

## **14.2S Initial Plant Test Program**

This information supplements the information provided in Section 14.2 of the reference ABWR DCD.

### **14.2S.1 Organization and Training in Support of the Initial Test Program**

Training for plant staff is described in Section 13.4. Additional training for test personnel consists of on-site training to the procedures processes described in the Site Startup Administrative Manual, the Startup Administrative Procedures, and on lessons learned from previous startups.

Combined startup testing training sessions are conducted with plant operations and key test personnel. This training includes the use of the plant simulator for the more complex tests.

### **14.2S.2 First of a Kind Systems**

The following tests are defined as first of a kind as they contain new, unique, or special tests for new design features associated with SSCs that are part of a new reactor design under 10 CFR Part 52.

- (1) Preoperational Tests
  - (a) Reactor Recirculation System Test (reference ABWR DCD 14.2.12.1.2)
  - (b) Recirculation Flow Control System Test (reference ABWR DCD 14.2.12.1.3)
  - (c) Feedwater Control System Test (reference ABWR DCD 14.2.12.1.4)
  - (d) Control Rod Drive System (CRD) Test (reference ABWR DCD 14.2.12.1.6)
  - (e) Rod Control and Information System Test (reference ABWR DCD 14.2.12.1.7)
  - (f) Safety System Logic and Control Test (reference ABWR DCD 14.2.12.1.11)
  - (g) Data Communications Function Preoperational Test (reference ABWR DCD 14.2.12.1.12)
  - (h) Leak Detection and Isolation System Test (reference ABWR DCD 14.2.12.1.13)
  - (i) Reactor Protection System Test (reference ABWR DCD 14.2.12.1.14)
  - (j) Neutron Monitoring System Test (reference ABWR DCD 14.2.12.1.15)
  - (k) Automatic Power Regulator Test (reference ABWR DCD 14.2.12.1.17)
  - (l) Combustion Turbine Generator (reference ABWR DCD 14.2.12.1.45)

- (m) Steam Bypass and Pressure Control System Test (reference ABWR DCD 14.2.12.1.66)
- (2) Startup Testing
  - (a) Control Rod Drive System Performance (reference ABWR DCD 14.2.12.2.5)
  - (b) Neutron Monitoring System Performance (reference ABWR DCD 14.2.12.2.6)
  - (c) Recirculation Flow Control (reference ABWR DCD 14.2.12.2.13)
  - (d) Plant Automation and Control (reference ABWR DCD 14.2.12.2.16)
  - (e) Loss of Feedwater Heating (reference ABWR DCD 14.2.12.2.28)
  - (f) Feedwater Pump Trip (reference ABWR DCD 14.2.12.2.29)
  - (g) Recirculation Pump Trip (reference ABWR DCD 14.2.12.2.30)
  - (h) Turbine Trip and Load Rejection (reference ABWR DCD 14.2.12.2.33)

### **14.2S.3 Overlap of Unit 3 Test Program with Unit 4 Test Program**

The project schedule indicates that the Unit 4 fuel load date is approximately 12 months later than that for Unit 3. Accordingly, the startup schedule indicates that Unit 3 will have completed most of the low and mid power testing before the preoperational program for Unit 4 commences. Unit 3 will be given priority should any additional personnel be required for initial startup testing. During the period of overlap, startup personnel will be allowed to work on both units.

### **14.2S.4 Testing Required to be Completed Prior to Fuel Load**

Table 14.2S-1 provides a cross-reference to each system preoperational test (or portion thereof) required to be completed before initial fuel loading, that is designed to satisfy the requirements for completing ITAAC in accordance with 10 CFR 52.99(a).

### **14.2S.12 Individual Test Descriptions**

Systems and features to be tested for the initial test program were identified in the reference ABWR DCD. At the time of DCD approval, it was recognized that there would be additional features and interfacing systems necessary to provide a complete test program. Using the screening criteria provided in Regulatory Guide 1.68, as well as the requirements identified in the reference ABWR DCD Subsection 14.2.13.1, the following test descriptions are provided. Testing of plant security systems will be in accordance with the equipment vendor recommendations and applicable industry and regulatory requirements. These requirements are addressed in the security plan.

**14.2S.12.1 Preoperational Testing****14.2S.12.1.78 Makeup Water Purification Preoperational Test***(1)* Purpose

To verify the ability of the Makeup Water Purified (MUWP) System to provide an adequate reserve of condensate quality water for makeup to the Condensate Storage Tank, as makeup water for Reactor Building Cooling Water, Turbine Building Cooling Water, Diesel Generator Cooling Water, and for other uses as designed.

*(2)* Prerequisites

The construction tests have been successfully completed, and the SCG has reviewed the test procedure and approved the initiation of testing. Additional prerequisites include but are not limited to the following:

- (a)* All system instrumentation shall be in accordance with the P&ID and Instrument Data Sheets and shall have been properly calibrated per the instrument supplier's instructions.
- (b)* The applicable power sources to supply electric power to motors, control circuits and instrumentation shall be available, as required, to support the performance of this testing.
- (c)* The system valve lineups shall have been completed in accordance with the applicable system operating procedures prior to the test.
- (d)* The Instrument Air System and The MWP System shall be available for use in support of this test, as required.
- (e)* A sufficient quantity of chemically acceptable water shall be available for performing this test.

*(3)* General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated system tests. These tests shall demonstrate that the MUWP System operates properly as specified in Subsection 9.2.10 and applicable MUWP System design specifications through the following testing:

- (a)* Proper operation of instrumentation and system controls in all combinations of logic and instrument channel trip.
- (b)* Proper operation of permissive and prohibit interlocks including components subject to interlocking.
- (c)* Verification of various component alarms used to monitor system operation and status, including condensate storage tank (CST) volume and/or level, for correct alarm actuation and reset.

- (d) Proper operation of freeze protection devices, if applicable.

**14.2S.12.1.79 Makeup Water Preparation Preoperational Test**

(1) Purpose

To verify the ability of the Makeup Water Preparation (MWP) System to provide an adequate quantity of makeup quality water for makeup to the Makeup Water Purified and Potable Water Systems, the condensate storage tank, the Reactor Building Cooling Water, Turbine Building Cooling Water and Diesel Generator Cooling Water Systems, and for other uses as designed.

(2) Prerequisites

The construction tests have been successfully completed, and the SCG has reviewed the test procedure and approved the initiation of testing. Additional prerequisites include but are not limited to the following:

- (a) All system instrumentation shall be in accordance with the P&ID and Instrument Data Sheets and shall have been properly calibrated per the instrument supplier's instructions.
- (b) The applicable power sources to supply electric power to motors, control circuits and instrumentation shall be available, as required, to support the performance of this testing.
- (c) The system valve lineups shall have been completed in accordance with the applicable system operating procedures prior to the test.
- (d) Instrument air system shall be available for use in support of this test, as required.
- (e) A sufficient quantity of chemically acceptable water shall be available for performing this test.
- (f) Temporary strainer screens shall be installed at the pump inlets of MWP throughout the test.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated system tests. These tests shall demonstrate that the MWP System operates properly as specified in Subsection 9.2.8 and applicable MWP System design specifications through the following testing:

- (a) Proper operation of instrumentation and system controls in all combinations of logic and instrument channel trip.
- (b) Proper operation of permissive and prohibit interlocks including components subject to interlocking.

- (c) Verification of various component alarms used to monitor system operation and status, including condensate storage tank (CST) volume and/or level, for correct alarm actuation and reset.
- (d) Proper operation of freeze protection devices, if applicable.
- (e) Verification that each unit of the MWP pumps can be operated normally during the following system operation tests:
  - (i) System operation test to confirm pump performance including: stable operation condition, pump discharge pressure comparison against the shop test pump curve, and the ability to provide desired flow rates to each applicable system and/or component.
  - (ii) Pump minimum flow test to confirm a stable pump operation and ability to operate continuously with pump discharge valve in the closed position.
  - (iii) Standby pump automatic start test to confirm auto start feature of a standby pump upon the trip of a running pump.

**14.2S.12.1.80 Electrical Switchyard System Preoperational Test****(1) Purpose**

To verify the ability of the Electrical Switchyard System to provide a means for supplying offsite AC power to safety-related and non-safety-related equipment including normal and standby lighting systems, via the appropriate distribution network(s).

**(2) Prerequisites**

The construction tests for the individual components associated with the Switchyard System have been successfully completed, and the 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 be 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 switchyard areas shall be available for use. Additionally, the plant EPDS (13.8kV and 4.16 kV power) shall be installed prior to this test.

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

The capability of the switchyard system to provide power to plant loads under various plant operating conditions and via normal and alternate paths will be demonstrated.

- (a) Proper operation of relaying and logic.
- (b) Proper operation of equipment protective devices, including permissive and prohibit interlocks.
- (c) Verification of various component alarms used to monitor system and equipment status for correct alarm actuation and reset.
- (d) Proper operation and load carrying capability of breakers, switchgear, transformers, and cables.
- (e) Sufficient level of redundancy and electrical independence as specified for each application.
- (f) Capability to transfer between onsite and offsite power sources as per design.
- (g) Acceptable voltage and frequency variations between no load and full load conditions in accordance with Subsection 8.2.3. Verification of voltage and frequency variations can be performed in startup test stage since insufficient loads are supplied by these buses during preoperational test stage.

**14.2S.12.1.81 Personnel Monitors and Radiation Survey Instruments Preoperational Test****(1) Purpose**

To verify the ability of the personnel monitors and radiation survey equipment to indicate and alarm normal and abnormal radiation levels.

**(2) Prerequisites**

The construction tests have been successfully completed and the SCG has reviewed the test procedure and approved the initiation of testing. High radiation alarm setpoints shall be properly established based on sensor location, background radiation level, expected radiation level and low occupation dose prior to the test. Indicator and trip units, power supplies, and sensor/converters have been calibrated according to vendor instructions.

(3) General Test Methods and Acceptance Criteria

Performance shall be observed and recorded during a series of individual component and integrated subsystem tests. This test shall demonstrate that each monitor or survey instrument operates as specified in Subsection 12.3.4 and the appropriate manufacturer's technical instruction manuals through the following testing:

- (a) Proper calibration of detector assemblies and associated equipment using a standard radiation source or portable calibration unit.
- (b) Proper functioning of indicators, recorders, annunciators, and audible alarms.
- (c) Proper system trips at correct prescribed setpoints in response to high radiation and downscale/inoperative conditions.
- (d) Proper operation of permissive, prohibit, interlock, and bypass functions.
- (e) Proper functioning and operation of the self-test feature for gross failure and loss of power detection.

**Table 14.2S-1 Comparison of Tier 1 (ITAAC) Testing Requirements with Tier 2 Test Descriptions**

Title	Tier 1 Section	Tier 2 Section
Feedwater Control	2.2.3	14.2.12.1.4
Reactor Water Cleanup	2.6.1	14.2.12.1.19
Standby Liquid Control	2.2.4	14.2.12.1.5
Main Steam	2.1.1, 2.1.2	14.2.12.1.1
Residual Heat Removal	2.4.1	14.2.12.1.8
Reactor Core Isolation Cooling	2.4.4	14.2.12.1.9
Seismic Monitoring		14.2.12.1.74
Reactor Recirculation and Control	2.1.3, 2.2.8	14.2.12.1.2, 14.2.12.1.3
Rod Control and Information	2.2.1	14.2.12.1.7
Control Rod Drive Hydraulic	2.2.2	14.2.12.1.6
Fuel Handling and Vessel Servicing Equipment	2.5.5, 2.5.4, 2.5.3, 2.5.2, 2.5.1, 2.2.13, 2.2.12, 2.5.6, 2.5.12, 2.5.11, 2.5.10, 2.5.9, 2.5.8, 2.5.7, 2.15.9	14.2.12.1.50
Fuel Pool Cooling and Cleanup	2.6.2	14.2.12.1.21
High Pressure Core Flooder	2.4.2	14.2.12.1.10
Remote Shutdown	2.2.6	14.2.12.1.18
Safety System Logic and Control	3.4	14.2.12.1.11
Suppression Pool Cleanup	2.6.3	14.2.12.1.20
Reactor Vessel Flow Induced Vibration Test Without Fuel		14.2.12.1.52
Data Communication Function	2.7.5	14.2.12.1.12
Leak Detection	2.4.3	14.2.12.1.13
Automatic Power Regulator	2.2.9	14.2.12.1.17
Reactor Protection	2.2.7	14.2.12.1.14
Power Range Neutron Monitoring Subsystem	2.2.5	14.2.12.1.15
Traversing In-core Probe (TIP)		14.2.12.1.15
Feedwater and Condensate	2.10.2	14.2.12.1.53
Process Radiation Monitoring System	2.3.1	14.2.12.1.23
Standby Gas Treatment	2.14.4	14.2.12.1.36
Atmospheric Control System	2.14.6	14.2.12.1.35
Plant Computer Functions	2.2.11	14.2.12.1.16, 14.2.12.1.28
Drywell Cooling	2.14.7	14.2.12.1.33
Steam Bypass and Pressure Control	2.2.10	14.2.12.1.66
Reactor Building and Turbine Building Sampling and Analysis	2.11.20	14.2.12.1.22
Makeup Water	2.11.1, 4.3	14.2.12.1.59
Loose Parts Monitor System	2.8.4	14.2.12.1.73
Condensate Storage and Transfer	2.11.2	14.2.12.1.59



**Table 14.2S-1 Comparison of Tier 1 (ITAAC) Testing Requirements with Tier 2 Test Descriptions**

Fire Protection Building HVAC		14.2.12.1.34
Radwaste Sumps	2.9.1	14.2.12.1.76
Neutron Monitoring, Startup Range Neutron Monitoring Subsystem	2.2.5	14.2.12.1.15
Filter Demineralizer Resin Transfer		14.2.12.1.76
Fire Protection	2.15.6	14.2.12.1.48
Potable Water and Sanitary Waste	2.22.23	14.2.12.1.79
Reactor Building Cooling Water	2.11.3	14.2.12.1.29
Turbine Building Cooling Water	2.11.4	14.2.12.1.62
Reactor Building Service Water	2.11.9, 4.5	14.2.12.1.61
Normal Chilled Water	2.11.5	14.2.12.1.33
Emergency Chilled Water	2.11.6	14.2.12.1.32
Building Cranes and Handling Equipment	2.15.3	14.2.12.1.50
Miscellaneous Non-Radioactive Drains – Nuclear Island		14.2.12.1.49
Service Air – Nuclear Island	2.11.11	14.2.12.1.27
Instrument Air – Nuclear Island	2.11.12	14.2.12.1.27
Nitrogen Supply System – Nuclear Island	2.11.13	14.2.12.1.28
Electric Power Distribution – Nuclear Island	2.12.1	14.2.12.1.45
Vital AC Power Supply – Nuclear Island	2.12.14	14.2.12.1.45
Instrument and Control Power Supply – Nuclear Island	2.12.15	14.2.12.1.45
Lighting and Servicing Power Supply – Nuclear Island	2.12.17	14.2.12.1.45
DC Power Supply	2.12.12	14.2.12.1.45
Emergency Diesel Generator	2.12.13	14.2.12.1.45
Plant Grounding – Nuclear Island	2.12.9	14.2.12.1.45
Raceway System – Nuclear Island	2.12.8	14.2.12.1.45
Reactor Building HVAC	2.15.5	14.2.12.1.34
Control Building HVAC	2.15.5	14.2.12.1.34
Technical Support Center HVAC		14.2.12.1.34
Water Treatment Building HVAC		14.2.12.1.34
Switchgear Building HVAC	2.15.5	14.2.12.1.34
Hot Machine Shop HVAC		14.2.12.1.34
Radwaste Tunnel HVAC		14.2.12.1.34
Switchyard Systems	2.12.1, 4.2	14.2.12.1.45
Area Radiation Monitoring	2.3.2	14.2.12.1.24
Containment Atmospheric Monitoring	2.3.3	14.2.12.1.26
LOOP/LOCA		14.2.12.1.46

**Table 14.2S-1 Comparison of Tier 1 (ITAAC) Testing Requirements with Tier 2 Test Descriptions**

Man Machine Interface	2.7.1	14.2.12.1.16
Plant Communication	2.12.16	14.2.12.1.47
Condensate Polishing	2.10.4, 2.10.5, 2.10.6	14.2.12.1.54
Reactor Water Chemistry Control	2.11.18, 2.11.17, 2.11.7,	14.2.12.1.55
Main Condenser Evacuation		14.2.12.1.56
Offgas	2.10.22	14.2.12.1.57
Hotwell Level Control	2.10.21	14.2.12.1.58
Circulating Water	2.10.23, 4.9, 2.10.24, 2.11.22	14.2.12.1.60
Turbine Building Service Water	2.11.10, 4.6	14.2.12.1.63
Main Turbine Control	2.10.7, 2.10.8	14.2.12.1.64
Turbine Main Steam, Auxiliary Steam and Bypass Steam Systems	2.10.13, 2.10.15, 2.10.1	14.2.12.1.65
Feedwater Heater and Drain System	2.10.3	14.2.12.1.67
Extraction Steam System	2.10.12	14.2.12.1.68
Moisture Separator/Reheater	2.10.11	14.2.12.1.69
Main Turbine and Auxiliaries	2.10.7, 2.10.10, 2.10.9	14.2.12.1.70
Main Generator and Auxiliaries	2.10.16, 2.10.17, 2.10.18, 1.10.19, 1.10.20	14.2.12.1.71
Liquid and Solid Radwaste	2.9.1, 2.7.2, 2.15.13	14.2.12.1.75
Ultimate Heat Sink	4.1	14.2.12.1.77
Primary Containment and Masc. Systems	2.14.12.14.2, 2.14.5, 2.12.10	14.2.12.1.38, 14.2.12.1.39 14.2.12.1.40, 14.2.12.1.41, 14.2.12.1.42, 14.2.12.1.43
Service Building HVAC	2.15.5m	14.2.12.1.34
Turbine Building HVAC	2.15.5k	14.2.12.1.34
Radwaste Building HVAC	2.15.5l	14.2.12.1.34
Hot Water Heating System	2.11.16, 2.11.14	14.2.12.1.21
Combustion Turbine Generator	2.12.11	14.2.12.1.45
Safety Intake Building HVAC		14.2.12.1.34

Note 1: Containment Isolation Valves will be tested per Tier 2 Subsection 14.2.12.1.37 and 14.2.12.1.41

Note 2: Containment Penetrations will be tested per Tier 2 Subsection 14.2.12.1.38