration"
14.2.12.2.18.2	14.2-55	Interation" should be "iteration"
14.2.12.2.22.3	14.2-57	"direcly" should be "directly"
14.2.12.3	14.2.64	"Other Testing" section not included.

SECTION 14.2

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SECTION 14.2

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review and approval of test results and for resolution of failures to meet acceptance criteria and of other operational problems or design deficiencies noted. It describes the various phases of the initial test program and establishes the requirements for progressing from one phase to the next as well as those for moving beyond selected hold points or milestones within a given phase. It also describes the controls in place that will assure the as-tested status of each system is known and that will track modifications, including retest requirements, deemed necessary for systems undergoing or already having completed specified testing. Additionally, the startup manual delineates the qualifications and responsibilities of the different positions within the startup group. The startup administrative procedures are intended to supplement normal plant administrative procedures by addressing those concerns that are unique to the startup program or that are best approached in a different manner. To avoid confusion, the startup program will attempt to be consistent with normal plant procedure where practical. The plant staff will typically carry out their duties according to normal plant procedures. However, in areas of potential conflict with the goals of the startup program, the startup manual or the individual test procedures will address the required interface.

14.2.5 Review, Evaluation, and Approval of Test Results

Individual test results are evaluated and reviewed by cognizant members of the startup group. Test exceptions or acceptance criteria violations are communicated to the affected and responsible organizations who will help resolve the issues by suggesting corrective actions, design modifications, and retests. GE and others outside the plant staff organization, as appropriate, will have the opportunity to review the results for conformance to predictions and expectations. Test results, including final resolutions, are then reviewed and approved by designated startup group supervisory personnel. ~~Final approval is obtained from the appropriate level of plant management as defined in the startup administrative manual. Plant management will also~~ have responsibility for final review and approval of overall test phase results and of that for selected milestones or hold points within the test phases.

14.2.6 Test Records

Initial test program results are compiled and maintained according to the startup manual, plant administrative procedures, and applicable regulatory requirements. Test records that demonstrate the adequacy of safety-related components, systems and structures should be retained for the life of the plant. Retention periods for other test records will be based on consideration of their usefulness in documenting initial plant performance characteristics.

14.2.7 Conformance of Test Program with Regulatory Guides

The NRC Regulatory Guides listed below were used in the development of the initial test program and the applicable tests comply with these guides, except as noted. The applicable revisions of the below listed regulatory guides can found in Table 1.8-20.

(1) Regulatory Guide 1.68--*Initial Test Programs for Water-Cooled Nuclear Power Plants.*

(2) Regulatory Guide 1.68.1--*Preoperational and Initial Startup Testing of Feedwater and Condensate Systems for Boiling Water Reactor Power Plants.*

(3) Regulatory Guide 1.68.2--*Initial Startup Test Program to Demonstrate Remote Shutdown Capability for Water-Cooled Nuclear Power Plants.*

(4) Regulatory Guide 1.68.3--*Preoperational Testing of Instrument and Control Air Systems.*

(5) Regulatory Guide 1.20--*Comprehensive Vibration Assessment Program for Reactor Internals During Preoperation and Initial Startup Testing.*

(6) Regulatory Guide 1.41--*Preoperational Testing of Redundant Onsite Electric Power Systems to Verify Proper Load Group Assignments.*

*Final approval is obtained from the SCG and the appropriate level of plant management as defined in the startup administrative manual. The SCG and the designated level of plant management will also *

(7) Regulatory Guide 1.52--*Design, Testing, and Maintenance Criteria for Engineered-Safety-Feature Atmosphere Cleanup System Air Filtration and Adsorption Units of Light-Water-Cooled Nuclear Power Plants.*

(8) Regulatory Guide 1.56--*Maintenance of Water Purity in Boiling Water Reactors.*

(9) Regulatory Guide 1.108--*Periodic Testing of Diesel Generators Used as Onsite Electric Power Systems at Nuclear Power Plants.*

(10) Regulatory Guide 1.140--*Design, Testing and Maintenance Criteria for Normal Ventilation Exhaust System Air Filtration and Absorption Units of Light Water Cooled Nuclear Power Plants.*

(11) Regulatory Guide 1.139, "Guidance for Residual Heat Removal"

(12) Regulatory Guide 1.95, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release"

14.2.8 Utilization of Reactor Operating and Testing Experience in the Development of Test Program

Since every reactor/plant in a GE BWR product line is an evolutionary development of the previous plant in the product line (and each product line is an evolutionary development from the previous product line), it is evident that the ABWR plants have the benefits of experience acquired with the successful and safe startup of more than 30 previous BWR/1/2/3/4/5/6 plants. The operational experience and knowledge gained from these plants and other reactor types has been factored into th
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14.2.9 Trial U
Emergency Pr

To the extent p
operational and initial startup test program, test procedures will utilize operating, emergency, and abnormal procedures where applicable in the performance of tests. The use of these procedures is intended to do the following:

(1) prove the specific procedure or illustrate changes which may be required;

(2) provide training of plant personnel in the use of these procedures; and

(3) increase the level of knowledge of plant personnel on the systems being tested.

A testing procedure utilizing an operating, emergency, or abnormal procedure will reference the procedure directly, extract a series of steps from the procedure, or both in a way that is optimum to accomplishing the above goals while efficiently performing the specified testing.

14.2.10 Initial Fuel Loading and Initial Criticality

Fuel loading and initial criticality are conducted in a very controlled manner in accordance with specific written procedures as part of the startup test phase (see Subsection 14.2.12.2). Approval for commencement of fuel loading typically is granted by the NRC, via the issuance of an operating license, after all prerequisite testing has been satisfactorily completed.

14.2.10.1 Pre-Fuel Load Checks

Once the plant has been declared ready to
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as described
at this time
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the initiation
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nuclear instruments

However, there may be unforeseen circumstances that arise that would prevent the completion of all preoperational testing (including the review and approval of the test results) that would not necessarily justify the delay of fuel loading. Under such circumstances, the applicant referencing the ABWR design may decide to request permission from the NRC to proceed with fuel loading. If portions of any preoperational tests are intended to be conducted, or their results approved, after commencement of fuel loading, then the following shall be documented in such a request: (1) list each test; (2) state which portions of each test will be delayed until after fuel loading; (3) provide technical justification for delaying these portions; and (4) state when each test will be completed and the results approved.

14.2.10.2 Initial Fuel Loading

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

(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*

Specific testing to c... applicable acceptance ... preoperational test are in accor... 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.

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 14.2.12.3.~~

* 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 be observed and recorded d... g 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;

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

...olVs and main ... 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; ~~and~~

(f) 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 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 be verified from certification or bench tests to be consistent with applicable requirements.

14.2.12.1.2 Reactor Recirculation System Preoperational Test

(1) Purpose

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

(2) Prerequisites

The construction tests have been suc... fully completed and the SCG has revie... test procedure and has approved the i... tion of testing. Cooling water from t... actor building cooling water system an... purge flow from the CRD hydraulic s... shall be available. The recirculation ... control system should be sufficiently t...

* Additionally, proper installation and setting of supports and restraints for SRV discharge piping will be verified as part of the testing described in 14.2.12.1.5.1.*

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-

ponents should have an initial calibration in accordance with vendor instructions. All 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

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

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

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

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

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

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

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

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

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

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

14.2.12.1.5 Standby Liquid Control System Preoperational Test

(1) Purpose

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

(2) Prerequisites

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

(3) General Test Methods and Acceptance Criteria

Performance 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, including timing, under expected operating conditions;

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

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

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

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

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

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

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

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

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

14.2.12.1.6 Control Rod Drive System Preoperational Test

(1) Purpose

To verify that the control rod drive (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 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 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 those associated with alternate rod insertion, alternate rod run-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;

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 ~~the~~ sampling and analysis of 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 be observed and recorded during a series of tests to demonstrate the following:

(a) proper operation of on-line sampling and monitoring equipment ~~including~~ calibration, indication, and alarm functions, including reactor water conductivity instrumentation;

~~fied in all required operating modes.~~

(2) Prerequisites

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

(3) General Test Method and Acceptance Criteria

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

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, including timing, under expected operating conditions;

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

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

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

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

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

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

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

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

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

14.2.12.1.21 Fuel Pool Cooling and Cleanup System Preoperational Test

(1) Purpose

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

(2) Prerequisites

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

(3) General Test Methods and Acceptance Criteria

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

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

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

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

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

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

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

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

14.2.13.1.7 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 should be observed and recorded during a series of tests to demonstrate the following:

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

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

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

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

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

14.2.12.1.8 Residual Heat Removal System Preoperational Test

(1) Purpose

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

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The reactor vessel shall be intact and capable of receiving injection flow from the various modes of RHR. The reactor building cooling water system and other required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

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

(b) proper functioning of indicators, recorders, annunciators, and alarms including those monitoring system availability;

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

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

(e) proper initiation and operation of detection and sampling functions including pump start and valve sequencing, if appropriate, in response to a LOCA signal; and

(f) proper operation of calibration gas supply systems and self calibration functions.

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

14.2.12.1.27 Instrument Air and Station Service Air Systems Preoperational Tests

(1) Purpose

To verify the ability of the instrument air and service air systems (IA and SA) to provide the design quantities of clean dry compressed air to user systems and components.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Primary and backup electrical power, the supplied system and components loads, and other required system interfaces are available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

The instrument air system and the service air system are specified as separate systems. However, since they are so closely related the preop test requirements are essentially the same.

Performance 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, including timing, under expected operating conditions;

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

(e) ability of compressor(s) to maintain receiver at specified pressure(s) and to recharge within specified time under design loading conditions;

(f) proper system flow paths and acceptable flow rates to individual loads at specified temperatures and pressures under design loading ~~conditions~~; "...conditions, including a determination that the total air demand at steady state conditions, including leakage for the system, is in accordance with design;"

(g) proper compressor start sequence (including load and unload) and margin to actuation of protective devices;

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

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

(j) proper system operation while powered from primary and alternate sources, including transfers, and in degraded

modes for which the system is expected to remain operational;

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

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

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

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

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

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

14.2.12.1.28 High Pressure Nitrogen Gas Supply System Preoperational Test

(1) Purpose

To verify the ability of the high pressure nitrogen gas supply system (HPIN) to furnish compressed nitrogen gas to user systems at design quantity and quality.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. User system loads and other required system interfaces shall be available, as needed, to support the specified system testing.

General

(3) 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 and instrument channel trip;

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

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

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

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

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

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

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

(i) acceptability of vibration levels and system piping movements during both transient and steady state operation;

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

(k) proper "failure" (open, close, or as is) of supplied components to both instantaneous (pipe break) and slow (plugging or freezing) simulated nitrogen gas supply losses (per Regulatory Guide 1.68.3).

System operation is considered acceptable

To verify the ability of the plant make-up water system(s) to resupply the designated plant systems with water of the design quantity and quality for each such system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Final interconnection with the supplied systems is complete and those systems are ready to accept transfer of design quantities of makeup water.

(3) General Test Methods and Acceptance Criteria

System performance 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;

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

(c) proper operation of pumps, motors, and valves under expected operating conditions;

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

(e) the adequacy of system flow paths and flow rates including pump and tank capacities;

(f) proper functioning of chemical addition and water treatment facilities and equipment;

(g) proper functioning of freeze protection devices, if applicable; and

(h) acceptability of pump and motor vibration levels and system piping movements during both transient and steady state operations.

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

14.2.12.1.31 Hot Water Heating System Preoperational Test

(1) Purpose

Verify the ability of the hot water heating system to provide hot water to the appropriate HVAC systems in order to maintain the specified design temperatures within the various building rooms and areas.

(2) Prerequisites

The construction tests have been completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Electrical power, the appropriate heating source(s), the various HVAC systems heating coils, and other required interfacing systems shall be available, as needed, to support the specified testing.

(3) 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 and instrument channel trip;

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

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

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

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

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

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

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

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

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

System operation is considered acceptable when the observed/measured performance characteristics, from the testing described above, meet the applicable design specifications. It may not be possible to fully evaluate heat exchanger and heating coil performance during the preoperational test phase because of process temperature limitations.

14.2.12.1.32 HVAC Emergency Chilled Water System Preoperational Test

(1) Purpose

To verify the ability of the HVAC emergency chilled water system (HECW) to supply the design quantities of chilled water at the specified temperatures to the various cooling coils of the HVAC systems serving rooms and areas containing essential systems and equipment.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. Normal and auxiliary electrical power, reactor building cooling water, applicable HVAC system cooling coils, and other required system interfaces shall be available, as needed, to support the specified system testing.

(3) 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 and instrument channel trip,

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

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

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

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

(f) proper system flow paths and flow rates to all supplied loads including pump capacity and discharge head;

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

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

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

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

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

(l) proper functioning of system surge tank and chemical addition features.

System operation is considered acceptable when the observed/measured performance

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

14.2.12.1.33 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) 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 and instrument channel trip;

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

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

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

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

(f) proper system flow paths and flow rates to all supplied loads including pump capacity and discharge head;

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

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

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

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

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

(l) proper functioning of system surge tank and chemical addition features.

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

14.2.12.1.34 Heating, Ventilation, and Air Conditioning Systems Preoperational Test

(1) Purpose

To verify the ability of the various HVAC systems to establish and maintain the specified environment, with regards to temperature, pressure, and airborne particulate level, in the applicable rooms, areas, and buildings throughout the plant, supporting essential and nonessential 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 Method 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 heating and cooling coils to maintain the specified thermal environment(s) while considering the heat loads present during the preop test phase; and

(l) the ability of primary and secondary containment HVAC systems to provide sufficient purge, exhaust, and recirculation flows in support of drywell inerting and deinerting operations.

(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;

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

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 Containment Integrated Leakage Rate Test

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

14.2.12.1.41 Pressure Suppression Containment Bypass Leakage Tests

Test procedures are identical to those us for other penetrations under isolation con tions 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 ti tests of containment isolation valves is cussed in Subsection 6.2.4.

14.2.12.1.43 Wetwell-to-Drywell Vacuum Breake System Preoperational Test

(1) Purpose

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

(2) Prerequisites

The construction tests have been suc fully 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 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;

(b) proper operation of instrumentation and alarms used to monitor system operation and status, such as valve position indication, including verification of operability during loss of preferred

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

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 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;

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

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

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

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

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

14.2.12.1.45 Electrical Systems Preoperational Test

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

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

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

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

(a) proper operation of initiating, transfer, and trip devices;

(b) proper operation of relaying and logic, including load shedding features;

(c) proper operation of equipment protective devices, including permissive and prohibit interlocks;

(d) proper operation of instrumentation and alarms used to monitor system and equipment status (including availability);

(e) proper operation and load carrying capability of breakers, motor controllers, switchgear, transformers, and cables;

(f) that a sufficient level of redundancy and electrical independence exists as specified for each application;

(g) the capability to transfer between onsite and offsite power sources as per design;

(h) the ability of emergency and vital loads to start in the proper sequence and to operate properly under simulated accident conditions, while powered from either preferred or standby sources, and over the specified range of available bus voltage; and

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

14.2.12.1.45.3 Emergency Diesel Generator Preoperational Test

(1) Purpose

To demonstrate the capability of the emergency diesel generators to provide highly reliable emergency electrical power during normal and simulated accident conditions when normal offsite power sources are unavailable, and to demonstrate the operability of the diesel generator auxiliary systems, e.g., diesel fuel oil transfer, diesel-generator starting air supply, jacket water, and lube oil.

(2) Prerequisites

The construction tests have been successfully completed and th CG has reviewed the test procedure and has approved the initiation of testing. All interfacing systems and equipment required to support system operation shall be available, as needed, for the specified testing configuration. Additionaly, sufficient diesel fuel should be available on site to perform the scheduled tests.

(3) 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 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

with the vessel internals completely intact with the exception of the fuel bundles, the control blades (unless fully withdrawn), and the steam dryer assembly. A post fuel load, subcritical flow test will be performed later on the complete reactor assembly unless it is shown analytically or experimentally that the preoperational results are already conservatively bounding. Additionally internals vibration will be measured during individual component or system preoperational testing where operation my result in significant vibrational excitation of reactor internals, such as HPCF testing.

The duration of preoperational testing at the various flow configurations should ensure that each critical component is subjected to at least 10^6 cycles of vibration, as calculated using the lowest frequency for which the component is expected to experience a significant structural response.

(c) Post Flow Vessel Inspection

The post flow inspection shall be performed after the resultant vibrational excitation from the preoperational flow testing described above. The structures and components inspected shall be the same as specified for the preflow inspection. Visual and remote observations are performed after the vessel has been depressurized and drained. Inspection of critical surfaces and components should be performed prior to any disassembly required for access to other internal structures.

(d) Acceptance Criteria

The acceptance criteria are generated as part of the analytical portion of the program in terms of maximum vibrational response levels of overall structures and components and translated to specific sensor locations.

Reactor vessel internals vibration is considered acceptable when results of the measurement program correlate and compare favorably with those of the analysis program, and, when the results of the inspections show no signs of defects, loose parts, extraneous material, or excessive wear due to flow testing, and are consistent with the results obtained from the analysis and measurement programs.

1.S3

14.2.12.38 Condensate and Feedwater Systems Preoperational Test

(1) Purpose

To verify proper operation of the various components that comprise the condensate and feedwater systems and their capability to deliver the required flow from the condenser hotwell to the nuclear boiler system.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure(s) and has approved the initiation of testing. The required interfacing systems shall be available as needed, to support the specified testing. For all flow testing their shall be an adequate suction source available and an appropriate flow path established.

(3) General Test Method and Acceptance Criteria

Preoperational testing of the condensate and feedwater systems will include the piping, components, and instrumentation between the condenser and the nuclear boiler but not the condensate filters or demineralizers nor the feedwater heaters, which will be tested separately per the specific discussions provided for those features.

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

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 should be intact, and all other required interfaces available, as needed, to support the specified testing.

(3) General Test Methods and Acceptance Criteria

Performance should be observed and recorded during a series of 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.

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

(d) acceptable system and component flow paths and flow rates including pump capacities and tank volumes;

(e) proper operation of system pumps, valves, and motors under expected operating conditions;

(f) proper operation of phase separators and waste evaporators;

(g) proper operation of concentrating, solidifying, and packaging functions including verification of the absence of free liquids in packaged waste;

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

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

(j) proper calibration and operation of radiation detectors and monitors.

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

14.2.12.2.76 Offgas System ~~Preoperation~~ Test

(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 approriate operational configuration with the specified prerequisite 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.

(4) Criteria

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

14.2.12.1.77 Ultimate Heat Sink Preoperational Test

(1) Purpose

To verify that the ultimate heat sink is capable of supplying design quantities of make-up and/or return water to the circulating water system and the reactor turbine service water systems.

(2) Prerequisites

The construction tests have been successfully completed and the SCG has reviewed the test procedure and has approved the initiation of testing. The circulating water system and the reactor and turbine

[To be relocated in 14.2.12.2]

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

(3) General Test Method and Acceptance Criteria

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

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

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

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

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

14.2.12.2 General Discussion of Startup Tests

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

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

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

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

14.2.12.2.1 Chemical and Radiochemical Measurements

(1) Purpose

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

(2) Prerequisites

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

(3) Description

Specific objectives of the test program include evaluation of fuel performance, evaluations of demineralizer operations by direct and indirect methods, measurements of filter performance, confirmation of condenser integrity, demonstration of proper steam separator-dryer operation, measurement and calibration of the offgas system, and evaluation and calibration of certain process instrumentation. 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. Data for these purposes is secured from a variety of [illegible] rating 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.*

(4) Criteria

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

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

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

14.2.12.2.2 Radiation Measurements

(1) Purpose

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

(2) Prerequisites

The preoperational tests have been completed [illegible] has reviewed the test

*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 pre-treatment 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.

(3) Description

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

(a) containment penetrations;

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

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

(4) Criteria

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

14.2.12.2.3 Fuel Loading

(1) Purpose

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

(2) Prerequisites

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

Additionally, the following requirements will be met prior t , at the applicable assure that th itical by at least safe manner: terms of reacti-

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

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

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

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

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

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

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

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

(3) Description

Fuel loading will commence and proceed according to detailed written procedures in a predetermined sequence that will assure a safe and efficient loading. The neutron count rates shall be monitored as the core loading progresses to ensure continuous subcriticality and shutdown margin demonstrations will be performed at specified loading intervals.

(4) Criteria

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

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

Thus, after it is verified that all CRDs operate properly when installed, tests are performed periodically during heatup to assure that there is no significant binding caused by thermal expansion of the core components and no significant effect on performance due to increased pressure, power or flow. Additionally, software functions such as those associated with the RC&IS are tested to the extent that they could not be checked during preoperational testing.

(4) Criteria

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

"Testing will also be conducted to verify proper operation of the SCRRI logic and function. The particular testing of the SCRRI function might be conducted, at least in part, with the RIP trip test described in 14.2.12.2.30 where the planned trip will automatically result in SCRRI actuation."

14.2.12.2.6 Neutron Monitoring System Performance

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

(4) Criteria

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

14.2.12.2.7 Process Computer System Operation

(1) Purpose

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

various plant control systems during actual plant operating conditions.

(2) Prerequisites

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

(3) Description

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

(4) Criteria

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

14.2.12.2.8 Core Performance

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

(4) Criteria

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

14.2.12.2.9 Nuclear Boiler Process Monitoring

(1) Purpose

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

14.2.12.2.12 Reactor Internals Vibration

(1) Purpose

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

(2) Prerequisite

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

(3) Description

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

(4) Criteria

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

14.2.12.2.13 Recirculation Flow Control

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

(4) Criteria

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

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

14.2.12.2.14 Feedwater Control

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

(4) Criteria

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

14.2.12.2.15 Pressure Control

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

"Such testing will include demonstration(s) that the dynamic response of the plant to design load swings for the facility, including limiting step and ramp changes as appropriate, is in accordance with design."

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

(4) Criteria

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

14.2.12.2.16 Plant Automation and Control

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

(4) Criteria

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

14.2.12.2.17 Reactor Recirculation System Performance

(1) Purpose

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

dance with design requirements.

(2) Prerequisites

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

(3) Description

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

(4) Criteria

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

14.2.12.2.18 Feedwater System Performance

(1) Purpose

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

(2) Prerequisites

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

(3) Description

Pertinent parameters will be monitored throughout the feedwater system, and condensate system if appropriate, across the spectrum of system flow and plant operating conditions in order to demonstrate that system operation is in accordance with design. Parameters to be monitored may include temperatures, pressures, flow rates, pressure drops, pump speeds and developed heads, and general equipment status. Of special interest will be data that serves to verify design assumptions used in plant transient performance and safety analysis calculations like maximum feedwater runout capabilities and feedwater temperature versus power level relationships.

(4) Criteria

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

14.2.12.2.19 Main Steam System Performance

(1) Purpose

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

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure and has approved the initiation of

"Steady state and transient testing will be conducted, as necessary, to assure that adequate margins exist between system variables and setpoints of instruments monitoring these variables to prevent spurious actuations or loss of system pumps and motor-operated valves."

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

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

(4) Criteria

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

14.2.12.2.22 RCIC System Performance

(1) Purpose

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

(2) Prerequisites

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

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

(3) Description

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

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

(4) Criteria

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

tendencies and should provide quick but stable response.

14.2.12.2.23 Plant Cooling/Service Water System(s) Performance

(1) Purpose

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

(2) Prerequisites

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

(3) Description

Power ascension phase testing of plant cooling water systems is necessary only to the extent that fully loaded conditions could not be approached during the preoperational phase. Pertinent parameters should be monitored in order to provide a final verification of proper system flow balancing and heat exchanger performance under near design or special conditions, as is appropriate.

(4) Criteria

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

14.2.12.2.24 HVAC System Performance

(1) Purpose

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

(2) Prerequisites

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

(3) Description

Power ascension phase testing of plant HVAC systems is necessary only to the extent that fully loaded conditions could not be approached during the preoperational phase. Pertinent parameters should be monitored in order to provide a final verification of proper system flow balancing and cooler performance under near design or special situation conditions, as is appropriate.

(4) Criteria

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

14.2.12.2.25 Turbine Valve Performance

(1) Purpose

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

(2) Prerequisites

The preoperational tests are complete and plant management has reviewed the test procedure(s) and has approved the initiation of testing. For each scheduled testing iteration, the plant shall be in the appropriate operational configuration with the specified

"This will include extrapolation of results obtained under normal or test conditions as needed to demonstrate required performance at limiting or accident conditions."

[2 PLACES]

In addition, at rated temperature and pressure, proper functioning and stroke timing of branch steamline isolation valves (e.g. on common drain line) will be demonstrated.

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

(4) Criteria

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

14.2.12.2.26 MSIV Performance

(1) Purpose

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

(2) Prerequisites

including branch steamline isolation valves

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

(3) Description

At rated temperature and pressure, and then again at an intermediate power level, each MSIV will be individually stroked in the fast closure mode. Valve operability and closure time will be verified and overall plant response observed. Closure times will be evaluated consistent with technical specification and safety analysis requirements. If appropriate, it is also desirable to determine the maximum power level at which such tests can safely be performed by observing plant response during such tests at successively higher power levels.

(4) Criteria

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

14.2.12.2.27 SRV Performance

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

"The testing described will also help to verify proper operation of the SCRRI logic and function in response to actual RIP trip, and will help demonstrate proper overall plant response to events that result in SCRRI actuation."

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

(4) Criteria

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

14.2.12.2.30 Recirculation Pump Trip

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

(4) Criteria

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

14.2.12.2.31 Shutdown From Outside the Main Control Room

(1) Purpose

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

(2) Prerequisites

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

(3) Description

This test should be performed from a low

14.2.12.2.34 Reactor Full Isolation

(1) Purpose

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

(2) Prerequisites

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

(3) Description

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

(4) Criteria

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

14.2.13 Interfaces

The preceding discussion of preoperational and startup tests were limited to those systems and components within, or directly related to, the ABWR Standard Plant. Other testing, with respect to site specific aspects of the plant will be necessary to satisfy certain ABWR interface requirements. Testing of such systems and components should be adequate to demonstrate conformance to such requirements as defined throughout the specific chapters of the SSAR. Below are systems that may require such testing:

(1) electrical switchyard and equipment; ~~and~~—

(2) the site security plan;

(3) Personnel monitors and radiation survey instruments; and

(4) the automatic dispatcher control system (if applicable).

Also to be supplied by the applicant referencing the ABWR design is the Startup Administration Manual described in Section 14.2.4, which will describe, among other things, what specific permissions are required for the approval of test results and the permission to proceed to the next testing plateau.