

## ArevaEPRDCPEm Resource

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**From:** WELLS Russell D (AREVA NP INC) [Russell.Wells@areva.com]  
**Sent:** Thursday, January 15, 2009 4:44 PM  
**To:** Getachew Tesfaye  
**Cc:** Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 77, FSAR Ch 14, Supplement 1  
**Attachments:** RAI 77 Supplement 1 Response US EPR DC.pdf

Getachew,

AREVA NP Inc. provided responses to 3 of the 4 questions of RAI No. 77 on November 3, 2008. The attached file, "RAI 77 Supplement 1 Response US EPR DC.pdf" provides a technically correct and complete response to the remaining question, as committed.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 77 Question 14.02-32.

The following table indicates the respective pages in the response document, "RAI 77 Supplement 1 US EPR DC.pdf," that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 77 — 14.02-32	2	2

This concludes the formal AREVA NP response to RAI 77, and there are no questions from this RAI for which AREVA NP has not provided responses.

Sincerely,

(Russ Wells on behalf of)

*Ronda Pederson*

[ronda.pederson@areva.com](mailto:ronda.pederson@areva.com)

Licensing Manager, U.S. EPR Design Certification  
New Plants Deployment

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**From:** WELLS Russell D (AREVA NP INC)  
**Sent:** Monday, November 03, 2008 8:22 PM  
**To:** 'Getachew Tesfaye'  
**Cc:** 'John Rycyna'; Pederson Ronda M (AREVA NP INC); BENNETT Kathy A (OFR) (AREVA NP INC); DELANO Karen V (AREVA NP INC)  
**Subject:** Response to U.S. EPR Design Certification Application RAI No. 77, FSAR Ch 14

Getachew,

Attached please find AREVA NP Inc.'s response to the subject request for additional information (RAI). The attached file, "RAI 77 Response US EPR DC.pdf" provides technically correct and complete responses to 3 of the 4 questions.

Appended to this file are affected pages of the U.S. EPR Final Safety Analysis Report in redline-strikeout format which support the response to RAI 77 Questions 14.02-31 and 14.02-33.

The following table indicates the respective pages in the response document "RAI 77 Response US EPR DC.pdf" that contain AREVA NP's response to the subject questions.

Question #	Start Page	End Page
RAI 77 — 14.02-31	2	2
RAI 77 — 14.02-32	3	3
RAI 77 — 14.02-33	4	4
RAI 77 — 14.02-34	5	5

A complete answer is not provided for 1 of the 4 questions. The schedule for a technically correct and complete response to this question is provided below.

Question #	Response Date
RAI 77 — 14.02-32	January 15, 2009

Sincerely,

(Russ Wells on behalf of)

*Ronda Pederson*

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**From:** Getachew Tesfaye [mailto:Getachew.Tesfaye@nrc.gov]

**Sent:** Thursday, October 02, 2008 8:52 PM

**To:** ZZ-DL-A-USEPR-DL

**Cc:** Dori Votolato; Peter Kang; Juan Peralta; Ronaldo Jenkins; Michael Miernicki; Joseph Colaccino; John Rycyna

**Subject:** U.S. EPR Design Certification Application RAI No. 77(1187,901,679), FSAR Ch 14

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on September 12, 2008, and on September 16, 2008, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,  
Getachew Tesfaye

Sr. Project Manager  
NRO/DNRL/NARP  
(301) 415-3361

**Hearing Identifier:** AREVA\_EPR\_DC\_RAIs  
**Email Number:** 125

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**From:** WELLS Russell D (AREVA NP INC)

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**Recipients Received:**

**Response to**

**Request for Additional Information No. 77 Supplement 1**

**10/2/2008**

**U. S. EPR Standard Design Certification**

**AREVA NP Inc.**

**Docket No. 52-020**

**SRP Section: 14.02 - Initial Plant Test Program - Design Certification and New  
License Applicants**

**Application Section: SRP section 14.2**

**CQVP and EEB Branches**

**Question 14.02-32:**

SRP 14.2.II.5.B states that test abstracts for the initial test program should include acceptance criteria in sufficient detail to establish the functional adequacy of the SSCs and design features tested. SRP 14.2, "Technical Rationale," further states that an objective of the ITP is to verify that SSCs are capable of performing their safety functions as specified in the design and as assumed/credited in safety analyses. RG 1.68.C.4, "Procedures," states that each test procedure should include acceptance criteria that account for the uncertainties used in transient and accident analysis.

In its review of Subsection 14.2.12 of the EPR FSAR, the staff noted that Section 3, "Test Method," of each test abstract includes a comprehensive list of activities that are needed to ensure functional adequacy of SSCs under test. The staff also noted that Section 5, "Acceptance Criteria," of each test abstract contains pointers to design information in other FSAR chapters, Technical Specifications, and sections of the ASME code. However, most test abstracts also include acceptance criteria under the test method section and/or the acceptance criteria section does not provide explicit values, prescribed limits, or measurable parameters to allow for the determination that the SSCs under test are capable of performing their safety function and that the test objectives have been met.

AREVA needs to review all the test abstracts in Section 14.2.12 to ensure that test method and acceptance criteria information are included in the appropriate sections. In addition, AREVA needs to revise the acceptance criteria section of each test abstract to include explicit, measurable criteria (e.g., values, prescribed limits, or measurable parameters) from the relevant EPR FSAR section(s) that establish the functional adequacy of the SSCs and design features tested, and that provide a direct correlation to the test objective(s) being effectively met.

**Response to Question 14.02-32:**

At the time of Design Certification the COL Holder test acceptance criteria (e.g., values, prescribed limits, or measurable parameters) for U.S. EPR FSAR Tier 2, Section 14.2.12 are not known. The primary obstacle to generating COL Holder test acceptance criteria during Design Certification is determining instrument uncertainties and engineering margin. However, test procedures of the COL Holder will contain final, explicit, and measurable criteria. U.S. EPR FSAR Tier 2, Section 14.2.3 will be revised to provide additional clarification on how explicit, measurable criteria will be developed for test procedures.

Test procedure acceptance values of the COL Holder include the accident analyses and design values listed in the U.S. EPR FSAR before adding instrument uncertainties and other corrections between test conditions and accident conditions (e.g., temperature, pressure, density). The test abstracts in U.S. EPR FSAR Tier 2, Section 14.2.12 will be revised to provide additional accident analyses and design values for a COL Holder to include during test procedures.

**FSAR Impact:**

U.S. EPR FSAR Tier 2, Section 14.2.3 and Section 14.2.12 will be revised as described in the response and as indicated on the enclosed markup.

# U.S. EPR Final Safety Analysis Report Markups

14.2-32

The explicit, measurable criteria that must be verified by testing will be entered into a database that contains the following:

- Clear description of the value, for example, maximum medium head safety injection flow into a depressurized reactor coolant system.
- Safety analysis value that must be assured.
- Instrument uncertainty.
- Process correction term (the safety analysis may have been performed at a different temperature than can be achieved during preoperational testing).
- The margin allowance between the preoperational test acceptance value and the in-service test allowable degradation limit.
- The site-specific test procedure number.
- The test abstract number.

Preoperational tests verify each alarm, permissive, interlock, automatic system response, etc. for the associated system unless specifically exempted from verification by the test review team. The preoperational test verification of an alarm, permissive, interlock, automatic system response, etc. is not a calibration and may not verify the actual setpoint value due to different fluid densities or other test conditions. If the observed value during the preoperational test is significantly different, then this should be recorded as a test deficiency and corrected prior to test review team review. The following items should be used when deciding the verification method to be used:

- Preference 1, system operation - It is recommended to operate the system in a manner to verify an alarm if it will not significantly increase the probability of equipment damage or personnel injury. An example is - CVCS letdown flow alarm is designed to prevent damage to the resin bed. This alarm could be verified prior to loading the CVCS resin.
- Preference 2, field test input - In this case the field lead to the sensor is temporally lifted by a qualified technician and a test signal is transmitted to the computer to generate the alarm, permissive, etc.

When performing a preoperational test it is common to have upstream or downstream systems that are not functional at the time that a test is performed. The preoperational test will document when upstream or downstream systems are not functional. An example of acceptable preoperational test with a non-functioning support follows:

- Normal operation of the LHSI pump requires CCW cooling of the pump seal but the pump vendor has authorized operation of the LHSI pump at temperatures  $\leq 180^{\circ}\text{F}$ . A preoperational test to verify shutoff head and verify the pump curve



percent power for SSC that are relied on to prevent, limit, or mitigate the consequences of postulated accidents.

- Approved test procedures should be in a form suitable for review by regulatory inspectors at least 60 days prior to their intended use or at least 60 days prior to fuel loading for fuel loading and startup test procedures.

~~The EPR startup schedule is as provided in Figure 14.2-1—Figure Deleted U.S. EPR Commissioning Milestones.~~

## 14.2.12 Individual Test Descriptions

The individual preoperational test abstracts identified in this section contain test descriptions that form one part of the bases for defining the minimum testing requirements.

In these abstracts:

- References to design or design requirements generally mean functional design or functional design requirements. For example, **actual** SSC may have higher design capacity than what is functionally required.
- Acceptance criteria are based on system design parameters that are used in the safety analysis and on programmatic requirements. For example, programmatic testing requirements for the pump and valve testing are described in Section 3.9.6.

Detailed EPR preoperational test procedures:

- Accomplish the testing described in the test abstracts via multiple test procedures that may be executed at different times.
- Establishes the prerequisite conditions per individual test requirements. For example, heating, ventilation, air conditioning (HVAC) testing will be done at current environmental conditions, not extremes of design-assumed temperatures.
- Include data requirements for individual tests in more detail (as necessary for verifying test objectives).

### 14.2.12.1 NSSS Support Systems

#### 14.2.12.1.1 Fuel Pool Cooling and Purification System (Test #001)

##### 1.0 OBJECTIVE

14.2-32 → 1.1 To demonstrate the capability to ~~remove decay heat~~ establish cooling flow from the spent fuel pool ~~to the spent fuel pool cooling heat exchanger.~~

1.2 To demonstrate the capability to purify the spent fuel pool.

1.3 To demonstrate electrical independence and redundancy of power supplies.  
14.2-32 →

2.0 PREREQUISITES

- 2.1 Construction activities on the fuel pool cooling and purification system (FPCPS) have been completed.
- 2.2 FPCPS system instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Test instrumentation available and calibrated per site procedures.
- 2.4 Component cooling water system (CCWS) water is available to the fuel pool cooling heat exchanger.
- 2.5 The leak tests on the following subsystems have been completed.
  - 2.5.1 Fuel pool.
  - 2.5.2 Refueling cavity.
  - 2.5.3 IRWST.
  - 2.5.4 Reactor vessel to refueling cavity seal.
- 2.6 Support systems required for the operation of the FPCPS are complete and functional.
- 2.7 The following have been filled to normal level, or shall be during the performance of this test:
  - 2.7.1 Fuel pool.
  - 2.7.2 Refueling cavity.
  - 2.7.3 IRWST.

3.0 TEST METHOD

- 3.1 ~~Verify~~ Measure the head versus flow curves for pumps.
- 3.2 14.2-32 → ~~Verify that~~ Check operation of controls, instrument interlocks and alarms using actual or simulated inputs.
- 3.3 ~~Verify~~ Check the functionality of the fuel pool gates and quantify gate leakage.
- 3.4 ~~Verify~~ Check to determine if the anti-siphons holes on the FPCPS suction lines are free of obstructions.
- 3.5 ~~Verify no~~ Quantify leakage of the spent fuel pool by checking the leak detection system (LDS).
- 3.6 ~~Verify no~~ Quantify leakage of the refueling cavity by checking the LDS.
- 3.7 ~~Verify no~~ Quantify leakage of the IRWST by checking the LDS.

3.8 ~~Verify that~~ Measure the purification system ~~meets the~~ design ~~flowrate~~ flow rate and filtration capacity when aligned to the following:

14.2-32 →

3.8.1 Fuel pool.

3.8.2 Refueling cavity.

3.8.3 IRWST.

3.9 ~~Verify~~ Measure the performance characteristics of power-operated valves (e.g., thrust, stroke time, fail position upon loss of motive power) as designed (refer to Section 9.1.3).

3.10 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.11 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

#### 4.0 DATA REQUIRED

4.1 Pump head versus flow and operating data for each pump.

4.2 Setpoints of alarms interlocks and controls.

4.3 Flow data through various system flow paths.

4.4 Fuel pool gate leakage data.

4.5 Valve performance data.

4.6 Control valve operation and position.

#### 5.0 ACCEPTANCE CRITERIA

5.1 The FPCPS meets design requirements (refer to Section 9.1.2 and performs as described in Section 9.1.3).

14.2-32 →

5.1.1 Verify FPCS pump performance within limits.

5.1.2 Verify FPCS controls, interlocks, and alarms function as designed.

5.1.3 Verify fuel pool leakage within design limits.

5.1.4 Verify refueling cavity leakage within design limits.

5.1.5 Verify IRWST leakage within design limits.

5.1.6 Verify valve performance within design limits.

5.1.7 Verify gate performance within design limits.

5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.1.2 CVCS Volume Control Tank (Test #002)**

1.0 OBJECTIVE

1.1 To ~~verify~~demonstrate proper operation of the volume control tank (VCT) subsystem of the chemical and volume control system (CVCS).  
14.2-32 →

2.0 PREREQUISITES

- 2.1 Construction activities on the VCT subsystem have been completed.
- 2.2 The VCT subsystem instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Water makeup system is available to the VCT.
- 2.4 Support systems required for operation of the VCT are complete and functional.

3.0 TEST METHOD

- 3.1 Operate motor operated valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 ~~Verify~~Record response of that power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 9.3.4 for anticipated response).

- 3.3 Partially fill the VCT with water makeup system and pressurize the VCT using the nitrogen pressurization system. Observe alarm operation.
- 3.4 Vent the VCT and pressurize using the nitrogen system.
- 3.5 Drain and refill the VCT with water makeup system. Observe level alarms and interlocks.
- 3.6 Simulate a full range of VCT temperatures and observe alarms.

4.0 DATA REQUIRED

- 4.1 Valve performance data, where required.
- 4.2 Valve position indication.
- 4.3 Position response of valves to loss of motive power.
- 4.4 VCT pressurization data.
- 4.5 VCT level program data.

4.6 Values of parameters at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

5.1 The VCT subsystem ~~performs as~~ meets design requirements (refer to described in Section 9.3.4).

5.1.1 Verify valve performance is within limits.

14.2-32

5.1.2 Verify alarms and interlocks function as designed.

5.1.3 Verify control system response is within design limits.

14.2.12.1.3 CVCS Charging and Seal Injection (Test #003)

1.0 OBJECTIVE

1.1 To ~~verify~~ demonstrate the proper performance of the CVCS charging subsystem.

1.2 To ~~verify~~ demonstrate the proper performance of the CVCS seal injection subsystem.

1.3 To demonstrate electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the CVCS charging and seal injection subsystems have been completed.

2.2 The CVCS charging and seal injection subsystem instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 The water makeup system subsystem is functional to provide a reliable supply to the charging pump suction.

2.4 The VCT subsystem is functional to supply charging pump suction.

2.5 The reactor vessel is ready to receive water from the charging headers.

2.6 The pressurizer is ready to receive water from the auxiliary spray line.

2.7 RCP are ready to receive seal injection water (pumps are coupled and off the backseat) and stand still seal is open.

2.8 Support systems required for operation of the CVCS charging and seal injection subsystems are functional.

3.0 TEST METHOD

3.1 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

14.2-32 →

- 3.2 ~~Verify~~ Record response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 9.3.4 for anticipated response).
- 3.3 ~~Manually start each charging pump per operating manual instructions. Prior to starting the charging pump, simulate a high seal injection filter differential pressure and verify proper indication and alarms.~~
- 3.4 Manually start each charging pump. Observe charging pump operation including charging pump alarms and interlocks.
- 3.5 With a charging pump running; ~~open the seal injection lines, and observe flow.~~
  - 3.5.1 Open the seal injection lines and observe flow.
  - 3.5.2 Verify proper operation of the seal injection filters.
- 3.6 With a charging pump running, open the auxiliary spray valve, and observe flow.
- 3.7 ~~Verify~~ Demonstrate the operation of the RCP seal injection flow control valves.
- 3.8 ~~Verify~~ Demonstrate the ~~flowrate~~ flow rate of the CVCS miniflow path.
- 3.9 ~~Verify~~ Demonstrate the operation of RCP seal injection header.
- 3.10 ~~Verify~~ Demonstrate performance, including head and flow characteristics, of the charging pumps.
- 3.11 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Valve performance data, where required.
- 4.2 Valve position indication.
- 4.3 Position response of valves to loss of motive power.
- 4.4 Charging pump and oil lubrication system performance.
- 4.5 Charging pump running data.
- 4.6 Setpoints at which alarms and interlocks occur.
- 4.7 Seal injection ~~flowrate~~ flow rates.
- 4.8 Auxiliary spray ~~flowrate~~ flow rates.
- 4.9 CVCS charging pump head versus flow.

5.0 ACCEPTANCE CRITERIA

- 5.1 The CVCS charging subsystem ~~performs as~~ meets design requirements as described in Section 9.3.4.
  - 5.1.1 Verify valve performance is within limits.
  - 5.1.2 Verify alarms and interlocks function as designed.
  - 5.1.3 Verify control system response is within design limits.
  - 5.1.4 Verify CVCS minimum / maximum system flow rates are within design limits
    - FSAR Table 14.3-1 Item 1-4.
  - 5.1.5 Verify charging pump head and flow.
  - 5.1.6 Verify charging pump miniflow performance.
  - 5.1.7 Verify various CVCS flow paths and flow rates.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

14.2-32



**14.2.12.1.4 CVCS Letdown (Test #004)**

- 1.0 OBJECTIVE
  - 1.1 To ~~verify~~ demonstrate the proper operation of the CVCS letdown subsystem for normal and emergency conditions.
  - 1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.
- 2.0 PREREQUISITES
  - 2.1 Construction activities on the CVCS letdown subsystem have been completed.
  - 2.2 Letdown subsystem instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
  - 2.3 Support systems required for the operation of the CVCS letdown subsystem control valves are functional.
  - 2.4 The RCS is operated at HZP pressure and temperature.
- 3.0 TEST METHOD
  - 3.1 Operate control valves remotely while:
    - a. Observing each valve operation and position indication, and
    - b. Measuring valve performance data (e.g., thrust, opening and closing times).
  - 3.2 Verify Record response of power-operated valves ~~fail~~ upon loss of motive power as designed (refer to Section 9.3.4).

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- 3.3 ~~Verify~~Observe response of letdown system to simulated pressurizer level signals.
- 3.4 Simulate a safety injection actuation signal (SIAS) and observe system response.
- 3.5 Simulate a containment isolation actuation signal (CIAS) and observe system response.
- 3.6 Simulate an inadvertent dilution event and observe system response.
- 3.7 Simulate a range of letdown temperatures and observe the response of control valves. Observe alarm and interlock operation.
- 3.8 Measure system pressure and temperature upstream and downstream of pressure control valves and verify sub-cooled conditions exist.
- 3.9 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
  - 4.1 Valve performance data, where required.
  - 4.2 Valve position indication.
  - 4.3 Position response of valves to loss of motive power.
  - 4.4 Response of control valves to simulated pressurizer level changes.
  - 4.5 Response of system and isolation valves to simulated isolation signals.
  - 4.6 Response of control valves to simulated letdown temperature.
  - 4.7 Delta P ( $\Delta P$ ) across letdown flow control.
  - 4.8 Setpoints at which alarms, indications, and interlocks occur.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 The CVCS letdown subsystem ~~performs as~~meets design requirements - described in(refer to Section 9.3.4).
    - 5.1.1 Verify valve performance meets design requirements.
    - 5.1.2 Verify alarms and interlocks function as designed.
    - 5.1.3 Verify control system response is within design limits.
    - 5.1.4 Verify that flow rates meet design requirements.
    - 5.1.5 Verify letdown system pressure and temperature meet sub-cooling design requirements.
    - 5.1.6 Verify response to simulated safety related signals.
  - 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.



**14.2.12.1.5 CVCS Chemical Addition (Test #005)**

1.0 OBJECTIVE

1.1 To demonstrate that the chemical addition subsystem can inject liquid chemicals into the suction supply of the charging pumps.

1.2 To ~~verify~~demonstrate a flow path from the chemical addition tank to the liquid waste system.

2.0 PREREQUISITES

2.1 Support systems required for operation of the chemical addition subsystem are complete and functional.

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2.2 The chemical addition tank has been filled from the makeup system with a predetermined amount of water makeup system.

2.3 The CVCS charging subsystem is functional and the charging pump is operating.

2.4 The associated instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.5 A charging pump is in operation.

3.0 TEST METHOD

3.1 Start the chemical addition pump and observe the chemical addition tank level.

3.2 Drain the chemical addition tank to the nuclear island drain and vent systems (NIDVS) and observe the chemical addition tank level.

4.0 DATA REQUIRED

4.1 Chemical addition tank levels.

5.0 ACCEPTANCE CRITERIA

5.1 Verify the flow path from the chemical addition tank to charging pump suction supply line.

5.2 Verify the flow path from the chemical addition tank to the NIDVS.

5.3 The chemical addition subsystem ~~performs as meets design requirements described in~~(refer to Section 9.3.4).

5.3.1 Verify the ability to inject chemicals into the CVCS.

**14.2.12.1.6 Coolant Supply & Storage System (Test #006)**

1.0 OBJECTIVE

1.1 To ~~verify~~demonstrate proper operation of the coolant supply and storage system (CSSS).

2.0 PREREQUISITES

- 2.1 Construction activities on the CSSS have been completed.
- 2.2 CSSS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Boric acid concentrator is ready to receive water from the CSSS.
- 2.4 Support systems required for operation of the CSSS are complete and functional.

3.0 TEST METHOD

- 3.1 Fill the coolant storage tanks and observe level indications and alarms.
- 3.2 Simulate a full range of coolant storage tank temperatures and observe indications and alarms.
- 3.3 Fill the boric acid column from the coolant storage tank using each evaporator feed pump.
- 3.4 Observe boric acid column level indications, alarms, interlocks, and evaporator feed pump discharge pressure.
- 3.5 Refill and isolate the boric acid column.
- 3.6 Open the boric acid column recirculation valves and start each circulation pump while observing boric acid column level changes and verify circulation pump performance.

- 3.7 ~~Verify~~ Observe operation of the electrical heater that supplies the initial heatup of the boric acid column.
- 3.8 ~~Observe~~ transfer performance by lining up the boric acid delivery pumps to the boric acid storage tank (BAST).
- 3.9 Line up the vapor compressors with the seal water pumps aligned to the seals and ~~verify that~~ determine if the condensate pumps can supply processed demineralized water to the reactor makeup storage tank.
- 3.10 ~~Verify~~ Observe operation of the degasifier column and associated components.
- 3.11 ~~Verify~~ Observe response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 9.3.4 for anticipated response).

14.2-32

- 3.12 Verify performance, including head and flow characteristics, for the coolant storage pumps.

4.0 DATA REQUIRED

- 4.1 Coolant storage tank level and temperature for each tank.
- 4.2 Coolant storage pump pressure.
- 4.3 Setpoints of alarms and interlocks.

4.4 Position response of valves to loss of motive power.

4.5 Pump head versus flow for system pumps.

5.0 ACCEPTANCE CRITERIA

5.1 The CSSS ~~performs as meets design requirement described in~~(refer to Section 9.3.4).

5.1.1 Verify that controls, interlocks, and alarms function as designed.

5.1.2 Verify that the coolant treatment components operation is within design limits.

14.2-32 →

5.1.3 Verify valve performance meets design requirements.

5.1.4 Verify that system indications function as designed.

14.2.12.1.7 Reactor Boron & Water Makeup System (Test #007)

1.0 OBJECTIVE

1.1 To ~~verify~~demonstrate the performance of the reactor boron and water makeup system (RBWMS).

2.0 PREREQUISITES

2.1 Construction activities on the RBWMS have been completed.

2.2 RBWMS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Plant demineralized water supply system is functional.

2.4 Coolant storage and supply system is available to support the operation of the RBWMS is complete and functional.

2.5 Support systems required for the operation of the RBWMS are complete and functional.

3.0 TEST METHOD

3.1 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 ~~Verify~~Observe response of power-operated valves ~~fail~~ upon loss of motive power as designed (refer to Section 9.3.4 for anticipated response).

3.3 Observe level indications and alarms while filling the BAST.

- 3.4 Simulate a range of BAST temperatures while observing indications and alarms.
- 3.5 Observe tank level, pump discharge pressure, alarms and controls while draining the BAST using each boric acid makeup (~~BAMU~~) pump.
- 3.6 ~~Verify~~Measure performance, including head and flow characteristics, for each boric acid makeup pump.
- 3.7 ~~Verify~~Measure performance, including head and flow characteristics, for each RBWMS demineralized water pump.
- 3.8 ~~Verify~~Demonstrate makeup to VCT, and supply to CVCS pump suction from the boric acid makeup pumps and demineralized water pumps.

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4.0 DATA REQUIRED

- 4.1 Valve position indication.
- 4.2 Position response of valves to loss of motive power.
- 4.3 BAST level, pressure and temperature.
- 4.4 Boric acid makeup pumps discharge pressure.
- 4.5 Demineralized water pumps discharge pressure.
- 4.6 RBWMS flow.
- 4.7 Setpoints of alarms and interlocks.
- 4.8 Pump head versus flow.
- 4.9 VCT levels.

5.0 ACCEPTANCE CRITERIA

- 5.1 The RBWMS ~~performs as~~ meets design requirements (refer to described in Section 9.3.4).
  - 5.1.1 Verify valve performance is within design limits.
  - 5.1.2 Verify alarm and interlocks function as designed.
  - 5.1.3 Verify that system controls function as designed.
  - 5.1.4 Verify pump flow and head are within design limits.
  - 5.1.5 Verify the ability to deliver boric acid to the VCT mixing components.
  - 5.1.6 Verify that system indications function as designed.

**14.2.12.1.8 Boric Acid Mixing Tank (Test #008)**

1.0 OBJECTIVE

- 1.1 To ~~verify~~demonstrate proper operation of the boric acid mixing tank subsystem.

2.0 PREREQUISITES

- 2.1 Construction activities on the boric acid mixing tank subsystem have been completed.
- 2.2 Support systems required for operation of the boric acid mixing tank are complete and functional.
- 2.3 The BAST subsystem is functional.

3.0 TEST METHOD

- 3.1 Fill the boric acid mixing tank with water from the demineralized water system.
- 3.2 Energize heaters and measure the length of time required to heat the tank.
- 3.3 Observe heater control setpoints.
- 3.4 Line up the boric acid mixing tank to the BAST.
- 3.5 Start a boric acid feed pump and observe the mixing tank level.
- 3.6 Refill the boric acid mixing tank, dissolve boric acid crystals and start the mixing tank agitator.
- 3.7 Take samples as the tank is drained to determine the boric acid concentration.

4.0 DATA REQUIRED

- 4.1 Mixing tank heater performance data.
- 4.2 Heatup rate.
- 4.3 Boric acid concentration.

5.0 ACCEPTANCE CRITERIA

- 5.1 The boric acid mixing tank subsystem ~~performs as~~ meets design requirements described in(refer to Section 9.3.4).
  - 5.1.1 Verify operation of the boric acid mixing components is within design limits.
  - 5.1.2 Verify alarms and interlocks function as designed.
  - 5.1.3 Verify system controls function as designed.

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**14.2.12.1.9 Boric Acid Storage Tank (Test #009)**

1.0 OBJECTIVE

- 1.1 To ~~verify~~ demonstrate the proper performance of the BAST subsystem components.

2.0 PREREQUISITES

- 2.1 Construction activities of the BAST subsystems have been completed.
- 2.2 The BAST subsystem instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 The CVCS charging subsystem is complete and functional.
- 2.4 The VCT subsystem is complete and functional.
- 2.5 The boric acid batching storage tank subsystem is complete and functional.
- 2.6 Support systems required for operation of the BAST subsystem ~~is~~are complete and functional.

3.0 TEST METHOD

- 3.1 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

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3.2 ~~Verify~~Determine response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 9.3.4 for anticipated response).

3.3 Observe level alarm setpoints while filling the BAST with ~~RMW~~reactor makeup water from the boric acid batching tank subsystem.

3.4 Operate each ~~BAMU~~boric acid makeup pump and observe pump performance.

3.5 Line up the ~~BAMU~~boric acid makeup to charging pump suction.

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3.6 ~~Verify~~Observe ability of the ~~BAMU~~boric acid makeup pumps to supply adequate flow to the charging pumps.

3.7 Line up the BAST to charging pump suction.

3.8 ~~Verify that~~Determine if adequate flow is delivered to the charging pumps from the BAST.

3.9 Simulate high and low BAST levels and observe indications, alarms and controls.

3.10 Simulate high and low BAST temperature and observe indications, alarms and controls.

3.11 Line up the ~~BAMU~~boric acid makeup pumps to the VCT and ~~verify that~~determine if the makeup system is capable of supplying ~~BAMU~~boric acid makeup to the VCT and charging pump suction at the selected rates and quantities in functional modes.

3.12 Observe alarms and interlocks associated with ~~BAMU~~boric acid makeup pumps and the VCT.

14.2-32 → 3.13 VerifyObserve performance, including head and flow characteristics, for the BAMUboric acid makeup pumps.

4.0 DATA REQUIRED

- 4.1 Valve performance data where required.
- 4.2 Valve position indication.
- 4.3 Position response of valves to loss of motive power.
- 4.4 BAMUboric acid makeup pump performance data.
- 4.5 Makeup system performance data.
- 4.6 Setpoints at which alarms, automatic actuations, and interlocks occur.
- 4.7 Pump head versus flow.

5.0 ACCEPTANCE CRITERIA

- 5.1 The BAST subsystem ~~performs as~~meets design requirements described in(refer to Section 9.3.4).
  - 5.1.1 Verify that alarms and interlocks function as designed.
  - 5.1.2 Verify that system controls function as designed.
  - 14.2-32 → 5.1.3 Verify that valve performance is within design limits.
  - 5.1.4 Verify that pump performance, flow and developed head, meet design limits.
  - 5.1.5 Verify that the BAST provides adequate net positive suction head (NPSH) to the CVCS charging pumps during design conditions.
  - 5.1.6 Verify that various system alignments function as designed.
  - 5.1.7 Verify that system indications function as designed.

**14.2.12.1.10 Coolant Degasification System (Test #010)**

1.0 OBJECTIVE

- 1.1 To ~~verify~~demonstrate proper operation of the coolant degasification system (CDS).

2.0 PREREQUISITES

- 2.1 Construction activities have been completed on the CDS.
- 2.2 CDS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the CDS are functional.

3.0 TEST METHOD

- 3.1 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 ~~Verify~~Observe response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 9.3.4 for anticipated response).

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3.3 Simulate interlock signals from interfacing equipment and observe CDS response.

3.4 Line up the CDS to interfacing systems and, using appropriate operating functional modes.

3.5 ~~Verify that~~Determine if flow paths have been established to interfacing systems.

3.6 Observe alarm and controller response.

4.0 DATA REQUIRED

4.1 ~~Verify by~~Record valve diagnostic testing data (e.g., stroke time, developed thrust). ~~that operation of power operated valves is within design limits.~~

4.2 Position response of valves to loss of motive power.

4.3 Setpoints at which alarms, automatic actuations, and interlocks occur.

4.4 Flow indications.

5.0 ACCEPTANCE CRITERIA

5.1 The CDS ~~performs as~~meets design requirements described in (refer to Section 9.3.4).

5.1.1 Verify valve operation is within design limits.

5.1.2 Verify applicable alarms, interlocks, and controls function as designed.

5.1.3 Verify that system indications function as designed.

5.1.4 Verify that various system alignments function as designed.

**14.2.12.1.11 Coolant Purification System (Test #011)**

1.0 OBJECTIVE

1.1 To ~~verify~~demonstrate flow paths between the following are available:

1.1.1 RBWMS.

1.1.2 Purification ion exchangers (demineralizers).



1.1.3 Solid waste management system.

1.2 To ~~verify~~demonstrate flow paths between the purification and deborating ion exchanger and gaseous waste processing system (GWPS).

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2.0 PREREQUISITES

- 2.1 Construction activities on the coolant purification system (CPS) have been completed.
- 2.2 CPS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Temporary test instrumentation is available and has been calibrated.
- 2.4 Support systems required for operation of the CPS are complete and functional.

3.0 TEST METHOD

- 3.1 Line up the purification system ion exchangers to complete a flow path from the water makeup system through each CPS ion exchanger to the solid waste management system.
- 3.2 Start a water makeup system pump and valve in each ion exchanger sequentially, so that only one ion exchanger is in use at a time.
- 3.3 ~~Verify flow by observing~~Observing water makeup system flow indicators and changes in ~~RMW~~reactor makeup water and spent resin tank levels. Select possible flow paths to the solid waste management system.
- 3.4 Connect each purification ion exchanger and the deborating ion exchanger to a compressed air system (CAS) and connect a pressure gage to the ion exchanger vent.
- 3.5 Adjust the air supply to 15-20 psig.
- 3.6 Start air flow to the ion exchangers and individually open each ion exchanger vent valve and align the ion exchanger to the GWPS.
- 3.7 Observe the ion exchanger vent pressure, air supply pressure, and ~~flowrate~~flow rate.

4.0 DATA REQUIRED

- 4.1 Water makeup system ~~flowrate~~flow rate.
- 4.2 Water makeup system and spent resin tank levels.
- 4.3 Air supply pressure and ~~flowrate~~flow rate.
- 4.4 Ion exchanger test pressure.

5.0 ACCEPTANCE CRITERIA

- 5.1 Verify flow paths between the water makeup system, the purification and deborating ion exchangers, and the solid waste management system.
- 5.2 Verify flow paths between the purification and deborating ion exchangers and the GWPS.
- 5.3 The CVCS purification subsystem ~~performs as~~ meets design requirements described in(refer to Section 9.3.4).
  - 5.3.1 Verify valve performance per design requirements.
  - 5.3.2 Verify alarm and interlocks function as designed.
  - 5.3.3 Verify that controls function as designed.

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**14.2.12.1.12 Reactor Coolant System (Test #012)**

1.0 OBJECTIVE

- 1.1 To perform the initial venting of the RCPs and the RCS.
- 1.2 To perform the initial operation of the RCPs.
- 1.3 To ~~verify~~ demonstrate RCP performance.
- 1.4 To ~~verify~~ observe alarm ~~setpoints~~ functions.
- 1.5 To ~~verify~~ observe the operation of the RCS sample isolation valves.
- 1.6 To perform checkout of humidity detection system.
- 1.7 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the RCS, RCPs, and RCS sample isolation system have been completed.
- 2.2 RCP and RCS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Component cooling water (CCW) to the RCP is available.
- 2.4 RCP motor initial operation preoperational test has been completed.
- 2.5 Pre-start RCP activities have been completed, including opening the stand still seal.
- 2.6 Support systems required for operation of the RCPs and RCS sample isolation valves are functional.
- 2.7 The humidity detection system has an installed test tube to route humid air to the detection system.
- 2.8 The humidity detection system humidity cell has been calibrated.

3.0 TEST METHOD

- 3.1 Simulate temperature, pressure, and flow signals from each RCP and verify alarm setpoints.
  - 3.2 Simulate temperature signals from each RCS RTD and ~~verify~~observe alarm ~~setpoints~~operation.
  - 3.3 Perform initial venting of RCPs, pressurizer, and reactor vessel.
  - 3.4 Perform initial run of RCPs.
  - 3.5 Vent the RCS after each run is complete.
  - 3.6 ~~Verify~~Observe power-operated valves ~~fail~~operation upon loss of motive power ~~as designed~~ (refer to Section 5.1 for anticipated response).
  - 3.7 Verify that the humidity detection system responds to a simulated high humidity.
  - 3.8 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
- 4.1 Setpoints at which alarms occur.
  - 4.2 RCP cold performance data.
  - 4.3 Position response of valves to loss of motive power.
- 5.0 ACCEPTANCE CRITERIA
- 5.1 Verify performance and alarms of the RCS and RCPs as designed ~~described in~~ (refer to Section 5.1, 5.2.5, and Section 5.4.1).
    - 5.1.1 Verify valve performance per design requirements.
    - 5.1.2 Verify alarm and interlocks function as designed.
    - 5.1.3 Verify that controls function as designed.
    - 5.1.4 Verify that RCP operation and vibration levels are within design limits.
    - 5.1.5 Verify that the RCP ratchet pawls on idle RCPs prevent reverse rotation when RCPs are started.
    - 5.1.6 Verify that RCP startup and operating currents are within design limits.
    - 5.1.7 Verify that humidity instrumentation is functional.
    - 5.1.8 Verify that RCS venting is accomplished.
  - 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

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14.2.12.2 Front Line Safety Systems

14.2.12.2.1 Combustible Gas Control System (Test #013)

1.0 OBJECTIVE

- 1.1 To perform the test described in this abstract on the combustible gas control system (CGCS) in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.
- 1.2 To demonstrate that the CGCS is properly installed and is functional prior to fuel loading.

1.3 ~~To demonstrate that the mixing vanes in the upper part of the IRWST reposition on a simulated high containment pressure signal.~~ To demonstrate the ability of the containment combustion gas controls to ensure that combustible hydrogen concentrations do not exist in the post-accident containment environment:

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- 1.3.1 Convection foils are installed per design drawings (refer to Section 6.2.5).
- 1.3.2 Rupture foils are installed per design drawings (refer to Section 6.2.5).
- 1.3.3 Mixing dampers are installed per design drawings (refer to Section 6.2.5).

1.4 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

2.0 PREREQUISITES

- 2.1 Construction activities on the CGCS, passive autocatalytic recombiners and mixing vane subsystems, have either been completed or exceptions have been recorded and the impact on the system performance has been determined.
- 2.2 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.
- 2.3 Factory acceptance tests on the CGCS have been completed and approved.

3.0 TEST METHOD

- 3.1 ~~Verify~~ Demonstrate that the hydrogen sample bottle with an appropriate hydrogen concentration for system checkout is available.
- 3.2 ~~Verify~~ Observe the operation of these ~~following are within design limits:~~

3.2.1 Hydrogen sensors.

3.2.2 Instrumentation and controls.

3.2.3 Alarms.

3.3 Simulate a high containment pressure signal and ~~verify that~~ determine if the mixing ~~vanes~~ dampers in the ~~IRWST~~ containment reposition.

4.0 DATA REQUIRED

4.1 Hydrogen concentration of the sample bottle.

4.2 Upstream and downstream hydrogen concentrations during test.

4.3 Pretest and post-test mixing vane positions.

5.0 ACCEPTANCE CRITERIA

5.1 The containment passive autocatalytic recombiners meet design criteria ~~as described in~~ designed (refer to Section 6.2.5).

5.2 The containment mixing ~~vanes~~ dampers perform as designed (refer to ~~described in~~ Section 6.2.5).

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5.2.1 The containment convection foils meet design criteria (refer to Section 6.2.5).

5.2.2 The containment rupture foils meet design criteria (refer to Section 6.2.5).

**14.2.12.2.2 Medium Head Safety Injection (Test #014)**

1.0 OBJECTIVE

1.1 To functionally test the operation and performance of each critical component within the medium head safety injection (MHSI) system in conditions that are representative of actual plant conditions or close enough to allow data to be extrapolated to actual conditions.

1.2 To ~~verify proper~~ observe MHSI response to an SIAS using normal, alternate, and emergency power sources.

1.3 To ~~verify~~ observe operation of the flow paths through the cold ~~and hot~~ leg MHSI piping to the reactor vessel, ~~which demonstrates that to~~ determine if the system is properly installed and is functional prior to fuel loading.

1.4 To ~~perform~~ confirm a full flow capability test of the MHSI system with minimum backpressure.

1.5 To ~~verify~~ observe operation of the MHSI sampling system isolation valves ~~function as designed~~.

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1.6 To ~~verify~~ observe operation of the elevation of MHSI containment isolation valves (CIV) relative to the IRWST water level to validate NPSH and loop seal design criteria.

1.7 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

1.8 To demonstrate electrical independence and redundancy of power supplies.

14.2-32 →

## 2.0 PREREQUISITES

2.1 Construction activities on the MHSI system have either been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 Support systems and instrumentation required for operation of the MHSI subsystem are complete and functional or the impact on system performance has been determined.

2.3 The IRWST is filled with sufficient primary makeup water to conduct testing on the MHSI system.

2.4 The reactor vessel head and internals have been removed and the reactor vessel water level has been lowered below the vessel nozzles.

2.5 Test instrumentation to be used for pump performance has been installed and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.6 The MHSI system instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.

2.7 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

## 3.0 TEST METHOD

3.1 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 Verify Observe operation of power-operated valves fail upon loss of motive power ~~as designed~~ (refer to Section 6.3 for anticipated response).

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3.3 Start each MHSI pump using an SIAS signal and collect initial pump operating data:

3.3.1 MHSI pumps shall be aligned to discharge to the depressurized RCS (vessel level maintained below the vessel nozzles).

3.3.2 MHSI discharge valves throttled and calibrated instrumentation installed to compare safety injection (SI)

pump flow and discharge pressure to the pump manufacturer head-flow curve. ~~3.3.3—Throttle capability of the discharge valve shall be verified over its full operating range.~~

3.3.3 Perform critical (full flow) sections of the test using normal and emergency power sources.

3.3.4 Collect valve data on valves that reposition to perform an accident mitigation function under maximum differential pressure conditions.

14.2-32 → 3.3.5 Verify adequate Measure suction supply (NPSH) to the MHSI pumps from the IRWST using the suction header under maximum flow conditions, minimum IRWST level, and minimum vessel level.

3.3.6 Compare the measured suction head to the MHSI pump manufacturer NPSH requirements when corrected for IRWST minimum level attainable during an SIAS and maximum IRWST fluid temperature. (Note: it is acceptable to correct available data if design conditions can not be duplicated).

3.3.7 Operate each MHSI pump available for cold leg safety injection (CLSI) through the CLSI header and collect pump operating data.

3.4 Operate each MHSI pump to document the full flow capability.

3.5 Collect fluid samples from each of the MHSI system sampling points.

3.6 Measure the MHSI pump minimum flow recirculation ~~flowrate~~flow rate to the IRWST. Compare the measured ~~flowrate~~flow rate to the required minimum ~~flowrate~~flow rate provided by the pump supplier.

3.7 Record the static head of water in pump discharge lines relative to IRWST level with the valves in the MHSI lines between the IRWST and RCS in the open position.

14.2-32 → 3.8 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

4.1 Valve position and position indication.

4.2 Position response of valves to loss of motive power.

4.3 Valve performance data, where required.

4.4 MHSI pump initial functional data including the following:

4.4.1 MHSI pump head versus flow.

4.4.2 MHSI pump suction pressure.

4.4.3 MHSI pumped fluid temperature.

4.4.4 Reactor vessel level.

- 4.4.5 IRWST level.
- 4.4.6 Chemistry of the water during the test.
- 4.4.7 Debris content of the water during the test as identified by sampling.
- 4.5 Response of MHSI system to SIAS when powered by normal, alternate and emergency power sources:
  - 4.5.1 Motor current.
  - 4.5.2 Buss voltage.
  - 4.5.3 Time from signal to rated flow.

5.0 ACCEPTANCE CRITERIA

- 5.1 The MHSI system ~~performs as~~ meets design requirements described in (refer to Section 6.3).
  - 5.1.1 Verify that the alarms and interlocks function as designed.
  - 5.1.2 Verify that the system controls function as designed.
  - 5.1.3 Verify that the MHSI pump flow and developed head meet design requirements.
    - FSAR Table 14.3-1 Item 1-16.
    - FSAR Table 14.3-1 Item 1-17.
    - FSAR Table 14.3-1 Item 1-18.
    - FSAR Table 14.3-1 Item 1-19.
    - FSAR Table 14.3-1 Item 1-63.
  - 5.1.4 Verify that MHSI pump NPSH meets design requirements.
  - 5.1.5 Verify that valve performance meets design requirements.
  - 5.1.6 Verify that MHSI flow rate meet minimum / maximum design limitations.
  - 5.1.7 Verify that MHSI small miniflow rate meets minimum / maximum design limitations.
  - 5.1.8 Verify that MHSI large miniflow rate meets minimum / maximum design limitations.
- 5.2 Verify that MHSI system response times are less than those specified in Section 15.6.5.
- 5.3 Verify that safety-related components meet electrical independence and redundancy requirements.

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14.2.12.2.3 Safety Injection Accumulator (Test #015)

1.0 OBJECTIVE

- 1.1 To perform the test described in this abstract on the safety injection accumulator system in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.
- 1.2 To demonstrate that the safety injection accumulator system is properly installed and is functional prior to fuel loading.
- 1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.
- 1.4 To demonstrate electrical independence and redundancy of safety-related power supplies.

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2.0 PREREQUISITES

- 2.1 Construction activities on the safety injection accumulator subsystem have been completed or exceptions have been recorded and the impact on system performance has been determined.
- 2.2 Support systems required for the operation of the safety injection accumulator subsystem are complete and functional prior to performing the following test.
- 2.3 Adequate supply of makeup water from the IRWST is available.
- 2.4 The reactor vessel head and internals have been removed.
- 2.5 The reactor vessel is filled above the reactor vessel injection nozzles.
- 2.6 Safety injection accumulator subsystem instrumentation has been checked and calibrated and is operating satisfactorily prior to performing the following test.
- 2.7 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.
- 2.8 The combination of reactor vessel and refueling cavity are available to receive the contents of the safety injection accumulator.
- 2.9 The safety injection accumulator discharge path restriction is within design limits.
- 2.9.1 FSAR Table 14.3-1 Item 1-13.
- 2.10 The safety injection accumulator minimum volume is within design limits.
- 2.10.1 FSAR Table 14.3-1 Item 1-12.

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3.0 TEST METHOD

- 3.1 ~~Verify~~Demonstrate that control valves can be remotely operated while observing valve operation and position indication. Where required, measure valve performance data.
- 3.2 ~~Verify~~Observe operation of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 6.3 for anticipated response).
- 3.3 Observe valve interlock and alarm operation.
- 3.4 Observe level indication and alarm operation while filling the safety injection accumulators from the IRWST.
- 3.5 Observe pressure indication, control operation and alarms while pressurizing the safety injection tanks with nitrogen.
- 3.6 Pressurize each safety injection accumulator to its maximum operating pressure and verify each SI accumulator discharge valve open against the maximum differential pressure.
- 3.7 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
  - 4.1 Valve position indication during test.
  - 4.2 Valve performance data, where required.
  - 4.3 Position response of valves to loss of motive power.
  - 4.4 Setpoints at which alarms and interlocks occurs.
  - 4.5 Times required for safety injection accumulators to discharge their contents to the RCS.
  - 4.6 Safety injection accumulator pressure when stroking valves.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 The safety injection accumulator ~~performs as~~meets design requirements described in(refer to Section 6.3).
    - 5.1.1 Verify alarm, interlock, and controls function as designed.
    - 5.1.2 Verify that valves function as designed.
  - 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

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**14.2.12.2.4 Residual Heat Removal (Test #016)**

1.0 OBJECTIVE

- 1.1 To perform the test described in this abstract on the RHRS in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.

1.2 To demonstrate that the RHRS including the residual heat removal (RHR) pumps is properly installed and is functional prior to fuel loading.

1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

14.2-32 → 1.4 To demonstrate electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the RHR/~~and~~ low head safety injection (LHSI) system have either been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 Plant systems required to support testing are functional and temporary systems are installed and functional.

2.3 Permanently installed instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.

2.4 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.5 All lines in the RHR/~~and~~ LHSI system have been filled and vented.

2.6 ~~The low temperature overpressure protection (LTOP) valve relief capacity has been verified by bench testing.~~

3.0 TEST METHOD

14.2-32 → 3.1 ~~Verify adequate~~ Observe the minimum flow rate of each ~~RHR and~~ LHSI pump with minimum flow established.

3.2 ~~Verify RHR and LHSI~~ Measure LHSI pump performance including head and flow characteristics for design flow paths which include the normal decay heat removal flow path and:

3.2.1 RHRS flow to the CVCS for purification during shutdown.

3.2.2 RHRS transfer of refueling water from the refueling cavity to the IRWST.

3.2.3 RHRS capability to cool the IRWST.

3.3 Perform a full flow test of the LHSI system when aligned to take suction from the IRWST and discharging to the reactor vessel, with vessel level below the hot and cold leg nozzles.

3.4 ~~Verify that the~~ Observe operation of the protective devices, controls, interlocks, indications, and alarms using actual or simulated signals. ~~is within design limits.~~

3.5 ~~Verify~~ Observe operation, stroking speed, position indication, and response to interlock of control and isolation valves. ~~is as designed.~~

3.6	<del>Verify</del> <u>Determine if</u> motor operated valve (MOV) isolation valves can be opened against design differential pressure. <del>3.7—Verify the setpoint of the LTOP relief valves.</del>
3.7	<del>Verify adequate</del> <u>Measure</u> NPSH <del>is available</del> to the <del>RHR and</del> LHSI pumps from suction sources at maximum design <del>flowrate</del> <u>flow rates</u> .
3.8	<del>Verify adequate heat removal</del> <u>Measure flow</u> capability <del>by of</del> the RHR- <del>and</del> LHSI heat exchangers.
3.9	<del>Verify</del> <u>Measure flow through</u> <del>that</del> the flow limiting device, <del>if applicable,</del> in the LHSI discharge lines prevents run-out flow when the LHSI system <del>flow control valves are fully open</del> <u>is at full flow</u> .
3.10	<del>Verify that</del> <u>Determine if</u> each RHR train is capable of being powered by the electrically independent and redundant emergency power supplies.
3.11	Operate each LHSI pump available for hot- <del>and cold</del> leg safety injection (HLSI) through the associated HLSI line and collect pump operating data.
3.12	<del>Verify that the</del> <u>Observe response of</u> RHR and LHSI power-operated valves <del>fail</del> upon loss of motive power <del>as designed</del> (refer to Section 6.3 <u>for anticipated response</u> ).
4.0	DATA REQUIRED
4.1	Valve position indications.
4.2	<del>LHSI</del> <u>LHSI</u> pump head versus flow.
4.3	Valve performance data, where required.
4.4	Setpoints of alarms and interlocks. <del>4.5—Setpoints of the LTOP relief valves.</del>
4.5	Position response of valves to loss of motive power.
5.0	ACCEPTANCE CRITERIA
5.1	The RHR <del>and</del> LHSI systems <del>performs as</del> <u>meets design requirements</u> (refer to <del>described in</del> Section 6.3).
5.1.1	<u>Verify that LHSI pump miniflow is within minimum/ maximum flow limits.</u>
5.1.2	<u>Verify adequate LHSI pump NPSH from all available pump suction paths.</u>
5.1.3	<u>Verify that the LHSI system can be aligned to take suction from the IRWST and discharge to the reactor vessel hot and cold leg within the minimum / maximum flow limits.</u>
	<ul style="list-style-type: none"> <li><u>FSAR Table 14.3-1 Item 1-14.</u></li> </ul>

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- 5.1.4 Verify the ability to align the LHSI pump to the hot leg and confirm that flow is within minimum/maximum limits.
- 5.1.5 Verify that LHSI pump flow and developed head are within minimum/maximum limits.
  - FSAR Table 14.3-1 Item 1-15.
  - FSAR Table 14.3-1 Item 1-63.
- 5.1.6 Verify that LHSI radial miniflow rate meets minimum / maximum design limitations.
- 5.1.7 Verify that LHSI tangential miniflow rate meets minimum / maximum design limitations.
- 5.1.8 Verify alarm, interlock, and controls function as designed.
- 5.1.9 Verify that RHR and LHSI valves function as designed.
- 5.1.10 Verify that RHR can be aligned to CVCS and flow rates are within minimum /maximum limits.
- 5.1.11 Verify the ability to align the RHR system to cool the IRWST.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.2.5 Mid-Loop Operations Verification (Test #017)**

1.0 OBJECTIVE

- 1.1 To perform the test described in this abstract in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.
- 1.2 To demonstrate that the mid-loop operations system is properly installed and is functional prior to fuel loading.
- 1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.
- 1.4 To ~~verify~~demonstrate that installed instrumentation for operations at reduced RCS inventory is accurate and reliable.
- 1.5 To ~~verify~~demonstrate the RHRS pumps can be operated at reduced RCS level without cavitation or excessive pump vibration.
- 1.6 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the RCS mid-loop instrumentation system have been completed or exceptions have been recorded and the impact on system performance has been determined.

- 2.2 RCS mid-loop system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for mid-loop operations are completed and functional.
- 2.4 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.
- 2.5 The RCS is at normal shutdown level, the pressurizer is drained and depressurized.
- 2.6 The RHR and mid-loop level instrumentation systems are functional.

3.0 TEST METHOD

- 3.1 ~~Verify~~Observe mid-loop operation of the RCS mid-loop level instrumentation, including indication, level controls, flow controls, and alarms.
- 3.2 ~~Verify~~Observe the operation of the LHSI pump at minimum / maximum design flow conditions (e.g., motor current, pump vibration, system flow) ~~of the RHR pumps~~ while operating at mid-loop level.
- 3.3 ~~Verify~~Demonstrate that the ~~RHR~~LHSI pumps can operate without cavitation at the minimum mid-loop level and maximum design flow, for mid-loop conditions.
- 3.4 ~~Verify~~Demonstrate that the ~~RHR~~LHSI pumps can operate without excessive vibration at the minimum mid-loop level and minimum design flow, for mid-loop conditions.
- 3.5 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

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4.0 DATA REQUIRED

- 4.1 Setpoints of alarms.
- 4.2 Mid-loop instrumentation data.
- 4.3 ~~RHR~~LHSI pump flow and vibration data.
- 4.4 ~~RHR~~LHSI pump performance data for limiting mid-loop design conditions.

5.0 ACCEPTANCE CRITERIA

- 5.1 The RHR and mid-loop instrumentation systems (e.g., controls, indication, alarms, interlocks) perform as ~~described in~~designed (refer to Section 7.7.)
- 5.2 Verify that LHSI pump performance meets the following design parameters (refer to Section 7.7):

- 5.2.1 Maximum allowable pump vibration and temperature limits.
- 5.2.2 Minimum / maximum flow limiting features.
- 5.2.3 Acceptable indications of pump cavitation.
- 5.3 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.2.6 Severe Accident Heat Removal System (Test #018)**

1.0 OBJECTIVE

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- 1.1 To perform the test described in this abstract on the severe accident heat removal system (SAHRS) simulating conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.
- 1.2 To demonstrate that the SAHRS is properly installed and is functional prior to fuel loading.
- 1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.
- 1.4 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the systems to be tested have either been completed or exceptions have been recorded and the impact on system performance has been determined.
- 2.2 Plant systems required to support testing are functional or temporary systems are installed and functional.
- 2.3 Permanently installed instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.
- 2.4 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.
- 2.5 Thermal camera is available to record thermography of SAHRS header with hot air discharged through the spray nozzles.
- 2.6 Temporary air compressor with more than 1500 cfm capacity (aftercooler must be bypassed) is available.
- 2.7 Temporary air hoses (minimum of two inch diameter) are installed between the temporary air compressor and the SAHRS header.

3.0 TEST METHOD

- 3.1 Verify Record parameters associated with operation of the SAHRS pump with minimum flow established ~~is within design limits.~~

- 3.2 ~~Verify~~Record parameters associated with SAHRS pump performance including head and flow characteristics for design flow paths that can be tested by practical means.
- 3.3 ~~Verify~~Demonstrate valve performance data are within design limits.
- 3.4 ~~Verify~~Demonstrate by using the temporary air source that the SAHRS header and nozzles are free of obstructions.
- 3.5 ~~Verify~~Demonstrate adequate heat removal capability by the SAHRS heat exchangers.
- 3.6 14.2-32 → ~~Verify~~Demonstrate response of power-operated valves ~~fail~~-upon loss of motive power ~~as designed~~ (refer to Section 19.0 for anticipated response).
- 3.7 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
  - 4.1 Valve position indications.
  - 4.2 SAHRS pump head versus flow characteristics.
  - 4.3 Valve performance data, where required.
  - 4.4 Setpoints at which interlocks and alarms occur.
  - 4.5 Position response of valves to loss of motive power.
  - 4.6 Thermography record that spray nozzles are unobstructed. Thermography evidence shall be conclusive without need for supporting documentation.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 The SAHRS meets design criteria ~~described in~~(refer to Section 19.0).
    - 5.1.1 Verify SAHRS pump performance is within minimum / maximum flow limits.
    - 5.1.2 Verify that SAHRS pump performance on miniflow is within limits.
    - 5.1.3 Verify that the SAHRS spray header nozzles are unobstructed.
    - 5.1.4 Verify that the SAHRS heat exchangers meet flow requirements.
  - 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.2.7 Extra Borating System (Test #019)**

1.0 OBJECTIVE



- 1.1 To perform the test described in this abstract on the extra borating system (EBS) in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.
- 1.2 To demonstrate that the EBS is properly installed and is functional prior to fuel loading.
- 1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.
- 1.4 14.2-32 → To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the RCS and EBS have either been completed or exceptions have been recorded and the impact on system performance has been determined.
- 2.2 EBS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.
- 2.4 The EBS boron supply tank is functional to supply the extra borating pump suction.
- 2.5 The reactor vessel is ready to receive water from the EBS.
- 2.6 Support systems required for operation of the EBS are functional.

3.0 TEST METHOD

- 3.1 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

- 3.2 14.2-32 → Verify~~Observe~~ response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 6.8 for anticipated response).
- 3.3 Verify~~Start~~ each EBS pump ~~can be~~ manually and automatically ~~started~~, using simulated signal.
- 3.4 Observe EBS pump operation including pump alarms and interlocks.
- 3.5 Verify the~~Observe~~ operation of EBS injection header (e.g., flow, pressure, temperature).

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- 3.6 ~~Verify~~Measure performance, including head and flow characteristics, of the EBS pumps.
- 3.7 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
  - 4.1 Valve performance data, where required.
  - 4.2 Valve position indication.
  - 4.3 Position response of valves to loss of motive power.
  - 4.4 EBS pump operating data.
  - 4.5 Setpoints at which alarms and interlocks occur.
  - 4.6 EBS pump head versus flow.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 The EBS ~~performs as~~ meets design requirements described in(refer to Section 6.8).
    - 5.1.1 Verify that EBS pump miniflow is within minimum/maximum flow limits.
    - 5.1.2 Verify adequate EBS pump NPSH from all available pump suction paths.
    - 5.1.3 Verify that the EBS can be aligned to take suction from the EBS Storage Tank and discharge to the reactor vessel cold leg within the minimum / maximum flow limits.
    - 5.1.4 Verify that EBS pump flow and developed head are within minimum/maximum limits.
    - 5.1.5 Verify alarm, interlock, and controls function as designed.
    - 5.1.6 Verify that EBS valves function as designed.
  - 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.2.8 Emergency Feedwater System (Test #020)**

1.0 OBJECTIVE

- 1.1 To perform the test described in this abstract on the emergency feedwater system (EFWS) in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.
- 1.2 To demonstrate that the EFWS is properly installed and is functional prior to fuel loading. This test shall demonstrate the ability of the

EFWS to supply feedwater to the steam generators (SG) for design emergency conditions.

1.3 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attributes.

1.4 To demonstrate electrical independence and redundancy of safety-related power supplies.

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2.0 PREREQUISITES

2.1 Construction activities on the systems to be tested have either been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 Permanently installed instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.

2.3 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.4 Plant systems required to support testing are functional, or temporary systems are installed and functional.

3.0 TEST METHOD

3.1 Verify ~~Test the~~ control logic and record response.

3.2 Verify Measure the following head and flow characteristics of emergency feedwater (EFW) pumps:

3.2.1 Pump head versus flow.

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3.2.2 Starting time (motor start time and time to reach rated flow).

3.3 Verify Align the EFW system to all possible design flow paths and verify record flow, ~~meets design requirement.~~

3.4 Verify Determine if the ~~that~~ operation in response to signals from the plant protection system is within design limits.

3.5 Verify that Measure EFW system operation in response to signals from the hardwired controls of the safety information and controls system, ~~is in accord with design.~~

3.6 Verify that Measure response of power operated valves ~~operate within design limits~~ (e.g., stroke time, developed thrust), ~~that operation of power operated valves is within design limits.~~

3.7 Verify that Record operation, of ~~these listed~~ the following using actual or simulated inputs, ~~is within design limits.~~

3.7.1 Protective devices.

3.7.2 Controls.

3.7.3 Interlocks.

3.7.4 Instrumentation response.

3.7.5 Alarms.

3.8 ~~Verify that Record~~ pump performance during an endurance test. ~~is within design limits.~~

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3.9 ~~Verify that~~ Observe response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 10.4.9 for anticipated response).

3.10 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

4.1 EFWS valve position indications.

4.2 EFWS valve performance data, where required including valve stroke time under design basis differential pressure.

4.3 EFWS pump head versus flow curves.

4.4 ~~Flowrate~~ Flow rates through venturi.

4.5 Response of EFW pumps to safety-related signals.

4.6 Pump start times.

4.7 Position response of EFWS valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

5.1 The EFWS meets design criteria ~~described in~~ (refer to Section 10.4.9).

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5.1.1 Verify that EFWS pump miniflow is within minimum/maximum flow limits.

5.1.2 Verify adequate EFWS pump NPSH from all available pump suction paths.

5.1.3 Verify that the EFWS can be aligned to take suction from the EFW Storage Tank and discharge to the steam generator within the minimum / maximum flow limits from the MCR.

- FSAR Table 14.3-1 Item 1-57.
- FSAR Table 14.3-1 Item 1-58.
- FSAR Table 14.3-1 Item 1-54.
- FSAR Table 14.3-1 Item 1-55.

5.1.4 Verify that EFW pump flow and developed head are within minimum/maximum limits.

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5.1.5 Verify that EFW pump startup time from event detection to full flow meet design limits.

- FSAR Table 14.3-1 Item 1-64.

5.1.6 Verify alarm, interlock, and controls function as designed.

5.1.7 Verify that EFW valves function as designed.

5.2 Verify safety-related components meet electrical independence and redundancy requirements.

**14.2.12.2.9 Emergency Feedwater Storage Pool (Test #021)**

1.0 OBJECTIVE

1.1 To perform the test described in this abstract on the EFWS in conditions that are representative of actual plant conditions or close enough to allow the data to be extrapolated to actual conditions.

1.2 To record data that is used to validate design basis assumptions or provide a baseline record of system performance for non-safety-related attribute.

1.3 To demonstrate that the EFW storage pool provides a reliable source of water for the EFWS.

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1.4 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITE

2.1 Construction activities on the EFW storage pool have either been completed or exceptions have been recorded and the impact on system performance has been determined.

2.2 The EFW storage pool instrumentation has been calibrated and is functional for performance of the following test.

2.3 Test instrumentation is available and calibrated. A record of calibrated test instrumentation used with individual tracking number and calibration due date shall be recorded in the official test record.

2.4 Support system required for the operation of the EFW storage pool is complete and functional.

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2.5 Verify that EFW pool capacity at minimum design level meets design volume requirements.

3.0 TEST METHOD

3.1 Verify Observe response of associated EFW pool control logic.

3.2 Verify Observe operation EFW pool design flow paths.

3.3 Operate control valves remotely while:

- a. Observing each valve operation and position indication.
- b. Measuring valve performance data (e.g., thrust, opening and closing times).

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3.4 ~~Verify~~Observe response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 10.4.9 for anticipated response).

3.5 ~~Verify~~Observe operation of protective devices, controls, interlocks, instrumentation, and alarms, using actual or simulated inputs.

3.6 Verify the EFW storage pool is maintained at acceptable ~~water-~~dissolved oxygen concentrations.

3.7 Verify flow paths.

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3.8 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Pump operating data.
- 4.2 Valve performance data, where required.
- 4.3 Valve position indication.
- 4.4 Position response of valves to loss of motive power.
- 4.5 Setpoints at which alarms and interlocks occur.
- 4.6 Applicable chemistry results.

5.0 ACCEPTANCE CRITERIA

- 5.1 The EFW storage pool meets design criteria (refer to described in Section 10.4.9).
  - 5.1.1 Verify operation of EFW pool controls, interlocks, and alarms.
  - 5.1.2 Verify that EFW pool valves function as designed.
  - 5.1.3 Verify that EFW pool capacity is within design limits.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.2.10 In-Containment Refueling Water Storage Tank System (Test #022)**

1.0 OBJECTIVE

- 1.1 To demonstrate the proper operation of the following subsystems:
  - 1.1.1 IRWST.
  - 1.1.2 ~~Containment~~Severe accident heat removal system (~~CHRS~~SAHRS) supply header.

1.1.3 MHSI supply header.

1.1.4 LHSI supply header.

1.1.5 CVCS supply header.

1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the IRWST are complete.

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2.2 Plant systems required to support testing are functional or temporary systems are installed and functional.

2.3 Permanently installed instrumentation is functional and calibrated.

2.4 Test instrumentation is available and calibrated.

2.5 Refueling cavity integrity can be established.

2.6 The core spreading area can receive water from the IRWST.

2.7 Verify that the minimum IRWST capacity is within design limits.

2.7.1 FSAR Table 14.3-1 Item 1-20.

3.0 TEST METHOD

3.1 Operate control valves remotely while:

3.1.1 Observing each valve operation and position indication.

3.1.2 Measuring valve performance data (e.g., thrust, opening and closing times).

3.2 Fill the IRWST with reactor makeup water and record volume versus indicated level. Observe level indication and alarms.

3.3 Simulate the full range of IRWST temperatures and observe indications and alarms.

3.4 ~~Verify~~Check design flow path from IRWST to the ~~CHRS and to SAHRS~~ including the core spreading area (e.g., sump, strainers, and other debris retention devices).

3.5 ~~Verify~~Check design flow path from IRWST to the safety injection systems (MHSI and LHSI) ~~and to~~ including the refueling cavity (e.g., sump, strainers, and other debris retention devices).

3.6 Check design flow path from IRWST to the CVCS suction (e.g., sump, strainers, and other debris retention devices).

3.7 Verify operation of the level alarms and indication of the reactor cavity.

3.8 ~~Verify the~~ Demonstrate functionality and adequacy of range of the IRWST pressure instrumentation.

- 3.9 ~~Verify~~Demonstrate the operation and configuration of the IRWST return screens.
- 3.10 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
  - 4.1 Valve position indications.
  - 4.2 Valve opening and closing time, where required.
  - 4.3 Setpoint at which alarms occur.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 The IRWST ~~performs as meets design requirements described in~~(refer to Section 6.3 and Section 19.2).
    - 5.1.1 Verify that the CVCS suction path meets design requirements.
    - 5.1.2 Verify that the safety injection suction path meets design requirements.
    - 5.1.3 Verify that the SAHRS suction path meets design requirements
    - 5.1.4 Verify alarm, interlock, and controls function as designed.
    - 5.1.5 Verify that IRWST valves function as designed.
  - 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

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**14.2.12.2.11 Core Melt Stabilization System (Test #023)**

- 1.0 OBJECTIVE
  - 1.1 To demonstrate proper construction of the core melt stabilization system (CMSS).
- 2.0 PREREQUISITES
  - 2.1 Construction activities on the CMSS are complete.
  - 2.2 Plant systems required to support testing are functional or temporary systems are installed and functional.
  - 2.3 Permanently installed instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.
  - 2.4 Test instrumentation is available and calibrated.
- 3.0 TEST METHOD
  - 3.1 ~~Verify~~Determine acceptability by visual examination system constructed as described in design documents.



3.2 Verify Measure the acceptability of the cooling system, as described in design documents.

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4.0 DATA REQUIRED

4.1 Punch list of deficiencies at time of acceptance walkdown have been corrected.

4.2 Cooling system ~~flowrate~~ flow rate.

5.0 ACCEPTANCE CRITERIA

5.1 All deficiencies noted during the walkdown have been corrected.

5.2 The configuration, including the cooling system ~~flowrate~~ flow rate, is as ~~described~~ designed (refer to -in Section 19.0).

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**14.2.12.3 Engineered Components**

**14.2.12.3.1 Containment Equipment Hatch Functional and Leak Test (Test #024)**

1.0 OBJECTIVE

1.1 To verify the measured leakage through the containment equipment hatch when summed with the total of other Type B and C leak rate tests (LRT) is within the limits as required by the Technical Specifications and 10 CFR 50, Appendix J.

1.2 To demonstrate the operation of the containment equipment hatch.

2.0 PREREQUISITES

2.1 Construction activities on the equipment have been completed.

2.2 Temporary pressurization equipment is installed and instrumentation calibrated.

3.0 TEST METHOD

3.1 Demonstrate the operation of the equipment hatch from its normal closed location to its open location and back to its normally closed location.

3.2 Place the hatch in the closed position and perform a 10 CFR 50, Appendix J, Type B LRT.

3.3 Place the hatch in the closed position and perform a seal structural integrity test at 110 percent of design basis accident pressure.

4.0 DATA REQUIRED

4.1 Containment equipment hatch leak data.

5.0 ACCEPTANCE CRITERIA

5.1 Verify leak rate, when summed with the total of other Type B and C LRTs, does not exceed the limits as required by the Technical Specifications and 10 CFR 50, Appendix J.

5.2 The equipment hatch assembly operates in accordance with manufacturer instructions.

5.3 The equipment hatch ~~performs as meets design requirements described in~~(refer to Sections 3.1.5, 3.8.1, and 3.8.2).

**14.2.12.3.2 Containment Personnel Airlock Functional and Leak Test (Test #025)**

1.0 OBJECTIVE

1.1 To verify the measured leakage, through each containment personnel airlock, is within the limits as required by the Technical Specifications and 10 CFR 50, Appendix J.

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1.2 To verify each, containment personnel airlock, operates as designed in Sections 3.1.5, 3.8.1, and 3.8.2.

2.0 PREREQUISITES

2.1 Construction activities on the containment personnel airlocks have been completed.

2.2 Temporary pressurization equipment is installed and instrumentation is calibrated.

2.3 Electrical checks are complete on the hatches.

3.0 TEST METHOD

3.1 Operate each airlock in accordance with manufacturer instructions; verify alarms, interlocks and indications.

3.2 Place each airlock in the closed portion and perform a 10 CFR 50, Appendix J, and Type B LRT.

3.3 Place each airlock in the closed portion and perform a structural integrity test at 110 percent of design basis accident pressure.

4.0 DATA REQUIRED

4.1 Individual airlock leak data.

5.0 ACCEPTANCE CRITERIA

5.1 Verify leak rates, when summed with the total of other Type B and C LRTs, do not exceed the limits as required by the Technical Specification and 10 CFR 50, Appendix J.

5.2 The containment personnel airlocks perform as ~~designed described in~~(refer to Sections 3.1.5, 3.8.1, and 3.8.2).

5.2.1 Structural integrity test.

5.2.2 [Appendix J LRT.](#)

5.2.3 [Verify alarms, interlocks, and system controls.](#)

**14.2.12.3.3 Containment Electrical Penetration Assemblies (Test #026)**

1.0 OBJECTIVE

1.1 To verify the integrity of the electrical penetration o-ring seals, and to verify that a summation of the Type B and C LRT results does not exceed the limits as required by the Technical Specifications and 10 CFR 50, Appendix J.

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2.0 PREREQUISITES

2.1 Containment electrical penetration assemblies must be complete with no identified exceptions or discrepancies which would affect the test.

3.0 TEST METHOD

3.1 Perform a 10 CFR 50, Appendix J, Type B LRT at 100 percent of design basis accident pressure.

4.0 DATA REQUIRED

4.1 Electrical penetration leak data.

5.0 ACCEPTANCE CRITERIA

5.1 Verify the sum of the containment electrical penetration assembly LRTs, when summed with other Type B and Type C tests, does not exceed limits as required by the Technical Specifications and 10 CFR 50, Appendix J.

5.2 Containment electrical penetration assemblies perform as ~~described~~ [designed \(refer to in Sections 3.1.5, 3.8.1, and 3.8.2\).](#)

5.2.1 [Appendix J LRT.](#)

**14.2.12.3.4 Containment Isolation Valves (Test #027)**

1.0 OBJECTIVE

1.1 To demonstrate that CIVs ~~can be operated manually and~~ operate [as designed from a remote manual signal and](#) in response to automatic actuation.

1.2 To verify that upon loss of actuating power, the valves fail as designed.

1.3 To verify that valves operate in less than the time specified in the system test procedure. The intent is not to perform stroke testing if already performed in individual system tests. For this test a table will be created for each CIV that includes the tested stroke time and the appropriate test reference.

- 1.4 To demonstrate electrical independence and redundancy of safety-related power supplies.
- 2.0 PREREQUISITES
- 14.2-32 → 2.1 Construction activities on the CIVs have been completed.
- 2.2 Support system required to operate the CIVs are functional.
- 2.3 Test instrumentation is available and calibrated.
- 3.0 TEST METHOD
- 3.1 Operate CIVs remotely while:
- a. Observing each valve operation and position indication, and
  - b. Measuring valve performance data if not performed during individual system test (e.g., thrust, opening and closing times).
- 3.2 Verify CIVs fail upon loss of motive power to their position specified in the safety analysis.
- 3.3 Verify that CIVs reposition to the position specified by design upon initiation of these simulated activation signals.:
- ~~3.4 GIAS.~~
- ~~3.5 Containment spray actuation signal (CSAS).~~
- ~~3.6 Main steam isolation signal (MSIS).~~
- ~~3.7 Emergency feedwater actuation signal (EFAS).~~
- ~~3.8 Alternate feedwater actuation signal (AFAS).~~
- ~~3.9 High radiation actuation signal (HRAS).~~
- ~~3.10 High humidity actuation signal (HHAS).~~
- ~~3.11 SIAS.~~
- 3.4 ~~The CCW low-low surge tank actuation signal.~~ Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
- 4.1 Valve performance data under differential pressure, flow, and temperature conditions as applicable.
  - 4.2 Valve position indications.
  - 4.3 Position response of valves to loss of motive power.
  - 4.4 Valve response to a simulated actuation signal.
- 5.0 ACCEPTANCE CRITERIA

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- 5.1 The CIVs operate as designed ~~described in~~ (refer to Section 3.1.5 and Section 6.2.4).
- 5.1.1 Valve operation (i.e., thrust, failure mode upon loss of motive power, opening and closing times).
- 5.2 The CIV closure times meet design requirements.
  - 5.2.1 FSAR Table 14.3-2 Item 2-10.
  - 5.2.2 FSAR Table 14.3-2 Item 2-14.
- 5.3 Verify that safety-related components meet electrical independence requirements and redundancy requirements.

**14.2.12.3.5 Containment Isolation Valves Leakage Rate (Test #028)**

- 1.0 OBJECTIVE
  - 1.1 To verify that the measured leakage through each containment penetration isolation valve when summed with the total of other Type B and C LRTs is within the limits as required by the Technical Specifications and 10 CFR 50, Appendix J.
- 2.0 PREREQUISITES
  - 2.1 Construction activities on the systems to be tested have been completed.
  - 2.2 Temporary pressurization equipment is installed and instrumentation is calibrated.
- 3.0 TEST METHOD
  - 3.1 Close the individual CIVs by the means provided for normal operation of each individual valve. The valves must be stroked to the closed position by the normal means to perform a valid leakage test.
  - 3.2 Perform 10 CFR 50 Appendix J, Type C test, by local pressurization of each penetration.
- 4.0 DATA REQUIRED
  - 4.1 Individual penetration leak data.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 Verify leak rates, when summed with the total of other Type B and C LRTs, do not exceed the allowable limits as required by the Technical Specifications and 10 CFR 50, Appendix J.
  - 5.2 The CIVs operate as designed ~~described in~~ (refer to Section 3.1.5, Section 3.8.1, and Section 6.2.6).

- Radial and vertical deflections of the containment wall adjacent to the equipment hatch opening shall be measured at twelve points around the hatch penetration. The twelve points shall be three locations each at the three, six, nine and twelve o'clock positions around the penetration.

4.2 Integrated leak rate data.

4.2.1 Containment temperature, pressure, and humidity.

4.2.2 Reference vessel temperature and pressure.

4.2.3 Atmospheric pressure and temperature.

4.2.4 Known leakage air flow.

5.0 ACCEPTANCE CRITERIA

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- 5.1 SIT results are satisfactory, in accordance with ASME BPV Code, Article CC-6000, as detailed in ~~Section 3.8.1~~ Section 3.8.1.7.1.
- 5.2 Containment vessel shows no signs of structural degradation following the SIT as designed ~~described in~~ (refer to Section 3.8.1).
- 5.3 The ILRT results are satisfactory as specified in Section 6.2.6.
  - 5.3.1 FSAR Table 14.3-1 Item 1-10.
  - 5.3.2 FSAR Table 14.3-2 Item 2-2.
- 5.4 Containment ~~performs as meets design requirements~~ (-described in refer to Section 3.1.5, Section 3.8.1, and Section 6.2.6).

**14.2.12.3.7 Reactor Coolant System Hydrostatic (Test #030)**

1.0 OBJECTIVE

1.1 To verify the integrity of the RCS pressure boundary and associated Safety Class I piping.

2.0 PREREQUISITES

2.1 The RCS is filled, vented, and above the minimum required temperature. Note that it is necessary to heat the RCS by running the RCPs so that the system shall remain above the minimum temperature during the soak period and the subsequent examination period.

2.2 All RCPs are functional.

2.3 A high head pump (1.25 times the RCS design pressure) is available for the hydrostatic test.

2.4 Primary safety valves are removed or gags are available for installation, after RCPs are secured.

2.5 Permanently installed instrumentation necessary for testing is functional and calibrated.

5.0 ACCEPTANCE CRITERIA

5.1 The RCS hydrostatic test meets the requirements of ASME BPV Code, Section III.

**14.2.12.3.8 Reactor Coolant Pump Motor Initial Operation (Test #031)**

1.0 OBJECTIVE

1.1 To verify the proper operation of each RCP motor.

1.2 To collect baseline data for each RCP motor.

1.3 To demonstrate electrical independence and redundancy of safety-related power supplies.

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2.0 PREREQUISITES

2.1 The RCP motor instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.2 Each RCP motor and its respective pump are uncoupled.

2.3 Support systems required for operation of each RCP motor are functional.

3.0 TEST METHOD

3.1 Start CCW flow to the RCP motor and observe indicating lights and alarms.

3.2 Rotate the RCP motor and verify that the wiring of motor leads and torque required to rotate the motor is correct using a torque wrench and phase rotation meter.

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3.3 Verify that RCP will not rotate in reverse direction using a torque wrench.

3.4 Verify the condition and the operation of the anti-rotation ratchet pawls.

3.5 Verify the condition and freedom of movement of the RCP flywheel.

3.6 Jog the RCP motor and verify correct rotation by independent means.

3.7 Start each RCP motor and verify that operation is within design limits.

3.8 Record the motor operating data.

3.9 Determine oil level setpoints of oil reservoirs by draining oil from motor reservoirs and subsequently refilling.

3.10 Simulate oil lift pumps and CCW system starting interlocks preventing RCP motor operation and observe effects.

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3.11 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Motor operating data.
- 4.2 Torque needed to rotate the RCP motors.
- 4.3 Setpoints at which indications, alarms, and interlocks occur.

5.0 ACCEPTANCE CRITERIA

5.1 The RCP motors, support systems, alarms, indications, and interlocks perform as designed ~~described in~~ (refer to Section 5.4.1).

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5.1.1 CW flow and indication to the RCP.

5.1.2 RCP instrumentation.

5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

5.3 Verify that the RCP anti-reverse rotation device does not allow reverse rotation when other RCPs are in operation.

5.3.1 FSAR Table 14.3-1 Item 1-5.

**14.2.12.3.9 Steam Generator Hydrostatic (Test #032)**

1.0 OBJECTIVE

- 1.1 To hydrostatically test the secondary side of the SG and portions of the following systems that can not be isolated from the SG:
  - 1.1.1 Main steam.
  - 1.1.2 Feedwater.
  - 1.1.3 SG blowdown.
  - 1.1.4 EFWSs.

2.0 PREREQUISITES

- 2.1 Construction activities on the SG secondary side are complete.
- 2.2 The RCS is available to be pressurized and the RCPs are functional.
- 2.3 The main steam safety valves are removed and blind flanges are installed.
- 2.4 Temporary hydrostatic test pump and relief valves are installed.
- 2.5 Temporary instrumentation (temperature and pressure) calibrated and installed.
- 2.6 Systems required to support the operation the RCS and RCPs are available.
- 2.7 Any permanent plant instrumentation not able to withstand hydrostatic pressure is removed from service.



3.0 TEST METHOD

- 3.1 Lower the SG water level below the feedwater sparger but within the narrow range (NR) level indication band for a period of 30 minutes (no feedwater shall be introduced into the generator through the sparger during this period).
- 3.2 Monitor for noise or vibration by stationing personnel as appropriate.
- 3.3 Initiate feedwater flow to restore SG level in a manner that simulates automatic EFWS actuation.
- 3.4 Repeat the test using the startup, standby pump to restore SG level in a manner that simulates automatic actuation.

4.0 DATA REQUIRED

- 4.1 Visually inspect the accessible portions of feedwater piping and piping supports following the performance of the test.
- 4.2 Visual inspection of SG sparger shall be performed prior to core load.

5.0 ACCEPTANCE CRITERIA

- 5.1 Perform a visual inspection of feedwater piping, supports, and sparger and determine if the integrity of components has not been violated with performance of EFWS initiation testing.

**14.2.12.3.11 Balance of Plant Piping Thermal Expansion Measurement (Test #034)**

1.0 OBJECTIVE

- 1.1 To demonstrate that the balance of plant (BOP) components are free to expand thermally as designed during initial plant heatup and return to their baseline cold position after the initial cooldown to ambient temperatures.

2.0 PREREQUISITES

- 2.1 This test is carried out in conjunction with the initial RCS heatup; prerequisite conditions for initial heatup of the RCS must be established.
- 2.2 Construction activities are complete on the pipes to be measured.
- 2.3 Adjustment, setting and marking of initial positions of spring hangers, hydraulic restraints, and special devices of the systems have been completed.
- 2.4 Temporary scaffolding and ladders are installed as required to make observations and record data.

3.0 TEST METHOD

- 3.1 Perform a visual inspection during HFT and precritical heatup for power escalation to verify that spring supports are within design range (i.e., indicator within spring scale) and recorded.
- 3.2 Perform a visual inspection of snubbers to verify they have not contacted either stop and are within expected travel range.
- 3.3 Perform a visual inspection of snubber piston scales to verify acceptance criteria for piston to stop gap is met. Hot displacement measurements of snubbers shall be obtained and motion shall be compared with predicted values.
- 3.4 Perform system walkthroughs during HFT to visually verify that piping and components are unrestricted from moving within their range.
- 3.5 Verify by observation or calculation (or both) that the snubbers shall accommodate the predicted thermal movement for systems that do not attain design operating temperature.
- 3.6 Inspect small pipe in the vicinity of connections to large pipe to verify that sufficient clearance and flexibility exists to accommodate thermal movements of the large pipe.
- 3.7 Obtain hot displacement measurements of the feedwater system (FWS) and EFWS during Phase IV Power Ascension Testing.
- 3.8 Re-inspect snubbers and spring supports, which required adjustments during the test in a subsequent hot condition to verify that adjustments are within design limits.

4.0 DATA REQUIRED

- 4.1 Tabulate position measurements for designated piping, spring supports, and snubbers at various temperature plateaus and the following reference points:
  - 4.1.1 Cold (ambient conditions).
  - 4.1.2 During heatup (transition from Mode 4 to Mode 3).
  - 4.1.3 Steady state HZP (pressure and temperature) conditions.
  - 4.1.4 During cooldown.
  - 4.1.5 After returning to ambient conditions.

5.0 ACCEPTANCE CRITERIA

14.2-32 → 5.1 Piping moves freely as ~~described in~~(refer to Section 3.9.2).

5.2 Thermal movement of piping at the locations of spring hangers and snubbers are within allowable travel range as ~~described in~~refer to Section 3.9.2).

- 5.3 Thermal movement of the piping at restricted measurement locations are within the acceptable limits or discrepant response is reconciled

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using acceptable reconciliation methods as ~~designed~~ (refer to ~~described~~ in Section 3.9.2).

#### 14.2.12.3.12 BOP Piping Vibration Measurement (Test #035)

##### 1.0 OBJECTIVE

- 1.1 To verify that piping layout and support or restraints (or both) are adequate to withstand normal transients without damage in the designated piping systems.
- 1.2 To demonstrate that flow induced vibration is sufficiently small to cause no fatigue or stress failures in the designated piping systems.

##### 2.0 PREREQUISITES

- 2.1 System components and piping supports have been installed in accordance with design drawings for system to be tested.
- 2.2 System piping has been installed in accordance with design drawings for system to be tested.
- 2.3 HFT or precritical heatup (or both) for power escalation are underway.
- 2.4 System piping has been filled and vented for normal operation.

##### 3.0 TEST METHOD

- 3.1 Perform an assessment of piping system vibration observed during system operation.

##### 4.0 DATA REQUIRED

- 4.1 Pipe response data to include piping drawings, vibration measurements and operating conditions.

##### 5.0 ACCEPTANCE CRITERIA

- 5.1 Steady state vibration testing based on limits established by the piping designers.
  - 5.1.1 Acceptance criteria are based on conservatively estimated stresses which are derived from measured velocities and conservatively assumed mode shapes.
- 5.2 Transient vibration testing based on limits established by the piping designers.
  - 5.2.1 No permanent deformation or damage in any system, structure or component important to nuclear safety is observed.
  - 5.2.2 All suppressors and restraints respond within their allowable ranges, between stops or with indicators on scale.

**14.2.12.3.13 Control Rod Drive Mechanism Control (Test #036)**

1.0 OBJECTIVE

- 1.1 To demonstrate proper input signals and proper sequencing of input signals to CRDM coils.
- 1.2 To demonstrate proper operation of the CRDM control system in functional modes.
- 1.3 To verify proper operation of the CRDM control system interlocks and alarms.

1.4 To demonstrate electrical independence and redundancy of power supplies.

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2.0 PREREQUISITES

- 2.1 Construction activities on the CRDM control system have been completed and system software is installed.
- 2.2 Cable continuity tests have been completed.
- 2.3 Special test instrumentation has been calibrated and is functional.
- 2.4 Special test equipment is functional.
- 2.5 RCCAs are installed in dummy or actual fuel assemblies, to allow movement of the RCCAs.
- 2.6 RCCAs are latched by lifting the drive shaft and observing the weight corresponding to a latched RCCA, prior to installing the reactor head.
- 2.7 Support systems required for operation of the CRDM control system are functional.
- 2.8 Reactor head installed, filled and vented to cool the CRDMs or an analysis has been performed to demonstrate that filling the CRDMs is not necessary.

3.0 TEST METHOD

- 3.1 Energize and latch CRDMs by closing the reactor trip breaker.
- 3.2 Observe the sequence in which withdraw and insert signals are passed to the appropriate CRDM coil using special test instrumentation.
- 3.3 Observe operation of the RCCA position indicators.
- 3.4 Operate the CRDM control system in functional modes.
- 3.5 Simulate input signals and observe operation of ~~interlocks and alarms~~the following:
  - 3.5.1 CRDM withdrawal inhibits interlocks.
  - 3.5.2 CRDM withdrawal sequence and overlap controls (control banks only).
  - 3.5.3 Partial reactor trip.

- 3.5.4 Realignment in proper overlap and sequence following a partial reactor trip.
  - 3.5.5 Park position.
  - 3.5.6 Bite position.
  - 3.5.7 Alarms.
  - 3.6 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 14.2-32 →
- 4.0 DATA REQUIRED
    - 4.1 CRDM coil current traces.
    - 4.2 CRDM control system rod step indications.
    - 4.3 CRDM control system operating data.
    - 4.4 Interlock and alarm actuation points.
  - 5.0 ACCEPTANCE CRITERIA
    - 5.1 The CRDM control system ~~performs as~~ meets design requirements described in (refer to Section 7.2.1).
      - 5.1.1 CRDM interlocks, controls, and alarms.
      - 5.1.2 CRDM latch operation.
    - 5.2 The RCCA bank withdrawal rate is within design limits.
      - 5.2.1 FSAR Table 14.3-1 Item 1-2.
    - 5.3 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.3.14 Pressurizer Safety Relief Valves (Test #037)**

1.0 OBJECTIVE

- 1.1 To verify the power operation setpoint of the pressurizer safety relief valves.
  - 1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.
  - 1.3 To verify remote manual operation of the pressurizer safety relief valves (PSRVs).
  - 1.4 To verify vibration response of the PSRV and its relief piping is acceptable.
  - 1.5 To verify piping displacements are acceptable.
- 14.2-32 →

2.0 PREREQUISITES

- 2.1 Construction activities on the pressurizer have been completed and associated instrumentation has been calibrated and is operating satisfactorily.
- 2.2 The RCS is at HZP (temperature and pressure).
- 2.3 Spring-operated pilot Relief valve lifting device with associated support equipment and calibration data is available.

14.2-32 → The PSRVs have been capacity and stroke time tested at a offsite test facility.

3.0 TEST METHOD

- 3.1 Increase the lifting force on ~~the safety valve~~ each spring-operated pilot valve, using a special lifting pilot valve actuator test device, until the ~~safety valve~~ main relief disk just starts to lift.
- 3.2 Determine setpoint pressure from the lifting device correlation data.
- 3.3 Adjust valve setpoint pressure if necessary and retest.
- 3.4 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function..
- 3.5 Verify remote manual operation of each PSRV.
- 3.6 Verify that piping displacement and vibration data have been acquired.

14.2-32 → Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function..

4.0 DATA REQUIRED

- 4.1 Pressurizer pressure and temperature at time of test.
- 4.2 Pressure applied to the lifting actuating device to lift the ~~safety valve~~ main relief disk off its seat.
- 4.3 Piping displacement and vibration data during each valve lift sequence.

5.0 ACCEPTANCE CRITERIA

- 5.1 ~~Safety valves perform as described in Section 5.4.1.1~~ The PSRVs respond to test overpressure conditions. Refer to the description in Section 5.4.13 and Section 5.2.2.
- 5.2 The PSRVs respond to manually initiated signals. Refer to the description in Section 5.4.13 and Section 5.2.2.

14.2-32 → Verify that safety-related components meet electrical independence requirements and redundancy requirements.

Piping displacement and vibration data is collected and reviewed.

PSRV capacity meets design requirements.

5.5.1 FSAR Table 14.3-1 Item 1-8.

PSRV measured stroke times meet design requirements.

- 5.6.1 [FSAR Table 14.3-1 Item 1-9.](#)
- 5.7 [PSRV setpoint meets design requirements.](#)
- 5.7.1 [FSAR Table 14.3-1 Item 1-65.](#)

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**14.2.12.3.15 Fuel Handling System (Test #038)**

1.0 OBJECTIVE

1.1 To verify the proper operation of the fuel handling system (FHS).

2.0 PREREQUISITES

- 2.1 Construction activities on the systems to be tested are complete.
- 2.2 Permanently installed instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Plant systems required to support testing are functional or temporary systems are installed and functional.
- 2.4 Special test instrumentation is available and calibrated.
- 2.5 The reactor vessel head and upper internals are removed.
- 2.6 The lower core barrel is installed and aligned.
- 2.7 Dummy fuel assemblies, dummy RCCAs and test weights are available.

3.0 TEST METHOD

- 3.1 Verify that the operation of the new fuel elevator and the associated interlocks is within design limits.
  - 3.1.1 [Verify each usable new fuel storage rack position is capable of storing a fuel assemble by performing a trial fit of the dummy fuel assembly \(drag test\) using the appropriate crane.](#)
- 3.2 Verify operation of the spent fuel handling [bridgerefueling machine](#) as follows:
  - 3.2.1 Check bridge trolley function is within design limits.
  - 3.2.2 Check that hoist speeds are within design limits.
  - 3.2.3 Load limits setpoints are within design limits.
  - 3.2.4 Interlocks function as designed.
  - 3.2.5 Limit switches function as designed.
- 3.3 Verify each usable spent fuel storage rack position is capable of storing a fuel assemble by performing a trial fit of the dummy fuel assembly\_ [\(drag test\)](#) using the spent fuel handling machine.
- 3.4 Verify that operation of the following transfer subsystems remotely is within design limits.
  - 3.4.1 Upender operation in the Fuel Building.

- 3.4.2 Upender operation in the Reactor Building.
- 3.5 Verify that operation of the reactor containment refueling machine as follows:
  - 3.5.1 Check bridge trolley function is within design limits.
  - 3.5.2 Check hoist speeds are within design limits.
  - 3.5.3 Load limits are within design limits.
  - 3.5.4 Interlocks function as designed.
  - 3.5.5 Limit switches function as designed.
- 3.6 Verify each core location is capable of accepting a fuel assembly by placing a dummy fuel assembly in each location (drag test) using the reactor containment refueling machine 14.2-32 ↗
- 3.7 Verify that operation of the refueling machine with the fuel assembly insert (FAI) guide tube installed is as follows:
  - 3.7.1 Check hoist speeds are within design limits.
  - 3.7.2 Load limits are within design limits.
  - 3.7.3 Interlocks function as designed.
  - 3.7.4 Limit switches function as designed.
- 3.8 Verify the following:
  - 3.8.1 Using the full sequence of focusing, camera tilt, and camera rotation verify the operation of the underwater television camera system is within design limits.
  - 3.8.2 Utilizing the complete fuel handling equipment, transfer a dummy fuel assembly from the new fuel elevator through a total fuel loading cycle in the reactor core and a total spent fuel cycle from the core to the spent fuel storage area both in automatic and manual modes of operation.
  - 3.8.3 Demonstrate the capabilities of the special fuel handling tools by verifying that operation with dummy fuel assembly and dummy RCCA meets design requirements.

4.0 DATA REQUIRED

- 4.1 Applicable indexing coordinates.
- 4.2 Monitoring instrumentation responses.

5.0 ACCEPTANCE CRITERIA

- 5.1 14.2-32 → The FHS ~~performs as~~ meets design requirements described in (refer to Section 9.1.4).
  - 5.1.1 Bridge trolley function is within design limits.
  - 5.1.2 Hoist speeds are within design limits.



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- 5.1.3 Load limits setpoints are within design limits.
- 5.1.4 Interlocks function as designed.
- 5.1.5 Limit switches function as designed.
- 5.1.6 Spent fuel rack storage cells are accessible or controls have been implemented to prevent attempted storage of fuel assemblies in these locations.
- 5.1.7 New fuel rack storage cells are accessible or controls have been implemented to prevent attempted storage of fuel assemblies in these locations.
- 5.1.8 Fuel handling tools function as designed.
- 5.1.9 Fuel transfer devices function as designed.

**14.2.12.3.16 Fuel Transfer System Operation and Leak Test (Test #039)**

1.0 OBJECTIVE

- 1.1 To verify the measured leakage through the fuel transfer tube when summed with the total of other Type B and Type C LRTs is within the limits as required by the Technical Specifications and 10 CFR 50, Appendix J and meets the requirements of the SIT.
- 1.2 To demonstrate the operation of the fuel transfer tube closure hatch.
- 1.3 To verify a leak tight seal between the spent fuel transfer penetration and the cask handling area, including the following:
  - 1.3.1 Supporting structure.
  - 1.3.2 Internal shell.
  - 1.3.3 Double barrier bellows.
  - 1.3.4 Flange into loading pit and upper cover.
  - 1.3.5 Docking flange.
  - 1.3.6 External shell.

2.0 PREREQUISITES

- 2.1 Construction activities on the fuel transfer tube have been completed.
- 2.2 Construction activities on the spent fuel transfer penetration have been completed.
- 2.3 Temporary pressurization equipment is installed and instrumentation calibrated.

3.0 TEST METHOD

- 3.1 Operate the fuel transfer tube closure hatch in accordance with manufacturer instructions.

- 3.2 Verify the hatch can be opened and closed within the stated amount of time.
- 3.3 Place the hatch in the closed position and perform a 10 CFR 50, Appendix J Type B LRT on the fuel transfer tube seal integrity at 110 percent design basis accident pressure.
- 3.4 Verify that the flange into loading pit and the upper cover provide a leak tight seal.

4.0 DATA REQUIRED

- 4.1 Fuel transfer tube assembly leak data.
- 4.2 Time to operate the fuel transfer hatch.
- 4.3 Spent fuel penetration assembly leak data.

5.0 ACCEPTANCE CRITERIA

- 5.1 The leak rate when summed with the total of other Type B and C LRTs does not exceed the limits as required by the Technical Specifications and 10 CFR 50, Appendix J.
- 5.2 The fuel transfer tube meets SIT acceptance criteria per ASME BPV Code, Section III, Division 1, Subsection NE.
- 5.3 The fuel transfer tube closure hatch operates in accordance with manufacturer instructions.
- 5.4 The fuel transfer tube penetration and quick closure hatch perform as designed (refer to ~~described in~~ Section 3.8.1 and Section 9.1.4).
- 5.5 The spent fuel penetration provides a leak tight seal in the floor of the loading pit.

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**14.2.12.4 Civil Components and Systems**

**14.2.12.4.1 Containment Polar Crane (Test #040)**

1.0 OBJECTIVE

- 1.1 To demonstrate the functional performance of the containment polar crane.

2.0 PREREQUISITES

- 2.1 Electric power available.
- 2.2 Containment polar crane instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Construction activities on the crane and associated equipment have been completed.

3.0 TEST METHOD

- 3.1 Verify functionality of trolley, bridge, and hoist.
- 3.2 Check hoist and trolley speeds.
- 3.3 Check capability of crane to position over required containment building equipment.
- 3.4 Perform a functional test of the polar crane at 100 percent of rated load.
- 3.5 Perform 125 percent static load capacity test.
- 3.6 Verify the operation of protective and safety devices.

4.0 DATA REQUIRED

- 4.1 Hoist and trolley speeds.
- 4.2 Verification of that operation of interlocks is within design limits.
- 4.3 Load capacity data.

5.0 ACCEPTANCE CRITERIA

- 5.1 The containment polar crane performs as meets design requirements described in (refer to Sections 3.8.3 and 9.1.5).
  - 5.1.1 Trolley, bridge, and hoist function as designed.
  - 5.1.2 Hoist and trolley speeds are within design limits.
  - 5.1.3 Polar crane is capable of being positioned over required containment building equipment.
  - 5.1.4 Polar crane protective and safety devices function as designed.
  - 5.1.5 Polar crane load tests are completed satisfactorily.

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**14.2.12.4.2 Fuel Building Cranes (Test #041)**

1.0 OBJECTIVE

- 1.1 To demonstrate the functional performance of the fuel handling cranes.

2.0 PREREQUISITES

- 2.1 Electric power available.
- 2.2 Fuel building cranes instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Construction activities on the crane and associated equipment have been completed.

3.0 TEST METHOD

- 3.1 Verify functionality of trolley, bridge, and hoist for each crane.

- 3.2 Check hoist and trolley speeds.
- 3.3 Check capability of cask handling and fuel handling crane to position over required fuel building equipment.
- 3.4 Perform a functional test of the cranes at 100 percent of rated load.
- 3.5 Perform 125 percent static load capacity test of the cask handling crane and the fuel handling crane.
- 3.6 Verify the operation of protective and safety devices.

4.0 DATA REQUIRED

- 4.1 Hoist and trolley speeds.
- 4.2 Verification of that operation of interlocks is within design limits.
- 4.3 Load capacity data.

5.0 ACCEPTANCE CRITERIA

- 5.1 The fuel handling cranes perform as designed described in(refer to Section 9.1.5).
  - 5.1.1 Trolley, bridge, and hoist function as designed.
  - 5.1.2 Hoist and trolley speeds are within design limits.
  - 5.1.3 Crane is capable of being positioned over required building equipment.
  - 5.1.4 Crane protective and safety devices function as designed.
  - 5.1.5 Crane load tests are completed satisfactorily.

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**14.2.12.4.3 Turbine Building Crane (Test #042)**

1.0 OBJECTIVE

- 1.1 To demonstrate the functional performance of the turbine building crane.

2.0 PREREQUISITES

- 2.1 Electric power available.
- 2.2 Turbine building crane instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Construction activities on the crane and associated equipment have been completed.

3.0 TEST METHOD

- 3.1 Verify functionality of trolley, bridge, and hoist.
- 3.2 Check hoist and trolley speeds.

- 3.3 Check capability of crane to position over required turbine building equipment.
- 3.4 Perform 125 percent load capacity test.

4.0 DATA REQUIRED

- 4.1 Hoist and trolley speeds.
- 4.2 Verification of that operation of interlocks is within design limits.
- 4.3 Load capacity data.

5.0 ACCEPTANCE CRITERIA

5.1 The turbine building crane meets manufacturers design specification.

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- 5.1.1 Trolley, bridge, and hoist function as designed.
- 5.1.2 Hoist and trolley speeds are within design limits.
- 5.1.3 Crane is capable of being positioned over required building equipment.
- 5.1.4 Crane protective and safety devices function as designed.
- 5.1.5 Crane load tests are completed satisfactorily.

**14.2.12.5 Distributed Utilities**

**14.2.12.5.1 Raw Water Supply System (Test #043)**

A COL applicant that references the U.S. EPR design certification will provide site-specific test abstract information for the raw water supply system. The following is a typical COLA test; if a site-specific test will be used, the COL applicant will provide the test.

1.0 OBJECTIVE

1.1 To demonstrate the ability of raw water supply system (RWSS) to supply filtered water to downstream systems (e.g., potable water, demineralized water system).

2.0 PREREQUISITES

- 2.1 Construction activities on the RWSS have been completed.
- 2.2 RWSS instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Support system required for operation of the RWSS is complete and functional.
- 2.4 Test instrumentation available and calibrated.
- 2.5 The RWSS intake is being maintained at the water level specified in the design documents.

2.6 The RWSS flow balance has been performed.

3.0 TEST METHOD

3.1 Verify that the RWSS pump and system flow meet design requirement (refer to Section 9.2.9).

3.2 Verify standby RWSS pump starts on low discharge pressure or a trip of the running pump.

4.0 DATA REQUIRED

4.1 Pump operating data.

4.2 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

5.1 The RWSS operates as designed (refer to Section 9.2.9).

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- 5.1.1 RWSS flow meets design requirements.
- 5.1.2 RWSS alarms, interlocks, and controls (manual and automatic) function as designed.
- 5.1.3 The RWSS pumps meet design requirements.

**14.2.12.5.2 Reserved (Test #044)**

**14.2.12.5.3 Seal Water Supply System (Test #045)**

1.0 OBJECTIVE

1.1 To demonstrate the ability of seal water supply system (SWSS) to supply filtered seal water under normal plant operations.

1.2 To verify that the SWSS provides adequate sealing water to systems containing radioactive fluids.

1.3 To verify that the SWSS provides adequate sealing water to the gaseous waste processing and operational chilled water system.

2.0 PREREQUISITES

2.1 Construction activities on the SWSS have been completed.

2.2 The SWSS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support system required for operation of the SWSS is complete and functional.

2.4 Test instrumentation available and calibrated.

2.5 The SWSS suction supply is being maintained at the water level (pressure) specified in the design documents.

2.6 The SWSS flow balance has been performed.

3.0 TEST METHOD

- 3.1 Verify SWSS pump and system flow meet design specifications.
- 3.2 Verify standby SWSS pump starts on low discharge pressure or a trip of the running pump.
- 3.3 Verify that the SWSS provides designed rated flow to systems that are supplied by the seal water header.
- 3.4 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

3.5 ~~Verify~~ Observe response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 9.2.7 for anticipated response).

3.6 Verify that operation of protective devices, controls, interlocks, instrumentation, and alarms meets design requirements.

3.7 Verify that the SWSS can meet the following minimum and maximum design requirements:

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- a. The SWSS pressure.
- b. The SWSS temperature.

4.0 DATA REQUIRED

- 4.1 Pump operating data.
- 4.2 Setpoints at which alarms and interlocks occur.
- 4.3 Valve performance data, where required.
- 4.4 Valve position indication.
- 4.5 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

5.1 The SWSS ~~performs as~~ meets design requirements described in (refer to Section 9.2.7).

- 5.1.1 SWSS pump and system flow meet design specifications.
- 5.1.2 Standby SWSS pump starts on low discharge pressure or a trip of the running pump.
- 5.1.3 SWSS provides designed rated flow to systems that are supplied by the seal water header.
- 5.1.4 System valves perform within design limits.

**14.2.12.5.4 Potable and Sanitary Water System (Test #225)**

1.0 OBJECTIVE

- 1.1 To demonstrate the ability of potable water system to supply potable water under normal plant operations.
- 1.2 To demonstrate the ability of sanitary water system to supply sanitary water under normal plant operations.

2.0 PREREQUISITES

- 2.1 Construction activities on the potable and sanitary water systems have been completed.
- 2.2 Potable and sanitary water systems instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Support system required for operation of the potable and sanitary water systems are complete and functional.
- 2.4 Test instrumentation available and calibrated.
- 2.5 The potable and sanitary water systems suction supplies are being maintained at the water level (pressure) specified in the design documents.

3.0 TEST METHOD

- 3.1 Verify potable and sanitary water system pump and system flow meet design specifications.
- 3.2 Verify that potable and sanitary water system interlocks and protective features perform as designed.
- 3.3 ~~Verify that potable water is supplied at the point of use and meets requirements.~~
- 3.4 ~~Verify that sanitary water is supplied at the point of use and meets requirements.~~

4.0 DATA REQUIRED

- 4.1 Pump operating data.
- 4.2 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

- 5.1 The potable and sanitary water system ~~performs as~~ meets design requirements described in (refer to Section 9.2.4).
  - 5.1.1 System flow is within design limits.
  - 5.1.2 Supplied water meets design requirements.

14.2-32 →



**14.2.12.5.5 Component Cooling Water System (Test #046)**

1.0 OBJECTIVE

- 1.1 To demonstrate the capability of the CCWS to provide treated cooling water under the following conditions:
  - 1.1.1 Normal unit operation.
  - 1.1.2 During unit cooldown.
  - 1.1.3 During refueling.
  - 1.1.4 During an emergency situation.

1.2 To demonstrate that system response to a simulated ESF actuation signal is as designed.

1.3 14.2-32 → To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the CCWS have been completed.
- 2.2 CCWS instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Test instrumentation is available and calibrated.
- 2.4 Plant systems required to support testing are functional, or temporary systems are installed and functional.

3.0 TEST METHOD

- 3.1 Demonstrate that operation of the surge tanks and their controls is within design limits.
- 3.2 Demonstrate that system and component flow paths, flowrateflow rates, and pressure drops including head versus flow verification for the CCW pumps is within design limits.
- 3.3 Perform a pump head versus flow verification for CCW pumps.
- 3.4 Verify the following responses to emergency signals:
  - a. Non-safety-related headers and the spent fuel pool heat exchangers are isolated on an SIAS.
  - b. CCW heat exchanger bypass valves close on an SIAS.
- 3.5 Verify the non-safety-related headers and RCP headers are isolated on a surge tank low-low level signal.
- 3.6 Verify a low CCW pump differential pressure signal starts the idle pump in each division.
- 3.7 Operate control valves remotely while:

- a. Observing each valve operation and position indication.
- b. Measuring valve performance data (e.g., thrust, opening and closing times).

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- 3.8 ~~Verify~~ Observe response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 9.2.2 for anticipated response).
- 3.9 Verify alarms, interlocks, indicating instruments, and status lights are functional.
- 3.10 Verify pump control from the MCR.
- 3.11 Demonstrate the ability of the CCWS in conjunction with the RHRS and essential service water system to perform a plant cooldown during HFT.
- 3.12 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
  - 4.1 Record pump head versus flow and operating data for each pump.
  - 4.2 Flow balancing data including flow to each component and throttle valve positions.
  - 4.3 Setpoints of alarms interlocks and controls.
  - 4.4 Valve performance data, where required.
  - 4.5 Valve position indication.
  - 4.6 Position response of valves to loss of motive power.
  - 4.7 Temperature data during cooldown.
  - 4.8 Response of CCW System to SIAS, CSAS, low-low surge tank level signal and CCW pump high differential pressure signal.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 The CCWS ~~performs as~~ meets design requirements described in (refer to Section 9.2.2).
    - 5.1.1 Operation of the surge tanks and their controls is within design limits.
    - 5.1.2 System and component flow paths, flow rates, and pressure drops including head versus flow verification for the CCW pumps is within design limits.
    - 5.1.3 Pump head versus flow verification for CCW pumps is within design limits.
    - 5.1.4 Response to emergency signals meets design requirements.

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- 5.1.5 Non-safety-related headers and RCP headers are isolated on simulated signals.
- 5.1.6 CCW pump differential pressure signal starts the idle pump in each division.
- 5.1.7 System valves meet design requirements.
- 5.1.8 Alarms, interlocks, indicating instruments, and status lights meet design requirements.
- 5.1.9 Verify pump control from the MCR.
- 5.1.10 Verify the ability of the CCWS in conjunction with the RHRS and essential service water system (ESWS) to perform a plant cooldown during HFT.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.5.6 Reserved (Test #047)**

**14.2.12.5.7 Essential Service Water System (Test #048)**

1.0 OBJECTIVE

- 1.1 To demonstrate the ability of the ~~essential service water system (ESWS)~~ to supply cooling water as designed under normal and emergency conditions.
- 1.2 To demonstrate the ability of the ESWS to provide cooling water to the SAHRS in beyond design basis conditions.
- 1.3 To demonstrate electrical independence and redundancy of power supplies.

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2.0 PREREQUISITES

- 2.1 Construction activities on the ESWS are complete and the system is functional.
- 2.2 ESWS instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Test instrumentation available and calibrated per applicable procedures.
- 2.4 CCWS available to provide a heat load.
- 2.5 Appropriate AC and DC power sources are available.
- 2.6 Support systems required for operation of the ESWS are complete and functional.
- 2.7 The Ultimate Heat Sink (UHS) is available and functional.

3.0 TEST METHOD

- 3.1 Demonstrate that ~~each~~the ESWS can be operated from the MCR.
- 3.2 Demonstrate that ~~each~~the ESWS starts automatically in response to an emergency signal.
- 3.3 Verify that the ESWS pumps supply cooling water at the rated flow and design conditions.
- 3.4 Verify ESWS water flow is supplied to components.
- 3.5 Verify alarms, interlocks, indicating instruments, and status lights are functional.
- 3.6 Verify head versus flow characteristics for the ESWS water pumps.
- 3.7 Record valve performance data, where required.
- 3.8 Record valve position indication.
- 3.9 Record position response of valves to loss of motive power.
- 3.10 Verify system baseline performance during HFT (with RHRS in service).

14.2-32

→ Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Record flows as required to components and throttle valve positions.
- 4.2 Record alarm, interlocks, and control setpoints.
- 4.3 Record pump head versus flow and operating data.
- 4.4 System operating parameters during HFT.
- 4.5 Verify Fflow to ~~the~~ CCW heat exchangers using ~~various~~the ESW pump in the normal and system alignment combinations.
- 4.6 ~~Valve diagnostic testing data (e.g., stroke time, developed thrust)~~Verify flow to the SAHRS using the dedicated ESW pump.
- 4.7 Valve position upon loss of motive power and valve position indication data.

5.0 ACCEPTANCE CRITERIA

14.2-32

5.1 The ESWS ~~performs as~~ meets design requirements described in(refer to Section 9.2.1).

- 5.1.1 Verify that each ESWS can be operated from the MCR.
- 5.1.2 Verify that each ESWS starts automatically in response to an emergency signal.
- 5.1.3 Verify that the ESWS pumps supply cooling water at the rated flow and design conditions.
- 5.1.4 Verify ESWS water flow supplied to components.

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- 5.1.5 Verify alarms, interlocks, indicating instruments, and status lights perform as designed.
- 5.1.6 Verify head versus flow characteristics for the ESWS water pumps meets design requirements.
- 5.1.7 Verify that system valves meet design requirements.
- 5.1.8 Verify system baseline performance during HFT (with RHRS in service).
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.5.8 Ultimate Heat Sink (Test #049)**

1.0 OBJECTIVE

- 1.1 To verify that the UHS is maintained by its associated support systems.
- 1.2 To demonstrate electrical independence and redundancy of power supplies.

14.2-32

2.0 PREREQUISITES

- 2.1 Construction activities on the UHS have been completed.
- 2.2 UHS makeup source available, as required.
- 2.3 UHS blowdown path available, as required.
- 2.4 The UHS system instrumentation has been calibrated and is functional for performance of the following test.
- 2.5 Test instrumentation available and calibrated per applicable procedures.

3.0 TEST METHOD

- 3.1 Simulate a range of temperature inputs and verify UHS response.
- 3.2 Verify that control logic starts forced draft fans and aligns critical components for UHS operation.
- 3.3 Perform valve performance tests (e.g., valve position response of valves to loss of motive power, thrust, stroke time)
- 3.4 Demonstrate that UHS makeup ~~flowrate~~flow rate meets design flow requirements.
- 3.5 Demonstrate that UHS blowdown ~~flowrate~~flow rate meets design flow requirements.
- 3.6 Demonstrate the operation of UHS level and temperature instruments and alarms.

14.2-32

Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 UHS makeup, blowdown, and air flow rates.
- 4.2 Valve performance data, where required.
- 4.3 Valve position indication.
- 4.4 Temperature and relative humidity trend data.
- 4.5 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

- 5.1 The UHS ~~performs as~~ meets design requirements described in (refer to Section 9.2.5).
  - 5.1.1 Verify that control logic starts forced draft fans and aligns critical components for UHS operation.
  - 14.2-32 → 5.1.2 Verify that valve performance tests (e.g., valve position response of valves to loss of motive power, thrust, stroke time) meet design requirements.
  - 5.1.3 Verify that UHS makeup flow rate meets design flow requirements.
  - 5.1.4 Verify that UHS blowdown flow rate meets design flow requirements.
  - 5.1.5 Verify that the operation of UHS level and temperature instruments and alarms meet design requirements.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

14.2.12.5.9 Reserved (Test #050)

14.2.12.6 General Supply Systems

14.2.12.6.1 Reserved (Test #051)

14.2.12.6.2 Safety Chilled Water (Test #052)

1.0 OBJECTIVE

- 1.1 To demonstrate proper operation of the safety chilled water system (SCWS).
- 1.2 To demonstrate electrical independence and redundancy of power supplies.

14.2-32 →

2.0 PREREQUISITES

- 2.1 Construction activities on the SCWS have been completed.

- 3.3 Demonstrate that each SCWS division starts automatically in response to each appropriate signal.
- 3.4 Verify that the chillers supply chilled water at the rated flow and design conditions.
- 3.5 Verify chilled water flow to each supplied component.
- 3.6 Verify alarms, interlocks, indicating instruments, and status lights are functional.
- 3.7 Verify system baseline performance during HFT.

3.8 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Record flows as required to components and throttle valve positions.
- 4.2 Record alarm, interlocks, and control setpoints.
- 4.3 Record chiller normal operating parameters.
- 4.4 Record pump head versus flow and operating data.
- 4.5 System operating parameters during HFT.

5.0 ACCEPTANCE CRITERIA

- 5.1 The SCWS operates as described in Section 9.2.8.
  - 5.1.1 Verify pump performance characteristics for the SCWS pumps meets design requirements.
  - 5.1.2 Verify that each SCWS division controls meet design requirements.
  - 5.1.3 Verify that each SCWS division starts automatically in response to each appropriate signal.
  - 5.1.4 Verify that the chillers supply chilled water at the rated flow and design conditions.
  - 5.1.5 Verify chilled water flow to each supplied component.
  - 5.1.6 Verify alarms, interlocks, indicating instruments, and status lights meet design requirements.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

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**14.2.12.6.3 Reserved (Test #053)**

**14.2.12.6.4 Fire Water Distribution System (Test #054)**

1.0 OBJECTIVE

1.1 To demonstrate the ability of the fire water distribution system (FWDS) to provide water at acceptable flows and pressures to protected areas.

## 2.0 PREREQUISITES

2.1 Construction activities on the FWDS have been completed.

2.2 FWDS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support systems required for operation of the FWDS are complete and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Verify that the fire water distribution system has two separate fresh water storage tanks that meet design requirements.

2.5.1 FSAR Table 14.3-3 Item 3-7.

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## 3.0 TEST METHOD

3.1 Demonstrate the head and flow characteristics of the fire water pumps and the operation of auxiliaries.

3.2 Verify control logic.

3.3 Verify flow rates in the various flow paths of the FWDS.

3.4 Verify alarms, indicating instruments, and status lights are functional.

3.5 Verify that the FWDS can be manually actuated, refer to Section 9.5.1.2.1.

## 4.0 DATA REQUIRED

4.1 Setpoints under which alarms and interlocks occur.

4.2 Pump head versus flow and operating data.



5.0 ACCEPTANCE CRITERIA

5.1 The FWDS operates as designed ~~described in~~(refer to Section 9.5.1, including manual features).

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5.1.1 Verify the head and flow characteristics of the fire water pumps and the operation of auxiliaries.

5.1.2 Verify FWDS control logic meets design requirements.

5.1.3 Verify flow rates in the various flow paths of the FWDS are installed per design.

5.1.4 Verify alarms, indicating instruments, and status lights meet design requirements.

5.1.5 Verify that the FWDS can be manually actuated (refer to Section 9.5.1.2.1).

5.1.6 Verify that the fresh water storage tanks minimum level alarms meet design requirements.

**14.2.12.6.5 Spray Deluge Systems (Test #055)**

1.0 OBJECTIVE

1.1 To demonstrate the ability of the spray deluge system (SDS) to provide effective spray pattern to protected areas.

2.0 PREREQUISITES

2.1 Construction activities on the SDS have been completed.

2.2 Support systems required for operation of the SDS are complete and functional.

2.3 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify sprinkler deluge spray patterns are not obstructed.

4.0 DATA REQUIRED

4.1 Pictures of deluge spray patterns.

5.0 ACCEPTANCE CRITERIA

5.1 The SDS operates as designed ~~described in~~(refer to Section 9.5.1).

5.1.1 Verify that spray patterns meet design requirements.

5.1.2 Activation devices (manual and automatic) meet design requirements.

**14.2.12.6.6 Sprinkler Systems (Test #056)**

1.0 OBJECTIVE

1.1 To demonstrate the ability of the sprinkler system (SPRS) to provide coverage of designated areas.

2.0 PREREQUISITES

2.1 Construction activities on the SPRS have been completed.

3.0 TEST METHOD

3.1 Verify drawings showing the location of installed sprinklers.

3.2 Verify sprinkler patterns are not obstructed.

3.3 Verify alarms, indicating instruments, and status lights are functional.

3.4 Verify that the sprinkler systems can be manually actuated (refer to Section 9.5.1.2.1).

4.0 DATA REQUIRED

4.1 Pictures of sprinkler spray nozzle patterns.

4.2 As-built drawings of installed sprinklers, including manual features.

5.0 ACCEPTANCE CRITERIA

5.1 The SPRS operates as designed ~~described in~~(refer to Section 9.5.1).

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5.1.1 Verify that spray patterns meet design requirements.

5.1.2 Activation devices (manual and automatic) meet design requirements.

**14.2.12.6.7 Gaseous Fire Extinguishing Systems (Test #057)**

1.0 OBJECTIVE

1.1 To demonstrate the ability of the gaseous fire extinguishing system (GFES) to provide non-combustible gas at acceptable to protected areas.

2.0 PREREQUISITES

2.1 Construction activities on the GFES have been completed.

2.2 Support systems required for operation of the GFES are complete and functional.

2.3 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify markup drawings showing the location of areas protected by GFES equipment.
- 3.2 Verify alarms, indicating instruments, and status lights are functional.
- 3.3 Verify that the gaseous fire extinguishing systems can be manually actuated (refer to Section 9.5.1.2.1).

4.0 DATA REQUIRED

- 4.1 As-built drawings showing the location of areas protected by GFES equipment.

5.0 ACCEPTANCE CRITERIA

- 5.1 The GFES operates as designed (refer to ~~described in~~ Section 9.5.1, including manual features).

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- 5.1.1 Verify that discharge patterns meet design requirements.
- 5.1.2 Activation devices (manual and automatic) meet design requirements.

**14.2.12.6.8 Reserved (Test #058)**

**14.2.12.7 Power Conversion Systems**

**14.2.12.7.1 Feedwater System (Test #059)**

1.0 OBJECTIVE

- 1.1 To demonstrate that the FWS, including startup feedwater pump, is capable of supplying feedwater to the SGs for normal operation.

- 1.2 To demonstrate electrical independence and redundancy of power supplies.

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2.0 PREREQUISITES

- 2.1 Construction activities on the FWS have been completed.
- 2.2 FWS instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Support systems required for operation of the FWS are complete and functional.
- 2.4 Test instrumentation available and calibrated.
- 2.5 Condensate system functional.
- 2.6 Main condenser functional.
- 2.7 Appropriate AC and DC power available.

3.0 TEST METHOD

- 3.1 Demonstrate design flow paths including economizer, downcomer, and cleanup recirculation (during HFT or PAT).
- 3.2 Demonstrate that startup feedwater valve alignments and flow paths function as designed.
- 3.3 Verify the starting, head, and flow characteristics of the motor-driven startup feedwater pump.
- 3.4 Demonstrate minimum flow recirculation protection using simulated inputs.
- 3.5 Verify operation of protective devices, controls, interlocks, instrumentation, and alarms using actual or simulated inputs function as designed.
- 3.6 Verify the starting, head, and flow characteristics of motor-driven feedwater pumps.
- 3.7 Operate feedwater isolation valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, stroke times).
- 3.8 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

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- 3.9 ~~Verify~~ Observe response of the feedwater isolation valves ~~fail~~ upon loss of motive power ~~to the position indicated in~~ (refer to Section 10.4.7 for anticipated response).
- 3.10 Verify the feedwater isolation valves close in response to ~~a MSIS~~ protective signals.
- 3.11 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 3.12 Demonstrate standby feedwater pumps response to loss of operating pumps.

4.0 DATA REQUIRED

- 4.1 Motor-driven startup feedwater pump head versus flow data.
- 4.2 Motor-driven feedwater pump head versus flow data.
- 4.3 Valve performance data, where required.
- 4.4 Valve position indication.
- 4.5 Position response of valves to loss of motive power.

- 4.6 Setpoints at which alarms and interlocks occur.
- 4.7 Feedwater isolation valve data.

5.0 ACCEPTANCE CRITERIA

- 5.1 The FWS (including startup feedwater) operates as designed (refer to ~~as described in~~ Section 10.4.7).
  - 5.1.1 Verify design flow paths including economizer, downcomer, and cleanup recirculation meet design requirements.
  - 14.2-32 → 5.1.2 Verify that startup feedwater valve alignments and flow paths function as designed.
  - 5.1.3 Verify the starting, head, and flow characteristics of the motor-driven startup feedwater pump meet design requirements.
  - 5.1.4 Verify that minimum flow recirculation protection meets design requirements.
  - 5.1.5 Verify operation of protective devices, controls, interlocks, instrumentation, and alarms function as designed.
  - 5.1.6 Verify the starting, head, and flow characteristics of motor-driven feedwater pumps meets design requirements.
  - 5.1.7 Verify that control valves control feedwater flow and system pressures as designed.
  - 5.1.8 Verify that standby feedwater pumps respond as designed to loss of operating pumps.
- 5.2 The feedwater isolation valves meet the test acceptance criteria (refer to ~~as described in~~ Section 10.4.7).
  - 5.2.1 Verify that isolation valves meet design requirements (e.g., response to signals, stroke speed).
- 5.3 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.7.2 Feedwater Heating System (Test #060)**

1.0 OBJECTIVE

- 1.1 To demonstrate that the feedwater heating system (FWHS) is capable of heating the FWS to the design temperature for normal plant operation. This test can only be performed during HFT or similar plant conditions.
- 1.2 To demonstrate the FWHS alarms and controls operate as designed.
- 1.3 To demonstrate electrical independence and redundancy of power supplies.

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2.0 PREREQUISITES

- 2.1 Construction activities on the FWHS have been completed.
- 2.2 Construction activities on the feedwater heater drains system have been completed.
- 2.3 FWHS instrumentation has been calibrated and is functional for performance of the following test.
- 2.4 Feedwater heater drains system instrumentation has been calibrated and is functional for performance of the following test.
- 2.5 Individual feedwater and main steam component testing is complete.
- 2.6 The power conversions systems are operating as required to support the test.

3.0 TEST METHOD

- 3.1 Verify the setpoints of alarms and interlock.
- 3.2 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

14.2-32 → 3.3 Verify ~~Observe~~ response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 10.4.7 for anticipated response).

- 3.4 Record the feedwater temperature to the SGs at maximum attainable feedwater flow and compare the readings to those predicted by the secondary model for similar conditions.
- 3.5 Demonstrate that the high pressure feedwater heating system level controls maintain level as designed and drain to the deareator.
- 3.6 Demonstrate that the low pressure feedwater heaters level controls maintain level as designed and drain to the main condenser.

4.0 DATA REQUIRED

- 4.1 Valve performance data, where required.
- 4.2 Valve position indication.
- 4.3 Position response of valves to loss of motive power.
- 4.4 Setpoints at which alarms and interlocks occur.
- 4.5 Feedwater temperature and feedwater ~~flowrate~~flow rate for each heater group.
- 4.6 Level controllers trend data.

5.0 ACCEPTANCE CRITERIA

- 5.1 The FWHS ~~performs as~~ meets design requirements (refer to described in Section 10.4.7).
- 5.1.1 Verify that alarms and interlocks function as designed.
- 5.1.2 Verify that system control and bypass valves meet design requirements.
- 5.1.3 Verify that feed water temperatures at the feedwater exit meet design requirements.

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**14.2.12.7.3 Main Steam – Turbine Bypass Systems (Test #061)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the main steam system (MSS).
- 1.2 To demonstrate the operation of the turbine bypass system (TBS).
- 1.3 To demonstrate electrical independence and redundancy of power supplies.

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2.0 PREREQUISITES

- 2.1 Construction activities on the MSS have been completed.
- 2.2 Construction activities on the TBS have been completed.
- 2.3 MSS and TBS instrumentation has been calibrated and is functional for performance of the following test.
- 2.4 Support systems required for operation of the MSS and TBS are complete and functional.
- 2.5 Test equipment is available and test instrumentation is calibrated.

3.0 TEST METHOD

- 3.1 Demonstrate automatic drain valve operation.
- 3.2 Demonstrate flow paths.
- 3.3 Verify opening of the turbine bypass valves in response to a signal simulating turbine trip and steam pressure above setpoint.
- 3.4 Verify the functionality of the main steam relief train (MSRT) valves at HZP steam pressure during HFT.
- 3.5 Verify the functionality of the turbine bypass valves at no-load steam pressure during HFT.
- 3.6 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

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- 3.7 Verify Observe response of the turbine bypass valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 10.4.4 for anticipated response).
- 3.8 Verify that operation of designated components such as protective devices, controls, interlocks, instrumentation, and alarms using actual or simulated inputs function as designed.
- 3.9 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
  - 4.1 Valve performance data, where required.
  - 4.2 Valve position indication.
  - 4.3 Position response of valves to loss of motive power.
  - 4.4 Setpoints at which alarms and interlocks occur.
  - 4.5 Flow path data.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 The MSS performance as designed (~~refer to described in~~ Section 10.4.4).
  - 5.2 Turbine bypass valves open in response to a signal simulating turbine trip and controls steam pressure, as designed (~~refer to described in~~ Section 10.4.4).
  - 5.3 Turbine bypass valves fail upon loss of motive power as designed (refer to Section 10.4.4).
  - 5.4 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.7.4 Main Steam Safety Valve (Test #062)**

- 1.0 OBJECTIVE
  - 1.1 To verify the popping pressure of the MSS safety valves during HFT.
  - 1.2 To verify an acceptable alternative method is to perform the setpoint verification at a certified testing facility.
  - 1.3 To demonstrate electrical independence and redundancy of power supplies.
- 2.0 PREREQUISITES
  - 2.1 Construction activities on the main steam safety valves have been completed.



- 2.2 MSS instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Support systems required for operation of the main steam safety valves are complete and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 MSS is at HZP (pressure and temperature), which is a suitable temperature and pressure for valve testing.
- 2.6 Lifting device with associated support equipment and calibration data is available.

3.0 TEST METHOD

- 3.1 Increase the lifting force on the safety valve, using the lifting device until the safety valve starts to simmer.
- 3.2 Determine popping set pressure.
- 3.3 Adjust valve popping set pressure if necessary and retest.
- 3.4 Repeat until three consecutive pops within the required range are obtained.
- 3.5 Verify safety valves have no seat leakage.

14.2-32 →

Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 MSS pressure and temperature.
- 4.2 Pressure applied to the lifting device to lift the safety valve off its seat.
- 4.3 Popping pressure of each main steam safety valve.

5.0 ACCEPTANCE CRITERIA

- 5.1 The main steam safety valves perform as designed (refer to ~~described in~~ Section 10.3).
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.7.5 Main Steam Isolation Valves and MSIV Bypass Valves (Test #063)**

1.0 OBJECTIVE

- 1.1 To demonstrate the functional performance of the main steam isolation valves (MSIV) and MSIV bypass valve controls.
- 1.2 To demonstrate the proper operation of the MSIVs at normal operating temperatures, during HFT.

- 1.3 To demonstrate electrical independence and redundancy of safety-related power supplies.
- 14.2-32 →
- 2.0 PREREQUISITES
  - 2.1 Construction activities on the MSIVs have been completed.
  - 2.2 MSS instrumentation has been calibrated and is functional for performance of the following test.
  - 2.3 Support systems required for operation of the MSIVs are complete and functional.
  - 2.4 Test equipment is available and test instrumentation is calibrated.
- 3.0 TEST METHOD
  - 3.1 Operate MSIV and MSIV bypass valves remotely while:
    - a. Observing each valve operation and position indication.
    - b. Measuring valve performance data (e.g., thrust, stroke times) at ambient and HFT conditions.
  - 14.2-32 → 
 3.2 Verify Observe response of the MSIVs and MSIV bypass valves ~~fail~~ upon loss of motive power ~~to the position indicated in~~ (refer to Section 10.3\_ for anticipated response).
  - 3.3 Verify MSIV and MSIV bypass valve controls, alarms, and interlocks.
  - 3.4 Verify MSIV and MSIV bypass valve response to MSIS.
  - 3.5 Verify MSIV and MSIV bypass valve seat leakage.
  - 3.6 Perform MSIV drift test.
  - 3.7 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
  - 4.1 MSIV and MSIV bypass valve performance data at ambient and HFT conditions.
  - 4.2 Valve position indication.
  - 4.3 Position response of valves to a loss of motive power.
  - 4.4 Setpoints at which alarms and interlocks occur.
  - 4.5 MSIV and MSIV bypass valve seat leakage.
  - 4.6 MSIV and MSIV bypass valve response to MSIS.
  - 4.7 MSIV drift data.
- 5.0 ACCEPTANCE CRITERIA

- 3.2 ~~Verify~~ Observe response of the MSIVs and MSIV bypass valves ~~fail~~ upon loss of motive power ~~to the position indicated in~~ (refer to Section 10.3 for anticipated response).
- 3.3 Verify MSIV and MSIV bypass valve controls, alarms, and interlocks.
- 3.4 Verify MSIV and MSIV bypass valve response to MSIS.
- 3.5 Verify MSIV and MSIV bypass valve seat leakage.
- 3.6 Perform MSIV drift test.
- 3.7 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 MSIV and MSIV bypass valve performance data at ambient and HFT conditions.
- 4.2 Valve position indication.
- 4.3 Position response of valves to a loss of motive power.
- 4.4 Setpoints at which alarms and interlocks occur.
- 4.5 MSIV and MSIV bypass valve seat leakage.
- 4.6 MSIV and MSIV bypass valve response to MSIS.
- 4.7 MSIV drift data.

5.0 ACCEPTANCE CRITERIA

- 5.1 The MSIVs and MSIV bypass valves operate as designed (refer to ~~described in~~ Section 10.3).
- ~~5.2 The MSIVs and MSIV bypass valves meet the test acceptance criteria described in Section 10.3.~~
  - 5.1.1 Verify that valve meet design requirements (e.g., stroke time, thrust, seat leakage, loss of motive power).
    - FSAR Table 14.3-1, Item 1-62.
  - 5.1.2 Verify that system controls, alarms, and interlocks function as designed.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

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**14.2.12.7.6 Turbine Gland Sealing System (Test #064)**

1.0 OBJECTIVE

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- 3.2 ~~Verify~~Observe response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 10.4.3 for anticipated response).
- 3.3 Place the TGSS in operation using auxiliary steam during turbine startup.
- 3.4 Verify that operation of the TGSS as turbine load is increased functions as designed.
- 3.5 Verify that performance of the sealing steam exhauster blowers and the sealing steam condenser function as designed.
- 3.6 Verify that operation of the high pressure turbine gland spillover valve for dumping excess gland seal leakage functions as designed.
- 3.7 Verify that operation of protective devices, controls, interlocks, instrumentation, and alarms function as designed.
- 4.0 DATA REQUIRED
  - 4.1 Valve performance data, where required.
  - 4.2 Valve position indication.
  - 4.3 Position response of valves to loss of motive power.
  - 4.4 Setpoints at which alarms and interlocks occur.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 The TGSS ~~performs as~~meets design requirements (refer to ~~described in~~ Section 10.4.3).
    - 5.1.1 TGSS provides adequate sealing of the turbine shaft.
    - 5.1.2 TGSS valves thrust, opening times, closing times, and controls (manual and automatic) meet design requirements.
    - 5.1.3 TGSS alarms, interlocks, and system controls meet design requirements

**14.2.12.7.7 Main Condenser and Main Condenser Evacuation System (Test #065)**

- 1.0 OBJECTIVE
  - 1.1 To demonstrate the ability of the main condenser and main condenser evacuation systems (CES) to provide a continuous heat sink for normal operation.
  - 1.2 To demonstrate the ability of the main condenser and CES to provide a sink for the turbine bypass system.
- 2.0 PREREQUISITES
  - 2.1 Construction activities on the main condenser and CES have been complete.

- 2.2 Main condenser and CES instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Support systems required for operation of the main condenser and CES are complete and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 Steam seals and lagging are available.
- 2.6 Turbine is on turning gear.
- 2.7 All electrical testing is complete on the vacuum pumps and condenser valves.

3.0 TEST METHOD

- 3.1 Verify the vacuum integrity of the condenser by performing the following tests:
  - 3.1.1 Hydrostatic test of the condenser with the water boxes clean and dry.
  - 3.1.2 Establish a vacuum and determine sources of in-leakage with helium, sulfur hexafluoride or equivalent tracer gas. (Look for leaks at each valve bonnet and at the dog-bone seal between the turbine and the condenser with the seal clean and dry).
- 3.2 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

14.2-32 → 3.3 Verify ~~Observe~~ response of power-operated valves fail upon loss of motive power ~~as designed~~.

- 3.4 Demonstrate that operation of the vacuum pumps with design operating modes and flow paths function as designed.
- 3.5 Verify operation of protective devices, controls, interlocks, instrumentation, and alarms using actual or simulated inputs function as designed.
- 3.6 Demonstrate the operation of the condenser makeup and reject to the feedwater tank deaerator controls.
- 3.7 Demonstrate the operation of the automatic condenser cleaning system.

4.0 DATA REQUIRED

- 4.1 Valve performance data, where required.
- 4.2 Valve position indication.
- 4.3 Position response of valves to loss of motive power.

4.4 Setpoints at which alarms and interlocks occur.

4.5 Vacuum pump running data.

5.0 ACCEPTANCE CRITERIA

5.1 The main condenser and CES perform as designed (refer to ~~described~~ in Section 10.4.2).

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5.1.1 Condenser vacuum is established within design limits.

5.1.2 Condenser air leakage is within established limits.

5.1.3 Condenser valves thrust, opening times, closing times, failure mode upon loss of motive power, and controls (manual and automatic) function as designed.

5.1.4 Condenser alarms, interlocks, instrumentation, and controls (automatic and manual) function as designed.

**14.2.12.7.8 Condensate System (Test #066)**

1.0 OBJECTIVE

1.1 To demonstrate that the condensate system (CS) is capable of supplying an adequate flow of water at the design pressure to support the remainder of the power conversion system.

2.0 PREREQUISITES

2.1 Construction activities on the CS have been completed.

2.2 The CS instrumentation has been calibrated and is functional for performance of the following test.

2.3 Support systems required for operation of the CS are complete and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Plant conditions are such to provide a flow path from the condensate pumps to the feedwater tank.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify head versus flow characteristics for the condensate pumps.

3.3 Demonstrate that operation of the feedwater tank deaerator meets design requirements.

3.4 Demonstrate that operation of design flow paths including system cleanup operation function as designed.

3.5 Demonstrate that operation of minimum flow recirculation protections meet design requirements.

- 3.6 Demonstrate that operation of the hotwell level control system meet design requirements.
- 3.7 Verify that operation of designated components, such as protective devices, controls, interlocks, instrumentation, and alarms using actual or simulated inputs function as designed.
- 3.8 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

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3.9 ~~Verify~~ Observe response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 10.4.7 for anticipated response).

4.0 DATA REQUIRED

- 4.1 Head versus flow performance and pump operating data.
- 4.2 Valve performance data, where required.
- 4.3 Valve position indication.
- 4.4 Position response of valves to loss of motive power.
- 4.5 Setpoints at which alarms and interlocks occur.
- 4.6 Setpoints of the hotwell level controls.
- 4.7 Setpoints of the pumps minimum flow recirculation protection.

5.0 ACCEPTANCE CRITERIA

- 5.1 The CS operates as designed (refer to ~~described in~~ Section 10.4.7).
  - 5.1.1 CS pumps, including pump seals, perform as designed.
  - 5.1.2 The CS alarms, interlocks, protective devices, and controls (automatic and manual) function as designed.
  - 5.1.3 CS valves perform as designed (e.g., thrust, seat leakage, opening time, closing time, bonnet air in-leakage, failure mode upon loss of motive power).

**14.2.12.7.9 Steam Generator Blowdown System (Test #067)**

1.0 OBJECTIVE

- 1.1 To verify the proper operation of the SG blowdown system (SGBS).
- 1.2 To demonstrate electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the SGBS have been completed.
- 2.2 The SGBS instruments have been calibrated and are functional for performance of the following test.
- 2.3 Support systems required for operation of the SGBS are complete and functional.
- 2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify the flow paths for generator blowdown and subsequent condensate recycle during HFT.
- 3.2 Verify blowdown flow path ~~flowrate~~flow rates during HFT.
- 3.3 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).

- 3.4 ~~Verify~~Observe response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 10.4.8 for anticipated response).
- 3.5 Verify that operation of the flash tank, valves, and heat exchanger in operational modes and flow paths function as designed.
- 3.6 Verify that the operation of protective devices, controls, interlocks, and alarms using actual or simulated inputs meet design requirements.
- 3.7 Verify system response to the following:
  - 3.7.1 The CIAS meets design requirements.
  - 3.7.2 EFAS.
- 3.8 Verify SG wet layup system operations.
- 3.9 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

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4.0 DATA REQUIRED

- 4.1 Valve performance data, where required.
- 4.2 Valve position indication.
- 4.3 Position response of valves to loss of motive power.
- 4.4 Setpoints at which alarms and interlocks occur.
- 4.5 Response to MSIS, CIAS and EFAS.
- 4.6 SG blowdown flow path ~~flowrate~~flow rates.



5.0 ACCEPTANCE CRITERIA

5.1 The SGBS operates as designed (refer to ~~described in~~ Section 10.4.8).

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5.1.1 SGBS alarms, interlocks, protective devices, and controls (manual and automatic) respond as required.

5.1.2 SGBS flow instrumentation performs as designed.

5.1.3 SGBS valves perform as designed (i.e., thrust, opening times, closing times, ability to initiate and terminate SGBS flow without introducing water hammers).

5.1.4 SGBS responds as designed to isolation signals.

5.1.5 SGBS flow rates meet design requirements.

5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.7.10 Steam Turbine (Test #068)**

1.0 OBJECTIVE

1.1 To demonstrate functional performance of the steam turbine controls.

1.2 To demonstrate functional performance of the steam turbine support system.

1.3 To perform initial operation of the steam turbine system (HFT and PAT).

1.4 To verify the steam turbine generator trips in response to the following:

1.4.1 Simulated reactor trip signal.

1.4.2 Simulated loss of condenser vacuum signal.

2.0 PREREQUISITES

2.1 Construction activities on the steam turbine system are complete.

2.2 Steam turbine system instrumentation has been calibrated and is functional for the performance of the following test.

2.3 Appropriate test equipment is available and has been calibrated.

2.4 Fluid levels throughout the system meet design limits. Personnel safety shall limit proximity to lubricating and hydraulic oils.

2.5 Schedule visual inspection of the secondary side of the SG following testing.

2.6 Appropriate AC and DC power sources are available and functional.

2.7 Support systems required for the steam turbine system are complete and functional.

2.8 MSS is available.

2.9 Main condenser is available.

3.0 TEST METHODS

3.1 Demonstrate the electro hydraulic control (EHC) system performs the following:

3.1.1 That turbine turning gear engages and disengages as designed.

3.1.2 That automatic control of turbine speed and acceleration functions through the entire speed range.

3.1.3 That automatic control of load and loading rate from auxiliary to full load, with continuous load adjustment and discrete loading rates.

3.1.4 Standby manual control of speed and load is functional when it becomes necessary to take the primary automatic control out of service.

3.1.5 Limiting of load in response to preset limits on operating parameters.

3.2 Verify that detection of dangerous or undesirable operating conditions, annunciation of detected conditions, and initiation of control response to such conditions meets design requirements, as follows:

3.2.1 Monitoring the status of the control systems including the power supplies and redundant control circuits.

3.2.2 Testing of valves and controls including response to a simulated reactor trip signal and simulated loss of condenser vacuum signal.

3.2.3 Pre-warming of valve chest and turbine rotor.

3.3 Perform steam turbine performance test per latest edition of ASME PTC-6 (Reference 3).

3.4 Operate control valves remotely while:

a. Observing each valve operation and position indication.

b. Measuring valve performance data (e.g., thrust, opening and closing times).

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3.5

Verify Observe response of power-operated valves ~~fail~~ upon loss of motive power ~~as designed~~ (refer to Section 10.3 for anticipated response).

3.6 Demonstrate turbine lube oil system operation.

3.7 Demonstrate hydrogen oil-sealed cooling system for rotor cooling operation.

3.8 Demonstrate stator water cooling system operation.

3.9 Demonstrate moisture separators, reheaters, and extraction steam systems operation.

4.0 DATA REQUIRED

4.1 Setpoint at which alarms and interlocks occur.

4.2 Setpoints of automatic trips.

4.3 Conditions under which manual trips operate.

4.4 Verification of control logic combinations.

4.5 Valve logic verification of EHC system.

4.6 Valve performance data, where required.

4.7 Valve position indication.

4.8 Position response of valves to loss of motive power.

4.9 Operating data and function verification of associated turbine support systems.

5.0 ACCEPTANCE CRITERIA

5.1 The steam turbine system and support systems perform as designed (refer to ~~described in~~ Section 10.3).

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5.1.1 Turbine turning gear engages and disengages as designed.

5.1.2 Turbine alarms, interlocks, protective devices, and controls (manual and automatic) meet design requirements.

5.1.3 Turbine valves (e.g., stroke speed, failure mode upon loss of motive power, ability to control turbine speed) meet design requirements.

5.1.4 Turbine performance meets design requirements.

5.2 Steam turbine performance is as required by vendor ratings.

5.3 Steam turbine generator trip signal is generated in response to a simulated reactor trip signal as designed (refer to ~~described in~~ Section 10.2).

5.4 Steam turbine generator trip is generated in response to a simulated loss of condenser vacuum signal as designed (refer to ~~described in~~ Section 10.2).

**14.2.12.7.11 Circulating Water Supply System (Test #069)**

A COL applicant that references the U.S. EPR design certification will provide site-specific test abstract information for the circulating water supply system. The following is a typical COLA test; if a site-specific test will be used, the COL applicant will provide the test.

1.0 OBJECTIVE

1.1 To demonstrate the ability of the circulating water supply system (CWS) to provide a continuous supply of cooling water to the main condensers and return the water to the cooling tower for heat dissipation.

2.0 PREREQUISITES

- 2.1 Construction activities on the CWS have been completed.
- 2.2 The CWS instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Support systems required for operation of the CWS are complete and functional.
- 2.4 Intake structure at the required level and water quality within limits.
- 2.5 Temporary test instruments installed and calibrated.

3.0 TEST METHOD

- 3.1 Verify head versus flow and functional characteristics for the circulating water supply pumps.
- 3.2 Verify required alarms and verify the corresponding actions.
- 3.3 Verify manual and automatic systems controls function as designed.
- 3.4 Verify that the cooling tower makeup pumps are capable of maintaining cooling tower level and blowdown during maximum design conditions.

4.0 DATA REQUIRED

- 4.1 Verification of trips and alarms.
- 4.2 Record pump head versus flow and operating data.
- 4.3 Flow data to upper and lower basins of the cooling tower.

5.0 ACCEPTANCE CRITERIA

5.1 The CWS ~~performs as~~ meets design requirements (refer to described in Section 10.4.5).

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- 5.1.1 CWS alarms, interlocks, and controls (manual and automatic) function as designed.
- 5.1.2 CWS pump performance meets design requirements.
- 5.1.3 CWS pumps are capable of maintaining basin levels, as designed.

**14.2.12.7.12 Reheater Drains System (Test #070)**

1.0 OBJECTIVE

- 5.1 The RHDS ~~performs as described in~~ meets design requirements (refer to Section 10.4.7).
- 5.1.1 RHDS alarms, interlocks, and controls (manual and automatic) function as designed.
- 5.1.2 RHDS valves perform as designed (i.e., opening times, closing times, and ability to control feedwater heater levels).
- 5.1.3 RHDS pumps perform as designed.
- 5.1.4 RHDS feedwater levels control feedwater heater levels as designed.

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**14.2.12.7.13 Secondary Sampling System (Test #071)**

1.0 OBJECTIVE

1.1 To verify the ability of secondary sampling system (SECSS) to collect and deliver representative samples of liquids and gases in various process systems to sample stations for chemical and radiological analysis during operation, cooldown and standby operation.

1.2 To demonstrate electrical independence and redundancy of power supplies.

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2.0 PREREQUISITES

- 2.1 Construction activities on the systems to be tested have been completed.
- 2.2 Systems being sampled are at or near normal operating pressure and temperature.
- 2.3 Calibrating gases and solutions are available.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 SECSS instrumentation has been calibrated and is functional for performance of the following test.

3.0 TEST METHOD

- 3.1 Withdraw fluid at each sample point, verifying adequate sample flow.
- 3.2 Verify that operation of alarms and interlocks meets design requirements.
- 3.3 Verify that operation of pump and heat exchangers in normal operation using normal flow paths meets design requirements.
- 3.4 Verify the analytical instrumentation provides indication and response that meet the design requirements.
- 3.5 Calculate the holdup times using the as-built piping lengths, piping volume and measured ~~flowrate~~ flow rate for the following:
  - 3.5.1 SG samples.

- 3.5.2 Blowdown demineralizer samples.
- 3.6 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).
- 3.7 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.3.2).
- 3.8 Verify that operation of continuous monitors and verify flow meets design requirements.
- 3.9 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

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4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms and interlocks occur.
- 4.2 Sampling ~~flowrate~~ flow rate from each sample point.
- 4.3 Analytical instrument data.
- 4.4 Valve performance data, where required.
- 4.5 Valve position indication.
- 4.6 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

- 5.1 ~~The SECSS performs as~~ meets design requirements (refer to described in Section 9.3.2).
  - 5.1.1 SECSS alarms, interlocks, and controls (manual and automatic) function as designed.
  - 5.1.2 SECSS valves perform as designed (i.e., opening times, closing times, and pressure/temperature controls).
  - 5.1.3 SECSS holdup times meet design requirements.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

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**14.2.12.7.14 Steam Generator Blowdown Demineralizing System (Test #072)**

1.0 OBJECTIVE

- 1.1 To verify the ability of SG blowdown demineralizing system (SGBDMS) to clean the SG blowdown by a combination of filtration and ion exchange.

2.0 PREREQUISITES

- 2.1 Construction activities on the systems to be tested have been completed.
- 2.2 Systems being sampled are at or near normal operating pressure and temperature.
- 2.3 Calibrating gases and solutions are available.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 Secondary sampling system instrumentation has been calibrated and is functional for performance of the following test.

3.0 TEST METHOD

- 3.1 Verify by physical inspection that the filter housing is constructed and assembled in a manner that doesn't permit bypass flow paths.
- 3.2 Verify that operation of alarms and interlocks meet design requirements.
- 3.3 Verify the analytical instrumentation provides indication and response that meets design requirements of ion exchanger outlet chemistry.
- 3.4 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).
- 3.5 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 10.4.8).

4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms and interlocks occur.
- 4.2 Valve performance data, where required.
- 4.3 Valve position indication.
- 4.4 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

5.1 The SGBDMS ~~performs as~~ meets design requirements (refer to described in Section 10.4.8).

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5.1.1 SGBDMS alarms, interlocks, and controls (manual and automatic) function as designed.

5.1.2 SGBDMS valves perform as designed (i.e., opening times, closing times, and ability to control feedwater heater levels).

**14.2.12.8 Heating Ventilation and Air Conditioning (HVAC) Systems**

**14.2.12.8.1 Containment Building Cooling (Test #073)**

1.0 OBJECTIVE

1.1 To demonstrate the capability of the containment cooling and ventilation system to maintain acceptable temperature limits and air quality in the containment during normal operations and normal shutdown.

2.0 PREREQUISITES

- 2.1 Major construction activities inside the containment building have been completed.
- 2.2 Construction activities on the containment cooling and ventilation system have been completed.
- 2.3 Containment cooling and ventilation system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.4 Support systems required for operation of the containment cooling and ventilation systems are complete and functional.
- 2.5 Test instrumentation is available and calibrated.
- 2.6 The RCS is at normal operating temperature and pressure during HFT.

3.0 TEST METHOD

- 3.1 Verify the operation of the containment recirculation cooling units.
- 3.2 Verify the operation of the reactor pit cooling fans.
- 3.3 Verify operation of the containment purge fans (both full flow and low flow).
- 3.4 Perform air balance as appropriate for each subsystem.

4.0 DATA REQUIRED

- 4.1 Operation of interlocks and set points.
- 4.2 Air balancing verification.
- 4.3 Fan operating data.
- 4.4 Containment building temperature data.
- 4.5 Prefilter, high efficiency particulate air (HEPA) filter and carbon absorber data for containment air clean up filtration units.

5.0 ACCEPTANCE CRITERIA

5.1 The containment cooling and ventilation system perform as designed (refer to ~~described in~~ Section 9.4.7).

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- 5.1.1 –Containment Building cooling alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.
- 5.1.2 Containment Building cooling fan performance meets design requirements.
- 5.1.3 Containment Building cooling dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.
- 5.1.4 Containment Building cooling air balance meets design requirements.

**14.2.12.8.2 Containment Building Cooling Subsystem (Test #074)**

1.0 OBJECTIVE

- 1.1 To verify the proper operation of the containment building cooling subsystem. This system provides cool air to the reactor coolant pumps (RCP), steam generators (SG), chemical and volume control system (CVCS), control rod drive mechanism (CRDM) system and vent and drain system.

2.0 PREREQUISITES

- 2.1 Construction activities on the containment building cooling subsystem are complete.
- 2.2 Permanently installed instrumentation is functional and calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Test instrumentation is available and calibrated.
- 2.4 Plant systems required to support testing are functional.
- 2.5 Reactor pit cooling system is operating.
- 2.6 Support systems required for operation of the containment building cooling subsystem are functional.

3.0 TEST METHOD

- 3.1 Verify control logic.
- 3.2 Operate the system in the normal alignment and verify system air flow and balance.
- 3.3 Verify that operation of interlocks and alarms meet design requirements.

4.0 DATA REQUIRED

- 4.1 Air ~~flowrate~~flow rates
- 4.2 RCS temperatures and pressures.

- 4.3 Setpoints at which interlocks and alarms occur.
- 4.4 RCP operating temperatures.
- 4.5 CVCS operating temperatures.
- 4.6 CRDMS operating temperatures.

5.0 ACCEPTANCE CRITERIA

5.1 The system temperatures are within the limits designed (refer to ~~described in~~ Section 9.4.7).

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- 5.1.1 Reactor pit cooling alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.
- 5.1.2 Reactor pit cooling fan performance meets design requirements.
- 5.1.3 Reactor pit cooling dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.
- 5.1.4 The reactor pit cooling air balance meets design requirements.

**14.2.12.8.3 Containment Building Ventilation System (Test #075)**

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the reactor containment building ventilation system (CBVS) to maintain design temperature conditions.

2.0 PREREQUISITES

- 2.1 Construction activities on the CBVS have been completed.
- 2.2 CBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems are complete and functional for operation of the CBVS.
- 2.4 Test Instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify control logic.
- 3.2 Verify that operation, stroking speed and position indication of dampers meet design requirements.
- 3.3 Verify the system maintains the Reactor Containment at a negative pressure.
- 3.4 Verify the system maintains the differential pressure between the equipment compartment and the service compartment.

- 3.5 Verify that operation of the ventilation supply units and fans meets design requirements.
- 3.6 Verify that operation of the ventilation exhaust units and fans meet design requirements.
- 3.7 Verify that operation of the equipment compartment cooling units meets design requirements.
- 3.8 Verify that operation of the equipment compartment ventilation units meets design requirements.
- 3.9 Verify HEPA filter efficiency, carbon absorber efficiency, and air flow capacity.
- 3.10 Verify the system rated air flow and air balance.
- 3.11 Verify that operation of protective devices, controls, interlocks instrumentation, and alarms using actual or simulated inputs meet design requirements.
- 3.12 Verify that operation of the reactor containment building cooling and ventilation system to associated radiation monitors meets design requirements.

4.0 DATA REQUIRED

- 4.1 Air balancing verification.
- 4.2 Fan and damper operating data.
- 4.3 Temperature data of building area.
- 4.4 Setpoints of alarms, interlocks, and controls
- 4.5 Reactor Containment Building negative pressurization data.
- 4.6 HEPA filter and carbon absorber data.
- 4.7 CBVS performance data in response to radiation monitors.

5.0 ACCEPTANCE CRITERIA

- 5.1 The CBVS operate as designed (refer to ~~described in~~ Section 9.4.7).
  - 5.1.1 CBVS alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.
  - 5.1.2 CBVS fan performance meets design requirements.
  - 5.1.3 CBVS dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.
- 5.2 The CBVS ~~performs as~~ meets design requirements to monitor ~~designed to~~ radiation ~~monitors described in~~ (refer to Section 7.3.1).

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14.2.12.8.4 Containment Purge (Test #076)

1.0 OBJECTIVE

1.1 To demonstrate the capability of the containment purge systems, both low-flow and full-flow, to maintain the containment air quality and cleanliness at the required value during normal operation (low-flow), inspection, testing, maintenance, and refueling operations.

14.2-32 → 1.2 To demonstrate electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities in the containment have been completed and acceptable levels of cleanliness established.
- 2.2 Construction activities on the containment purge systems have been completed.
- 2.3 Containment purge system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.4 Support systems required for operation of the containment purge systems are complete and functional.
- 2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Demonstrate manual and automatic system controls.
- 3.2 Verify alarms, indicating instruments and status lights are functional.
- 3.3 Verify design air flows for high purge, low purge and two containment cleanup systems.
- 3.4 Perform HEPA filters and carbon absorber efficiency tests.
- 3.5 Demonstrate system responses to a high radiation signal and high relative humidity signal.
- 3.6 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).
- 3.7 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.4.7).
- 3.8 Simulate the following and observe isolation valve response:
  - 3.8.1 CIAS.
  - 3.8.2 ~~HHAS~~ High humidity actuation signal.

3.8.3 ~~HRAS~~ High radiation actuation signal.

3.9 Verify that operation of containment purge system radiation monitors meets design requirements.

3.10 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

14.2-32 →

4.0 DATA REQUIRED

4.1 Air balancing verification.

4.2 Fan operating data for low purge and high purge fans.

4.3 HEPA filter and carbon absorber data for exhaust filter trains.

4.4 Valve performance data, where required.

4.5 Valve position indication.

4.6 Position response of valves to loss of motive power.

4.7 Setpoints at which alarms and interlocks occur.

4.8 Temperature of air supply (outside) to high purge supply and discharge into containment.

4.9 Valves respond to the following simulated signals:

4.9.1 CIAS.

4.9.2 ~~HHAS~~ High humidity actuation signal.

4.9.3 ~~HRAS~~ High radiation actuation signal.

4.10 Containment purge system radiation monitors performance data.

5.0 ACCEPTANCE CRITERIA

5.1 The containment purge system ~~performs as~~ meets design requirements (refer to ~~described in~~ Section 9.4.7).

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5.1.1 The containment purge alarms, remote indications, interlocks, and controls (manual and automatic) respond as designed.

5.1.2 The containment purge valves meet the design requirements (i.e., thrust opening speed, closing speed, failure mode upon loss of motive power).

- FSAR Table 14.3-2 Item 2-10.

5.1.3 The containment purge flow rate meets design requirements.

5.2 The containment purge system responds as required to the radiation monitors designed (refer to ~~described in~~ Section 7.3.1).

5.2.1 The containment purge system isolates purge flow as designed.

5.3 Verify that safety-related components meet electrical independence and redundancy requirements.

### 14.2.12.8.5 Annulus Ventilation System (Test #077)

#### 1.0 OBJECTIVE

- 1.1 To demonstrate the capability of the annulus ventilation system (AVS) to produce and maintain a negative pressure in the annulus following a loss of coolant accident (LOCA).
- 1.2 To minimize the release of radioisotopes following a LOCA by filtering large volumes of annulus air prior to discharge to the plant vent stack.
- 1.3 To demonstrate electrical independence and redundancy of power supplies.

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#### 2.0 PREREQUISITES

- 2.1 Construction activities on the containment wall and shield wall are complete with penetrations sealed in place.
- 2.2 Construction activities on the AVS have been completed.
- 2.3 AVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.4 Support systems required for operation of the AVS are complete and functional.
- 2.5 Test instrumentation is available and calibrated.

#### 3.0 TEST METHOD

- 3.1 Verify control logic, including response to ESFAS.
- 3.2 Verify that operation, failure mode, stroke speed and position indication of control valves and dampers meets design requirements.
- 3.3 Demonstrate that the AVS shall achieve a negative pressure in the Annulus within the design requirements:
  - 3.3.1 Greater than or equal to the required inches water gauge.
  - 3.3.2 Within the required elapsed time since actuation.
- 3.4 Verify that operation of protective devices, controls, interlocks, instrumentation and alarms meet design requirements.
- 3.5 Verify design air flow for normal and emergency operation.
- 3.6 Perform HEPA filter and carbon absorber efficiency tests.
- 3.7 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

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#### 4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms, interlocks, and controls occur.
- 4.2 Valve and damper operating data.

- 4.3 Air balancing verification.
- 4.4 Fan operating data.
- 4.5 HEPA filter and carbon absorber efficiency data.
- 4.6 Annulus negative pressurization data: Annulus pressure and drawdown time response curve.

5.0 ACCEPTANCE CRITERIA

5.1 The AVS operates as designed (refer to ~~described in~~ Section 6.2.3).

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5.1.1 Verify that the response of alarms, interlocks, and control logic meets design requirements.

5.1.2 Verify that operation of valves and dampers meet design requirements.

5.1.3 Verify that system response to simulated accident signal meets design requirements.

- FSAR Table 14.3-2 Item 2-1.

5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.8.6 Electrical Division of Safeguard Building Ventilation System (Test #078)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the electrical division of safeguard building ventilation system (SBVSE):
  - 1.1.1 Vital instrument and equipment room ventilation subsystems.
  - 1.1.2 Computer room ventilation subsystems.
  - 1.1.3 Operations support center ventilation subsystem.
  - 1.1.4 Shift and assembly offices ventilation subsystem.
  - 1.1.5 CAS and SEC group ventilation subsystem.
  - 1.1.6 Personnel decontamination room ventilation subsystem.
  - 1.1.7 The battery room ventilation subsystem.
  - 1.1.8 Break room ventilation subsystem.
  - 1.1.9 Electrical and mechanical equipment room HVAC units.

14.2-32

1.2 To demonstrate electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities in the Safeguard Building controlled area are complete with penetrations sealed.

- 2.2 Construction activities on the SBVSE have been completed.
- 2.3 SBVSE instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.4 Support systems required for operation of the SBVSE are functional.
- 2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify control logic.
- 3.2 Verify the operation of the computer room air handling units or fans or both.
- 3.3 Verify the operation of the operations support center air handling units or fans or both.
- 3.4 Verify the operation of the shift and assembly offices air handling units or fans or both.
- 3.5 Verify the operation of the CAS and SEC group air handling units or fans or both.
- 3.6 Verify the operation of the battery room air handling unit and fan.
- 3.7 Verify the operation of the personnel decontamination room air handling units or fans or both.
- 3.8 Verify the operation of the break room air handling units or fans or both.
- 3.9 Verify the operation of the electrical and mechanical equipment room air handling units or fans or both.
- 3.10 Verify operation of the smoke purge fans.
- 3.11 Verify alarms, indicating lights and status lights are functional.
- 3.12 Perform air flow balancing of the SBVSE.
- 3.13 Verify that operation of dampers meet design requirements.
- 3.14 Verify that operation of the vital instrument and equipment room HVAC units or fans or both meet design requirements.
- 3.15 14.2-32 → Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Damper operating data.
- 4.2 Air flow and balancing verification.
- 4.3 Setpoints at which alarms, center backs and control occur.
- 4.4 Temperature data for each of the SBVSE.



5.0 ACCEPTANCE CRITERIA

- 5.1 The SBVSE operates as designed (refer to ~~described in~~ Section 9.4.6).
  - 5.1.1 Safeguard Building cooling alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.
  - 5.1.2 Safeguard Building cooling fan performance meets design requirements.
  - 5.1.3 Safeguard Building cooling dampers/valve performance (thrust, opening times, closing times, and ability to control flow) meets design requirements.
  - 5.1.4 Safeguard Building cooling air balance meets design requirements.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

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**14.2.12.8.7 Nuclear Auxiliary Building Ventilation System (Test #079)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the nuclear auxiliary building ventilation system (NABVS).
- 1.2 To demonstrate electrical independence and redundancy of power supplies.

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2.0 PREREQUISITES

- 2.1 Construction activities in the nuclear auxiliary building are complete with penetrations sealed.
- 2.2 Construction activities on the NABVS have been completed.
- 2.3 NABVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.4 Support systems required for operation of the NABVS are functional.
- 2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify control logic.
- 3.2 Verify the operation of the air handling units or fans or both.
- 3.3 Verify alarms, indicating lights and status lights are functional.
- 3.4 Perform air flow balancing of the NABVS.
- 3.5 Verify that operation of dampers meets design requirements.
- 3.6 Perform HEPA filter and carbon absorber efficiency tests.

- 14.2-32 → 3.7 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 4.0 DATA REQUIRED
- 4.1 Damper operating data.
  - 4.2 Air flow and balancing verification.
  - 4.3 Setpoints at which alarms and control occur.
  - 4.4 Temperature data for each of the NABVS.
  - 4.5 HEPA filter and carbon absorber efficiency data.
- 5.0 ACCEPTANCE CRITERIA
- 5.1 The NABVS operates as designed (refer to ~~described in~~ Section 9.4.3).
    - 5.1.1 NABVS alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.
    - 5.1.2 NABVS fan performance meets design requirements.
    - 5.1.3 NABVS dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.
    - 5.1.4 NABVS air balance meets design requirements.
  - 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.8.8 Radioactive Waste Building Ventilation System (Test #080)**

- 1.0 OBJECTIVE
- 1.1 To demonstrate the proper operation of the radioactive waste building ventilation system (RWBVS) to maintain design condition.
- 2.0 PREREQUISITES
- 2.1 Construction activities on the RWBVS have been completed.
  - 2.2 RWBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
  - 2.3 Support systems required for operation of the RWBVS are complete and functional.
  - 2.4 Test instrumentation is available and calibrated.
- 3.0 TEST METHOD
- 3.1 Verify control logic.

- 3.2 Verify that operation, stroking speed and position indication of dampers meets design requirements.
- 3.3 Verify the capacity of the HVAC system to maintain the area temperature.
- 3.4 Verify the system maintains the Radioactive Waste Processing Building at a negative pressure.
- 3.5 Verify that operation of the general ventilation supply units and fans meets design requirements.
- 3.6 Verify that operation of the general ventilation exhaust units and fans meets design requirements.
- 3.7 Perform HEPA filter and carbon absorber efficiency tests.
- 3.8 Verify the systems rated air flow and air balance.
- 3.9 Verify that operation of protective devices, controls, interlocks instrumentation and alarms using actual or simulated inputs meets design requirements.
- 3.10 Verify that operation of the RWBVS response to high radiation monitor signal meets design requirements.

4.0 DATA REQUIRED

- 4.1 Air balancing verification.
- 4.2 Fan and damper operating data.
- 4.3 Temperature data.
- 4.4 Setpoints of alarms interlocks and controls.
- 4.5 The Radioactive Waste Building negative pressure readings.
- 4.6 RWBVS performance data in response to radiation monitor signals.
- 4.7 HEPA filter and carbon absorber efficiency data.

5.0 ACCEPTANCE CRITERIA

- 5.1 The RWBVS operates as designed (refer to ~~described in~~ Section 9.4.8).
  - 5.1.1 RWBVS alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.
  - 5.1.2 RWBVS fan performance meets design requirements.
  - 5.1.3 RWBVS dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.
  - 5.1.4 RWBVS air balance meets design requirements.
- 5.2 The RWBVS responds as designed to radiation monitor signals designed (refer to ~~described in~~ Section 9.4.8).

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**14.2.12.8.9 Fuel Building Ventilation System (Test #081)**

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the fuel building ventilation system (FBVS) to maintain design conditions.

1.2 To demonstrate electrical independence and redundancy of power supplies.

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2.0 PREREQUISITES

2.1 Construction activities on the FBVS have been completed.

2.2 FBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the FBVS are complete and functional.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify that operation, stroke speed and position indication of dampers meet design requirements.

3.3 Verify the system maintains the Fuel Building at a negative pressure.

3.4 Verify that operation of the ventilation supply units and fans meet design requirements.

3.5 Verify that the operation of the fuel handling area ventilation exhaust units and fans meet design requirements.

3.6 Verify that operation of the heating and cooling units meet design requirements.

3.7 Verify HEPA filter efficiency, carbon absorber efficiency, and air flow capacity.

3.8 Verify the systems rated air flow and air balance.

3.9 Verify that operation of protective devices, controls, interlocks instrumentation, and alarms using actual or simulated inputs.

3.10 Verify system response to a high radiation signal.

3.11 Verify that operation of the FBVS radiation monitor meets design requirements.

3.12 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

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4.0 DATA REQUIRED

- 4.1 Air balancing verification.
- 4.2 Fan and damper operating data.
- 4.3 Temperature data in the Fuel Building.
- 4.4 Setpoints at which alarms, interlocks, and controls occur.
- 4.5 Fuel Building negative pressurization data during normal and postulated emergency conditions.
- 4.6 Filter and carbon absorber data.
- 4.7 FBVS performance data in response to radiation monitor signals.

5.0 ACCEPTANCE CRITERIA

- 5.1 The FBVS operates as ~~described~~designed (refer to in Section 9.4.2).
  - 5.1.1 ~~FBVS alarms, interlocks, and controls (manual and automatic) function as designed.~~
  - 5.1.2 ~~FBVS valves and dampers function as design.~~
  - 5.1.3 ~~FBVS maintains the FHB at the required negative pressure.~~
    - ~~FSAR Table 14.3-2 Item 2-9.~~
  - 5.1.4 ~~FBVS recirculation rate (e.g., through the HEPA filters, carbon absorbers) meet design requirements.~~
  - 5.1.5 ~~FMVS normal operation heating and ventilation system performs as designed.~~
- 5.2 The FBVS responds as ~~designed~~to radiation monitor signals as ~~designed~~ ~~described in~~(refer to Section 9.4.2).
- 5.3 ~~Verify that safety-related components meet electrical independence and redundancy requirements.~~

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14.2.12.8.10 Main Control Room Air Conditioning System (Test #082)

1.0 OBJECTIVE

- 1.1 To verify that operation of the main control air conditioning (CRACS) system establishes that a proper environment for personnel and equipment under postulated conditions in the following areas:
  - 1.1.1 MCR.
  - 1.1.2 Technical Support Center.
  - 1.1.3 Other offices and equipment areas of the control room envelope (CRE).

- 1.2 ~~To demonstrate~~ electrical independence and redundancy of power supplies.

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2.0 PREREQUISITES

- 5.2 The FBVS responds ~~as designed~~ to radiation monitor signals as designed described in (refer to Section 9.4.2).
- 5.3 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.8.10 Main Control Room Air Conditioning System (Test #082)**

1.0 OBJECTIVE

- 1.1 To verify that operation of the main control air conditioning (CRACS) system establishes that a proper environment for personnel and equipment under postulated conditions in the following areas:
  - 1.1.1 MCR.
  - 1.1.2 Technical Support Center.
  - 1.1.3 Other offices and equipment areas of the control room envelope (CRE).
- 1.2 To demonstrate electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities in the MCR complex have been completed and penetrations sealed.
- 2.2 Construction activities on the CRACS have been completed.
- 2.3 The CRACS system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.4 Support systems required for operation of the CRACS are complete and functional.
- 2.5 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify control logic.
- 3.2 Verify that operation, stroke speed and position indication of dampers meet design requirements.
- 3.3 Verify in manual operating mode that system rated air flow and air balance meet design requirements.
- 3.4 Demonstrate in automatic mode the transfer to emergency-operations as a result of the following:

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- 3.4.1 Radiation detection in MCR HVAC air supply.
- 3.4.2 Smoke detection.
- 3.4.3 Toxic chemical detection, ~~if applicable.~~

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3.4.4 Safety injection actuation / primary containment isolation signals ~~(SIAS)~~.

- 3.5 Verify the HEPA filter efficiency, carbon absorber efficiency, and filter bank air flow capacity.
- 3.6 Verify that operation of protective devices, controls, interlocks, instrumentation, and alarms using actual or simulated inputs meets design requirements.
- 3.7 Verify that the system maintains the CRE at the required positive pressure relative to the outside atmosphere during system operation, ~~in the pressurized mode as required by the Technical Specifications.~~
- 3.8 Verify the isolation capability of the CRE on detection of toxic gas at the intakes meets the requirements of RG ~~1.95~~ 1.78, ~~if applicable.~~
- 3.9 Demonstrate the operation of the battery room exhaust fans.
- 3.10 Verify the CRE air in-leakage rate when aligned in the emergency mode.
- 3.11 Verify that operation of CRACS in response to radiation monitors meets design requirements.

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3.12 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Air balancing verification.
- 4.2 Fan and damper operating data.
- 4.3 Temperature and humidity data in the CRE.
- 4.4 Response to radioactivity, toxic gas ~~(if applicable)~~, and products of combustion.
- 4.5 Setpoints of alarms, interlocks, and controls.
- 4.6 Pressurization data for the CRE.
- 4.7 Filter and carbon absorber data.
- 4.8 CRE in-leakage rate when aligned in the emergency mode.
- 4.9 The CRACS response to radiation monitors.

5.0 ACCEPTANCE CRITERIA

14.2-32 →

- 5.1 The CRACS operates as ~~described~~ designed (refer to ~~in~~ Section 9.4.1).
  - 5.1.1 CRACS alarms, interlocks, and controls (manual and automatic) function as designed.
  - 5.1.2 CRACS valves and dampers function as design.
  - 5.1.3 CRACS responds as designed to a simulated smoke signal.

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- 5.1.4 CRACS responds as designed to a simulated toxic gas signal.
- 5.1.5 CRACS recirculation flow rate meets design requirements.
  - FSAR Table 14.3-2 Item 2-7.
- 5.1.6 CRACS unfiltered air in-leakage rate while in recirculation mode meets design requirements.
  - FSAR Table 14.3-2 Item 2-8.
- 5.1.7 -CRACS is capable of generating a positive MCR pressure relative to adjacent areas, as designed.
  - FSAR Table 14.3-2 Item 2-6.
- 5.1.8 CRACS responds as designed to a simulated SIS signal.
  - FSAR Table 14.3-2 Item 2-5.
- 5.2 The CRACS radiation monitors perform as ~~described~~designed ~~(refer to in~~ Section 9.4.1).
- 5.2.1 CRACS responds as designed to a simulated high radiation signal.
  - FSAR Table 14.3-2 Item 2-5.
- 5.3 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.8.11 Safeguard Building Controlled Area Ventilation System (Test #083)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the safeguard building controlled area ventilation system (SBVS):
  - 1.1.1 Hot mechanical area serviced by the SBVS.
  - 1.1.2 SBVS air supply subsystem.
  - 1.1.3 SBVS air exhaust subsystem.
  - 1.1.4 Electric air heating convectors (area heaters).

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1.2

To demonstrate electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities in the safeguard building mechanical area are complete with penetrations sealed.
- 2.2 Construction activities on the SBVS have been completed.



3.10 Verify that operation of dampers meet design requirements.

3.11 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

14.2-32 →

4.0 DATA REQUIRED

4.1 Damper operating data.

4.2 Air flow and balancing verification.

4.3 Setpoints at which alarms, center backs and control occur.

4.4 Temperature data for each of the SBVS.

5.0 ACCEPTANCE CRITERIA

5.1 The SBVS operates as designed ~~described~~ (refer to ~~in~~ Section 9.4.5).

5.1.1 SBVS air handlers/fans perform as designed.

5.1.2 The operation of the SBVS operational air exhaust mode in the mechanical area meets design requirements.

5.1.3 The operation of the SBVS accident air exhaust mode in the mechanical area meets design requirements.

5.1.4 The operation of the SBVS electric air convectors (area heaters) meets design requirements.

5.1.5 The operation of the SBVS filter air heaters, prefilters, HEPA filters, and absorbers meets design requirements.

5.1.6 The operation of the SBVS recirculation cooling units meets design requirements.

5.1.7 SBVS alarms, indicating lights and status lights meet design requirements.

5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.8.12 Emergency Power Generating Building Ventilation (Test #084)**

1.0 OBJECTIVE

1.1 To demonstrate proper operation of the emergency power generating building ventilation system (EPGBVS).

1.2 To demonstrate proper operation of the EPGBVS.

1.3 To demonstrate electrical independence and redundancy of power supplies.

14.2-32 →

2.0 PREREQUISITES

2.1 Construction activities on the EPGBVS have been completed.

- 2.2 EPGBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the EPGBVS are complete and functional.
- 2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify control logic.
- 3.2 Verify design air flow with each EPGBVS in operation.
- 3.3 Verify design temperature can be maintained in each Emergency Power Generating Building.
- 3.4 Verify alarms, indicating instruments, and status lights are functional.

14.2-32

- 3.5 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Fan and damper operating data.
- 4.2 Air flow verification
- 4.3 Setpoint at which alarms, interlocks, and controls occur.
- 4.4 Temperature data of each Emergency Power Generating Building.

5.0 ACCEPTANCE CRITERIA

- 5.1 The EPGBVS operates as designed (refer to ~~described in~~ Section 9.4.9).
  - 5.1.1 EPGBVS alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.
  - 5.1.2 EPGBVS fan performance meets design requirements.
  - 5.1.3 EPGBVS dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.
  - 5.1.4 EPGBVS air balance meets design requirements.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.8.13 Smoke Confinement System (Test #085)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the smoke confinement system (SCS) for NI.

- 14.2-32 → 1.2 To demonstrate electrical independence and redundancy of power supplies.
- 2.0 PREREQUISITES
- 2.1 Construction activities in the SCS are complete with penetrations sealed.
  - 2.2 Construction activities on the SCS have been completed.
  - 2.3 SCS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
  - 2.4 Support systems required for operation of the SCS.
  - 2.5 Test instrumentation is available and calibrated.
- 3.0 TEST METHOD
- 3.1 Verify control logic.
  - 3.2 Verify the operation of the air handling units or fans or both.
  - 3.3 Verify operation of the smoke purge fans.
  - 3.4 Verify alarms, indicating lights and status lights are functional.
  - 3.5 Perform air flow balancing of the SCS.
  - 3.6 Verify that operation of dampers meets design requirements.
  - 3.7 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 14.2-32 →
- 4.0 DATA REQUIRED
- 4.1 Fan operating data for each of the air handling units and the smoke purge fans.
  - 4.2 Damper operating data.
  - 4.3 Air flow and balancing verification.
  - 4.4 Setpoints at which alarms and control occur.
  - 4.5 Temperature data for each of the SCS.
- 5.0 ACCEPTANCE CRITERIA
- 5.1 The SCS operates as designed described(refer to ~~in~~ Section 9.4.13).
    - 5.1.1 SCS alarms, status lights, interlocks, and control logic meets design requirements.
    - 5.1.2 The operation of the SCS smoke purge fans meet the design requirements.
    - 5.1.3 The air balance of the SCS meets design requirements.

14.2-32 → 5.1.4 SCS dampers meet the design requirements.  
 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

14.2.12.8.14 ~~Station Blackout Room~~Switchgear Building Ventilation System (Test #086)

1.0 OBJECTIVE

1.1 To demonstrate proper operation of the ventilation to the station blackout room ventilation system (SBORVS)~~SBORVS~~diesel generator divisions located inside the Switchgear Building.

14.2-32 → 1.2 To demonstrate electrical independence and redundancy of power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the switchgear building ventilation system (SGBVS)~~SBORVS~~ have been completed.

2.2 ~~SBORVS~~SGBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the ~~SBORVS~~SGBVS are complete and functional.

2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

3.1 Verify control logic.

3.2 Verify design air flow with each ~~SBORVS~~SGBVS in operation.

3.3 Verify design temperature can be maintained in each station blackout diesel ventilation area.

3.4 Verify alarms, indicating instruments, and status lights are functional.

14.2-32 → 3.5 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

4.1 Fan and damper operating data.

4.2 Air flow verification.

4.3 Setpoint at which alarms, interlocks, and controls, occur.

4.4 Temperature data of each station blackout diesel area with and without diesel operating.

5.0 ACCEPTANCE CRITERIA

14.2-32

- 5.1 The ~~SBORV~~SGBVS operates as designed~~described~~ (refer to ~~in~~ Section 9.4.10).
- 5.1.1 SGBVS alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.
- 5.1.2 SGBVS fan performance meets design requirements.
- 5.1.3 SGBVS dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.
- 5.1.4 SGBVS air balance meets design requirements.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.8.15 Turbine Island Ventilation Systems (Test #087)**

1.0 OBJECTIVE

- 1.1 To demonstrate that the turbine building ventilation system (TBVS) provides a suitable operating environment for equipment and personnel during normal operations.
- 1.2 To demonstrate that the main steam and feedwater valve room ventilation system (VRVS) provides a suitable operating environment for equipment and personnel during normal operations.

2.0 PREREQUISITES

- 2.1 Construction activities on the TBVS have been completed.
- 2.2 Construction activities on the VRVS have been completed.
- 2.3 TBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.4 VRVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.5 Support systems required for operation of the TBVS are complete and functional.
- 2.6 Support systems required for operation of the VRVS are complete and functional.

3.0 TEST METHOD

- 3.1 Verify control logic.
- 3.2 Verify that operation of inlet air dampers and damper controls meets design requirements.
- 3.3 Verify that operation of the exhaust fan units and dampers meets design requirements.

3.4 Verify that operation of protective devices, controls, interlocks, instrumentation, and alarms meets design requirements.

4.0 DATA REQUIRED

4.1 Fan and damper operating data.

4.2 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

5.1 The VRVS operates as designed ~~described~~(refer to ~~in~~ Section 9.4.12).

14.2-32



5.1.1 VRVS alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.

5.1.2 VRVS fan performance meets design requirements.

5.1.3 VRVS dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.

5.1.4 VRVS air balance meets design requirements.

5.2 The TBVS operates as designed ~~described in~~(refer to Section 9.4.4).

5.2.1 TBVS alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.

5.2.2 TBVS fan performance meets design requirements.

5.2.3 TBVS dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.

5.2.4 TBVS air balance meets design requirements.

**14.2.12.8.16 Essential Service Water Pump Building Ventilation System (Test #088)**

1.0 OBJECTIVE

1.1 To verify the essential service water pump building ventilation system (ESWPBVS) can maintain the space temperature as required.

1.2 To demonstrate electrical independence and redundancy of power supplies.

14.2-32



2.0 PREREQUISITES

2.1 Construction activities on the ESWPBVS have been completed.

2.2 ESWPBVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the ESWPBVS are complete and functional.

2.4 Test Instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify control logic and interlock.
- 3.2 Verify design air flow of each fan.
- 3.3 Verify alarms, indicating instruments and status lights are functional.
- 3.4 Verify design temperatures can be maintained in the structure.

14.2-32

 → Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Temperature data for the structure from each fan unit.
- 4.2 Fan operating data.
- 4.3 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

- 5.1 The ESWPBVS operates as ~~designed described in~~(refer to Section 9.4.11).
  - 5.1.1 ESWPBVS alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.
  - 5.1.2 ESWPSVS fan performance meets design requirements.
  - 5.1.3 ESWPSVS dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.
  - 5.1.4 ESWPVS air balance meets design requirements.
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.8.17 Reserved (Test #089)**

**14.2.12.8.18 Reserved (Test #090)**

**14.2.12.8.19 Access Building Ventilation System (Test #224)**

1.0 OBJECTIVE

- 1.1 To verify the access building ventilation system (ABVS) can maintain the space temperature as required.
- 1.2 To verify that radiological control features route the building exhaust to the plant stack.

2.0 PREREQUISITES

- 2.1 Construction activities on the ABVS have been completed.

- 2.2 ABVS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the ABVS are complete and functional.
- 2.4 Test Instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify control logic and interlock.
- 3.2 Verify design air flow of each fan.
- 3.3 Verify alarms, indicating instruments and status lights are functional.
- 3.4 Verify design temperatures can be maintained in the structure.

4.0 DATA REQUIRED

- 4.1 Temperature data for the structure from each HVAC unit.
- 4.2 HVAC unit operating data.
- 4.3 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

5.1 The ABVS operates as designed ~~described in~~ (refer to Section 9.4.14).

14.2-32 →

- 5.1.1 ABVS alarms, interlocks, protective devices, and controls (manual and automatic) function as designed.
- 5.1.2 ABVS fan performance meets design requirements.
- 5.1.3 ABVS dampers/valve performance (i.e., thrust, opening times, closing times, and ability to control flow) meets design requirements.
- 5.1.4 ABVS air balance meets design requirements.

**14.2.12.9 Auxiliary Systems**

**14.2.12.9.1 Leak-off System (Test #091)**

1.0 OBJECTIVE

- 1.1 To demonstrate the functionality of the leak-off system (LOS) to collect and route valve packing leak-off from valves in the Containment Building containing primary fluid to the RCDDT.
- 1.2 To demonstrate the functionality of the LOS to collect and route valve packing leak-off from valves in the Auxiliary Building containing primary fluid to the equipment drain tank (EDT).

2.0 PREREQUISITES

- 2.1 Construction activities on the LOS have been completed.



- 3.3 Verify control actuation by the monitor and record the response time meet design requirements.
- 3.4 Simulate a high radiation signal to the appropriate radiation monitors to verify that control actuations meet design requirements.
- 3.5 Verify that alarm actuation in the control room meet design requirements.
- 3.6 Simulate a high radiation signal to the radiation monitors to verify that alarm actuations in the MCR or locally, as designed.

4.0 DATA REQUIRED

- 4.1 The monitor response to check source.
- 4.2 Technical data associated with the source.
- 4.3 Signal levels necessary to cause alarm actuation.
- 4.4 Response time of the monitor to perform control functions.

5.0 ACCEPTANCE CRITERIA

14.2-32 5.1 → The SAMS operates as designed described in(refer to Section 11.5).

**14.2.12.9.3 Solid Waste Storage (Test #093)**

1.0 OBJECTIVE

- 1.1 To demonstrate the functionality of the solid waste storage system to collect and package solid wastes for shipment.

2.0 PREREQUISITES

- 2.1 Construction activities on the solid waste management system have been completed.
- 2.2 Solid waste management system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the solid waste management system are completed and functional.
- 2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify the operation of the solid waste transfer system.
- 3.2 Verify the radioactive waste processing building crane can reach design points.
- 3.3 Verify expended resin beds from the LWPS can be sluiced to the solid waste storage system.
- 3.4 Verify that operation of alarms, controls and interlocks meets design requirements.

3.5 Verify system design flow paths.

4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms and interlocks occur.
- 4.2 Solid waste transfer system operating data.
- 4.3 Radioactive waste processing building crane data.
- 4.4 System flow path data.

5.0 ACCEPTANCE CRITERIA

5.1 The solid waste management system operates as ~~designed described~~ in (refer to Section 11.4).

14.2-32



**14.2.12.9.4 Radioactive Concentrates Processing - Solid Waste (Test #094)**

1.0 OBJECTIVE

1.1 To verify the performance of the radioactive concentrates processing system.

2.0 PREREQUISITES

- 2.1 Construction activities have been completed on the radioactive concentrates processing system.
- 2.2 Support systems required for operation of the radioactive concentrates processing evaporator are complete and functional.
- 2.3 Radioactive concentrates processing system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

3.0 TEST METHOD

- 3.1 Operate radioactive concentrates processing evaporator control valves from appropriate control positions and observe valve operation and position indication.
- 3.2 Simulate interlock signals from interfacing equipment and observe radioactive concentrates processing system response, including observation of alarms.
- 3.3 Line up the radioactive concentrates processing system to interfacing systems and, using appropriate operating modes and indications, establish flow paths to these systems.

4.0 DATA REQUIRED

- 4.1 Valve position indication.
- 4.2 Radioactive concentrates processing system response to simulated interlocks.

- 3.8 Verify alarms, indicating instruments, and status lights are functional.
- 3.9 Simulate a high radiation signal to the liquid waste processing system discharge radiation monitor and verify response.

4.0 DATA REQUIRED

- 4.1 Waste pump operating data.
- 4.2 Valve performance data, where required.
- 4.3 Valve position indication.
- 4.4 Position response of valves to loss of motive power.
- 4.5 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

- 5.1 The LWPS operates as designed (refer to ~~described in~~ Section 11.2).
- 5.2 The LWPS discharge radiation monitor operates as designed (refer to ~~described in~~ Sections 7.3.1, 11.2, and 11.5).

14.2-32



**14.2.12.9.6 Reactor Coolant Drain Tank (Test #096)**

1.0 OBJECTIVE

- 1.1 To verify the proper performance of the reactor coolant drain tank (RCDT) subsystem.

2.0 PREREQUISITES

- 2.1 Construction activities on the RCDT subsystem have been completed.
- 2.2 The RCDT subsystem instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 EDT subsystem is ready to accept water from the RCDT.
- 2.4 The plant nitrogen system is functional.
- 2.5 Support systems required for operation of the RCDT subsystem are functional.

3.0 TEST METHOD

- 3.1 Operate control valves remotely while:
  - 3.1.1 Observing each valve operation and position indication.
  - 3.1.2 Measuring valve performance data (e.g., thrust, opening and closing times).
- 3.2 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.3.4).
- 3.3 Simulate a CIAS and observe isolation valve response.

- 3.4 Fill the RCDT from any convenient source and observe level and pressure indications and alarms.
- 3.5 Pressurize the RCDT, using the nitrogen system, to a full range of operating pressures and observe indications and alarms.
- 3.6 Line up the RCDT to the EDT and drain the RCDT using each RCDT pump.
- 3.7 Observe level and pressure indicators, alarms and interlocks.
- 3.8 Simulate RCDT full range of operating temperatures and observe indications and alarms.

4.0 DATA REQUIRED

- 4.1 Valve performance data, where required.
- 4.2 Valve position indications.
- 4.3 Response of valves to simulated failed conditions.
- 4.4 Position response of valves to loss of motive power.
- 4.5 The RCDT level, pressure and temperature.
- 4.6 Setpoints of alarms and interlocks.

5.0 ACCEPTANCE CRITERIA

14.2-32 → 5.1 The reactor coolant drain tank subsystem performs as meets design requirements (refer to described in Section 9.3.4).

**14.2.12.9.7 Equipment Drain Tank (Test #097)**

1.0 OBJECTIVE

- 1.1 To verify the proper performance of the EDT subsystem.

2.0 PREREQUISITES

- 2.1 Construction activities on the EDT subsystem have been completed.
- 2.2 The EDT subsystem instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Verify holdup tank, RCDT, and ~~RMW~~ reactor makeup water subsystems are functional.

3.0 TEST METHOD

- 3.1 Operate control valves from appropriate control positions and observe valve operation and position indication.
- 3.2 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.3.4).

- 3.3 Fill the EDT from the ~~RMW~~reactor makeup water subsystem and observe indications, alarms, and interlocks.
- 3.4 Drain the EDT using an RCDT pump and observe indications, alarms, and interlocks.
- 3.5 Simulate a range of EDT temperatures while observing indications and alarms.
- 3.6 Simulate a range of EDT pressures while observing indications and alarms.

4.0 DATA REQUIRED

- 4.1 Valve position indications.
- 4.2 Position response of valves to loss of motive power.
- 4.3 The EDT level, pressure and temperature.
- 4.4 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

- 5.1 14.2-32 → The EDT subsystem ~~performs as~~meets design requirements (refer to ~~described in~~ Section 9.3.3).

**14.2.12.9.8 Equipment and Floor Drainage System (Test #098)**

1.0 OBJECTIVE

- 1.1 To demonstrate that the drain lines are correctly routed to their designated destination.
- 1.2 To demonstrate the sump pumps operate per design including alarms and interlocks.
- 1.3 To demonstrate the waste tanks operate per design including alarms and interlocks.
- 1.4 To demonstrate the sump level instrumentation operates per design including alarms and indications to demonstrate system segregation.
- 1.5 To demonstrate the turbine building floor drain sump operates per design.

2.0 PREREQUISITES

- 2.1 Construction activities on the equipment and floor drainage system have been completed.
- 2.2 Equipment and floor drainage system instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Support systems required for operation of the equipment and floor drainage system is complete and functional.
- 2.4 Water is available for flow paths to be checked.

2.5 Several colors of non-toxic dye are available for verifying source of water.

3.0 TEST METHOD

- 3.1 Verify the operation of alarms and interlocks.
- 3.2 Verify sump levels as required to demonstrate that operation of the sump pumps meet design requirements.
- 3.3 Flow water in each drain path to the equipment and floor drainage system.
- 3.4 Verify that the drains discharge to their designated destination and that system segregation is maintained.

4.0 DATA REQUIRED

- 4.1 Sump pump operating data is available for review.
- 4.2 Setpoints at which alarms and interlocks occur.
- 4.3 Discharge points of each drain.

5.0 ACCEPTANCE CRITERIA

5.1 The equipment and floor drainage system operates as designed (refer to ~~described in~~ Section 9.3.3).

14.2-32 →

**14.2.12.9.9 Gaseous Waste Processing System (Test #099)**

1.0 OBJECTIVE

1.1 To demonstrate the ability of the gaseous waste management system (GWPS) to collect and process radioactive gases vented from plant equipment.

2.0 PREREQUISITES

- 2.1 Construction activities on the GWPS have been completed.
- 2.2 The GWPS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the GWPS are completed and functional.
- 2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify flow paths.
- 3.2 Demonstrate that discharge isolation features and other system controls function as designed.

- 3.3 Simulate a high radiation signal to the GWPS discharge radiation monitor.
- 3.4 Verify alarms, indicating instruments and status lights are functional.
- 3.5 Simulate a high radioactivity signal to the GWPS discharge radiation monitor and verify alarm actuation in the MCR.
- 3.6 Demonstrate the operation of the gas drying equipment.
- 3.7 Demonstrate that hold up time of gas through the charcoal absorbers meet design requirements.
- 3.8 Demonstrate the operation of the dryer regeneration equipment.
- 3.9 Demonstrate the operation of the system gas analyzers.
- 3.10 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).
- 3.11 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 11.3).

4.0 DATA REQUIRED

- 4.1 Setpoints of alarms, interlocks, and controls.
- 4.2 Gas dryer operating data.
- 4.3 Dryer regenerating equipment operating data.
- 4.4 Gas analyzer operating data.
- 4.5 Gas transport times.
- 4.6 Position response of valves to loss of motive power.
- 4.7 Valve performance data.

5.0 ACCEPTANCE CRITERIA

- 5.1 The GWPS operates as designed (refer to ~~described in~~ Section 11.3).
- 5.2 The GWPS discharge radiation monitor operates as designed (refer to ~~described in~~ Section 7.3.1).

**14.2.12.9.10 Nuclear Sampling System (Test #100)**

1.0 OBJECTIVE

- 1.1 To verify the ability of nuclear sampling system (NSS) to collect and deliver representative samples of liquids and gases in various process systems to sample stations for chemical and radiological analysis during operation cooldown.

1.2 To verify the ability of the severe accident sampling system (SASS) to collect and deliver gaseous and liquid samples from inside the containment following a severe accident for the purpose of confirming whether the containment atmosphere contains airborne activity.

1.3 To demonstrate electrical independence and redundancy of power supplies.

14.2-32



2.0 PREREQUISITES

- 2.1 Construction activities on the systems to be tested have been completed.
- 2.2 Systems being sampled are at or near normal operating pressure and temperature.
- 2.3 Calibrating gases and solutions are available.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 NSS instrumentation has been calibrated and is functional for performance of the following test.

3.0 TEST METHOD

- 3.1 Verify adequate flow from each sample location.
- 3.2 Verify that operation of alarms and interlocks meet design requirements.
- 3.3 Verify that operation of pump and heat exchangers in normal operating modes and flow paths meets design requirements.
- 3.4 Verify the analytical instrumentation provides indication and response as designed.
- 3.5 Calculate the holdup times using the as-built piping lengths, piping volume and measured ~~flowrate~~flow rate for the following:
  - 3.5.1 RCS samples.
  - 3.5.2 Pressurizer samples.
  - 3.5.3 Equipment rooms inside containment.
  - 3.5.4 Annular rooms inside containment.
  - 3.5.5 IRWST, via severe accident heat removal system (SAHRS).
- 3.6 Operate control valves remotely while:
  - a. Observing each valve operation and position indication.
  - b. Measuring valve performance data (e.g., thrust, opening and closing times).
- 3.7 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.3.2).



3.8 Verify that operation of continuous monitors and verify adequate flow meet design requirements.

14.2-32 → 3.9 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

4.1 Setpoints at which alarms and interlocks occur.

4.2 Sampling ~~flowrate~~flow rate from each sample point.

4.3 Analytical instrument data.

4.4 Valve performance data, where required.

4.5 Valve position indication.

4.6 Position response of valves to loss of motive power.

4.7 Calculated holdup time for RCS and pressurizer samples.

5.0 ACCEPTANCE CRITERIA

14.2-32 → 5.1 The NSS ~~performs as~~meets design requirements (refer to described in Section 9.3.2.Sections 9.3.2.2.1.1).  
 5.2 The SASS performs as described in Sections 9.3.2.2.1.3.  
 5.3 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.9.11 Station Blackout Diesel Generator Set (Test #101)**

1.0 OBJECTIVE

1.1 To demonstrate the station blackout diesel generator (SBODG) set system operates reliably.

2.0 PREREQUISITES

2.1 Construction activities on the SBODG system have been completed. This includes, but is not limited to the following:

2.1.1 SBODG fuel oil system.

2.1.2 SBODG engine lube oil system.

2.1.3 SBODG cooling system.

2.1.4 SBODG starting air system.

2.1.5 SBODG air intake and exhaust systems.

2.2 SBODG system instrumentation has been calibrated and is functional for performance of the following test.

- 3.6 Demonstrate full load capability.
- 3.7 Demonstrate SBO DG speed control.

4.0 DATA REQUIRED

- 4.1 SBO engine operating parameters.
- 4.2 SBO engine consecutive starts data.
- 4.3 Setpoints of SBODG trips.
- 4.4 SBODG governor operating data.
- 4.5 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

- 5.1 The SBODG mechanical system ~~performs as described~~ meets design requirements (refer to in Section 8.4).

14.2-32



**14.2.12.9.12 Station Blackout Diesel Generator Electrical (Test #102)**

1.0 OBJECTIVE

- 1.1 To verify the SBODGs can supply power at the rated load, voltage and frequency under design conditions.

2.0 PREREQUISITES

- 2.1 Construction activities on the SBODG system have been completed.
- 2.2 SBODG mechanical system test is completed (Test #101).
- 2.3 SBODG system instrumentation has been calibrated and is functional for performance of the following test.
- 2.4 Support systems required for operation of the SBODG system are complete and functional
- 2.5 Test instrumentation is available and calibrated.
- 2.6 Electrical testing is complete as needed to allow the required buses to be energized.
- 2.7 The SBODG electrical voltage tests are complete.
- 2.8 The SBODG loads are available to be loaded onto the bus.
- 2.9 SBODG ventilation system test is completed (Test #086).

3.0 TEST METHOD

- 3.1 Demonstrate control logic and controls and response to SBO actuation signals.
- 3.2 Demonstrate 90 to 100 percent of the continuous rating of the SBODG, for an interval of not less than one hour and until temperature equilibrium has been attained.

- 3.12 Demonstrate the ability to synchronize the SBODG unit with offsite power.
- 3.13 Transfer load to the offsite power while the unit is connected to the SBODG load.
- 3.14 Isolate the diesel generator unit and restore it to standby status.
- 3.15 Demonstrate that with the SBODG operating in a test mode while connected to its bus, a simulated actuation signal overrides the test mode by returning the SBODG to standby operation.
- 3.16 Demonstrate that, by starting and running redundant SBODG units simultaneously, potential common failure modes that may be undetected in single SBODG unit tests do not occur.

4.0 DATA REQUIRED

- 4.1 Starting and loading sequence timing.
- 4.2 Test data traces for starting, stopping and load shedding.
- 4.3 Running data for the parameters monitored during each of the required testing sequences.
- 4.4 Verification of field performance data versus shop data.
- 4.5 Periodic area temperatures, collected at least once per hour.

5.0 ACCEPTANCE CRITERIA

- 5.1 The SBODG electrical system ~~performs as described in~~ meets design requirements (refer to Section 8.4).
- 5.2 The SBODG ventilation system ~~performs as described in~~ meets design requirements (refer to Section 9.4.10).

14.2-32 →

**14.2.12.9.13 Station Blackout Diesel Generator Auxiliaries (Test #103)**

1.0 OBJECTIVE

- 1.1 To confirm whether or not the SBODG fuel oil system provides a reliable and adequate supply to each SBODG.
- 1.2 To confirm whether or not the operation of the SBO engine cooling water system is adequate.
- 1.3 To confirm whether or not the SBO engine starting air system provides adequate amount of air for five consecutive starts of its SBODG without makeup air.
- 1.4 To confirm adequate operation of the SBO engine lube oil system.

2.0 PREREQUISITES

- 2.1 Construction activities on the SBODG auxiliary systems have been completed.

- 3.19 Demonstrate the operation of the SBODG lube oil transfer pump.
- 3.20 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 8.4).

4.0 DATA REQUIRED

- 4.1 SBO fuel oil consumption rate.
- 4.2 Setpoints of alarms, interlocks, and controls.
- 4.3 Operating data for pumps and compressors.
- 4.4 Operating data for the heaters.
- 4.5 SBO starting air volume parameters after consecutive starts.
- 4.6 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

- |         |   |  |
|---------|---|--|
| 14.2-32 | → | 5.1 The SBODG engine fuel oil system operates as <del>described</del> <u>indesigned</u> (refer to Section 8.4).      |
|         |   | 5.2 The SBODG engine cooling water system operates as <del>described</del> <u>indesigned</u> (refer to Section 8.4). |
|         |   | 5.3 The SBODG engine starting air system operates as <del>described</del> <u>indesigned</u> (refer to Section 8.4).  |
|         |   | 5.4 The SBODG engine lube oil system operates as <del>described</del> <u>indesigned</u> (refer to Section 8.4).      |

**14.2.12.9.14 Emergency Diesel Generator Set (Test #104)**

1.0 OBJECTIVE

- 1.1 To demonstrate the emergency diesel generator (EDG) set system operates reliably.
- 1.2 To demonstrate electrical independence and redundancy of power supplies.
- 1.3 To verify that EDG diesel generator and auxiliary system alarms, interlocks, and control functions perform as designed.

14.2-32

2.0 PREREQUISITES

- 2.1 Construction activities on the EDG system have been completed. This includes, but is not limited to the following:
  - 2.1.1 EDG fuel oil system (refer to Section 9.5.4).
  - 2.1.2 EDG engine lube oil system (refer to Section 9.5.7).
  - 2.1.3 EDG cooling system (refer to Section 9.5.5).
  - 2.1.4 EDG starting air system (refer to Section 9.5.6).

- 3.4.3 EDG over speed.
- 3.4.4 Loss of control power.
- 3.4.5 Generator fault.
- 3.4.6 Low air and oil pressure.
- 3.4.7 Maintenance mode.
- 3.5 Demonstrate 25 consecutive starts and loading capability.
- 3.6 Demonstrate full load capability.
- 3.7 Demonstrate EDG speed control.

14.2-32

- 3.8 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 3.9 Demonstrate that EDG instrumentation operates over the design range using actual or simulated signals.
- 3.10 Demonstrate that EDG alarms and interlocks occur as designed.
- 3.11 Demonstrate that the EDG instrumentation responds as designed to actual or simulated limiting malfunctions or failures.
- 3.12 Demonstrate that the EDG instrumentation response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

4.0 DATA REQUIRED

- 4.1 EDG engine operating parameters.
- 4.2 EDG engine consecutive starts and loading data.
- 4.3 Setpoints of EDG trips.
- 4.4 EDG governor operating data.
- 4.5 Setpoints at which alarms and interlocks occur.

5.0 ACCEPTANCE CRITERIA

14.2-32

5.1 The EDG mechanical system meets design requirements (refer to ~~to performs as described in~~ Section 8.3.1).

- 5.1.1 Manual and automatic controls.
- 5.1.2 Trips, alarms, interlocks, status lights, and system controls.
- 5.1.3 System responds as required to actual or simulated signals.

14.2-32

5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.9.15 Emergency Diesel Generator Electrical (Test #105)**

1.0 OBJECTIVE

1.1 To verify the EDGs can supply power at the rated load, voltage, and frequency under design conditions.

14.2-32 → 1.2 To demonstrate electrical independence and redundancy of power supplies.

1.3 To verify that EDG alarms, interlocks, and control functions perform as designed.

2.0 PREREQUISITES

2.1 Construction activities on the EDG system have been completed.

2.2 EDG mechanical system test is completed (Test #104).

2.3 EDG system instrumentation has been calibrated and is functional for performance of the following test.

2.4 Support systems required for operation of the EDG system are complete and functional.

2.5 Test instrumentation is available and calibrated.

2.6 Electrical testing is complete as needed to allow the buses to be energized.

2.7 EDG electrical voltage tests are complete.

2.8 Engineered safety feature (ESF) loads are available to be loaded onto the bus.

2.9 EDG ventilation system test is completed. (Test #084).

3.0 TEST METHOD

3.1 Demonstrate control logic and controls including the EDG sequencer and response to ESF actuation signals.

3.2 Demonstrate 90 to 100 percent of the continuous rating of the emergency diesel generator, for an interval of not less than one hour and until temperature equilibrium has been attained.

3.3 Demonstrate that the EDG starts from standby conditions, reaches required voltage and frequency within acceptable limits and time requirements.

3.4 Demonstrate by simulating a LOOP that:

3.4.1 The emergency buses are de-energized and the loads are shed from the emergency buses.

3.4.2 The EDG starts on the auto-start signal from its standby conditions, attains the required voltage and frequency within acceptable limits and time, energizes the auto-connected shutdown loads through the load sequencer and operates while loaded with its shutdown loads for greater than or equal to five minutes.

- 3.5 Demonstrate that on an SIAS, the EDG starts on the auto-start signal from its standby conditions, attains the required voltage and frequency within acceptable limits and time, and operates for greater than or equal to five minutes.
- 3.6 Demonstrate that on a combined SIAS and a LOOP that:
  - 3.6.1 The emergency buses are de-energized and the loads are shed from the emergency buses.
  - 3.6.2 The EDG starts on the auto-start signal from its standby conditions, attains the required voltage and frequency within acceptable limits and time, energizes the auto-connected shutdown loads through the load sequencer, and operates while loaded with its shutdown loads for greater than or equal to five minutes.
- 3.7 Demonstrate the EDGs capability to reject a loss of the largest single load while operating at power factor between 0.8 and 0.9, and verify that the voltage and frequency requirements are met and that the EDG unit shall not trip on over speed.
- 3.8 Demonstrate the EDGs capability to reject a load equal to 90 to 100 percent of its continuous rating while operating at power factor between 0.8 and 0.9, and verify that the voltage requirements are met and that the EDG shall not trip on over speed.
- 3.9 Confirm EDG endurance and margin test as follows:
  - 3.9.1 Full-load carrying capability at a power factor between 0.8 and 0.9.
  - 3.9.2 For an interval of not less than 24 hours, of which 2 hours are at a load equal to 105 to 110 percent of the continuous rating of the ~~SBO~~EDG.
  - 3.9.3 That 22 hours of the 24 hours are at a load equal to 90 to 100 percent of its continuous rating.
  - 3.9.4 That voltage and frequency requirements are maintained.
  - 3.9.5 That mechanical systems such as fuel, lubrication, and cooling function within design limits.
  - 3.9.6 Operation of the air handling units or fans or both.
  - 3.9.7 Area temperatures are maintained within design limits.
- 3.10 Demonstrate hot restart functional capability at full-load temperature conditions (after it has operated for 2 hours at full load).
- 3.11 Verify that the EDG starts on a manual or automatic start signal.
- 3.12 Verify that the EDG attains the required voltage and frequency within acceptable limits and time, and operates for longer than five minutes.
- 3.13 NOTE: Perform this testing immediately after the full load carrying capability demonstration.

- 3.14 Demonstrate the ability to synchronize the EDG unit with offsite power.
- 3.15 Transfer this load to the offsite power while the unit is connected to the emergency load.
- 3.16 Isolate the EDG, and restore it to standby status.
- 3.17 Demonstrate that with the EDG operating in a test mode while connected to its bus, a simulated SIAS overrides the test mode by returning the EDG to standby operation, and automatically energizing the emergency loads from offsite power.
- 3.18 Demonstrate that, by starting and running redundant EDG units simultaneously, potential common failure modes that may be undetected in single EDG unit tests do not occur.

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→ Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

- 3.20 Verify that EDG instrumentation operates over the design range using actual or simulated signals.
- 3.21 Verify that EDG alarms and interlocks occur as designed.
- 3.22 Verify that the EDG instrumentation responds as designed to actual or simulated limiting malfunctions or failures.
- 3.23 Verify that the EDG instrumentation response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

4.0 DATA REQUIRED

- 4.1 Starting and loading sequence timing.
- 4.2 Test data traces for starting, stopping and load shedding.
- 4.3 Running data for the parameters monitored during each of the required testing sequences.
- 4.4 Verification of field performance data versus shop data.
- 4.5 Periodic area temperatures, collected at least once per hour.

5.0 ACCEPTANCE CRITERIA

14.2-32

5.1 The EDG electrical system meets design requirements ~~performs as described in~~(refer to Section 8.3.1).

5.1.1 Verify the EDG provides power to essential safety equipment if there is a simulated loss of normal power.

- FSAR Table 14.3-1 Item 1-56.

5.2 The EDG ventilation system ~~performs as described~~meets design requirements (refer to in Section 9.4.9).



5.3 Verify that safety-related components meet electrical independence and redundancy requirements.

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**14.2.12.9.16 Emergency Diesel Generator Auxiliaries (Test #106)**

1.0 OBJECTIVE

- 1.1 To confirm whether or not the EDG fuel oil system provides a reliable and adequate supply to each EDG.
- 1.2 To confirm whether or not the operation of the EDG engine cooling water system is adequate.
- 1.3 To confirm whether or not the EDG engine starting air system:
  - 1.3.1 ~~p~~Provides adequate amount of air for five consecutive starts of its EDG without makeup air.
  - 1.3.2 Is capable of achieving a single EDG start when the receiver is at the minimum receiver design pressure.
- 1.4 To confirm whether or not the operation of the EDG engine lube oil system is adequate.
- 1.5 To demonstrate electrical independence and redundancy of safety-related power supplies.
- 1.6 To confirm that the EDG intake air and exhaust gas systems demonstrate the ability to support full load capacity.
- 1.7 To verify that EDG auxiliary alarms, interlocks, and EDG auxiliary control functions perform as designed.

14.2-32

2.0 PREREQUISITES

- 2.1 Construction activities on the EDG auxiliary systems have been completed.
- 2.2 EDG auxiliary systems instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Support systems required for operation of the EDG auxiliary systems are complete and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 The EDGs are available for a loaded run to measure fuel consumption and to perform consecutive starts.

3.0 TEST METHOD

- 3.1 Demonstrate the operation of the fuel oil automatic transfer feature from the storage tanks to the day tank.
- 3.2 Demonstrate the operation of the fuel oil and day tank level alarms.
- 3.3 Demonstrate the day tank can be filled manually.
- 3.4 Demonstrate the operation of the fuel oil booster pump.

- 3.5 Demonstrate the operation of the fuel oil recirculation system.
- 3.6 Demonstrate by performing a loaded run of the EDG with its day tank filled to its low level alarm point, that the day tank provides sufficient fuel for at least 60 minutes of EDG operation with the EDG supplying the power requirements of the most limiting design basis accident.
- 3.7 Demonstrate by performing a loaded run of the EDG and analysis of EDG fuel storage capacity, that each EDG has sufficient fuel storage capacity to operate for a period of no less than seven days with the EDG supplying the power requirements of the most limiting design basis accident.
- 3.8 Demonstrate the operation of the EDG cooling water system keep warm pump.
- 3.9 Demonstrate the operation of EDG cooling system heaters.
- 3.10 Demonstrate the operation of the EDG cooling system alarms.
- 3.11 Demonstrate the operation of EDG starting air compressors.
- 3.12 Demonstrate that each EDG starting air system:
  - 3.12.1 ~~h~~Has sufficient volume available to perform five consecutive starts of its EDGs.
  - 3.12.2 Is capable of achieving a single EDG start when the receiver is at the minimum receiver design pressure.
- 3.13 Demonstrate the EDG starting air system operates the EDG pneumatic controls as designed.
- 3.14 Demonstrate the EDG starting air alarm interlocks and automatic operation.
- 3.15 Demonstrate the operation of the EDG lube oil pre-lube pump.
- 3.16 Demonstrate the operation of EDG lube oil heaters.
- 3.17 Demonstrate the operation of EDG lube oil alarms.
- 3.18 Demonstrate the operation of the EDG lube oil transfer pump.
- 3.19 Verify power-operated valves fail upon loss of motive power as designed (refer to Section 9.5).
- 3.20 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 3.21 Demonstrate by performing a loaded run of the EDG and analysis of EDG lube oil storage capacity, that each EDG has sufficient lube oil storage capacity to operate for a period of no less than seven days with the EDG supplying the power requirements of the most limiting design basis accident.
- 3.22 Verify that EDG auxiliary instrumentation operates over the design range using actual or simulated signals.

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- 3.23 Verify that EDG auxiliary alarms and interlocks occur as designed.
- 3.24 Verify that the EDG auxiliary instrumentation responds as designed to actual or simulated limiting malfunctions or failures.
- 3.25 Verify that the EDG auxiliary instrumentation response meets the accident analysis assumptions, such as time response, accuracy, and control stability.

4.0 DATA REQUIRED

- 4.1 EDG fuel oil consumption rate.
- 4.2 Setpoints of alarms, interlocks, and controls.
- 4.3 Operating data for pumps and compressors.
- 4.4 Operating data for the heaters.
- 4.5 EDG starting air volume parameters after consecutive starts.
- 4.6 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

- 5.1 14.2-32 → The EDG engine fuel oil system supplies adequate fuel for full load operation and operates as designed (refer to ~~described in~~ Section 9.5.4).
- 5.2 The EDG engine cooling water system provides adequate cooling for full load operation and operates as designed (refer to ~~described in~~ Section 9.5.5).
- 5.3 The EDG engine starting air system provides adequate starting air to recharge the receivers within the allowable design time and operates as designed (refer to ~~described in~~ Section 9.5.6).
- 5.4 The EDG engine lube oil system provides adequate engine lubrication and operates as designed (refer to ~~described in~~ Section 9.5.7).
- 5.5 Verify that safety-related components meet electrical independence and redundancy requirements.
- 5.6 The EDG intake air and exhaust gas systems provide sufficient capacity to support full load operation and operate as described in Section 9.5.8.

**14.2.12.9.17 Auxiliary Steam Generating System (Test #107)**

1.0 OBJECTIVE

- 1.1 To demonstrate the auxiliary steam generating system (ASGS) provides the steam to various plant components at designed pressures and flow.

2.0 PREREQUISITES

- 2.1 Construction activities on the ASGS have been completed.
- 2.2 ASGS instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

- 1.1 To verify the switchyard and preferred power system is capable of supplying power as designed to the unit through the preferred power circuits.
- 1.2 To verify the power generated by the turbine generator can be fed to grid through the switchyard and preferred power system.

2.0 PREREQUISITES

- 2.1 Construction activities on the switchyard and preferred power system have been completed.
- 2.2 Offsite power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems are completed and functional for operation of the switchyard and preferred power system.
- 2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify operation of the switchyard protective relaying system.
- 3.2 Verify operation of switchyard power current breakers and motor-operated disconnects from the following:
  - 3.2.1 The MCR.
  - 3.2.2 Switchyard relay house.
  - 3.2.3 Switchyard local control cabinet.
- 3.3 Verify operation of interlock between the separate offsite power connections.
- 3.4 Verify operation of the switchyard 125 Vdc auxiliary supply system and its associated controls, alarms, and batteries.
- 3.5 Verify the operation of the switchyard 480 Vac auxiliary power system and its associated controls, alarms, and annunciators.

4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms and interlocks occur.
- 4.2 Setpoint of protective relays.

5.0 ACCEPTANCE CRITERIA

- 5.1 The switchyard and preferred power system operates as designed (refer to described in Section 8.2).

14.2-32 →

**14.2.12.10.2 Unit Main Power (Test #109)**

1.0 OBJECTIVE

- 1.1 To demonstrate that the unit main power system is capable of supplying power to designated house loads.
- 1.2 To demonstrate that the unit main power system is capable of transmitting power from the main generator to the transmission system.

2.0 PREREQUISITES

- 2.1 Construction activities on the unit main power system have been completed.
- 2.2 The offsite power distribution system is available.
- 2.3 Buses and equipment have been voltage tested with acceptable results.
- 2.4 Equipment has been visually inspected.
- 2.5 Control power is available.
- 2.6 Plant conditions are such that the main generator can be operated.

3.0 TEST METHOD

- 3.1 Demonstrate the ability of the unit transformers to supply power to the unit auxiliary transformers from the offsite power source.
- 3.2 Demonstrate the ability of the unit transformers to transmit power from the main generator to the offsite power transmission system at rated voltage and load.
- 3.3 Demonstrate the ability of the main generator to generate designed voltage and load.
- 3.4 Demonstrate the ability of the unit auxiliary transformers to supply station loads.
- 3.5 Verify the operation of the generator circuit breaker.
- 3.6 Verify the operation of interlocks, alarms and protective relays.
- 3.7 Verify the operation of the main generator auxiliary systems.

4.0 DATA REQUIRED

- 4.1 Main generator operating data at load.
- 4.2 Unit transformer operating data.
- 4.3 Unit auxiliary transformer operating data.
- 4.4 Setpoints of alarms interlocks and controls.

5.0 ACCEPTANCE CRITERIA

- 14.2-32 → 5.1 The unit main power system operates as designed (refer to described in Section 8.2.1).

### 14.2.12.10.3 Class 1E Uninterruptible Power (Test #110)

#### 1.0 OBJECTIVE

1.1 To demonstrate the Class 1E DC power systems supply power as designed in required operating modes.

1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

14.2-32

#### 2.0 PREREQUISITES

2.1 Construction activities on the Class 1E DC power system have been completed.

2.2 Class 1E DC power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the Class 1E DC power system are completed and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Batteries are fully charged.

2.6 Load banks are available for discharge test.

2.7 Operation of breakers and cables has been verified.

2.8 Ventilation systems are in operation, as needed.

#### 3.0 TEST METHOD

3.1 Demonstrate that the batteries and battery chargers meet design capacities by performing discharge and charging tests.

3.2 Verify that minimum bank and individual cell limits are not exceeded during battery discharge test.

3.3 Verify that operation of the inverters, manual transfer switches, frequency synchronization, and blocking diodes meets design requirements.

3.4 Verify that the inverters automatically transfer input to the battery upon loss of preferred power while maintaining uninterrupted power output.

3.5 Place the battery chargers on equalize and verify that DC equalizing voltage shall not result in driving the inverter or relieving the rectifier from carrying the inverter load.

3.6 Verify that operation of protective devices, controls, interlocks, alarms, computer inputs, and ground detection meet design requirements.

3.7 Verify that operation of the vital instrumentation and control power status information subsystem meets design requirements.

3.8 Verify that operation of bus transfer devices meet design requirements.

3.9 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

14.2-32 →

4.0 DATA REQUIRED

4.1 Battery voltage and load current without charger.

4.2 Record of the charger float voltage and current.

4.3 Test discharge recordings of voltage, current, temperature, capacity in ampere hours, and individual cell voltages.

4.4 Charger voltage and current as battery eliminator.

4.5 Inverter voltage, frequency, and current from preferred source.

4.6 Inverter voltage, frequency, and current from battery source.

4.7 Setpoint at which alarms, interlocks, and controls occur.

4.8 System status information subsystem indications.

5.0 ACCEPTANCE CRITERIA

5.1 The Class 1E uninterruptible power system supplies the loads as designed (refer to ~~described in~~ Section 8.3.2).

5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.10.4 Non-Class 1E Uninterruptible Power (Test #111)**

1.0 OBJECTIVE

1.1 To demonstrate the operation of the following systems:

1.1.1 The 250 Vdc auxiliary power system.

2.0 PREREQUISITES

2.1 Construction activities on the non-Class 1E DC power system have been completed.

2.2 Non-Class 1E DC power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the non-Class 1E power system are completed and functional.

2.4 Test instrumentation is available and calibrated.

2.5 Batteries are fully charged.

2.6 Load banks are available for discharge test.

2.7 Operation of breakers and cables is verified.

2.8 Ventilation systems are in operation, as needed.

3.0 TEST METHOD

3.1 Demonstrate that the batteries and battery charges of the 250 Vdc auxiliary power system meet design capacities by performing discharge and charging tests.

3.2 Verify that minimum bank and individual cell limits are not exceeded during battery discharge tests.

3.3 Verify that operation of the inverters, manual transfer switches, frequency synchronization and blocking diodes meets design requirements.

3.4 Verify that the inverters automatically transfer the input to the battery upon loss of preferred power while maintaining uninterrupted power output.

3.5 Place the battery chargers on equalize and verify the DC equalizing voltage shall not result in driving the inverter or relieving the rectifier from carrying the inverter load.

3.6 Verify that operation of protective devices, controls, interlocks, alarms, computer inputs, and ground detection meets design requirements.

3.7 Verify the operation of bus transfer devices.

4.0 DATA REQUIRED

4.1 Battery voltage and load current without charger.

4.2 Charger float voltage and current.

4.3 Test discharge recording of voltage, current, temperature, capacity in ampere hours, and individual cell voltages.

4.4 Charger voltage and current as battery eliminator.

4.5 Inverter voltage, frequency, and current from preferred source.

4.6 Inverter voltage, frequency, and current from battery source.

4.7 Setpoint at which alarms, interlocks, and controls occur.

5.0 ACCEPTANCE CRITERIA

5.1 The non-Class 1E uninterruptible power system supplies the loads as designed (refer to ~~described~~ in Section 8.3.2).

14.2-32 →

**14.2.12.10.5 Control Rod Drive Power (Test #112)**

1.0 OBJECTIVE

1.1 To demonstrate the operation of the control rod drive power system.



14.2-32 → 1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the control rod drive power system have been completed.
- 2.2 The control rod drive power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the control rod drive power systems are completed and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 Applicable equipment has been visually inspected.

3.0 TEST METHOD

- 3.1 Demonstrate the functionality of the control rod drive source and reactor trip breakers locally and remotely.
- 3.2 Demonstrate the functionality of the bus interlocks alarms and protective relays.
- 3.3 Verify the operation of indication and automatic responses.
- 3.4 Perform energization of control rod drive power system.

14.2-32 → 3.5 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

- 5.1 The control rod drive power system operates as designed (refer to ~~described in~~ Section 8.3.1).
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.10.6 Normal Lighting (Test #113)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the normal lighting system.

2.0 PREREQUISITES

- 2.1 Construction activities on the normal lighting system have been completed.
- 2.2 Normal lighting system instrumentation has been calibrated and is operating satisfactorily prior to performing the test, if applicable.
- 2.3 Support systems required for operation of the normal lighting system are completed and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 Equipment has been visually inspected.
- 2.6 Normal lighting system power is available.

3.0 TEST METHOD

- 3.1 Demonstrate the functionality of the source and feeder circuit breakers locally and remotely.
- 3.2 Demonstrate the functionality of the bus interlocks alarms and protective relays.
- 3.3 Verify the operation of indication and automatic responses.
- 3.4 Verify normal lighting levels for each system with other lighting systems de-energized.

4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

14.2-32 → 5.1 Normal lighting systems operate as designed (refer to described in Section 9.5.3).

14.2.12.10.7 ~~Security Lighting (Test #114)~~ Reserved

1.0 ~~OBJECTIVE~~

- 1.1 ~~To demonstrate that the security lighting systems provide adequate illumination for plant operations.~~

2.0 ~~PREREQUISITES~~

- 2.1 ~~Construction activities on the security lighting system have been completed.~~
- 2.2 ~~Test instruments are calibrated per applicable procedures and available.~~

3.0 ~~TEST METHOD~~

- 3.1 ~~Place the security plant lighting in service and check that illumination levels are adequate.~~

- 3.2 ~~Demonstrate that a single circuit failure shall not cause the loss of lighting in a room which requires normal access.~~
- 3.3 ~~Demonstrate that loss of normal power results in activation of the security lighting system for each affected room, where required to monitor isolation zones, and outdoor areas within the plant protected perimeter as designed.~~
- 3.4 ~~Demonstrate the security lighting system provides adequate illumination levels, including, but not limited to, those required to support plant closed circuit TV security functions.~~
- 4.0 ~~DATA REQUIRED~~
  - 4.1 ~~Illumination levels in designated areas.~~
- 5.0 ~~ACCEPTANCE CRITERIA~~
  - 5.1 ~~The security lighting systems operate as described in Section 13.6.~~

**14.2.12.10.8 Emergency Lighting (Test #115)**

1.0 OBJECTIVE

- 1.1 To demonstrate that the emergency lighting system provides adequate illumination to operate equipment during emergency operations.
- 1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

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2.0 PREREQUISITES

- 2.1 Construction activities on the emergency lighting system have been completed.
- 2.2 Test instruments are calibrated per applicable procedures and available.

3.0 TEST METHODS

- 3.1 Demonstrate that the emergency lighting system provides levels of illumination as required in designated control areas.
- 3.2 Demonstrate that the emergency lighting system provides levels of illumination in other designated areas of the plant.
- 3.3 Demonstrate that the emergency lighting system comes on upon loss of normal lighting.
- 3.4 Demonstrate that the battery operated emergency lights provide adequate illumination at designated locations.
- 3.5 Demonstrate that the battery operated emergency lights are capable of providing lighting for the designated amount of time.

14.2-32

3.6 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

4.1 Illumination levels in designated areas.

4.2 Battery powered lighting data.

5.0 ACCEPTANCE CRITERIA

5.1 The emergency lighting system operates as designed (refer to ~~described in~~ Section 9.5.3).

5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.10.9 6.9 kV Class 1E Emergency Power (Test #116)**

1.0 OBJECTIVE

1.1 To demonstrate the operation of 6.9 kV Class 1E systems.

1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the 6.9 kV Class 1E emergency power system have been completed.

2.2 The 6.9 kV Class 1E emergency power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.

2.3 Support systems required for operation of the 6.9 kV Class 1E emergency power system are completed and functional.

2.4 Test Instrumentation is available and calibrated.

2.5 All 6.9 kV feeders and buses voltage tested with acceptable results.

2.6 6.9 kV power is available from the normal and alternate ESF transformer sources.

2.7 Switchgear assembly, breakers, control and protective equipment, and circuits have been inspected and tested and are capable of being placed into service.

2.8 The EDG and emergency AC sources are available.

3.0 TEST METHOD

3.1 Demonstrate the functionality of the feeder and cross-tie protective circuit breakers locally and remotely.

- 3.2 Demonstrate the functionality of the bus interlocks, alarms, and protective relays.
- 3.3 Verify the operation of indication and automatic responses.
- 3.4 Load the systems to the extent practical and verify full load voltage is within system design parameters.
  - 3.4.1 Verify the capability of bus loads to start and operate as designed when connected to the Class 1E 6.9 kV buses at ±10 percent nominal voltage.
- 3.5 Verify the 6.9 kV and 480 V safety-related systems load shed as designed on under voltage.
- 3.6 Verify the 6.9 kV Class 1E buses can be energized from the following power sources:
  - 3.6.1 Respective emergency auxiliary transformer.
  - 3.6.2 Respective EDG.
  - 3.6.3 Respective alternate AC source.

14.2-32

3.7 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Full load bus voltage data.
- 4.2 Setpoints at which alarms, interlocks, and protective relays occur.
- 4.3 System response to low bus voltage.

5.0 ACCEPTANCE CRITERIA

- 5.1 The 6.9 kV Class 1E emergency power system operates as designed (refer to ~~described in~~ Section 8.3.1).
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.10.10 480 Volt Class 1E Emergency Power (Test #117)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the 480 V Class 1E emergency power system.
- 1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the 480V Class 1E emergency power system have been completed.

- 2.2 The 480 V Class 1E emergency power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the 480V Class 1E emergency power systems are completed and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 Buses and equipment meggered with acceptable results.
- 2.6 Applicable equipment has been visually inspected.

3.0 TEST METHOD

- 3.1 Demonstrate the functionality of the 480 Vac source and feeder circuit breakers locally and remotely.
- 3.2 Demonstrate the functionality of the bus interlocks alarms and protective relays.
- 3.3 Verify the operation of indication and automatic responses.
- 3.4 Perform energization of 480 Vac Class 1E emergency power system.

14.2-32 →

3.5 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

- 5.1 The 480 V Class 1E emergency power system operates as designed (refer to ~~described in~~ Section 8.3.1).
- 5.2 Verify that safety-related components meet electrical independence and redundancy requirements.

**14.2.12.10.11 13.8 kV Normal Power (Test #118)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the 13.8 kV normal power system.

2.0 PREREQUISITES

- 2.1 Construction activities on the 13.8 kV normal power system have been completed.
- 2.2 13.8 kV normal power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the 13.8 kV normal power system are completed and functional.

- 2.4 Test instrumentation is available and calibrated.
- 2.5 Normal auxiliary transformers available.
- 2.6 All 13.8 kV feeders and buses have been voltage tested with acceptable results.
- 2.7 Switchgear assembly, breaker, control and protective equipment, and circuits have been inspected and tested and are capable of being placed into service.

3.0 TEST METHOD

- 3.1 Demonstrate the functionality of the 13.8 kV feeder circuit breakers locally and remotely.
- 3.2 Demonstrate the functionality of the bus interlocks, alarms, and protective relays.
- 3.3 Verify the operation of indication and automatic responses.

4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

- 5.1 The 13.8 kV normal power system operates as designed (refer to described in Sections 8.2 and 8.3.1).

14.2-32 →

**14.2.12.10.12 6.9 kV Normal Power (Test #119)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the 6.9 kV normal power system.

2.0 PREREQUISITE

- 2.1 Construction activities on the 6.9 kV normal power system have been completed.
- 2.2 The 6.9 kV normal power system instrumentation are calibrated and are operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the 6.9 kV normal power system are completed and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 All 6.9 kV feeders and buses have been voltage tested with acceptable results.
- 2.6 The 6.9 kV power is available from the following:
  - 2.6.1 Normal auxiliary transformer.
  - 2.6.2 Respective alternate AC source.

- 2.3 Support systems required for operation of the 480 V normal power systems are completed and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 Buses and equipment have been meggered with acceptable results.
- 2.6 Equipment has been visually inspected.
- 2.7 The 6.9 kV normal auxiliary power supply is available.

3.0 TEST METHOD

- 3.1 Demonstrate the functionality of the 480 Vac source and feeder circuit breakers locally and remotely.
- 3.2 Demonstrate the functionality of the bus interlocks alarms and protective relays.
- 3.3 Verify the operation of indication and automatic responses.
- 3.4 Perform energization of 480 Vac normal power system.

4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms, interlocks, and protective relays occur.

5.0 ACCEPTANCE CRITERIA

- 5.1 The 480 V normal power system operates as designed (refer to ~~described in~~ Section 8.3.1).

14.2-32 →

**14.2.12.10.14 Class 1E DC Power (Test #121)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the Class 1E DC power system.
- 1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the Class 1E DC power systems have been completed.
- 2.2 Class 1E DC power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the Class 1E DC power systems are completed and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 Buses and equipment have been meggered with acceptable results.
- 2.6 Equipment has been visually inspected.



3.0 TEST METHOD

- 3.1 Demonstrate the functionality of the Class 1E DC source and feeder circuit breakers locally and remotely.
- 3.2 Demonstrate the functionality of the bus interlocks alarms and protective relays.
- 3.3 Verify the operation of indication and automatic responses.
- 3.4 Perform energization of Class 1E DC power system.

4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms, interlocks and protective relays occur.
- 4.2 Capacity estimates of the batteries.

5.0 ACCEPTANCE CRITERIA

- 5.1 The Class 1E DC power system operates as designed (refer to described in Section 8.3.2.1).

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**14.2.12.10.15 Non-Class 1E DC Power (Test #122)**

1.0 OBJECTIVE

- 1.1 To demonstrate the operation of the severe accident non-Class 1E DC power system.
- 1.2 To demonstrate the operation of the TI non-Class 1E DC power system.

2.0 PREREQUISITES

- 2.1 Construction activities on both non-Class 1E DC power systems have been completed.
- 2.2 Non-Class 1E DC power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the non-Class 1E DC power systems are completed and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 Buses and equipment have been meggered with acceptable results.
- 2.6 Equipment has been visually inspected.

3.0 TEST METHOD

- 3.1 Demonstrate the functionality of the non-Class 1E DC source and feeder circuit breakers locally and remotely.
- 3.2 Demonstrate the functionality of the bus interlocks alarms and protective relays.

- 3.3 Verify the operation of indication and automatic responses.
- 3.4 Perform energization of both non-Class 1E DC power system.

4.0 DATA REQUIRED

- 4.1 Setpoints at which alarms, interlocks, and protective relays occur.
- 4.2 Estimated capacity of the batteries.

5.0 ACCEPTANCE CRITERIA

- 5.1 The non-Class 1E DC power system operates as designed (refer to ~~described in~~ Section 8.3.2.1).

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**14.2.12.10.16 Severe Accident Uninterruptible Power (Test #123)**

1.0 OBJECTIVE

- 1.1 To demonstrate the severe accident DC power systems supply power as designed in required operating modes.

2.0 PREREQUISITES

- 2.1 Construction activities on the severe accident DC power system have been completed.
- 2.2 Severe accident DC power system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Support systems required for operation of the severe accident DC power system are completed and functional.
- 2.4 Test instrumentation is available and calibrated.
- 2.5 Batteries are fully charged.
- 2.6 Load banks are available for discharge test.
- 2.7 Operation of breakers and cables has been verified.
- 2.8 Ventilation systems are in operation, as needed.

3.0 TEST METHOD

- 3.1 Demonstrate that the batteries and battery chargers meet design capacities by performing discharge and charging tests.
- 3.2 Verify that minimum bank and individual cell limits are not exceeded during battery discharge test.
- 3.3 Verify that operation of the inverters, manual transfer switches, frequency synchronization, and blocking diodes meets design requirements.
- 3.4 Verify that the inverters automatically transfer input to the battery upon loss of preferred power while maintaining uninterrupted power output.

- 3.5 Place the battery chargers on equalize and verify DC equalizing voltage shall not result in driving the inverter, relieving the rectifier from carrying the inverter load.
- 3.6 Verify that operation of protective devices, controls, interlocks, alarms, computer inputs, and ground detection meet design requirements.
- 3.7 Verify that operation of the vital instrumentation and control power status information subsystem meets design requirements.
- 3.8 Verify proper operation of bus transfer devices.

4.0 DATA REQUIRED

- 4.1 Battery voltage and load current without charger.
- 4.2 Charger float voltage and current.
- 4.3 Test discharge recordings of voltage, current, temperature, capacity in ampere hours, and individual cell voltages.
- 4.4 Charger voltage and current as battery eliminator.
- 4.5 Inverter voltage, frequency, and current from preferred source.
- 4.6 Inverter voltage, frequency, and current from battery source.
- 4.7 Setpoint at which alarms, interlocks, and controls occur.
- 4.8 System status information subsystem indications.

5.0 ACCEPTANCE CRITERIA

14.2-32

- 5.1 The severe accident uninterruptible power system supplies the loads as designed (refer to ~~described in~~ Sections 8.3.1 and 8.3.2).

14.2.12.11 I&C ~~Plant~~ Systems

14.2.12.11.1 ~~Reserved~~ Non-Safety Instrument & Control (Test #124)

1.0 OBJECTIVE

- 1.1 ~~To demonstrate proper operation of the non-safety instrument and control system.~~

2.0 PREREQUISITES

- 2.1 ~~Construction activities on the non-safety instrument and control system have been completed.~~
- 2.2 ~~Non-safety instrument and control system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.~~
- 2.3 ~~Special test instrumentation is available and calibrated.~~
- 2.4 ~~Verify that factory acceptance testing has been completed~~

- 3.9 Verify that the SMS system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.
- 3.10 Verify redundancy and electrical independence of the SMS design.

4.0 DATA REQUIRED

- 4.1 Record sensor response to simulated seismic inputs.

5.0 ACCEPTANCE CRITERIA

- 5.1 The as-built location of the SMS equipment is as shown on the plant layout drawings.~~The SMS operates as described in Section 3.7.4.~~
- 5.2 The SMS system can compute the cumulative absolute velocity (CAV) and provide indication of the CAV in the main control room (MCR).
- 5.3 The SMS has sufficient dynamic range.
- 5.4 The SMS has a sufficient bandwidth.
- 5.5 The SMS has a sufficient sampling rate.
- 5.6 The SMS has a sufficient trigger level.
- 5.7 The SMS backup battery has sufficient capacity to power its instruments for continuous operation as described in the equipment specification.
- 5.8 The SMS function as described in Section 3.7.4.

**14.2.12.11.3 Boron Concentration Measurement System (Test #126)**

1.0 OBJECTIVE

- 1.1 To demonstrate proper operation of the safety-related boron concentration measurement system (BCMS). The system measures the nuclear cross-section of CVCS fluid and calculates a corresponding boron concentration.
- 1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

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2.0 PREREQUISITES

- 2.1 The BCMS has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.2 Support systems required for BCMS operation are complete and functional.
- 2.3 Verify that factory acceptance testing has been completed.
- 2.4 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

4.0 DATA REQUIRED

- 4.1 Setpoints under which alarms and interlocks occur.
- 4.2 PICS functional data (input data and corresponding output).

5.0 ACCEPTANCE CRITERIA

- 5.1 The PICS provides monitoring and control of process systems.~~The PICS operates as described in Section 7.1.1.~~
- 5.2 The PICS provides the status of the automatic reactor trip and engineered safety features.
- 5.3 The PICS provides the manual reset of automatic reactor trip and engineered safety features.
- 5.4 The PICS provides manual component control of safety-related process systems via the PAS and the PACS.
- 5.5 The PICS provides safety parameter display system (SPDS) functions.
- 5.6 The PICS displays the Type A-E post-accident monitoring (PAM) variables.
- 5.7 The PICS provides monitoring and control of systems required to mitigate severe accidents.
- 5.8 The PICS displays bypassed and inoperable status of safety systems.
- 5.9 The PICS provides alarm management capability.
- 5.10 The PICS provides the capability to archive plant data.
- 5.11 The PICS provides the interface to external I&C computers.
- 5.12 The PICS provides an interface to external computers via a unidirectional firewall.
- 5.13 The PICS functions as described in Section 7.1.1.

**14.2.12.11.7 Communication System (Test #130)**

1.0 OBJECTIVE

- 1.1 To demonstrate the adequacy of the intra-plant communication system to provide communications between vital plant areas.
- 1.2 To demonstrate the offsite communication system to provide communications with exterior entities.
- 1.3 Verify that safety-related portions of the communication system function as designed to malfunctions or failures.
- 1.4 To demonstrate electrical independence and redundancy of safety-related power supplies.

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2.0 PREREQUISITES

- 2.1 Construction activities on the intraplant communication system have been completed.
- 2.2 Support systems required for operation of the intraplant communication system are complete and functional.
- 2.3 Plant equipment that contributes to the ambient noise level shall be in operation.

3.0 TEST METHOD

- 3.1 Verify the intraplant portable wireless communication system functions as designed.
- 3.2 Verify that the intraplant (PABX) telephone system functions as designed.
- 3.3 Verify the intraplant sound powered telephone system functions as designed.
- 3.4 Verify the intraplant public address system functions as designed.
- 3.5 Verify that the intraplant cell telephone system functions as designed.
- 3.6 Verify the security radio system functions as designed at locations throughout the plant.
- 3.7 Verify the normal offsite telephone system functions as designed.
- 3.8 Verify the emergency telephone system (emergency notification system, health physics network and ring down phone system) function as designed.
- 3.9 Verify that the communication system responds as designed to actual or simulated limiting malfunctions or failures.
- 3.10 Verify redundancy and electrical independence of the communication system.
- 3.11 Verify that the communication system's response meets the accident analysis assumptions.
- 3.12 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.
- 3.13 Verify that the communications equipment will perform under anticipated maximum plant noise levels.
- 3.14 Verify the effectiveness of the exclusion zones established for protecting the safety-related I&C equipment from mis-operation due to EMI/RFI effects from the portable phones and radios of the communication system.

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4.0 DATA REQUIRED

- 4.1 Record the results of communication attempts from each system and its locations.

5.0 ACCEPTANCE CRITERIA

- 5.1 The portable wireless communication system provides radio coverage throughout the plant, except in areas restricted due to potential EMI/RFI considerations.~~The intraplant and offsite communication system operates as described in Section 9.5.2.~~
- 5.2 The portable wireless communication system provides an interconnection to the public switched telephone network (PSTN) to allow offsite communications.
- 5.3 The digital telephone system provides plant-wide intercom capability.
- 5.4 The digital telephone system provides an interconnection to the public switched telephone network (PSTN) to allow offsite communications.
- 5.5 The public address and alarm system operates as described in the design specification.
- 5.6 The sound powered system operates as described in the design specification.
- 5.7 The security communication system operates as described in the design specification.
- 5.8 The communication system provides communication with the emergency notification system and the health physics network.
- 5.9 The communication equipment is capable of operating under maximum noise conditions.
- 5.10 Verify that safety-related components meet electrical independence and redundancy requirements.
- 5.11 Safety-related I&C equipment is not adversely impacted by the portable phones and radios of the communication system.
- 5.12 The intraplant and offsite communication systems functions as described in Sections 9.5.2.

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14.2.12.11.8 Vibration Monitoring System~~Reserved~~ (Test #131)

1.0 OBJECTIVE

- 1.1 To verify that the operation of the non-safety-related vibration monitoring system meets the design requirements.
- 1.2 To verify that the vibration monitoring setpoints are suitable for initial power operation.

2.0 PREREQUISITES

- 2.1 Construction activities on the vibration monitoring system are completed.
- 2.2 Sensors, cables, and conditioning electronics are installed and functional.

5.3 The PFAS is provided with both an electrically supervised primary and secondary power source that will transfer automatically to the secondary power source upon loss of the primary power source. A trouble signal is provided in the MCR upon loss of either power source to any local fire control panel or workstation.

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5.4 The PFAS operates as designed (refer to Sections 9.5.1).

**14.2.12.11.10 Loose Parts Monitoring System (Test #133)**

1.0 OBJECTIVE

1.1 To verify that operation of the non-safety-related loose parts monitoring system (LPMS) meets design requirements.

~~1.2 To verify that operation of the vibration monitoring system meets design requirements.~~

1.2 To verify that the loose parts setpoints are suitable for initial power operation.

~~1.4 To verify that the vibration alarm setpoints are suitable for initial power operation.~~

2.0 PREREQUISITES

2.1 Construction activities on the loose parts system are completed.

~~2.2 Construction activities on the vibration monitoring system are completed.~~

2.2 Sensors, cables, and signal conditioning electronics are installed and functional.

2.3 Power cabinets, test circuits, and amplifiers are ready to support testing.

2.4 Required test equipment is functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

3.1 Verify the response of the ~~vibration~~loose parts monitoring channels with a mechanical impulse type device.

3.2 Verify alarm functions using simulated signals.

3.3 Establish baseline monitoring data for a cold subcritical plant.

3.4 Establish the alarm level for loose parts channels in a cold subcritical plant.

3.5 Verify that the LPMS operates over the design range using actual or simulated signals.



- 5.9 The TG I&C system provides monitoring of thermal, hydraulic, and electrical parameters associated with the turbine generator and initiates a turbine trip for the conditions listed in Section 10.2.2.10.
- 5.10 The TG I&C system functions as described in Section 10.2.

**14.2.12.11.12 Reactor Pressure Vessel Level Measurement System (Test #135)**

1.0 OBJECTIVE

- 1.1 To verify the reactor pressure vessel level (RPVL) measurement system is capable of indicating vessel level.

2.0 PREREQUISITES

- 2.1 Construction activities on the RPVL measurement system have been completed.
- 2.2 The RPVL measurement system instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 Support systems required for operation of the RPVL measurement system are complete and functional.
- 2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Demonstrate control logic and controls and response to reactor pressure vessel level changes.
- 3.2 Verify that the RPVL system operates over the design range using actual or simulated signals.
- 3.3 Verify that the RPVL system responds as designed to actual or simulated limiting malfunctions or failures.
- 3.4 Verify that the RPVL system response meets the design assumptions, such as time response, accuracy, and control stability.
- 3.5 Verify redundancy and electrical independence of the RPVL design.

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4.0 DATA REQUIRED

- 4.1 RPVL measurement system indication.

5.0 ACCEPTANCE CRITERIA

- 5.1 The RPVL measurement system provides reactor vessel water level measurement. The RPVL measurement system performs as described in Section 7.1.1.5.7.
- 5.2 The RPVL conditioning cabinets receive power from their respective Class 1E division.

- 5.4 The alarm setpoints have been established.
- 5.5 The LDS functions as described in Sections 5.2.5 and 7.1.15.12.

**14.2.12.11.15 ~~Accident Monitoring~~Reserved (Test #138)**

**1.0 OBJECTIVE**

- 1.1 ~~To verify proper operation of the postaccident and severe accident systems, which comprise the accident monitoring system. The systems that are used for accident monitoring consist of radiation monitoring, reactor vessel water level indicating system, and selected instrumentation.~~
- 1.2 ~~To verify that the accident monitoring system monitors the established parameters.~~

**2.0 PREREQUISITES**

- 2.1 ~~Construction activities on the accident monitoring systems are complete.~~
- 2.2 ~~Required special test equipment is available and functional.~~
- 2.3 ~~Verify that factory acceptance testing has been completed.~~
- 2.4 ~~Verify proper operation of alarm, control, and indication functions.~~

**3.0 TEST METHOD**

- 3.1 ~~Simulate data that is indicative of normal and abnormal accident data.~~
- 3.2 ~~Verify that accident monitoring systems alert and alarm setpoints have been defined.~~
- 3.3 ~~Verify that various displays meet system requirements.~~

**4.0 DATA REQUIRED**

- 4.1 ~~Simulated normal and abnormal accident data.~~

**5.0 ACCEPTANCE CRITERIA**

- 5.1 ~~The accident monitoring system performs as described in Sections 7.1.2 and 7.5.2.~~

**14.2.12.11.16 Reserved (Test #139)**

**14.2.12.11.17 Remote Shutdown Station (Test #140)**

**1.0 OBJECTIVE**

- 1.1 To verify proper operation of the remote shutdown station (RSS).
- 1.2 To determine transfer of control occurs and that the plant can be controlled and cooled down from the RSS.

14.2-32 1.3 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 All construction activities on the RSS have been completed.
- 2.2 The RSS instrumentation has been calibrated and is functional for performing the following test.
- 2.3 The communication systems between the MCR and RSS location have been demonstrated to be functional.
- 2.4 Verify that factory acceptance testing has been completed.
- 2.5 Verify proper operation of alarm, control, and indication functions.

3.0 TEST METHOD

- 3.1 Simulate signals to verify that operation of RSS instrumentation meets design requirements.
- 3.2 Perform a full transfer of control from the MCR during the performance of the HFT.
- 3.3 Perform a controlled cooldown from the remote shutdown panel during the performance of the HFT.
- 3.4 Verify that the RSS operates over the design range using actual or simulated signals.
- 3.5 Verify that the RSS responds as designed to actual or simulated limiting malfunctions or failures.
- 3.6 Verify that the RSS response meets the accident analysis assumptions, such as time response, accuracy, and control stability.
- 3.7 Verify redundancy and electrical independence of the RSS.

14.2-32 3.8 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 RCS temperatures and pressures.

5.0 ACCEPTANCE CRITERIA

- 5.1 The ability to cooldown using remote shutdown instrumentation and controls has been demonstrated.
- 5.2 The RSS transfer switches provide the capability to transfer control from the Main Control Room (MCR) to the RSS. ~~The RSS performs as described in Sections 6.4.2, 7.4.1, and 7.4.3.~~
- 5.3 Electrical isolation is provided between the MCR and the RSS.

- 14.2-32 5.4 Verify that safety-related components meet electrical independence and redundancy requirements.
- 5.5 The RSS functions as described in Sections 6.4.2, 7.4.1, and 7.4.3.

#### 14.2.12.11.18 Incore Instrumentation (Test #141)

##### 1.0 OBJECTIVE

- 1.1 To measure fixed incore cable insulation resistance.
- 1.2 To verify proper amplifier operation.
- 14.2-32 1.3 To demonstrate electrical independence and redundancy of safety-related power supplies.

##### 2.0 PREREQUISITES

- 2.1 Construction activities on the incore instrumentation system are complete. However, detectors (instrument lances) do not need to be installed.
- 2.2 Fixed incore nuclear signal channel instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Special test instrumentation has been calibrated.
- 2.4 Incore instrumentation system support systems are functional.
- 2.5 Verify that factory acceptance testing has been completed.
- 2.6 Verify proper operation of alarm, control, and indication functions.

##### 3.0 TEST METHOD

- 3.1 Measure and record cabling insulation resistance.
- 3.2 Simulate incore signals into the signal conditioning circuits using external test instrumentation.
- 3.3 Test each amplifier for as designed operation in accordance with the manufacturer instruction manual using the internal test circuits.
- 3.4 Simulate variable inputs to the amplifier and record its values displayed by the DPS.
- 3.5 Verify that the incore system operates over the design range using actual or simulated signals.
- 3.6 Verify that the incore system responds as designed to actual or simulated limiting malfunctions or failures.
- 3.7 Verify that the incore system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.
- 3.8 Verify redundancy and electrical independence of the incore design.

14.2-32 → 3.9 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Cabling insulation resistance readings.
- 4.2 Status and performance of the internal test circuits.
- 4.3 Values of simulated input and derived output signals for correlation purposes.

5.0 ACCEPTANCE CRITERIA

5.1 The incore instrumentation is arranged as shown on the plant layout drawings. Reference U.S. EPR FSAR Tier 2 Figure 4.4-8 for additional information. ~~The incore instrumentation cables and instrumentation perform as described in Section 7.1.1.~~

5.2 The self-powered neutron detectors generate neutron flux measurement signals as input to the protection system using simulated signals.

5.3 The core outlet thermocouples generate core outlet temperature measurement signals as input to the safety automation system using simulated signals.

14.2-32 → 5.4 Verify that safety-related components meet electrical independence and redundancy requirements.

5.5 The incore instrumentation cables and instrumentation function as described in Section 7.1.1.5.2.

**14.2.12.11.19 Excore Instrumentation (Test #142)**

1.0 OBJECTIVE

- 1.1 To verify the proper functional performance of the excore instrumentation system.
- 1.2 To verify the proper performance of audio and visual indicators.

14.2-32 → 1.3 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the excore instrumentation system have been completed.
- 2.2 Excore instrumentation system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 External test equipment has been calibrated and is functional.

- 2.4 Support systems required for operation of the excore instrumentation system are functional.
- 2.5 Verify that factory acceptance testing has been completed.
- 2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

- 3.1 Simulate and vary input signals to the startup, safety, and control channels of the excore instrumentation system using appropriate test instrumentation.
- 3.2 Monitor and record output signals as a function of variable inputs provided by test instrumentation.
- 3.3 Record the performance of audio and visual indicators in response to changing input signals.
- 3.4 Verify that the excore system operates over the design range using actual or simulated signals.
- 3.5 Verify that the excore system responds as designed to actual or simulated limiting malfunctions or failures.
- 3.6 Verify that the excore system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.
- 3.7 Verify redundancy and electrical independence of the excore design.
- 3.8 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

14.2-32



4.0 DATA REQUIRED

- 4.1 Values of input and output signals for correlation purposes, as required.
- 4.2 Values of output signals triggering audio and visual alarms.

5.0 ACCEPTANCE CRITERIA

- 5.1 The excore instrumentation is arranged as illustrated on the plant layout drawings. Reference U.S. EPR FSAR Tier 2 Figure 7.1-15 for additional information.~~The excore instrumentation system performs as described in Section 7.1.1.~~
- 5.2 The intermediate range and power range detectors generate neutron flux measurement signals as inputs to the protection system using simulated signals.
- 5.3 The excore instrumentation receives power from its respective Class 1E division.
- 5.4 Verify that safety-related components meet electrical independence and redundancy requirements.

14.2-32



- 3.5 Verify as designed alarm actuation in the MCR.
- 3.6 Simulate a high radiation signal to the radiation monitors.
- 3.7 Record alarm actuations in the MCR or local control room, as appropriate.
- 4.0 DATA REQUIRED
  - 4.1 The monitor response to check source.
  - 4.2 Technical data associated with the source.
  - 4.3 Signal levels necessary to cause alarm actuation.
  - 4.4 Response time of the monitor to perform control functions.
- 5.0 ACCEPTANCE CRITERIA

- 5.1 Verify that the process and effluent radiological monitoring system operates as follows: described in Section 11.5.1.
  - 5.1.1 Radiation monitors are installed on all effluent paths as shown on plant layout drawings.
  - 5.1.2 The radiation monitors have been source checked to verify response.
  - 5.1.3 Preliminary alarm setpoints have been established and calibrated in the equipment.
  - 5.1.4 Upon activating the alarm setpoint, automatic actions (valve closure, pumps stopping, etc.) occur as designed.
  - 5.1.5 Radiation monitors function as described in Section 11.5.1.

**14.2.12.11.22 Hydrogen Monitoring (Test #145)**

1.0 OBJECTIVE

- 1.1 To demonstrate the proper operation of the safety-related hydrogen monitoring system.
- 1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

14.2-32

2.0 PREREQUISITES

- 2.1 Construction activities on the hydrogen monitoring system have been completed.
- 2.2 Hydrogen monitoring instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 Electrical power systems required for the hydrogen monitoring system are available.
- 2.4 Test instrumentation is available and calibrated.

3.0 TEST METHOD

- 3.1 Verify hydrogen monitoring system logic and indication.
- 3.2 Verify hydrogen monitoring system response to sample hydrogen concentrations.
- 3.3 Verify that the hydrogen monitoring system operates over the design range using actual or simulated signals.
- 3.4 Verify that the hydrogen monitoring system responds as designed to actual or simulated limiting malfunctions or failures.
- 3.5 Verify that the hydrogen monitoring system response meets the accident analysis assumptions, such as time response, and accuracy.
- 3.6 Verify redundancy and electrical independence of the hydrogen monitoring system design.
- 3.7 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

14.2-32

4.0 DATA REQUIRED

- 4.1 Response to hydrogen samples.

5.0 ACCEPTANCE CRITERIA

- 5.1 The low range hydrogen monitoring system (HMS) consists of hydrogen sensors arranged in the following containment areas: upper dome, upper pressurizer compartment, upper stem generator compartments 1/2 and 3/4, annular rooms. ~~The hydrogen monitoring system operates as described in Section 6.2.5.~~
- 5.2 The low range HMS signal processing unit is located in Safeguard Building 1 and is powered from the Class 1E electrical power supply.
- 5.3 Verify that safety-related components meet electrical independence and redundancy requirements.
- 5.4 The HMS functions as described in Section 6.2.5.

14.2-32

14.2.12.11.23 Protection System (Test #146)

1.0 OBJECTIVE

- 1.1 To demonstrate the proper operation of the safety-related reactor protection system (RPS).
- 1.2 To determine the PS RPS-response times.
- 1.3 To demonstrate electrical independence and redundancy of safety-related power supplies.

14.2-32

2.0 PREREQUISITES



- 2.1 Construction activities on the trip circuit breaker and RPS have been completed.
- 2.2 RPS system instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 External test instrumentation is available and calibrated.
- 2.4 Verify that factory acceptance testing has been completed.
- 2.5 Support systems required for PS operation ~~of the following~~ are functional and the plant is configured so that equipment damage or personnel injury will not occur. For example, pump breakers racked to test to prevent inadvertent pump start, or pump motors uncoupled.:
  - 2.5.1 Reactor trip ~~circuit~~ breakers.
  - 2.5.2 ~~Verify that factory acceptance testing has been completed~~Reactor trip contactors.
  - 2.5.3 ~~Verify proper operation of alarm, control and indication functions~~Transistors of CRDM operating coils.
  - 2.5.4 Safety injection system (SIS) components are energized and positioned in a manner to respond to an actuation.
  - 2.5.5 Emergency feedwater system (EFWS) components are energized and positioned in a manner to respond to an actuation.
  - 2.5.6 Manual RT signals from SICS.

3.0 TEST METHOD

- 3.1 Energize power supplies and verify output voltage.
- 3.2 Simulate ground faults and observe operation of the ground fault detectors.
- 3.3 Activate manual trips and monitor ~~relay operation~~PS response.
- 3.4 Simulate combinations of the two-out-of-four trip logic for each of the actuation ~~signals~~ systems (SIAS, CIAS, CSAS, CCAS, MSIS, EFAS) and observe actuation ~~of the appropriate trip circuit~~ and associated alarms.
- 3.5 ~~Exercise the control functions to the safety depressurization and shutdown cooling system to verify as designed operations~~Simulate PS inputs that would generate a reactor trip signal and trip each reactor trip breaker. Observe reactor trip breaker operation.
- 3.6 Simulate PS inputs that would generate a reactor trip signals and trip each reactor trip ~~contactor~~circuit breaker with the breaker in the test position. Observe ~~reactor trip contactor~~circuit breaker operation.
- 3.7 Exercise the bi-stable comparators using internal and external test circuitry and observe the setpoints and operation of the appropriate logic. Simulate PS inputs that would generate a reactor trip signal and trip each CRDM operating coil transistor. Observe CRDM operating

- ~~coil transistor discharge. Repeat the previous step with the reactor trip circuit breakers in the operate position.~~
- 3.8 Simulate PS inputs that would generate a SIS actuation signal and observe SIS response. ~~Exercise the bistable comparators using internal and external test circuitry and observe the setpoints and operation of the appropriate logic.~~
- 3.9 Simulate PS inputs that would generate an EFWS actuation signal and observe EFWS response. ~~Check the operation of trip channel bypass features including, where applicable, observation of the setpoints at which the trip bypasses are cancelled automatically.~~
- 3.10 Initiate a manual reactor trip from SICS and observe the following: ~~Activate manual trips and observe relay operation.~~
  - 3.10.1 Reactor trip breaker operation.
  - 3.10.2 Reactor trip contactor operation.
  - 3.10.3 CRDM operating coil transistor discharge.
- 3.11 ~~Check the~~ at operation of bypass features including, where applicable, observation of the setpoints at which the trip bypasses are cancelled automatically. ~~low pressurizer pressure and low SG pressure trip setpoints track the process variable at the prescribed rate and can be manually reset to the as designed margin below the process variable.~~
- 3.12 ~~Verify as designed operation of the core protection calculator system by input/output and internal function tests.~~
- 3.13 ~~Inject signals into appropriate sensors or sensor terminals and measure the elapsed time to achieve tripping of the reactor trip circuit breakers or actuation of the logical actuation relays. Trip or actuation paths may be tested in several segments.~~
- 3.14 Inject signals into appropriate sensors or sensor terminals and measure the elapsed time to achieve actuation of the field device (e.g., breaker, contactor). Trip or actuation paths may be tested in several segments.
- 3.15 Observe protection system operation over the design range using actual or simulated input signals.
- 3.16 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing from service (i.e., loss of power condition) three of four PS divisions and determining which functions are lost on the energized PS division and which overall PS functions are lost. Repeat test for all PS divisions.

14.2-32 →

4.0 DATA REQUIRED

- 4.1 Power supply voltages.
- 4.2 Resistance for ground fault detector operation.
- 4.3 Circuit breaker and indicator operation.
- 4.4 Point of actuation of bi-stable comparators.

- 14.2-32 → 5.17 Verify that safety-related components meet electrical independence and redundancy requirements.
- 5.18 The PS functions as described in Section 7.1.14.1.

**14.2.12.11.24 Reactor Control, Surveillance & Limitation (Test #147)**

1.0 OBJECTIVE

- 1.1 To demonstrate the proper operation of the non-safety-related reactor control, surveillance and limitation system (RCSL).
- 1.2 To demonstrate electrical independence and redundancy of power supplies.

14.2-32 →

2.0 PREREQUISITES

- 2.1 Construction activities on the RCSL have been completed.
- 2.2 RCSL software is installed and instrumentation has been calibrated and is operating satisfactorily prior to performing the following test.
- 2.3 External test equipment has been calibrated and is functional.
- 2.4 Support systems required for operation of the RCSL are functional.
- 2.5 Cabling has been completed between the RCSL and interface equipment.
- 2.6 Verify that factory acceptance testing has been completed.
- 2.7 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

- 3.1 Simulate inputs to the RCSL; observe receipt of these signals at the RCSL and system response.
- 3.2 Verify that the RCSL operates over the design range using actual or simulated signals.
- 3.3 Verify that the RCSL responds as designed to actual or simulated limiting malfunctions or failures.
- 3.4 Verify that the RCSL response meets design bases assumptions.
- 3.5 Verify redundancy and electrical independence of the RCSL design.

4.0 DATA REQUIRED

- 4.1 Input signal values.
- 4.2 RCSL output response.

5.0 ACCEPTANCE CRITERIA

4.4 Value of parameters required to actuate alarms.

5.0 ACCEPTANCE CRITERIA

5.1 The process radiation monitor of the process sampling functions as follows:

5.1.1 Radiation monitors are installed on process paths as shown on plant layout drawings.

5.1.2 The radiation monitors have been source checked to verify response.

5.1.3 Preliminary alarms setpoints have been established and calibrated in the equipment.

5.2 Process radiation monitors function as described in Section 11.5.4.

**14.2.12.11.26 Reserved Test (#139)**

**14.2.12.11.27 Reserved (Test #157)**

**14.2.12.11.28 Reserved (Test #158)**

**14.2.12.11.29 Reserved Personnel Radiation Monitors (Test #160)**

A COL applicant that references the U.S. EPR design certification will provide site-specific test abstract information for personnel radiation monitors.

**14.2.12.12 I&C Functions**

**14.2.12.12.1 Accident Monitoring (Test # 138)**

Note: The Accident Monitoring is not a separate system but is a collection of functions provided by other systems.

1.0 OBJECTIVE

1.1 To verify proper operation of the postaccident and severe accident systems, which comprise the accident monitoring system. The systems that are used for accident monitoring consist of radiation monitoring, reactor vessel water level indicating system, and selected instrumentation.

1.2 To verify that the accident monitoring system monitors the established parameters.

1.3 To demonstrate electrical independence and redundancy of safety-related power supplies.

14.2-32

2.0 PREREQUISITES

2.1 Construction activities on the systems that provide the accident monitoring functions are complete.

- 2.2 Required special test equipment is available and functional.
- 2.3 Verify that factory acceptance testing has been completed.
- 2.4 Verify proper operation of alarm, control, and indication functions.
- 2.5 Verify preoperational Test #143 has been satisfactorily completed for radiation monitoring instrumentation.

3.0 TEST METHOD

- 3.1 Simulate data that is indicative of normal and abnormal accident data.
- 3.2 Verify that accident monitoring systems alert and alarm setpoints have been defined.
- 3.3 Verify that various displays meet system requirements.
- 3.4 Verify that the I&C system operates over the design range using actual or simulated signals.
- 3.5 Verify that the I&C system responds as designed to actual or simulated limiting malfunctions or failures.
- 3.6 Verify that the I&C system response meets the accident analysis assumptions, such as time response, accuracy, and control stability.
- 3.7 Verify redundancy and electrical independence of the I&C design.

14.2-32



Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Simulated normal and abnormal accident data.

5.0 ACCEPTANCE CRITERIA

- 5.1 The accident monitoring system provides the outputs described in the accident response procedures (Abnormal Operating Procedures, Emergency Operating Procedures, Severe Accident Mitigation Procedures, etc.).

14.2-32



Verify that safety-related components meet electrical independence and redundancy requirements.

- 5.3 The accident monitoring system functions as described in Section 7.5.1.2.

**14.2.12.12.2 Main Steam Relief Trains (Test #148)**

1.0 OBJECTIVE

- 1.1 To demonstrate the proper operation of the MSRT.
- 1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

14.2-32



## 2.0 PREREQUISITES

- 2.1 Construction activities on the MSRT (MSRCV and MSRIV) and interfacing equipment have been completed.
- 2.2 The ~~MSRT~~MSRIV pilot valves have been calibrated and are operating satisfactorily prior to performing the following test.
- 2.3 External test equipment has been calibrated and is functional.
- 2.4 Support systems required for operation of the MSRT are functional.
- 2.5 Verify that factory acceptance testing has been completed.
- 2.6 Verify proper operation of alarm, control, and indication functions.
- 2.7 Verify that the MSRT tested flow capacity meets the design requirements.
  - 2.7.1 FSAR Table 14.3-1 Item 1-50.

14.2-32

## 3.0 TEST METHOD

- 3.1 Simulate inputs to the MSRT and observe receipt of these signals as follows:-
  - 3.1.1 Verify that the MSRCV responds as follows to simulated levels of thermal power:
    - From zero to 20 percent thermal power-40 percent open.
    - From 20 to 50 percent thermal power-linear variation between 40 and 100 percent open.
    - For greater than 50 percent thermal power-100 percent open.
  - 3.1.2 Verify that the MSRIV responds to simulated steam pressure changes.
- 3.2 Verify that the MSRT (MSRCV and MSRIV) operates over the design range using actual or simulated signals.
- 3.3 Simulate varying system inputs and observe output responses at the MSRT and at interfacing equipment.
- 3.4 Verify response of the MSRT valves and position indicators.
- 3.5 Demonstrate dynamic operation of the MSRT valves during HFT, using Test #152.
- 3.6 Verify that the MSRT responds as designed to actual or simulated limiting malfunctions or failures.
- 3.7 Verify that the MSRT system response meets the accident analysis assumptions, i.e., time response, accuracy, and control stability.

14.2-32

3.7.1 FSAR Table 14.3-1 Item 1-61.

3.8 Verify redundancy and electrical independence of the MSRT design.

14.2-32

3.9 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

4.1 Input signal values.

4.2 MSRT output response.

5.0 ACCEPTANCE CRITERIA

5.1 The MSRT preliminary setpoints have been calibrated into the system.~~The MSRT performs as described in Sections 7.3 and 10.3.~~

5.2 The MSRT responds as designed to simulated signals.

14.2-32

5.3 Verify that safety-related components meet electrical independence and redundancy requirements.

5.4 The MSRT functions as described in Sections 7.3 and 10.3.

### 14.2.12.12.3 Steam Generator Level Control (Test #149)

Note: The steam generator level control is performed by the PAS and is separated from other PAS functions in this test for clarity.

1.0 OBJECTIVE

1.1 To demonstrate the proper operation of the SG level control system.

14.2-32

1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

2.1 Construction activities on the SG level control system and interfacing equipment have been completed.

2.2 The SG level control system instrumentation has been calibrated and is functional for performance of the following test.

2.3 External test equipment has been calibrated and is functional.

2.4 Support systems required for the operation of the SG level control system are functional.

2.5 Verify that factory acceptance testing has been completed.

2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

3.1 Simulate inputs to the SG level control system and observe receipt of these signals at the non-safety control system.

- 3.2 Simulate varying input signals to the SG level control system and observe output responses at the non-safety control system.
- 3.3 Monitor the system during initial operation and verify as-designed operation, including control stability.
- 3.4 Verify that the steam generator level controls respond as designed to actual or simulated limiting malfunctions or failures.
- 3.5 Verify the redundancy and electrical independence of the I&C design.
- 3.6 Verify that the steam generator level control function operates over the design range using actual or simulated signals.

14.2-32 → Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Input signal values.
- 4.2 The SG level control system response.

5.0 ACCEPTANCE CRITERIA

- 5.1 The steam generator level control setpoints have been installed in the PAS computer. ~~The SG level control system performs as described in Section 7.7.2 and Section 10.4.7.~~
- 5.2 The steam generator controls respond as designed to simulated high and low signals by opening and closing the feedwater regulating valves.
- 5.3 The steam generator level controls start the SSS and EFW pumps, as designed.
- 14.2-32 → Verify that safety-related components meet electrical independence and redundancy requirements.
- 5.5 The steam generator level control system functions as described in Sections 7.7.2 and 10.4.7.

**14.2.12.12.4 Reactor Partial Trip (Test #150)**

Note: The partial trip function is performed by the RCSL system and is separated from other RCSL functions in this test for clarity.

1.0 OBJECTIVE

- 1.1 To demonstrate proper operation of the reactor partial trip (RPT).
- 1.2 To demonstrate electrical independence and redundancy of safety-related power supplies.

14.2-32 →

2.0 PREREQUISITES



- 2.1 Construction activities on the RPT have been completed.
- 2.2 RPT instrumentation has been calibrated and is functional for performance of the following test.
- 2.3 External test equipment has been checked and calibrated.
- 2.4 Support systems required for the operation of the RPT are functional.
- 2.5 Verify that factory acceptance testing has been completed.
- 2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

- 3.1 Simulate signals to plant control system that are equivalent to hot full power.
- 3.2 Simulate loss of single RCP input to the RPT; observe response.

14.2-32 → 3.3 Simulate loss of ~~single~~ feedwater pump without startup of standby feedwater pump input to the RPT; observe response.

3.4 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Input signal values.
- 4.2 RPCS output response.

5.0 ACCEPTANCE CRITERIA

- 5.1 The reactor partial trip setpoints have been properly configured in the RCSL software. ~~The RPT performs as described in Sections 7.1.1 and 7.7.2.~~
- 5.2 The reactor partial trip function sends the signal to drop the designated RCCAs upon receiving the appropriate simulated signal.
- 5.3 The reactor partial trip function sends the signal to runback the turbine load upon receiving the appropriate simulated signal.
- 14.2-32 → 5.4 Verify that safety-related components meet electrical independence and redundancy requirements.
- 5.5 The reactor partial trip functions as described in Sections 7.1.1 and 7.7.2.

**14.2.12.12.5 Primary Depressurization (Test #151)**

1.0 OBJECTIVE

- 1.1 To verify the flow paths of the primary depressurization system.

- 1.2 To verify that pressurizer safety valves and associated piping perform as designed.
- 1.3 To verify that pressurizer severe accident valves and associated piping perform as designed
- 1.4 To verify the proper operation of the reactor coolant gas vent system and the associated piping.
- 1.5 14.2-32 → To demonstrate electrical independence and redundancy of safety-related power supplies.

2.0 PREREQUISITES

- 2.1 Construction activities on the system to be tested are essentially complete.
- 2.2 Plant is at hot zero power (HZP) (pressure and temperature) conditions during HFT.
- 2.3 Plant systems required to support testing are functional, or temporary systems are installed and functional.
- 2.4 Permanently installed instrumentation is functional and calibrated, and is functional for performance of the following test.

3.0 TEST METHOD

- 3.1 Verify the performance of the pressurizer safety valves from the pressurizer to the pressurizer relief tank (PRT) by simulating an over pressurizer condition. To simulate an overpressure condition, a test device is used to apply the required differential pressure between the normal operating pressure and the lift setpoint.
- 3.2 Verify the performance of the pressurizer severe accident valves from the pressurizer to the PRT by simulating an over pressurizer condition.
- 3.3 Verify that the reactor coolant gas vent system (both the pressurizer vent and the reactor vessel upper head vent) meets design depressurization rates.
- 3.4 Verify flow paths through the rapid depressurization system from the pressurizer to the PRT, ~~using water or air~~ during valve discharge at HZP fluid conditions.
- 3.5 Verify ~~power-operated~~ pressurizer safety relief and reactor coolant gas vent valves fail to the closed position upon loss of motive power ~~to the closed position.~~
- 3.6 Verify pressurizer severe accident valves fail-as-is upon loss of motive power.
- 3.7 14.2-32 → Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

4.0 DATA REQUIRED

- 4.1 Valve position indications.
- 4.2 RCS temperature and pressures.
- 4.3 RCS depressurization rates.
- 4.4 PRT temperature, pressure, and level.
- 4.5 Reactors drain tank temperature, pressure, and level.
- 4.6 IRWST temperature, pressure, and level.
- 4.7 Position response of valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

- 5.1 The RCS allows venting of the pressurizer and reactor vessel through designed flow paths, as shown on the plant layout drawings~~described in Section 5.4.~~
- 5.2 The primary depressurization system provides a depressurization path through designed flow paths.
- 5.3 The primary depressurization piping systems vibration and displacement data has been collected and is being evaluated.
- 5.4 The primary depressurization system functions as described in Section 5.4.
- 5.5 Verify that safety-related components meet electrical independence and redundancy requirements.

14.2-32 →

14.2.12.12.6 ~~Rapid-Depressurization~~ Partial Cooldown (Test #152)

1.0 OBJECTIVE

- 1.1 To verify the flow paths of the MSRT during partial cooldown~~rapid-depressurization system.~~
- 1.2 To verify ~~that MSRT and associated piping perform as designed~~the MSRT setpoint is reduced upon receipt of a safety injection signal.
- 1.3 To demonstrate electrical independence and redundancy of safety-related power supplies.
- 1.4 To verify response of the MSRT (MSRCV and MSRIV) to simulated signals.

14.2-32 →

2.0 PREREQUISITES

- 2.1 Construction activities on the MSRT and main steam system ~~to be tested~~ are essentially complete.
- 2.2 Plant is at HZP (pressure and temperature) conditions during HFT.
- 2.3 Plant systems required to support testing are functional. ~~or temporary systems are installed and functional.~~

- 2.4 Permanently installed instrumentation is ~~functional and~~ calibrated and ~~is~~ functional for performance of the following test.
- 2.5 Verify that factory acceptance testing has been completed.
- 2.6 Verify proper operation of alarm, control and indication functions.

3.0 TEST METHOD

- 3.1 Verify the performance of the MSRT by simulating a safety injection signal and verifying that the MSRT setpoint is reduced.
- 3.2 Verify power-operated valves fail upon loss of motive power as designed.

14.2-32 → 3.3 Check electrical independence and redundancy of power supplies for safety-related functions by selectively removing power and determining loss of function.

- 3.4 Verify that the MSRCV positions to 40 percent open based on a thermal power level of 0 percent.

4.0 DATA REQUIRED

- 4.1 Valve position indications s as a function of time.
- 4.2 RCS temperature and pressures s as a function of time.
- 4.3 RCS depressurization rates s as a function of time.
- 4.4 SG pressure and level as a function of time.
- 4.5 Position response of MSRT valves to loss of motive power.

5.0 ACCEPTANCE CRITERIA

- 5.1 The ~~rapid depressurization~~ main steam system provides a depressurization path through ~~designed flow paths~~ the MSRT valves and associated silencers to atmosphere, as designed (refer to Section 10.3.2.2).
- 5.2 The MSRT setpoint is reduced upon receipt of a safety injection signal, as designed (refer to Sections 6.3.3.1, 10.3.2.2, and 16 B 3.3.1).
- 5.3 Verify that safety-related components meet electrical power supply independence and redundancy requirements, as designed (refer to Section 8.1.4.2).
- 5.4 The MSRCV positions to 40 percent based on a thermal power of 0 percent, as designed (refer to Section 10.3.2.2).
- 5.5 The MSRIV positions as required to control the rate of steam pressure reduction with minimal overshoot.

14.2-32 → 5.6 Verify the response of the partial cooldown function to a SIS signal.  
 5.6.1 FSAR Table 14.3-1 Item 1-44.

- 1.1 To demonstrate that the inputs and appropriate outputs between the following digital systems are in agreement:
  - 1.1.1 Plant protection system.
  - 1.1.2 Process instrumentation.
  - 1.1.3 Discrete indication and alarm system.
  - 1.1.4 DPS.
- 1.2 To verify NR temperature and pressure instrumentation accuracy and operation by comparing similar channels of instrumentation.
- 2.0 PREREQUISITES
  - 2.1 Instrumentation has been calibrated and is functional.
- 3.0 TEST METHOD
  - 3.1 Record wide range process instrumentation readings as directed by the pre-core HFT.
  - 3.2 Record NR process instrumentation readings as directed by the pre-core HFT.
- 4.0 DATA REQUIRED
  - 4.1 MCR panel instrument reading.
  - 4.2 DIAS readings.
  - 4.3 DPS readings.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 NR instrument readings shall agree within the accuracy of the instrumentation as ~~described in~~designed (refer to Section 7.1.2 and Section 7.5.1).
  - 5.2 Wide range instrument readings shall agree within the accuracy of the instrumentation as ~~described in~~designed (refer to Section 7.1.2 and Section 7.5.1).

14.2-32 →

**14.2.12.13.3 Pre-Core Test Data Record (Test #163)**

- 1.0 OBJECTIVE
  - 1.1 To monitor instrumentation during integrated plant operation.
  - 1.2 To verify, by cross checking channels, the satisfactory tracking of process instrumentation.
  - 1.3 To provide a permanent record of plant pre-core loading parameter indication.
- 2.0 PREREQUISITES

2.1 Instrumentation has been calibrated and is functional.

3.0 TEST METHOD

3.1 Record MCR instrumentation steady-state readings as directed by the pre-core HFT controlling document.

4.0 DATA REQUIRED

4.1 Plant conditions at the time instrument readings are recorded.

4.2 Instrument readings.

5.0 ACCEPTANCE CRITERIA

5.1 Similar instrumentation readings shall agree within the accuracy limits of the instrumentation as ~~described in~~ designed (refer to Section 7.1.2).

**14.2.12.13.4 Pre-Core Reactor Internals Vibration Measurements (Test #164)**

1.0 OBJECTIVE

1.1 To demonstrate that the reactor internal vibration measurements are within design limits.

2.0 PREREQUISITES

2.1 Construction activities have been completed on the reactor vessel.

2.2 The lower internals have been installed.

2.3 Dummy fuel assemblies have been constructed from ~~actual~~ fuel skeletons with stainless fuel pins.

2.4 Dummy fuel assemblies have been installed in available core locations.

2.5 If the ITAAC requires vibration data from inside the reactor, install a special instrumented dummy fuel assembly with data cables routed through one of the instrument ports in the reactor head.

3.0 TEST METHOD

3.1 Operate the reactor normally and record operating data during HFT.

3.2 Remove the upper internals, dummy fuel assemblies, and lower internals and place in storage location.

3.3 Inspect upper and lower internals, paying special attention to contact surfaces between internals and reactor vessel or upper and lower internals.

4.0 DATA REQUIRED

4.1 Plant conditions.

4.2 Clearances at the upper to lower internals interfaces.

5.1 Unrestricted expansion for selected points on components as described in Section 3.9.2.

14.2-32 → 5.2 Verification that components return to their baseline ambient position as ~~described in~~ designed (refer to Section 3.9.2).

5.3 Verification that as designed gaps exist for selected points on components as ~~described in~~ designed (refer to Section 3.9.2).

**14.2.12.13.6 Pre-Core Primary and Secondary Chemistry Data (Test #166)**

1.0 OBJECTIVE

1.1 To demonstrate that as-designed water chemistry for the RCS and SG can be maintained.

2.0 PREREQUISITES

- 2.1 Primary and secondary sampling systems are functional.
- 2.2 Chemicals to support HFT are available.
- 2.3 The primary and secondary chemical addition systems are functional.
- 2.4 Purification ion exchangers are charged with resin.

3.0 TEST METHOD

- 3.1 Perform sampling frequency for the SG and RCS as specified by the AREVA Chemistry Manual. The sampling frequency can be increased as necessary to ~~ensure~~ confirm the as-designed RCS and SG water chemistry.
- 3.2 Perform RCS and SG sampling and chemistry analysis after every significant change in plant conditions (i.e., heatup, cooldown, chemical additions).

4.0 DATA REQUIRED

- 4.1 Plant conditions.
- 4.2 SG chemistry analysis.
- 4.3 RCS chemistry analysis.

5.0 ACCEPTANCE CRITERIA

14.2-32 → 5.1 RCS and SG water chemistry can be maintained as ~~described in~~ designed (refer to Section 5.4.2 and the AREVA Chemistry Manual).

**14.2.12.13.7 Pre-Core Pressurizer Performance (Test #167)**

1.0 OBJECTIVE

1.1 The pressurizer pressure and level control systems function properly.

- 1.2 To demonstrate proper operation of the auxiliary spray valves and pressurizer heaters.
- 1.3 To demonstrate proper operation of the letdown control valves and charging pumps.
- 2.0 PREREQUISITES
  - 2.1 Pressurizer pressure and level control system instrumentation has been calibrated.
  - 2.2 Support systems required for the operation of the pressurizer pressure and level control systems are functional.
  - 2.3 Test equipment is available and calibrated.
- 3.0 TEST METHOD
  - 3.1 Simulate a decreasing pressurizer pressure and observe heater response and alarm and interlock setpoints.
  - 3.2 Simulate an increasing pressurizer pressure and observe heater and spray valve response and alarm and interlock setpoints.
  - 3.3 Simulate a low level error in the pressurizer and observe as-designed CVCS response and alarm and interlock setpoints.
  - 3.4 Simulate a high level error in the pressurizer and observe as designed CVCS response and alarm and interlock setpoints.
  - 3.5 Simulate a low-low pressurizer level and observe heater response and alarm and interlock setpoints.
- 4.0 DATA REQUIRED
  - 4.1 Response of pressurizer heaters to simulated pressure and level signals.
  - 4.2 Response of spray valves to simulated pressurizer pressure.
  - 4.3 Response of CVCS to simulated pressurizer level.
  - 4.4 Values of parameters at which alarms and interlocks occur.
- 5.0 ACCEPTANCE CRITERIA

14.2-32 → 5.1 The pressurizer ~~performs as described in~~ meets design requirements (refer to Section 5.4.10).

**14.2.12.13.8 Pre-Core Pressurizer Surge Line Stratification (Test #168)**

- 1.0 OBJECTIVE
  - 1.1 To demonstrate pressurizer surge line stratification is within acceptable limits.
- 2.0 PREREQUISITES



- 2.7 Containment pit cooling system is functional and operating in normal.
- 2.8 Test equipment is available and calibrated.
- 2.9 Support systems required for operation of the CRDM system are functional.
- 2.10 Preoperational Test #036 has been completed satisfactorily.

3.0 TEST METHOD

- 3.1 Measure the loop resistance for each of the CRDM coils at specified RCS temperature and pressures.
- 3.2 Balance the containment pit cooling system as required to maintain the coil temperatures within the specified limits.
- 3.3 Verify that the cabling between the reactor bulkhead and the CRDM cabinets has been connected.
- 3.4 Energize each CRDM.
- 3.5 Measure the DC voltage across the upper gripper coil and across the shunt on the CRDM.
- 3.6 Operate each CRDM a minimum of 24 steps and observe rod demand count operation.

4.0 DATA REQUIRED

- 4.1 CRDM cold coil resistance.
- 4.2 CRDM cable resistance.
- 4.3 RCS temperature and pressure.
- 4.4 CRDM coil loop resistance at specified RCS temperature and pressure.
- 4.5 DC voltage across the upper gripper coil at the specified RCS temperature and pressure.
- 4.6 DC voltage across the shunt.
- 4.7 CRDM rod demand digital position readings.

5.0 ACCEPTANCE CRITERIA

- 5.1 The CRDM system ~~performs as described in~~ meets design requirements (refer to Section 4.5 and Section 4.6).

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**14.2.12.13.10 Pre-Core Reactor Coolant System Flow Model Verification (Test #170)**

Note: It is not possible to measure RCS flow prior to operating at a core power that allows measurement of calorimetric power. The RCS elbow tap flow transmitters will be normalized to 100 percent but this activity will have to be repeated after fuel loading.

1.0 OBJECTIVE

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1.1 To predict the pre-core RCS ~~flowrate~~flow rate. ~~Note that it is not possible to measure RCS flow prior to operating at a core power that allows measurement of calorimetric power.~~

1.2 To establish baseline RCS pressure drops.

1.3 To collect RCP coastdown data.

2.0 PREREQUISITES

2.1 Permanently installed instrumentation has been calibrated and is functional.

2.2 Test instrumentation has been checked and calibrated.

2.3 Reactor vessel internals have been installed with full flow debris filters, dummy fuel assemblies, or equivalent that approximates the pressure drop across the core.

2.4 RCS operating at nominal HZP (pressure and temperature) conditions.

2.5 Desired RCPs are operating.

2.6 The associated digital DPS(s) are in operation.

3.0 TEST METHOD

3.1 The RCS elbow tap flow instrumentation has been normalized to 100 percent RCS flow.

3.2 RCS flow, pressure drops, and the data necessary to calculate RCS flows for four RCP operations shall be obtained for various RCP configurations.

3.3 Measure RCP coastdown data for each RCP.

3.3.1 FSAR Table 14.3-1 Item 1-6.

4.0 DATA REQUIRED

4.1 ~~DPS~~Steam generator differential pressure.

4.2 RCP differential pressure.

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4.3 RCS elbow tap flow indication.

4.4 RCS temperature and pressures at practical locations.

4.5 RCP speed (rpm).

4.6 Reactor vessel differential pressure.

4.7 Operating RCP configuration corresponding to data set.

5.0 ACCEPTANCE CRITERIA

5.1 The predicted RCS flow exceeds the value necessary to establish that post-core flow is in excess of that used for analysis in Chapter 15 and Section 5.0.

14.2-32	<p>5.2 The predicted RCS flow is less than the design maximum <del>flowrate</del><u>flow rate as described in</u>(refer to Section 5.1).</p> <p>5.3 <u>RCP coastdown data has been collected.</u></p>
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**14.2.12.13.11 Pre-Core Reactor Coolant System Heat Loss (Test #171)**

1.0 OBJECTIVE

- 1.1 To measure RCS heat loss under HZP (pressure and temperature) conditions.
- 1.2 To measure the pressurizer heat loss under HZP (pressure and temperature) conditions.

2.0 PREREQUISITES

- 2.1 Test instrumentation is available and calibrated.
- 2.2 Construction activities on the RCS and associated systems are completed.
- 2.3 Verify pressurizer spray bypass valves are closed.
- 2.4 Permanently installed instrumentation on the system to be tested is available and calibrated.

3.0 TEST METHOD

- 3.1 Determine the RCS heat loss using the steamdown method:
  - 3.1.1 Stabilize the SG levels with the RCS at HZP (pressure and temperature) conditions.
  - 3.1.2 Secure SG feedwater and blowdown.
  - 3.1.3 By leaving pressurizer spray flow in automatic and varying the number of pressurizer heaters maintain RCS temperature constant.
  - 3.1.4 Measure the pressurizer heater power required to maintain RCS temperature and pressure constant.
  - 3.1.5 Measure the RCP power during the period.
  - 3.1.6 Perform a heat balance calculation to determine heat loss.
- 3.2 Determine the pressurizer heat loss without continuous spray flow as follows:
  - 3.2.1 Manually close the spray bypass valves.
  - 3.2.2 Measure the pressurizer heater power required to maintain the pressurizer pressure constant with the RCS at HZP (pressure and temperature).
  - 3.2.3 Perform a heat balance calculation to determine heat loss for the pressurizer (ignore RCP power).

- 3.1.2 Reactor coolant filter.
- 3.1.3 Seal water injection filter.
- 3.1.4 Seal return filter.
- 3.1.5 Seal water control valve.
- 3.1.6 Charging flow control valve.

4.0 DATA REQUIRED

- 4.1 Letdown temperature, pressure and ~~flowrate~~flow rates.
- 4.2 Charging temperature and ~~flowrate~~flow rates.
- 4.3 Charging pump parameters (i.e., motor power, vibration levels, bearing temperatures).
- 4.4 Differential pressure across specified components.
- 4.5 VCT pressure and level.
- 4.6 Pressurizer level.
- 4.7 RCS temperature and pressure.
- 4.8 Regenerative heat exchanger inlet and outlet temperatures:
  - 4.8.1 Shell side.
  - 4.8.2 Tube side.
- 4.9 High pressure cooler inlet and outlet temperatures:
  - 4.9.1 Shell side.
  - 4.9.2 Tube side.

5.0 ACCEPTANCE CRITERIA

- 5.1 14.2-32 → The CVCS ~~performs as described in~~meets design requirements (refer to Section 9.3.4).

**14.2.12.13.14 Pre-Core Turbine Overspeed (Test #174)**

1.0 OBJECTIVE

- 1.1 ~~(Deleted)To verify that the mechanical overspeed trip protects the turbine as designed.~~
- 1.2 To verify that the ~~electronic~~primary and secondary overspeed trip ~~systems~~ protects the turbine as designed.
- 1.3 14.2-32 → To demonstrate electrical independence and redundancy of non-safety-related power supplies.

2.0 PREREQUISITES

- 5.1 Verification that the RCS loop check valves shall pass flow with the RCS at elevated pressure and temperature conditions.
- 5.2 Verification that the SI accumulator discharge check valves shall pass flow with the RCS at elevated pressure and temperature conditions.

**14.2.12.13.16 Pre-Core Boration and Dilution Measurements (Test #176)**

1.0 OBJECTIVE

- 1.1 To demonstrate the ability of the CVCS to control the boron concentration of the RCS by the feed and bleed method.
- 1.2 To demonstrate the ability of the CVCS to supply concentrated boric acid to the RCS.

2.0 PREREQUISITES

- 2.1 BAST is filled with borated water.
- 2.2 The reactor boron and water makeup system (RBWMS) (i.e., boron addition system) is functional.
- 2.3 The boron measurement system is functional.
- 2.4 RCS and CVCS boron concentration is approximately zero (0 ppmB).

3.0 TEST METHOD

- 3.1 Line up the boric acid pumps to take suction from the BAST and discharge to the charging pump suction and to the RCS, and observe operation of the RBWMS.
- 3.2 Perform boration and dilution operation of the RCS by operating the boric acid makeup control system in its various modes of operation.
- 3.3 Sample the RCS during boration and dilution operations and observe operation of the boron measurement system.

4.0 DATA REQUIRED

- 4.1 RCS temperature and pressure.
- 4.2 Makeup controller flow readings and setpoints.
- 4.3 Chemical analysis of boron concentration.
- 4.4 VCT level.
- 4.5 Boron measurement system readings.
- 4.6 Charging ~~flowrate~~flow rates.
- 4.7 Letdown ~~flowrate~~flow rate.

5.0 ACCEPTANCE CRITERIA

- 5.1 The RBWMS perform as ~~described in~~designed (refer to Section 9.3.4).

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**14.2.12.13.17 Pre-Core Safety Injection Initiated at HZP (Test #177)**

- 1.0 OBJECTIVE
  - 1.1 To demonstrate the ability of the SI system to inject into a pressurized RCS.
- 2.0 PREREQUISITES
  - 2.1 The RCS is at HZP (pressure and temperature) conditions.
  - 2.2 The normal RCP trip function on SI injection has been disabled. With no decay heat the RCS could cool uncontrollably.
- 3.0 TEST METHOD
  - 3.1 Initiate an SI signal.
- 4.0 DATA REQUIRED
  - 4.1 The following time dependent data shall be collected at a frequent scan rate:
    - 4.1.1 RCS parameters (temperature and pressure).
    - 4.1.2 SI parameters (e.g., flow, pump discharge pressure, fluid temperature).
  - 4.2 Pressurizer parameters (e.g., pressure, level).
  - 4.3 VCT pressure and level.
  - 4.4 Letdown ~~flowrate~~ flow rate.
- 5.0 ACCEPTANCE CRITERIA

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5.1 The safety injection system ~~performs as described in~~ meets design requirements (refer to Section 6.3).

**14.2.12.13.18 Pre-Core Loss of Instrument Air (Test #178)**

- 1.0 OBJECTIVES
  - 1.1 To demonstrate that a reduction and loss of instrument air pressure causes no adverse operation of active safety-related equipment.
- 2.0 PREREQUISITES
  - 2.1 Construction activities on items to be tested have been completed.
  - 2.2 Individual valves and equipment are functional.
  - 2.3 The instrument air system is in service at rated pressure with support systems functional to the extent necessary to conduct the test. Pneumatic loads are cut-in to the extent possible at the time test begins.

5.1 ICRR does not show significant approach to criticality.

**14.2.12.14.2 Post-Core Sequencing Document (Test #180)**

1.0 OBJECTIVE

- 1.1 To verify system function of systems impacted by fuel load, prior to Mode 2 and Mode 1 operation.
- 1.2 To demonstrate the proper integrated operation of plant systems with fuel assemblies loaded in the core.

2.0 PREREQUISITES

- 2.1 Required pre-core tests have been completed.
- 2.2 Permanently installed instrumentation on systems to be tested is available and calibrated in accordance with regulatory requirements and test procedures.
- 2.3 Test instrumentation is available and installed in accordance with plant requirements and calibrated per the calibrated tool program.
- 2.4 Fuel loading has been completed.
- 2.5 The CRDMs and the CRDM control system are functional.
- 2.6 The SGs are in wet lay-up in accordance with the AREVA NSSS chemistry manual.

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3.0 TEST METHOD

- 3.1 Establish the specific plant conditions required by each procedure while maintaining Technical Specification operability.
- 3.2 Coordinate the execution of tests to prevent unanalyzed configurations.

4.0 DATA REQUIRED

- 4.1 As specified by the individual post-core tests.

5.0 ACCEPTANCE CRITERIA

- 5.1 Tests are completed within Technical Specification limitations.

**14.2.12.14.3 Post-Core Loose Parts Monitoring Baseline (Test #181)**

1.0 OBJECTIVE

- 1.1 To obtain baseline data on the loose parts and vibration monitoring systems.
- 1.2 To eliminate nuisance alarms during normal operation.

2.0 PREREQUISITES

- 2.1 Prefunctional tests on the loose parts and vibration monitoring systems have been completed.
- 2.2 The loose parts and vibration monitoring systems instrumentation has been calibrated and is functional.
- 3.0 TEST METHOD
  - 3.1 Collect baseline data using the loose parts and vibration monitoring systems during plant heatup and at normal operating conditions.
  - 3.2 Analyze baseline data and, if necessary, adjust alarm setpoints.
- 4.0 DATA REQUIRED
  - 4.1 Baseline data using the loose parts and vibration monitoring systems.
  - 4.2 Loose parts and vibration monitoring systems alarm setpoints.
  - 4.3 RCS temperature and pressure.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 14.2-32 → The loose parts and vibration monitoring systems perform as ~~described~~ indesigned (refer to Section 7.1.1).
  - 5.2 The loose parts and vibration monitoring systems alarm setpoints have been adjusted using the baseline data.

**14.2.12.14.4 Post-Core RCS Temperature Cross Calibration (Test #182)**

- 1.0 OBJECTIVE
  - 1.1 To normalize the RCS ~~flow-temperature~~ transmitters.
  - 1.2 ~~To determine the RCP flow coastdown characteristics.~~
  - 1.3 To measure post-core RCS pressure drops.
  - 1.4 ~~To collect flow related data on the operation of the RCPs for steady-state and transient conditions.~~
- 2.0 PREREQUISITES
  - 2.1 Construction activities have been completed and the RCS is operational or functional as required by regulatory requirements.
  - 2.2 Permanently installed temperature instrumentation is calibrated and functional or operable, as required.
  - 2.3 ~~Temporary test instrumentation is calibrated and installed in a manner that complies with Technical Specification limitations. The test instrumentation shall be installed to collect RCS pressures at accessible locations around the RCS.~~
  - 2.4 The RCS is operating at nominal HZP-350°F (pressure and temperature) conditions with RHR removed from service.



3.0 TEST METHOD

- 3.1 ~~Verify that the RCS flow indications are normalized at 100 percent RCS flow.~~ Collect Tcold and Thot data from RCS RTD.
- 3.2 ~~Record indicated RCS flow data for functionally allowed RCP combinations.~~ Collect core exit thermocouple data from each thermocouple located in the core area.
- 3.3 ~~Record RCS pressures that have been corrected for the same reference elevation as the permanently installed instrumentation. Coordinate data timestamps with permanent plant instrumentation.~~ Slowly increase RCS temperature and collect data at 50°F increments.
- 3.4 ~~Measure the RCS flow coastdown data while tripping various RCPs.~~

4.0 DATA REQUIRED

- 4.1 The following data shall be recorded with a frequent scan rate and time stamped.
  - 4.1.1 ~~RCS flow related.~~ Tcold data.
  - 4.1.2 ~~RCP speed for pumps.~~ RCS Thot data.
  - 4.1.3 ~~RCS pressure at permanent and temporary instrumentation locations.~~ RCS core exit thermocouple data for each functional thermocouple.
  - 4.1.4 ~~RCS temperature.~~
  - 4.1.5 ~~RCP breaker status.~~
  - 4.1.6 ~~RCP coastdown speed.~~

5.0 ACCEPTANCE CRITERIA

- 5.1 ~~RCS flow loops indications are normalized to 100 percent.~~ The RCS RTD data has been incorporated into the RTD calibration procedures.
- 5.2 ~~The data from this test has been correlated with the RCS model that was used to predict RCS flow.~~

**14.2.12.14.5 Post-Core Reactor Coolant System Flow Baseline (Test #183)**

1.0 OBJECTIVE

- 1.1 To normalize the RCS flow transmitters.
- 1.2 To determine the RCP flow coastdown characteristics.
- 1.3 To measure post-core RCS pressure drops.
- 1.4 To collect flow related data on the operation of the RCPs for steady-state and transient conditions.

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1.5 To collect post-core RCP coastdown data.

## 2.0 PREREQUISITES

- 2.1 Construction activities have been completed and the RCS is operational or functional as required by regulatory requirements.
- 2.2 Permanently installed instrumentation is calibrated and functional or operable, as required.
- 2.3 Temporary test instrumentation is calibrated and installed in a manner that complies with Technical Specification limitations. The test instrumentation shall be installed to collect RCS pressures at accessible locations around the RCS.
- 2.4 The RCS is operating at nominal HZP (pressure and temperature) conditions.

## 3.0 TEST METHOD

- 3.1 Verify that the RCS flow indications are normalized at 100 percent RCS flow.
- 3.2 Record indicated RCS flow data for functionally allowed RCP combinations.
- 3.3 Record RCS pressures that have been corrected for the same reference elevation as the permanently installed instrumentation. Coordinate data timestamps with permanent plant instrumentation.
- 3.4 Measure the RCS flow coastdown data while tripping various RCPs.

## 4.0 DATA REQUIRED

- 4.1 The following data shall be recorded with a frequent scan rate and time stamped:
  - 4.1.1 RCS flow related data.
  - 4.1.2 RCP speed for pumps.
  - 4.1.3 RCS pressure at permanent and temporary instrumentation locations.
  - 4.1.4 RCS temperature.
  - 4.1.5 RCP breaker status.
  - 4.1.6 RCP coastdown speed.

## 5.0 ACCEPTANCE CRITERIA

- 5.1 RCS flow loops indications are normalized to 100 percent.
- 5.2 The data from this test has been correlated with the RCS model that was used to predict RCS flow.

- 5.3 RCP coastdown data has been compared with data used in the accident analyses.

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**14.2.12.14.6 Post-Core Control Rod Drive Mechanism Performance (Test #184)**

1.0 OBJECTIVE

- 1.1 To demonstrate that operation of the CRDMs at HZP (pressure and temperature) conditions meets design requirements.
- 1.2 To demonstrate the as designed operation of the RCCAs, including RCCA drop times, at HZP cold conditions with all four RCPs in operation ~~(pressure and temperature) conditions~~.
- 1.3 To demonstrate the as designed operation of the RCCAs, including RCCA drop times, at HZP (pressure and temperature) conditions with all four RCPs in operation.
- 1.4 To demonstrate as designed operation of the RCCA position indicating system and alarms.

2.0 PREREQUISITES

- 2.1 The CRDM (Rod Pilot) pre-core performance test has been completed.
- 2.2 The CRDM (Rod Pilot) instrumentation is functional and calibrated.
- 2.3 The plant monitoring system is functional.
- 2.4 The CRDM cooling system (i.e., containment pit cooling) is functional.
- 2.5 CRDM coil resistance values have been measured.

3.0 TEST METHOD

- 3.1 Withdraw and insert each RCCA to verify as designed operation of CRDM.
- 3.2 Measure and record at least one to three drop times for each RCCA:
  - 3.2.1 Perform three measurements of rod drop time for each of those RCCAs falling outside the two-sigma limit for similar RCCAs.
- 3.3 Withdraw and insert each RCCA while recording position indications and alarms.

4.0 DATA REQUIRED

- 4.1 RCCA drop time.
- 4.2 RCS temperature and pressure to be taken during measurement and recording of drop time for each RCCA.
- 4.3 RCCA position and alarm indications.

5.0 ACCEPTANCE CRITERIA

- 5.1 14.2-32 → The CRDM, RCCAs and their associated position indications operate as ~~described in~~ designed (refer to Section 4.6).

1.2 To measure the rate at which pressurizer pressure can be reduced using pressurizer spray.

2.0 PREREQUISITES

2.1 The RCS is being maintained at HZP (pressure and temperature) conditions.

2.2 Permanently installed instrumentation, associated with this test, is functional, calibrated, and is operating satisfactorily prior to performing the following test.

2.3 Pressurizer surge line insulation is installed in the configuration that is anticipated for plant operation.

3.0 TEST METHOD

3.1 Secure pressurizer heaters except the proportional band heaters. Continuously monitor the proportional heater output throughout the remainder of the test.

3.2 Secure the spray valves, so that the only flow through the spray header and the pressurizer surge line is passing through the continuous spray valves.

3.3 Adjust the continuous spray valves to just clear the minimum pressurizer surge line temperature. Verify that both continuous spray valves are open approximately the same amount.

3.4 Determine the remaining proportional band heater capacity and adjust the continuous spray valves until only 50 percent of the previously determined margin remains. Verify that both continuous spray valves are open approximately the same amount.

3.5 Using various combinations of pressurizer spray valves, measure and record the rate at which the pressurizer pressure can be reduced.

4.0 DATA REQUIRED

4.1 RCS temperature and pressure.

4.2 Pressurizer surge line temperature.

4.3 Pressurizer proportional heater output with the pressurizer spray valves closed.

4.4 Continuous spray valve settings.

4.5 Pressurizer pressure and pressurization spray valve positions during depressurization.

5.0 ACCEPTANCE CRITERIA

5.1 The pressurizer ~~performs as described in~~ meets design requirements (refer to Section 5.4.10).

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- 2.1 Prefunctional tests on LDS have been completed.
- 2.2 The leak detection instrumentation has been calibrated and is functional.
- 3.0 TEST METHOD
  - 3.1 Collect baseline data using the LDS during plant heatup and at normal operation.
- 4.0 DATA REQUIRED
  - 4.1 Leak detection baseline data.
  - 4.2 RCS temperature and pressure.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 Performance of the LDS is as ~~described in~~ designed (refer to Section 5.2.5).
  - 5.2 The leak detection alarm setpoints have been adjusted using the baseline data.

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**14.2.12.15 Phase III: Initial Criticality and Low Power Physics Tests**

**14.2.12.15.1 Critical Boron Concentration: All Rods Out (Test #190)**

- 1.0 OBJECTIVE
  - 1.1 To measure the HZP critical boron concentration with rods fully withdrawn.
- 2.0 PREREQUISITES
  - 2.1 The rods are fully withdrawn except for the control bank, which is 50 pcm to 200 pcm inserted.
  - 2.2 Available pressurizer heaters are energized.
  - 2.3 The reactor is taken critical by boron dilution method.
  - 2.4 The reactivity computer is functional.
  - 2.5 Reactor power is below the point of adding heat.
- 3.0 TEST METHOD
  - 3.1 Verify that just critical reactor is maintained by rod movement until boron concentration is stabilized and boron sample results are recorded.
  - 3.2 Verify that rods are fully withdrawn except for the control bank, which is 50 pcm to 200 pcm inserted. If rod position is no longer within required limits borate or dilute as necessary to restore rod position and return to previous step.

5.4 The worth of the remaining test banks is within 15% of the predicted values.

**14.2.12.16 Phase IV: Power Ascension Tests, 5 Percent Power Ascension Plateau**

Some of the following tests are performed in more than one plateau. In those instances the test is listed in the first plateau that it is recommended to be performed. The plant instrumentation shall be functional prior to each test.

**14.2.12.16.1 Low Power Biological Shield Survey (Test #193)**

1.0 OBJECTIVE

- 1.1 To measure radiation in accessible locations of the plant outside of the biological shield.
- 1.2 To obtain baseline levels for comparison with future measurements of level buildup with operation.

2.0 PREREQUISITES

- 2.1 Radiation survey instruments are calibrated and operating satisfactorily prior to performing the following test.
- 2.2 Background radiation levels have been measured in designated areas prior to initial criticality.

3.0 TEST METHOD

- 3.1 Measure gamma and neutron dose rates while holding reactor power at the specified power plateau.

4.0 DATA REQUIRED

- 4.1 Reactor power level.
- 4.2 Gamma and neutron dose rates at each specified location.

5.0 ACCEPTANCE CRITERIA

- 5.1 The biological shield in containment ~~performs as described in~~ meets design requirements (refer to Section 12.3.2.2).

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**14.2.12.16.2 Comparison of Digital Systems and Design Predictions (Test #194)**

1.0 OBJECTIVE

- 1.1 To compare measured plant parameters with predicted values (i.e., design models).
- 1.2 To compare control room indications with those collected from field sensors (i.e., transmitters) remotely.
- 1.3 This procedure shall be repeated at the following plateaus:

- 3.4 Verify that the following feedwater systems are capable of removing decay heat, residual heat from the metal mass, and RCP heat following shutdown:
  - 3.4.1 Startup and shutdown feedwater.
  - 3.4.2 Emergency feedwater.

4.0 DATA REQUIRED

- 4.1 Conditions of the measurement:
  - 4.1.1 Reactor power.
  - 4.1.2 RCS temperatures.
  - 4.1.3 Pressurizer pressure.
  - 4.1.4 SG levels and pressures.
  - 4.1.5 Steam and feedwater flows.
  - 4.1.6 Feedwater temperature and pressure.
  - 4.1.7 RCCA position.

5.0 ACCEPTANCE CRITERIA

- 14.2-32 → 5.1 The main, startup and EFWSs perform as ~~designated by the system description and as described in~~ designed (refer to Section 10.4.7).
- 5.2 No effects due to water hammer are detected.
- 5.3 The following feedwater systems demonstrate the design capability to remove decay heat, residual heat from the metal mass, and RCP heat following a reactor trip:
  - 5.3.1 Startup and shutdown feedwater.
  - 5.3.2 Emergency feedwater.

14.2.12.16.4 Natural Circulation (Test #196)

1.0 OBJECTIVE

- 1.1 To confirm that natural circulation flow shall remove decay heat from the reactor (no forced circulation from the RCPs).
- 1.2 To confirm boron mixing occurs under natural circulation conditions.
- 1.3 To determine the response to a sudden loss of forced RCS flow. This procedure shall be performed at the following plateau:
  - 1.3.1 ~~Five percent reactor power is~~ Less than or equal to five percent reactor power in accordance with RG 1.68. ~~It is permissible to substitute test data from plants of similar design in lieu of performing this test.~~
  - 1.3.2 The natural circulation test shall be performed with emergency feedwater providing water to the steam generators.

## 2.0 PREREQUISITES

- 2.1 The reactor is operating at the required power level.
- 2.2 RCS and pressurizer samples have determined the boron concentration.
- 2.3 ~~Calculate the~~ Verify that natural circulation flow is adequate to remove decay heat equivalent to  $\leq 5$  percent reactor power following a reactor trip.

## 3.0 TEST METHOD

- 3.1 Secure operating RCPs.
- 3.2 Verify that the emergency feedwater system is capable of removing residual heat from the metal mass and simulated end of core life decay heat. The core remains critical at  $\leq 5$  percent reactor power until natural circulation is established and core is made subcritical.
- 3.3 Verify that the reactor is ~~tripped~~ operating at  $\leq 5$  percent rated thermal power prior to injecting boric acid to establish the reactor in a subcritical state.
- 3.4 Reduce the RCS pressure using the CVCS auxiliary pressurizer spray.
- 3.5 Continuously sample the RCS and the pressurizer while monitoring the boron trend on the boron monitor.
- 3.6 Continuously inject boron until adequate shutdown margin is achieved.
- 3.7 Initiate a reactor trip after verifying that the reactor has been verified to be in a subcritical state via boron injection.

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## 4.0 DATA REQUIRED

- 4.1 The following data shall be collected at a short sampling frequency:
  - 4.1.1 RCS Temperature.
  - 4.1.2 Pressurizer pressure and level.
  - 4.1.3 SG levels and pressure.
  - 4.1.4 RCS boron concentration and isotopic abundance of boron-10.

## 5.0 ACCEPTANCE CRITERIA

- 5.1 The natural circulation power to flow ratio is less than 1.0.
- 5.2 The RCS can be borated while in natural circulation.
- 5.3 The emergency feedwater system demonstrates the capability to remove residual heat from the metal mass and simulated end of core life decay heat, using steam generators with no forced RCS flow.



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data has been taken that shall demonstrate the plant's ability to meet unit load swing design transients as ~~described in~~ designed (refer to Sections 3.9.1.1, 4.4.3.4, and 7.7.1.1).

- 5.2 That no audible noise or significant vibration is observed in the SG or in the rest of the feedwater and EFSs due to water hammer.

### 14.2.12.18.3 Secondary Calorimetric Power (Test #201)

#### 1.0 OBJECTIVE

- 1.1 To verify that various indications of core power have been calibrated to the calculated calorimetric power produced by the secondary systems.
- 1.2 To determine core power distributions using incore instrumentation. This procedure shall be repeated at the following plateaus:
- 1.2.1 ~~30~~25 percent reactor power in accordance with RG 1.68.
- 1.2.2 50 percent reactor power in accordance with RG 1.68.
- 1.2.3 75 percent reactor power in accordance with RG 1.68.
- 1.2.4  $\geq$ 98 percent reactor power in accordance with RG 1.68.

#### 2.0 PREREQUISITES

- 2.1 The reactor is operating at the desired power.
- 2.2 The data required for calculating secondary calorimetric power is available.

#### 3.0 TEST METHOD

- 3.1 Maintain reactor power,  $T_{avg}$ , and pressurizer level constant during data collection.
- 3.2 Compare reactor power calculated by independent sources (e.g., delta-temperature, first stage steam pressure, excore nuclear instrumentation) and recalibrate as necessary to maintain acceptable disagreement between independent sources.

#### 4.0 DATA REQUIRED

- 4.1 Reactor power indicated by various sources.

#### 5.0 ACCEPTANCE CRITERIA

- 5.1 The various reactor power indications have been calibrated to agree with the calculated secondary calorimetric power.

**14.2.12.18.4 Primary Calorimetric (Test #202)**

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Note: Test results at lower power levels may be unreliable and not indicative of results performed at higher power levels.

1.0 OBJECTIVE

- 1.1 To determine the RCS ~~flowrate~~flow rate by calorimetric.
- 1.2 This procedure shall be repeated at the following plateaus:
  - 1.2.1 ~~30~~25 percent reactor power in accordance with RG 1.68.
  - 1.2.2 50 percent reactor power in accordance with RG 1.68.
  - 1.2.3 75 percent reactor power in accordance with RG 1.68.
  - 1.2.4 ≥98 percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

- 2.1 The reactor is operating at the desired power.
- 2.2 The data required for calculating secondary calorimetric power, RCS temperature, and RCS flow data is available.

3.0 TEST METHOD

- 3.1 Maintain reactor power,  $T_{avg}$ , and pressurizer level constant during data collection.

4.0 DATA REQUIRED

- 4.1 Secondary calorimetric data.
- 4.2 RCS flow data.
- 4.3 RCS temperature data.
- 4.4 Design value for RCP pump heat.

5.0 ACCEPTANCE CRITERIA

- 5.1 The RCS flow indications have been calibrated to agree with the calculated primary calorimetric.

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The RCS flow rate meets the requirements of Technical Specification 3.4.1 or the discrepancy has been analyzed and appropriate levels of management have determined that it is acceptable to proceed to the next test plateau.

- 5.2.1 FSAR Table 14.3-1 Item 1-3.

**14.2.12.18.5 Ventilation Capability (Test #203)**

1.0 OBJECTIVE

- 1.1 To verify that various heating, ventilating and air conditioning (HVAC) systems for the following buildings and structures are capable of maintaining design temperatures:
  - 1.1.1 Containment.
  - 1.1.2 Containment annulus.
  - 1.1.3 Safeguard Buildings.
  - 1.1.4 Nuclear Auxiliary Building.
  - 1.1.5 Fuel Building.
  - 1.1.6 Radioactive Waste Building.
  - 1.1.7 Essential Service Water Building.
- 1.2 This test shall be performed at the following power plateaus:
  - 1.2.1 ~~30~~25 percent reactor power.
  - 1.2.2 50 percent reactor power.
  - 1.2.3 ~~100~~≥98percent reactor power.

2.0 PREREQUISITES

- 2.1 The plant is operating at or near the desired power.

3.0 TEST METHOD

- 3.1 Verify that the minimum number of operable air handlers is supplying cooling to each area. If there is more than one potentially limiting alignment make sure that limiting alignments are tested.
- 3.2 Record temperature values in rooms with safety-related components while operating with normal ventilation lineups.
- 3.3 Record temperature readings in specified areas during the LOOP test.

4.0 DATA REQUIRED

- 4.1 Reactor power level.
- 4.2 Temperature data in designated locations (i.e., general area and adjacent to major heat loads).
- 4.3 Equipment operating data.

5.0 ACCEPTANCE CRITERIA

- 5.1 14.2-32 → Temperature conditions are maintained within the operable limits in areas as ~~described in~~designed (refer to Section 9.4).

**14.2.12.18.6 Sampling Primary and Secondary Systems (Test #204)**

1.0 OBJECTIVE

5.1 Measured activity levels are within their limits.

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5.2 Laboratory analyses and process radiation monitors agree with the within measurement uncertainties as ~~described in~~ designed (refer to Section 9.3.2), or investigation of the discrepancies has been initiated.

5.3 Samples of RCS and secondary fluids can be obtained from design locations as ~~described in~~ designed (refer to Section 9.3.2).

**14.2.12.18.7 Failed Fuel Detection (Test #205)**

1.0 OBJECTIVE

1.1 To collect chemistry samples of the RCS and secondary at the specified power level to record the following:

1.1.1 Boron concentration and boron-10 isotopic abundance.

1.1.2 Concentration of non-radioactive elements and soluble particulates.

1.1.3 Measured pH of the fluids.

1.1.4 Radioisotopic concentration data of the radioactive elements (e.g., cesium, iodine, iron, cobalt).

1.2 To demonstrate performance of permanent plant sampling and analysis procedures. There is typically some RCS activity from tramp, fuel dust that is on the outer surface of the cladding.

1.3 To perform a cross-check of the failed fuel monitor instrumentation.

1.4 This test shall be performed at the following power plateaus:

1.4.1 ~~30~~25 percent reactor power.

1.4.2 ≥98 percent reactor power.

2.0 PREREQUISITES

2.1 The reactor is stable at the desired power level.

2.2 Required sampling systems are functional.

3.0 TEST METHOD

3.1 Samples shall be collected from the RCS and secondary system at various power levels and analyzed in the laboratory using applicable sampling and analysis procedures.

3.2 Collect samples at various process radiation monitors, perform analysis in the laboratory, and compare the samples with the process radiation monitor output.

4.0 DATA REQUIRED

4.1 Reactor power.

- 4.2 RCS and secondary temperature.
- 4.3 Boron concentration and boron-10 isotopic abundance.
- 4.4 Core average burnup.
- 4.5 Isotopic activities.
- 5.0 ACCEPTANCE CRITERIA
  - 5.1 Measured activity levels are within their limits.
  - 5.2 Laboratory analyses and process radiation monitors agree with the within measurement uncertainties as ~~described in~~ designed (refer to Section 9.3.2) or investigation of the discrepancies has been initiated.
  - 5.3 Samples of RCS and secondary fluids can be obtained from design locations as ~~described in~~ designed (refer to Section 9.3.2).

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#### 14.2.12.18.8 Self Powered Neutron Detector Calibration (Test #206)

- 1.0 OBJECTIVE
  - 1.1 To perform a full core flux map using the movable incore detector (i.e., AMS).
  - 1.2 Normalize the fixed incore detector system (SPNDs) to the AMS (using the POWERTRAX system) at the following power plateaus:
    - 1.2.1 ~~30~~25 percent reactor power.
    - 1.2.2 50 percent reactor power.
    - 1.2.3 75 percent reactor power.
    - 1.2.4  $\geq$ 98 percent reactor power.
- 2.0 PREREQUISITES
  - 2.1 The reactor is at the specified power level and equilibrium xenon conditions.
  - 2.2 The incore detector systems, related digital processing computers, and POWERTRAX are operable.
- 3.0 TEST METHOD
  - 3.1 Movable incore (i.e., AMS) signals are measured.
  - 3.2 Full core flux map is processed.
  - 3.3 Normalization of fixed incore system is performed by POWERTRAX.
  - 3.4 Background detector signals are recorded.
- 4.0 DATA REQUIRED
  - 4.1 Reactor power.

- 5.0 ACCEPTANCE CRITERIA
- 5.1 The xenon transient is controlled by rod movement at the appropriate time.
- 5.2 Correlate available indications of RCCA position including the following:
- 5.2.1 Rod position measurement as ~~described in~~ designed (refer to Section 7.2.1).
- 5.2.2 Fixed incore detector system data.
- 5.2.3 Movable incore detector (i.e., AMS) flux mapping system.
- 5.3 Incore flux map data is available to calibrate the excore indication of AO.

#### 14.2.12.18.12 Penetration Temperature Survey (Test #210)

- 1.0 OBJECTIVE
- 1.1 To verify concrete temperatures surrounding containment penetrations do not exceed design allowable temperatures.
- 1.2 This procedure shall be repeated at the following plateaus:
- 1.2.1 ~~30~~25 percent reactor power.
- 1.2.2 50 percent reactor power.
- 1.2.3 ~~98~~ percent reactor power.
- 2.0 PREREQUISITES
- 2.1 Plant is at the desired power plateau.
- 3.0 TEST METHOD
- 3.1 Collect baseline fluid temperature data for fluid systems that operate above 100°F.
- 3.2 Collect penetration sleeve concrete temperature data inside and outside the containment building for each fluid system that operates above 100°F.
- 3.3 Collect penetration sleeve concrete temperature data inside and outside the containment shield building for each fluid system that operates above 100°F.
- 4.0 DATA REQUIRED
- 4.1 Fluid temperatures.
- 4.2 Penetration sleeve temperatures on each adjacent surface.
- 5.0 ACCEPTANCE CRITERIA

- 3.4 Control room operators bring unit to hot standby and maintained in this condition for  $\geq 30$  minutes.
- 3.5 Transfer control of the unit back to the MCR using the switches located outside of the control room.
- 3.6 Verify that the following feedwater system is capable of removing decay heat, residual heat from the metal mass, and RCP heat following shutdown:
  - 3.6.1 Emergency feedwater.

4.0 DATA REQUIRED

- 4.1 Collect the following time stamped data with a short scan rate:
  - 4.1.1 Pressurizer pressure and level.
  - 4.1.2 RCS temperatures.
  - 4.1.3 SG pressure and level.
  - 4.1.4 Reactor power.
  - 4.1.5 RCCA position.
  - 4.1.6 Steam isolation valve times (elapsed time from reactor trip signal to valve closure).

5.0 ACCEPTANCE CRITERIA

- 14.2-32 → 5.1 The reactor controlled in mode 3 (hot standby) from the remote shutdown panel is demonstrated ~~as described in~~ to perform as designed (refer to Section 7.4.1.1).
- 5.2 Transfer of control to the RSP is demonstrated from switches near the MCR exits and at appropriate locations inside the equipment rooms.
- 5.3 Steam valve isolation occurs within the times described in the accident analyses, with margin, or as specified in regulatory documents.
- 5.4 The following feedwater system is capable of removing decay heat, residual heat from the metal mass, and RCP heat following shutdown:
  - 5.4.1 Emergency feedwater.

**14.2.12.19 Power Ascension Plateau, 50 Percent Power Ascension Plateau**

Some of the following tests are performed in more than one plateau. In those instances the test is listed in the first plateau that it is recommended to be performed. Each test assumes that plant instrumentation shall be functional prior to the test.

**14.2.12.19.1 Biological Shield Survey (Test #212)**

1.0 OBJECTIVE

- 1.1 To measure the radiation levels in accessible locations of the plant outside of the biological shield.
- 1.2 To determine permissible stay times for these areas during power operation.
- 1.3 To perform radiation surveys to determine shielding effectiveness. This procedure shall be repeated at the following plateaus:
  - 1.3.1 50 percent in accordance with RG 1.68.
  - 1.3.2 ≥98 percent in accordance with RG 1.68.

2.0 PREREQUISITES

- 2.1 Radiation survey instruments have been calibrated and are functional for performance of the following test.
- 2.2 Results of the radiation surveys performed at zero power conditions are available.

3.0 TEST METHOD

- 3.1 Measure gamma and neutron dose rates at 50 and ~~100~~ ≥98 percent power levels.

4.0 DATA REQUIRED

- 4.1 Power level.
- 4.2 Gamma dose rates in the accessible locations.
- 4.3 Neutron dose rates in the accessible locations.

5.0 ACCEPTANCE CRITERIA

- 5.1 Accessible areas and occupancy times during power operation have been defined as described in Section 12.3.2.

14.2-32 → 5.2 The biological shield ~~performs as described in~~ meets design requirements (refer to Section 12.3.2.2).

**14.2.12.19.2 Single RCCA Misalignment (Test #213)**

1.0 OBJECTIVE

- 1.1 To demonstrate multiple indications of one high worth misaligned control rod.
- 1.2 This procedure shall be repeated at the following plateau:
  - 1.2.1 50 percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

- 2.1 The reactor is at the required power level with the following:



- 2.1.1 RCCAs are within 20 steps of the rods out position
- 2.1.2 AO has been stable ( $\pm 4$  percent) for previous 12 hours.

3.0 TEST METHOD

- 3.1 Record the position of each control rod bank.
- 3.2 Insert one control bank rod until the rod is fully inserted and record indications of misaligned control rods, including a full core flux map performed with the movable incore (i.e., AMS) flux mapping system when RCCA is fully inserted.
- 3.3 Return the misaligned control rod to the initial control rod position and record indications.

4.0 DATA REQUIRED

- 4.1 Reactor thermal power.
- 4.2 RCCA configuration.
- 4.3 RCS temperatures (i.e.,  $T_{hot}$ ,  $T_{cold}$  &  $T_{avg}$ ).
- 4.4 POWERTRAX indications.

5.0 ACCEPTANCE CRITERIA

5.1 The indications of a misaligned RCCA include the following:

14.2-32 → 5.1.1 Rod position measurement as ~~described in~~ designed (refer to Section 7.2.1).

- 5.1.2 Fixed incore detector system (i.e., self powered neutron detectors).
- 5.1.3 Movable incore detectors (i.e., AMS) flux mapping system.

**14.2.12.19.3 Securing a Single Train of Feedwater Heaters (Test #214)**

1.0 OBJECTIVE

- 1.1 To demonstrate impact on primary and secondary systems due to securing a single train of feedwater heaters.
- 1.2 This procedure shall be repeated at the following plateaus:
  - 1.2.1 50 percent reactor power in accordance with RG 1.68.
  - 1.2.2  $\geq 98$  percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

- 2.1 The reactor is operating at the desired power level.
- 2.2 The following systems are in automatic operation:
  - 2.2.1 Primary and secondary level controls (e.g., pressurizer, feedwater heaters, VCT, deaerator, SG).

- 3.2 Verify isotopic concentrations in the liquid stream.
- 3.3 Verify that the LWSPS is capable of collecting and processing liquid waste.

4.0 DATA REQUIRED

- 4.1 Conditions of Measurement.
  - 4.1.1 Reactor power history and RCS radioactivity level.
  - 4.1.2 Liquid waste processing system tank levels.
  - 4.1.3 Liquid waste processing system demineralizer data.

5.0 ACCEPTANCE CRITERIA

- 5.1 14.2-32 → The LWSPS processes radioactive effluents as ~~described in~~ designed (refer to Section 11.2).

**14.2.12.20.2 Gaseous Waste Processing System (Test #216)**

1.0 OBJECTIVE

- 1.1 To demonstrate that the operation of the gaseous waste processing system (GWPS) for collection and processing of radioactive gases vented from plant equipment is performing satisfactorily.
- 1.2 To determine the ability of plant systems to process radioactive effluents. This procedure shall be performed at the following plateaus:
  - 1.2.1 75 percent reactor power in accordance with RG 1.68.
  - 1.2.2 ≥98 percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

- 2.1 The gaseous waste processing equipment is functional.

3.0 TEST METHOD

- 3.1 Verify that the gaseous waste processing simultaneously collects and processes gaseous waste.

4.0 DATA REQUIRED

- 4.1 Conditions of Measurement:
  - 4.1.1 Reactor power history and RCS radioactivity level.
  - 4.1.2 Containment temperature and humidity.
  - 4.1.3 Condenser operating data.
  - 4.1.4 Effluent control monitor operating data.
  - 4.1.5 Gas analyzer operating data.

4.1.6 Gas transport times.

5.0 ACCEPTANCE CRITERIA

5.1 The GWPS processes radioactive effluent as ~~described in~~ designed (refer to Section 11.3).

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**14.2.12.20.3 Loss of Feedwater Pump (Test #217)**

1.0 OBJECTIVE

- 1.1 To evaluate system response to a loss of one of three operating feedwater pumps.
- 1.2 To demonstrate system effectiveness of instrumentation in detecting a dropped rod and verification of automatic actions in accordance with RG 1.68.
- 1.3 To demonstrate that rapid load changes can be accomplished in a manner that maintains plant safety.
- 1.4 This procedure shall be performed at the following plateau:
  - 1.4.1 75 percent reactor power.

2.0 PREREQUISITES

- 2.1 The reactor is operating at the desired power level.
- 2.2 Establish a band of operation in which there are no restrictions on the rate of load increase or decrease based on AREVA Fuel Preconditioning Guidelines.
- 2.3 The following systems are in automatic operation:
  - 2.3.1 Primary and secondary level controls (e.g., pressurizer, feedwater heaters, VCT, deaerator, SG).
  - 2.3.2 Primary and secondary pressure controls (e.g., pressurizer, VCT, condensate).
  - 2.3.3 Primary and secondary flow controls (e.g., CVCS letdown, feedwater).
  - 2.3.4 Primary and secondary temperature controls (e.g., RCS Tavg).
  - 2.3.5 Rod control (the rod pilot system is operating in automatic with no RCCA movement prior (20 minutes) to the test).
- 2.4 Verify that each feedwater pump is providing approximately 33 percent of the required feedwater flow.

3.0 TEST METHOD

- 3.1 Loss of main feedwater pump:
  - 3.1.1 One of the three operating feedwater pumps is tripped.

2.0 PREREQUISITES

- 2.1 The reactor is at a high power level with the following:
- 2.1.1 Equilibrium xenon.
  - 2.1.2 RCCAs are within 10 steps of the rods out position.
  - 2.1.3 AO has been stable ( $\pm 2$  percent) for previous 24 hours.
  - 2.1.4 Measure boron concentration and boron-10 isotopic concentration.

3.0 TEST METHOD

- 3.1 The reactivity coefficients are determined by updating the three dimensional core model (POWERTRAX) with current plant data.
- 3.2 The tests.

4.0 DATA REQUIRED

- 4.1 Reactor thermal power.
- 4.2 RCCA configuration.
- 4.3 Boron concentration (ppmB) and isotopic abundance of boron-10.
- 4.4 Core burnup.
- 4.5 RCS temperature.

5.0 ACCEPTANCE CRITERIA

- 5.1 The core designer shall investigate differences greater than 500 pcm between measured values and predications.
- 5.2 Test criteria specified ~~in ANSI/ANS 19.6.1~~ by the fuel designer.

**14.2.12.21.2 Trip of Generator Main Breaker (Test #219)**

1.0 OBJECTIVE

- 1.1 To demonstrate that the plant responds and is controlled as designed following a full-power turbine trip.
- 1.2 This procedure shall be performed at the following plateau:
- 1.2.1  $\geq 98$  percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

- 2.1 The following systems are in automatic operation:
- 2.1.1 Primary and secondary level controls (e.g., pressurizer, feedwater heaters, VCT, deaerator, SG).
  - 2.1.2 Primary and secondary pressure controls (e.g., pressurizer, VCT, condensate).

2.1.3 Primary and secondary flow controls (e.g., CVCS letdown, feedwater).

2.1.4 Primary and secondary temperature controls (e.g., RCS  $T_{avg}$ ).

3.0 TEST METHOD

3.1 The turbine is tripped from the MCR simultaneous with trip of each RCP.

3.2 Verify that RCPs cease to operate.

3.3 The plant behavior is monitored to establish that the control systems maintain the NSSS within operating limits.

3.4 Verify that the following feedwater systems are capable of removing decay heat, residual heat from the metal mass, and RCP heat following shutdown:

3.4.1 Startup and shutdown feedwater.

3.4.2 Emergency feedwater.

3.5 After verifying that the startup and shutdown feedwater system is capable of controlling the plant cooldown, secure the startup and shutdown feedwater pump and verify that the emergency feedwater pump can control the cooldown.

4.0 DATA REQUIRED

4.1 Plant condition prior to trip.

4.2 The following acceptance criteria parameters are monitored prior to and throughout the transient:

4.2.1 Pressurizer parameters (i.e., pressure and level).

4.2.2 RCS temperatures (i.e.,  $T_{cold}$ ,  $T_{hot}$  and  $T_{avg}$ ).

4.2.3 SG parameters (i.e., flow, pressure, temperature and level).

4.2.4 RCCA position.

4.3 Additional key plant parameters shall be monitored for ~~base-~~line data.

5.0 ACCEPTANCE CRITERIA

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5.1 The plant responds as ~~described in~~ designed (refer to Section 15.2.2).

5.2 The following feedwater systems demonstrate the design capability to remove decay heat, residual heat from the metal mass, and RCP heat following a reactor trip:

5.2.1 Startup and shutdown feedwater.

5.2.2 Emergency feedwater.

4.2.5 RCCA position.

4.2.6 RCS boron concentration.

4.3 Additional key plant parameters shall be monitored for ~~base-~~  
linebaseline data.

5.0 ACCEPTANCE CRITERIA

5.1 14.2-32 → The plant responds as ~~described in~~designed (refer to Section 10.2).

**14.2.12.21.4 Loss of Offsite Load (Test #221)**

1.0 OBJECTIVE

1.1 To demonstrate that the plant responds and is controlled as designed following a loss of offsite load.

1.2 This procedure shall be performed at the following plateau:

1.2.1 ≥98 percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

2.1 The following systems are in automatic operation:

2.1.1 Primary and secondary level controls (e.g., pressurizer, feedwater heaters, VCT, deaerator, SG).

2.1.2 Primary and secondary pressure controls (e.g., pressurizer, VCT, condensate).

2.1.3 Primary and secondary flow controls (e.g., CVCS letdown, feedwater).

2.1.4 Primary and secondary temperature controls (e.g., RCS  $T_{avg}$ ).

2.1.5 RCSL control of RCCAs.

3.0 TEST METHOD

3.1 The turbine-generator is removed from the grid by opening the output breaker.

3.2 Verify that RCPs continue to operate with power supplied from the offsite grid.

3.3 Verify that a partial rod trip occurs but the reactor remains critical.

3.4 ~~Verify that the turbine-generator continues to provide house loads.~~

3.5 The plant behavior is monitored to establish that the control systems maintain the NSSS within operating limits.

4.0 DATA REQUIRED

4.1 Plant condition prior to trip.

**14.2.12.21.6 Cooling Tower Acceptance (Test #223)**

A COL applicant that references the U.S. EPR design certification will provide site-specific test abstract information for the cooling tower. The following is a typical COLA test; if a site specific test will be used the COL applicant will provide the test.

1.0 OBJECTIVE

1.1 To verify the cooling tower is capable of rejecting the design heat load.

2.0 PREREQUISITES

- 2.1 Construction activities are complete.
- 2.2 Circulating water system flow balance has been performed.
- 2.3 Permanently installed instrumentation is functional and calibrated.
- 2.4 Test instrumentation is calibrated and available.
- 2.5 Plant output is at approximately full-power.

3.0 TEST METHOD

3.1 Perform a measurement of the cooling tower performance using Cooling Tower Institute (CTI) standards.

4.0 DATA REQUIRED

4.1 Cooling water temperature and flows.

5.0 ACCEPTANCE CRITERIA

5.1 The cooling tower performance meets manufacturers design ~~as described in~~(refer to Section 10.4.5.1).

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**14.2.12.21.7 Loss of Offsite Power with Plant Auxiliary Loads Supplied in Island Mode (Test #227)**

1.0 OBJECTIVE

- 1.1 To demonstrate that the plant responds and is controlled as designed following a loss of offsite grid.
- 1.2 This procedure shall be performed at the following plateau:
  - 1.2.1 ≥98 percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

2.1 A transient load flow analysis has been performed that demonstrates the electrical transient (voltage and frequency) from the test will not exceed safety-related equipment capabilities and protection system setpoints.