

14.2 Specific Information to be Included in Final Safety Analysis Reports

The information in this section of the reference ABWR DCD, including all subsections, tables, and figures, is incorporated by reference with the following departures and supplements.

STD DEP T1 2.4-3

STD DEP T1 2.14-1

STD DEP T1 3.4-1 ([Table 14.2-1](#))

[STD DEP 4.6-1](#)

STD DEP 8.3-1

STD DEP 9.1-1

[STD DEP 9.5-1](#)

STD DEP 11.2-1

STD DEP 11.4-1

STD DEP 14.2-1 (Table 14.2-1)

STD DEP Admin

[STD DEP Vendor, Vendor Replacement](#)

14.2.2.1 Normal Plant Staff

[STD DEP Admin](#)

[STD DEP Vendor, Vendor Replacement](#)

Normal plant staff responsibilities, authorities, and qualifications are ~~outside the scope of the ABWR Standard Plant and will be provided by the COL applicant, as discussed in Chapter Section 13.1.~~ During the construction cycle and the various testing phases, additional staff is supplied by the plant owner/operator, ~~GE~~ [nuclear steam supply system \(NSSS\) vendor](#), and others.

The following supplement augments that provided by this subsection.

The plant staff is involved in the initial plant test program in several capacities; including the review of preoperational and startup test procedures and results, performing as startup engineers and other direct participation in test activities. Plant staff will assume increasing responsibility for performing preventative and selected corrective maintenance activities on plant components when released from construction to the Startup Organization. Plant staff will be assigned to assist startup test engineers in performing tests and in operating permanent plant equipment which

has been released from construction to the Startup Organization. Plant Operations directs the fuel loading and is responsible for the operation of the plant during initial startup testing. The duties and responsibilities of key plant staff are described in ~~Section 3.2 of NEDO 33305, "Advanced Boiling Water Reactor (ABWR) the STP Units 3 & 4 Startup Administrative Manual," dated February 22, 2007.~~

14.2.2.2 Startup Group

STD DEP Vendor, Vendor Replacement

It is likely that the startup group will also include an augmented staff of individuals from other concerned parties such as the NSSS vendor (~~GE~~), the architect-engineer, and the plant constructor. The normal plant staff will be included in as many aspects of the test programs as is practicable considering their normal duties in the operation and maintenance of the plant.

14.2.2.3 ~~General Electric Company~~ Nuclear Steam Supply System (NSSS) Vendor

The ~~General Electric Company~~ (~~GE~~) NSSS vendor is the supplier of the boiling water reactor (BWR) nuclear steam supply system (NSSS) and is responsible for generic and specific BWR designs. During the construction and testing phases of the plant cycle, ~~GE~~ NSSS vendor personnel are onsite to offer consultation and technical direction with regard to ~~GE~~ NSSS vendor-supplied systems and equipment. The ~~GE~~ NSSS vendor resident site manager is responsible for all ~~GE~~ NSSS vendor-supplied equipment disposition and, as the senior NSSS vendor representative onsite, is the official site spokesman for ~~GE~~ the NSSS vendor. He coordinates with the plant owner's normal and augmented plant staff for the performance of his duties, which include:

- (1) ~~Reviewing and approving all test procedures, changes to test procedures, and test results for equipment and systems within the ~~GE~~ NSSS vendor scope of supply~~
- (2) ~~Providing technical direction to the station staff~~
- (3) ~~Managing the activities of the ~~GE~~ NSSS vendor site personnel in providing technical direction to shift personnel in the testing and operation of ~~GE~~ NSSS vendor-supplied systems~~
- (4) ~~Liaison between the site and the ~~GE San Jose~~ NSSS vendor home office to provide rapid and effective solutions for problems which cannot be solved onsite~~
- (5) ~~Participating as a member of the Startup Coordinating Group (SCG) [Note: The official designation of this group may differ for the plant owner/operator referencing the ABWR Standard Plant design and SCG is used throughout this discussion for illustrative purposes only.]~~

14.2.2.5 Interrelationships and Interfaces

Effective coordination between the various site organizations involved in the test program is achieved through the SCG, which is composed of representatives of the plant owner/operator, ~~GE~~ NSSS vendor, and others. The duties of the SCG are to review and approve project testing schedules and to effect timely changes to construction or testing in order to facilitate execution of the preoperational and initial startup test programs.

14.2.3 Test Procedures

Specifically, ~~GE~~ the NSSS vendor will provide the COL applicant with scoping documents (i.e., preoperational and startup test specifications) containing testing objectives and acceptance criteria applicable to its scope of design responsibility.

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~~ The NSSS vendor and others outside the plant staff organization, as appropriate, will have the opportunity to review the results for conformance to predictions and expectations.

14.2.7 Conformance of Test Program with Regulatory Guides

STD DEP 9.5-1

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 regulatory guides listed below can be found in Table 1.8-20.

- (10) ~~Regulatory Guide 1.108—"Periodic Testing of Diesel Generators Used as Onsite Electric Power Systems at Nuclear Power Plants."~~ Regulatory Guide 1.9—"Selection, Design, Qualification, and Testing of Emergency Diesel Generator Units Used As Class 1E Onsite Electric Power Systems at Nuclear Power Plants."

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

STD DEP Vendor, Vendor Replacement

~~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/1-6 and ABWR plants. The operational experience and knowledge gained from these plants and other reactor types has been factored into the design and test specifications of ~~GE~~ NSSS vendor-supplied systems and equipment that will be demonstrated during the preoperational and startup test programs.~~

14.2.11 Test Program Schedule

The following supplement addresses the COL License Information Item contained within the text of this subsection.

The schedule, relative to the initial fuel load date, for conducting each major phase of the initial test program, including the timetable for generation, review and approval of procedures, testing and analysis of results will be provided to the NRC 6 months prior to commencement of the initial test program. (COM 14.2-1)

14.2.12 Individual Test Descriptions

14.2.12.1 Preoperational Test Procedures

STD DEP Vendor, Vendor Replacement

Specific testing to be performed and the applicable acceptance criteria for each preoperational test will be documented in detailed test procedures to be made available to the NRC approximately 60 days prior to their intended use. Preoperational testing will be in accordance with the detailed system specifications and associated equipment specifications for equipment in those systems (provided as part of scoping documents to be supplied by GE the NSSS vendor and others as described in Subsection 14.2.3).

14.2.12.1.2 Reactor Recirculation System Preoperational Test

The following supplement augments that provided by this subsection.

~~NEDO 33316, "Advanced Boiling Water Reactor (ABWR) Vibration Assessment Program in compliance with The United States Nuclear Regulatory Commission Regulatory Guide 1.20," dated April 2007, identifies the testing/inspection requirements for verifying reactor vessel internals flow induced vibration is within limits. For STP 3 & 4 reactor internals testing requirements reference Tier 2 Subsections 3.9.2.3 and 3.9.2.4.~~

14.2.12.1.3 Recirculation Flow Control System Preoperational Test

STD DEP T1 3.4-1

(2) Prerequisites

The construction tests have been successfully completed, and the SCG has reviewed the test procedure and approved the initiation of testing. The following systems shall be available, as needed, to support the specified testing and the corresponding system configurations: Reactor Recirculation System, Feedwater Control System, Steam Bypass and Pressure Control System, Electric Power Distribution System/instrumentation and control power supply, ~~Process Computer~~ Plant Information and Control System, Reactor Water Cleanup System, CRD System, RCIS, Neutron Monitoring System, Automatic Power Regulator System, Condensate and Feedwater System and Reactor Protection System.

14.2.12.1.4 Feedwater Control System Preoperational Test

(2) Prerequisites

Appropriate instrumentation and control power supply, Turbine Control System, Reactor Recirculation Flow Control System, Condensate and Feedwater System, ~~Process-Computer~~ Plant Information and Control System, Reactor Water Cleanup System, RCIC System, and Nuclear Boiler System ~~and Multiplexing System~~ shall be available and operational to support the performance of this test.

14.2.12.1.8 Residual Heat Removal System Preoperational Test

(2) Prerequisites

Reactor Building Cooling Water System, Instrument Air System, Fuel Pool Cooling and Cleanup System, Leak Detection System, RCIC System, Suppression Pool Water System, Nuclear Boiler System, ~~Process-Computer System~~, Electric Power Distribution System, ~~Process-Computer~~ Plant Information and Control System and other required interfacing systems shall be available, as needed, to support the specified testing and the appropriate system configurations.

14.2.12.1.9 Reactor Core Isolation Cooling System Preoperational Test

STD DEP T1 2.4-3

(3) General Test Methods and Acceptance Criteria

~~The RCIC turbine shall be tested in accordance with the manufacturer's recommendations. Usually this involves the turbine first being tested while disconnected from and then while coupled to the pump.~~

(f) Satisfactory performance of the RCIC System during the following modes of operation. This test shall be performed using temporary steam supply, equipment, piping and instrumentation as necessary for the test:

(iv) Turbine quick start in response to the simulated automatic initiation signal with suction from the condensate storage pool and discharge via test return line to the ~~condensate storage~~ suppression pool. This test shall demonstrate proper system flow rate and time to rated flow and no malfunction in the system.

(k) ~~Proper operation of the barometric condenser condensate pump and vacuum pump.~~

14.2.12.1.11 Safety System Logic and Control Preoperational Test

STD DEP T1 3.4-1

(2) Prerequisites

The ~~process computer~~ Plant Information and Control System shall be available for displaying and logging, as required, the SSLC supplied parameters and fault identification and bypass status signals. Additionally, a ~~dedicated diagnostic instrument surveillance test controller (STC)~~ equipment shall be available and used as an aid in performing SSLC functional logic testing, including trip, initiation, and interlock logic.

14.2.12.1.12 ~~Multiplexing System~~ Data Communication Function Preoperational Test

STD DEP T1 3.4-1

(1) Purpose

To verify proper functioning of the plant ~~multiplexing system~~ data communications, including both essential and nonessential ~~(EMS and NEMS) subsystems~~ functions.

(2) Prerequisites

The construction test have been successfully completed, and the SCG has reviewed the test procedure and approved the initiation of testing. The power supply, ~~logic units (SSLC), and other components (MCU, RMU, CMU)~~ associated with the ~~essential and non-essential multiplexing systems~~ data communications function shall be operable. The interfacing systems' actuators, alarms, and displays which receive the processed control signals ~~from the essential and non-essential multiplexing systems~~ shall be operational. The data acquisition and communication software required to support the ~~essential and non-essential multiplexing system~~ functions shall be available.

(3) General Test Method and Acceptance Criteria

Since this ~~system~~ function provides the ~~is the primary~~ communication interface between the various plant systems, it shall be adequately tested during the preoperational phase testing performed on those interconnected systems. The integrated hardware/software testing shall check the system functional performance and interface requirements as specified in ~~the non-essential multiplexing system (NEMS) and essential multiplexing system (EMS)~~ design specifications. The verification and validation (V&V) tests are performed to check the input signal coming from appropriately assigned input point and the output signal to the appropriately assigned signal points. This testing shall also check the Remote Digital Logic Controller (RDLC) Function and fail-safe functions of both the sending system (input point) and receiving

~~system (output point), function of the redundant multiplexing system and the fail-safe function of both systems. The capability of both warm and cold starts upon power interruption and automatic self test function of the systems shall also be demonstrated to meet the design requirements. Additionally, after the above verification, the validated essential multiplexing system shall be checked for final validation during integrated EMS/SSLC testing as part of the SSLC preoperational test (Subsection 14.2.12.1.11). Testing shall include confirmation of every multiplexed sensor signal for accuracy, and functional requirements of control, interlock or display as specified in the documents of the system integrated within the SSLC.~~

14.2.12.1.13 Leak Detection and Isolation System Preoperational Test

STD DEP T1 2.14-1

(2) Prerequisites

(k) Other auxiliary systems (e.g., PRM, RD, RCW, HNCW, HVAC, ACS, FCS, SPCU, etc.) associated with the LDS functions

14.2.12.1.14 Reactor Protection System Preoperational Test

STD DEP T1 3.4-1

(2) Prerequisites

Additionally, appropriate simulated RPS multiplexed input signals shall be provided for each of the four RPS divisions.

14.2.12.1.16 ~~Process Computer~~ Plant Information and Control System Preoperational Test

(1) Purpose

To verify the proper operation of the ~~Process Computer~~ Plant Information and Control System (PICS), including the Performance Monitoring and Control System (PMCS) and the Power Generation Control System (PGCS) and their related functions.

(3) General Test Methods and Acceptance Criteria

Proper performance of system hardware and software will be verified by a series of individual and integral tests. These tests shall demonstrate that the PICS, including PMCS and PGCS, operates properly as specified in Subsection 7.7.1.5 and applicable PICS design specifications through the following testing:

(d) Proper data transmission and interface with other plant equipment such as the ~~multiplexing system~~, neutron monitoring system, ATLM, ~~site host computer~~ and emergency operation facility.

14.2.12.1.17 Automatic Power Regulator Preoperational Test**(2) Prerequisites**

The ~~Process Computer~~ Plant Information and Control System, RCIS, RFC System, Turbine Control System, SB&PC System, and other required system interfaces shall be available to support the specified system testing.

14.2.12.1.18 Remote Shutdown System Preoperational Test

STD DEP T1 2.14-1

STD DEP 8.3-1

(2) Prerequisites

~~FGS~~The construction tests have been successfully completed, and the SCG has reviewed the test procedure and approved the initiation of testing. Communication shall be established between the RSS panel, main control room, and each system associated with the RSS. Additionally, the 480 VAC and ~~6-9~~ 4.16 kVAC electrical power system shall be in operation and available and 125 VAC/125 VDC control power shall be supplied to the remote shutdown panel. The applicable portions of the RHR, HPCF, RCW, RSW, NBS, ACS, ~~FGS~~ and MUWC shall be available, as needed, to support the specified testing.

14.2.12.1.45.4 Electrical Power Distribution System Preoperational Test

STD DEP 8.3-1

STD DEP ~~ADM~~Admin

(2) Prerequisites

The construction tests for the individual component associated with the EPDS have been successfully completed, and the Startup Coordination Group (SCG) has reviewed the test procedure and approved the initiation of testing. All the necessary permanently installed and test instrumentation shall have been properly calibrated and operational. Appropriate electrical power sources shall be available for remote control, parameter information and annunciators associated with the electrical power distribution system. Adequate ventilation to both switchgear and battery rooms shall be available and operational. The portion of Fire Protection System covering the EPDS areas shall be available for use. Additionally, the plant EPDS (27 kV, ~~6-9 kV~~, 13.8 kV, 4.16kV, 480V, ~~and~~ 120 VAC, and 125 VDC power) shall be installed prior to this test.

14.2.12.1.50 Fuel-Handling and Reactor Component Servicing Equipment Preoperational Test

STD DEP 9.1-1

(3) *General Test Methods and Acceptance Criteria*

Fuel-handling and reactor component servicing equipment testing described herein includes that of the reactor building crane, refueling ~~machine~~ bridge, auxiliary platform, and the associated hoists and grapples, as well as other lifting and rigging devices.

Performance shall be observed and recorded during a series of individual component and integrated system tests. These tests shall demonstrate that the system operates properly as described in Subsection 9.1.4 during following testing:

- (d) *Proper assembly and operation of reactor vessel servicing equipment, including reactor vessel servicing tools, main steamline plugs, shroud head stud wrench, head holding pedestal, ~~RPV head tensioning and detensioning~~, dryer/separator strongback, and RPV head strongback carousel and stud tensioning system.*
- (f) *Dynamic and static load testing of all cranes, hoists, and associated lifting and rigging equipment, including static load testing at 125% of rated load and full operational testing at 100% of rated load. Heavy load strongbacks will be tested to ANSI 14.6 requirements.*
- (h) *Proper installation and operation of fuel servicing equipment, such as fuel preparation machine, new fuel inspection stand, channel bolt wrenches and handling tools, and general-purpose grapples ~~and fuel-pool vacuum sipper~~.*
- (i) *Correct installation and operation of under-reactor vessel servicing equipment, including FMCRD servicing tools and handling equipment, incore ~~flange seal test plug~~ sealing equipment, and RIP handling equipment.*

14.2.12.1.51 Expansion, Vibration and Dynamic Effects Preoperational Test

STD DEP T1 2.14-1

(2) Prerequisite

(b) The BOP scope of piping systems are as follows:

(xiii) ~~FGS-hydrogen recombiner piping~~ Not Used

14.2.12.1.52 Reactor Vessel Flow-Induced Vibration Preoperational Test

The following supplement augments that provided by this subsection.

~~NEDO 33316, "Advanced Boiling Water Reactor (ABWR) Vibration Assessment Program in compliance with The United States Nuclear Regulatory Commission Regulatory Guide 1.20," dated April 2007 provides references to the comprehensive vibration assessment test results for the ABWR Valid Prototype reactor. The LTR provides the basis for classifying STP 3 & 4 as having "Non Prototype, Category I" reactor internals of the Valid Prototype Standard 1350 MWe Plant. For Non Prototype, Category I ABWR units, the vibration assessment program consists of (1) a vibration analysis program and (2) an inspection program prior to and following the pre-operational tests. This program complies with Regulatory Guide 1.20. For STP 3 & 4 reactor internals testing requirements reference Tier 2 Subsections 3.9.2.3 and 3.9.2.4.~~

14.2.12.1.55 Reactor Water Chemistry Control Systems Preoperational Test

STD DEP T1 2.14-1

(2) Prerequisites

The construction tests have been successfully completed, and the SCG has reviewed the test procedure(s) and approved the initiation of testing. The FCS, Offgas System, appropriate electrical power, and other required interfacing systems shall be available, as needed, to support the specified testing.

The following supplement augments that provided by this subsection.

Testing for systems that will not be placed in service during the initial operating cycle may be deferred.

14.2.12.1.70 Main Turbine and Auxiliaries Preoperational Test

STD DEP Admin

(2) Prerequisites

To the extent practicable, a temporary steam supply shall be available to apply to the main turbine and reactor feed pump seals.

14.2.12.1.72 ~~Flammability Control System Preoperational Test~~ Not Used

STD DEP T1 2.14-1

~~NEDE 33330P, "Advanced Boiling Water Reactor (ABWR) Hydrogen Recombiner Requirements Elimination," dated May 2007 describes the elimination of the hydrogen recombiners from the certified design. The markup information on pages C-100 and C-101 of NEDE 33330P is incorporated by reference.~~

~~(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, including the pressure proof test, have been successfully completed, and the SCG has reviewed the test procedure and approved the initiation of testing. All system instrumentation shall be in accordance with the FCS instrument data sheets and calibrated per instrument supplier's instructions. All services, including water, electricity and communications, shall be available and performing at their rated design levels (flow, voltage, pressure, etc.). The wetwell and drywell airspace regions of the primary containment shall be intact, and all other required interfaces shall be available, as needed, to support the specified testing.~~

~~(3) General Test Methods and Acceptance Criteria~~

~~Performance shall be observed and recorded during a series of individual component and integrated system tests. This test shall demonstrate that the FCS operates properly as specified in Subsection 6.2.5 and applicable FCS design specifications through the following testing:~~

- ~~(a) Proper operation of instrumentation and system controls in all combinations of logic~~
- ~~(b) Verification of various component alarms including alarm actuation and reset, alarm set value, alarm indication and operating logic~~
- ~~(c) Proper operation of all motor operated and air operated valves, including stroking using valve opening/closing switches at the control room, verification of indicator lamp, timing and isolation function, if applicable~~
- ~~(d) Proper system operating conditions (i.e., the system shall be operated normally without any abnormalities, vibration, or leakage in components, valves, and piping within the FCS) for the following test cases while the FCS is in accident operating mode and regular testing mode of operation as defined in the design specification:

 - ~~(i) Triple heater test for inside heater box temperature during steadystate operation~~
 - ~~(ii) Blower running test for blower flow rate, flow control valve position and each line's gas flow rate~~~~

- ~~(iii) Reaction chamber heatup test for blower flow rate, flow control valve position, each line's gas flow rate and the time for heating up the reactor chamber~~
- ~~(e) Proper operation of interlocks including operation of all components subject to interlocking, interlocking set value and operating logic~~
- ~~(f) Proper operation of permissive, prohibit, and bypass functions~~
- ~~(g) Proper system operation while powered from primary and alternate sources, including transfers, and in degraded modes for which the system is expected to remain operational~~

14.2.12.1.75 Liquid and Solid Radwaste Systems Preoperational Tests

STD DEP 11.2-1

~~STP~~STD DEP 11.4-1

STD DEP Admin

- (3) *General Test Methods and Acceptance Criteria*
 - (b) *Proper operation of equipment protective features and automatic isolation functions, including those for ventilation systems and liquid effluent pathways (as applicable).*
 - (g) *Acceptable functions of the ~~thin film dryer, pelletizer, pellet filling machine, mixing tank, drum conveyor and incinerator during integrated solid radwaste system operation in solidifying, packaging, compacting, and incinerating processes,~~ as specified by Subsection 11.4.*
 - (h) *Proper operation of filter ~~and demineralizer regeneration~~ cycles of the liquid radwaste system and their associated support facilities.*
 - (j) *Capability of the solid radwaste system to receive, process and transfer waste ~~between designated locations using simulated waste variation in accordance with the Process Control Program (PCP).~~*
 - (k) *Proper operation of the automatic isolation function of ~~radwaste system~~ containment isolation valves upon receipt of a simulated containment isolation initiation signal.*

14.2.12.1.77 Ultimate Heat Sink Preoperational Test

The conceptual design information in this subsection of the reference ABWR DCD is replaced with the following site-specific supplemental information.

- (2) *Prerequisites*

The construction tests have been successfully completed, and the SCG has reviewed the test procedure and approved the initiation of testing. All instrumentation and devices associated with the UHS has been properly calibrated. The HVAC System within ~~spray pond~~ the RSW pump house structure is operational and available. The Reactor Service Water System is operational and available for all anticipated modes of RSW System operation. Sufficient quantity of water ~~are~~ is available in the ~~spray pond~~ UHS basin for use. All of the required interfacing systems shall be available, as needed, to support the specified testing.

- (3) General Test Methods and Acceptance Criteria
- (b) Proper operating conditions and performance capability of the UHS cooling tower spray networks during all anticipated modes of the RSW System operations as specified in Subsection 9.2.5.4.1.
 - (d) Proper operation of the makeup water valve to maintain proper water level in the UHS ~~spray pond~~ basin through makeup line and maintain water quality in conjunction with the blowdown operation as specified in Subsection 9.2.5.3.4.
 - (e) Proper operation of blowdown from the UHS ~~spray pond~~ basin to remove excess water and maintain water quality control through the blowdown line as specified in Subsection 9.2.5.3.4.

14.2.12.2.5 Control Rod Drive System Performance

STD DEP 4.6-1

(2) Prerequisites

The preoperational tests have been completed and plant management has reviewed the test procedures and 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. The applicable instrumentation shall be checked or calibrated, as appropriate. Additionally, a special test fixture contains a small pump associated hydraulic controls and shall be available for performing drive line friction testing.

STD DEP 14.2-1

(3) Description

In addition, the drive-line friction will be measured in terms of the pressure under hollow piston for each CRD at cold conditions (if not previously done during preoperational test phase) ~~and again verified on four selected CRDs at rated temperature and pressure conditions during initial heatup of the startup test program.~~

14.2.12.2.6 Neutron Monitoring System Performance

STD DEP Vendor, Vendor Replacement

(4) Criteria

Level 2

Each LRPM reading shall agree with its calibrated value within the accuracy specified by the ~~GE~~ Startup Test Specifications.

The total ATIP uncertainty (including random noise and geometry uncertainty components) shall be less than the limits specified by the ~~GE~~ Startup Test Specifications.

14.2.12.2.7 ~~Process Computer~~ Plant Information and Control System Operation

STD DEP T1 3.4-1

STD DEP Vendor, Vendor Replacement

(1) Purpose

To verify the ability of the ~~Process Computer~~ Plant Information and Control System (PICS) to collect, process, and display plant data, execute plant performance calculations, and interface with various plant control systems during actual plant operating conditions.

(3) Description

During plant heatup and the ascension to rated power, the various process variables that are monitored by the PICS and required by the reactor core performance and plant performance calculations begin to enter their respective ranges for normal plant operation. During this time, it will be verified that the PICS 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 PICS to interface correctly with other plant control systems during operation will be demonstrated.

(4) Criteria

Level 2

The reactor core performance calculation programs that calculate the core performance parameters (MCPR, MAPLHGR, and MLHGR) and LRPM gain adjustment factors shall produce results that agree with an independent method of calculation within the accuracy specified by the ~~GE~~ Startup Test Specifications.

14.2.12.2.8 Core Performance

STD DEP Vendor, Vendor Replacement

(4) Criteria

Level 1

~~For any non-GE fuel only, the~~ Maximum Linear Heat Generation Rate (MLHGR) shall not exceed the limits specified by the plant Technical Specifications.

14.2.12.2.9 Nuclear Boiler Process Monitoring

(4) Criteria

Level 2

The difference between the actual reference leg temperature and the value(s) assumed during initial calibration shall be less than that amount which will result in a scale end point error as specified in the ~~GE~~ Startup Test Specifications (i.e., 1% of the instrument span for each range).

With all recirculation pumps in operation at rated core flow and power conditions, the bottom head temperature as measured by the bottom drain line thermocouple shall agree with the saturated water temperature corresponding to steam dome pressure within the accuracy specified by the ~~GE~~ Startup Test Specifications.

14.2.12.2.12 Reactor Internals Vibration

The following supplement augments that provided by this subsection.

~~NEDO 33316, "Advanced Boiling Water Reactor (ABWR) Vibration Assessment Program in Compliance with The United States Nuclear Regulatory Commission Regulatory Guide 1.20," dated April 2007 provides references to the comprehensive vibration assessment test results, for the ABWR Valid Prototype Reactor. The LTR provides the basis for classifying STP 3 & 4 as having "Non Prototype, Category I" reactor internals of the Valid Prototype Standard 1350 MWe Plant. For Non Prototype, Category I ABWR units, the vibration assessment program consists of (1) a vibration analysis program and (2) an inspection program prior to and following the pre-operational tests. This program complies with Regulatory Guide 1.20. For STP 3 & 4 reactor internals vibration assessment program reference Tier 2 Subsections 3.9.2.3, 3.9.2.4, and 3.9.2.6.~~

14.2.12.2.13 Recirculation Flow Control

STD DEP Vendor, Vendor Replacement

(4) Criteria

Level 2

For any of the above test maneuvering, no high flux scram shall result as stated in the applicable Recirculation Flow Control System Design Specification and the trip avoidance margins shall at least comply with the requirements as stated in the ~~GE~~ Startup Test Specifications (i.e., at least 7.5% for neutron flux and 5.0% for simulated heat flux).

14.2.12.2.15 Pressure Control**(4) Criteria****Level 2**

For all pressure controller transients, no high flux or vessel pressure scram shall result and the trip avoidance margin shall at least meet the requirements as stated in the ~~GE~~ Startup Test Specifications (i.e., at least 7.5% for neutron flux, 5.0% for simulated heat flux and 68.6 kPaD for vessel pressure).

14.2.12.2.16 Plant Automation and Control**STD DEP T1 3.4-1****(2) Prerequisites**

Additionally, affected systems and equipment, including lower level control systems such as RCIS, recirc flow control, feedwater control and turbine control, as well as monitoring and predicting functions of the ~~plant process computer and/or automation computer~~ PICS, shall have been adequately tested under actual operating conditions.

14.2.12.2.17 Reactor Recirculation System Performance**STD DEP Vendor, Vendor Replacement****(4) Criteria****Level 2**

At rated power and flow, the measured core pressure drop shall not exceed the predicted value by an amount as required by the ~~GE~~ Startup Test Specifications.

14.2.12.2.22 RCIC System Performance**STD DEP T1 2.4-3****STD DEP Vendor, Vendor Replacement****(1) 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 1.03 MPaG 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. After the operability demonstration, the RCIC turbine speed control loop will be adjusted at near rated reactor pressure conditions. Reactor vessel injection tests at near rated reactor pressure will follow to complete the controller adjustments, as necessary, and to demonstrate automatic starting from hot standby condition. Subsequently, a reactor vessel injection demonstration at 1.03 MPaG reactor pressure, including an automatic mode start and stability demonstration, shall be conducted to verify satisfactory system performance under the final set of optimized controller settings. ~~Proper controller adjustment is verified by introducing small step disturbances in speed and flow demand and then demonstrating satisfactory system response at both low RCIC pump flow (but above minimum turbine speed) and near rated RCIC pump flow conditions, in order to span the RCIC operating range.~~

(2) Criteria

Level 2

~~The RCIC turbine speed and pump flow control loops shall be adjusted so that the RCIC System flow related variable responses to test inputs are at least quarter damped (i.e., the decay ratio of the second to first overshoot of each variable is less than or equal to 0.25) as stated in the applicable RCIC System Design Specification.~~

~~The RCIC Turbine Gland Seal System shall be capable of preventing significant steam leakage to the atmosphere.~~

For automatic start tests, in order to provide margins to overspeed and isolation trip setting, the transient start first and subsequent turbine speed peaks shall not exceed the requirement specified by the GE Startup Test Specifications.

The RCIC Turbine Steam Supply line high flow isolation trip shall be calibrated to actuate at the value specified in the plant Technical Specifications.

14.2.12.2.25 Turbine Valve Performance

STD DEP Vendor, Vendor Replacement

(4) Criteria

Level 2

During full closure testing of individual turbine control, stop, and bypass valves, the transient peak values of reactor vessel pressure, neutron flux, simulated fuel surface heat flux, and main steamline flow must have adequate scram avoidance margins as required by the ~~GE~~ Startup Test Specifications.

14.2.12.2.26 MSIV Performance(4) Criteria**Level 2**

During full trip closure testing of individual MSIV, the transient peak values of reactor vessel pressure, neutron flux, simulated fuel surface heat flux, and main steamline flow must have adequate scram avoidance margins as required by the ~~GE~~ Startup Test Specifications.

14.2.12.2.27 SRV Performance(4) Criteria**Level 2**

The temperature measured by thermocouples on the discharge side of the safety/relief valves shall return to the temperature recorded before the valve was opened within 5.6°C range as specified in the ~~GE~~ Startup Test Specifications.

During the manual actuation of each SRV, the steam flow discharge through the valve (as measured by change in MWe, BPV position etc.) shall not differ from the average of all the valve responses by more than the limit as specified in the ~~GE~~ Startup Test Specifications.

14.2.12.2.28 Loss of Feedwater HeatingSTD DEP Admin(4) Criteria**Level 1**

The increase in simulated fuel surface heat flux shall not exceed the predicted Level 2 criterion value by more than 2%, as specified by the ~~Transient Safety Analysis Design Report (TSADR)~~ Startup Test Analysis Report (STAR) document.

Level 2

The increase in simulated fuel surface heat flux shall not exceed the predicted value referenced to the actual test values of feedwater temperature drop and power level. The predicted value is provided in the plant ~~TSADR~~ STAR and will be used as the basis to which the actual transient is compared.

14.2.12.2.29 Feedwater Pump Trip

STD DEP Vendor, Vendor Replacement

(4) Criteria

Level 2

The reactor shall avoid low water level scram by the margin required by the ~~GE~~ Startup Test Specifications from an initial water level halfway between the high and low level alarm setpoints.

14.2.12.2.30 Recirculation Pump Trip

(4) Criteria

Level 2

The reactor water level swell during RIP trip transients shall have a minimum scram avoidance margin as required by the ~~GE~~ Startup Test Specifications.

During RIP trip recovery, the scram avoidance margins for neutron flux and simulated fuel surface heat flux shall at least meet the requirements as specified by the ~~GE~~ Startup Test Specifications.

14.2.12.2.33 Turbine Trip and Load Rejection

STD DEP Admin

STD DEP Vendor, Vendor Replacement

(4) Criteria

Level 1

For turbine trip or load rejection event at power levels greater than 50% of rated, bypass valve quick opening shall begin no later than the specified time delay following the start of stop/control valve closure, and bypass valves shall be opened to a point corresponding to greater than or equal to 80% of their capacity within the specified time interval from the beginning of stop/control valve closure. The time delay and time interval are specified in the ~~GE~~ Startup ~~Transient~~ Test Specifications.

Feedwater Control System settings must prevent flooding of the steamline following generator or turbine trip transients.

The core flow coastdown transient during the first three seconds after either turbine trip or load rejection at greater than 50% of rated power must be bounded by the limiting curves defined in the plant ~~transient/stability-performance requirements~~ Transient and Stability Basic Design Specification document.

The positive change in vessel dome pressure occurring within 30 seconds after either turbine trip or load rejection at greater than 50% of rated power must not exceed the Level 2 criteria by more than 172.6 kPaD as specified by the ~~Transient Safety Analysis Design Report (TSADR)~~ Startup Test Specification document.

The positive change in simulated fuel surface heat flux shall not exceed the Level 2 criteria by more than 2% as specified by the applicable ~~TSADR~~ Startup Test Specification document.

Level 2

If any SRVs open, the temperatures, measured by the thermocouples on the discharge side of the actuated SRVs must return to the temperature recorded before the valve was opened within 5.6°C range as specified by the ~~GE~~ Startup Test Specifications.

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

14.2.12.2.34 Reactor Full Isolation

(4) Criteria

Level 1

The positive change in vessel dome pressure occurring within the first 30 seconds after closure of all MSIVs must not exceed the Level 2 criteria by more than 172.6 kPaD as specified by the applicable ~~TSADR~~ Startup Test Specification document.

The positive change in simulated fuel surface heat flux shall not exceed the Level 2 criteria by more than 2%, as specified by the applicable ~~TSADR~~ Startup Test Specification document.

Level 2

If any SRVs open, the temperature measured by the thermocouples on the discharge side of the actuated SRVs must return to the temperature recorded before the valve was opened within 5.6°C range as specified by the ~~GE~~ Startup Test Specifications.

The HPCF and RCIC Systems shall be initiated automatically, if the low-water-level (Level 1.5 and 2, respectively) is reached during the initial transient following isolation. The minimum capacity and maximum delay time (including instrumentation delay) between the time vessel water level drops below the setpoint and makeup water enters the vessel shall meet the safety analysis requirements specified in the applicable ~~plant transient/stability performance requirements~~ Emergency Core Cooling System Design Requirements and Startup Test Specifications documents.

The positive changes in vessel dome pressure and simulated fuel surface heat flux occurring within the first 30 seconds after the closure of all MSIVs must not exceed the predicted values referenced to actual test conditions of initial power level and dome pressure and corrected for the measured control rod insertion speed and initiation time. The predicted values are provided in the applicable ~~TSADR~~ STAR document based on the beginning-of-cycle design basis and shall be used as the basis to which the actual transient is compared.

14.2.13 COL License Information

14.2.13.1 Other Testing

The following site-specific supplement addresses COL License Information Item 14.1.

FSAR Section 14.2S provides the additional testing requirements for the following systems.

- (1) Electrical switchyard and equipment
- (2) Personnel monitors and radiation survey instruments
- (3) Site security equipment

There is no automatic dispatcher control system for STP 3 & 4.

14.2.13.2 Test Procedures/Startup Administrative Manual

The following site-specific supplement addresses COL License Information Item 14.2.

~~NEDO-33305, "Advanced Boiling Water Reactor (ABWR) The Startup Administrative Manual" dated February 2007~~ document delineates the processes that will be used to administer the Initial Test Program at STP 3 & 4. These processes include:

- Conduct of the test program (Subsection 14.2.4)
- Review, evaluation, and approval of test results

- Methods for controlling pre-fuel load checks, initial fuel loading, pre-critical testing and initial criticality
- Test program schedule
- Determinations of operability and availability of interfacing support systems requirements

~~NEDO-33310, "Advanced Boiling Water Reactor (ABWR) Startup Test Specification" dated April 2007~~ document provides guidance for sequencing testing during the Startup Test Phase. This scoping document contains the following elements for the Startup Test Phase of the Initial Test program:

- Testing objectives and acceptance criteria
- Plant operational conditions at which tests are to be conducted, testing methodologies to be utilized, specific data to be collected, and acceptable data reduction techniques.
- Reconciliation methods needed to account for test conditions, methods or results if testing is performed at conditions other than representative design operating conditions

Site-specific Preoperational and Startup Test Specifications, containing testing objectives and acceptance criteria, will be provided to the NRC at least 6 months prior to the start of the Initial Test Program. (COM 14.2-2) These scoping documents will delineate:

- Plant operational conditions at which tests are to be conducted, testing methodologies to be utilized, specific data to be collected, and acceptable data reduction techniques.
- Reconciliation methods needed to account for test conditions, methods or results if testing is performed at conditions other than representative design operating conditions.

Approved preoperational test procedures will be available for NRC review approximately 60 days prior to their intended use but no later than 60 days prior to fuel loading (Subsection 14.2.3). (COM 14.2-3)

Approved startup test procedures will be available for NRC review approximately 60 days prior to fuel loading (Subsection 14.2.3). (COM 14.2-4)

Table 14.2-1 Startup Test Matrix

Power Ascension Test	Testing Plateau					Notes
	OV	HU	LP	MP	HP	
<i>Control Rod Drive System Performance:</i>						
<i>Friction Testing</i>	<u>✓</u>	<u>✓</u>				<i>HU—4 selected rods at rated pressure</i>
Process Computer <u>Plant Information and Control System Operation:</u>						
<u>NSS/BOP Monitoring Programs</u>		<u>✓</u>	<u>✓</u>	<u>✓</u>	<u>✓</u>	

