NOTE: Sections 13.1 through 13.4 are historical information as defined by NEI 98-03 Revision 1 and updates to these sections are not expected.

13.1 TESTS PRIOR TO REACTOR FUELING

Prior to initial fuel loading, a preoperational test program will be conducted to assure that specific systems have been properly installed in the Plant and will function as designed. Test procedures will be prepared for each system which will define system functions and equipment to be tested. The procedures will be prepared and reviewed jointly by Consumers Power Company, Bechtel Corporation and Combustion Engineering. These procedures will also define the parameters such as flows, pressures, temperatures, etc, which are to be measured during the tests. The results of all tests will be recorded and retained as baseline operating characteristics of the systems. Any design deficiencies of a system noted during the test program will be remedied prior to considering the preoperational test completed on the system. The preoperational tests will be conducted under the direction of Consumers Power Company with advisory assistance from Bechtel and Combustion Engineering.

The following is a list of preoperational test procedures which will be prepared prior to testing of the systems. This list is in alphabetical order and does not relate to the order of conducting the tests.

1. Bypass Valve and Steam Dump Valves Systems
2. Chemical and Volume Control System
3. Circulating Water System
4. Communications System
5. Component Cooling System
6. Condensate System
7. Containment and Containment Isolation Valves
8. Control Rod Drive System
9. Demineralized Water Makeup System
10. Electrical Distribution System (AC and DC)
11. Emergency Diesels
12. Engineered Safeguards (Emergency Core Cooling, Containment Cooling, SIRW Tank)

13. Feedwater System
14. Fire Water System
15. Fuel Pool Cooling and Demineralizer System
16. Heating Boiler
17. Heating, Ventilating and Air Conditioning Systems
18. Incore Instrumentation
19. Lighting System
20. Main Turbine and Auxiliaries
21. Main Turbine Lube Oil System
22. Moisture Separator and Heater Drain Systems
23. Nuclear Instrumentation System
24. Nuclear Steam Supply System (Pressurizer, Primary Coolant Pumps, Piping and Valves, Quench Tank)
25. Process Instrumentation
26. Radioactive Waste Treatment System
27. Radioactivity Instrumentation (Liquid, Gaseous and Area)
28. Reactor Regulating and Protective Systems
29. Reactor Shield Cooling System
30. Refueling System
31. Resin Transfer System
32. Sampling System
33. Screens and Screen Wash System
34. Service and Instrument Air Systems
35. Service Water System
36. Shutdown Cooling System

37. Steam Generator Level Control

38. Well and Domestic Water System

The tests will be conducted on these systems as they are completed and will follow the flushing and hydrostatic test sequences for the finished systems.

Following the preoperational tests on the individual systems and prior to fuel loading, extensive hot functional tests will be conducted. These tests will consist of bringing the primary system to operating temperature and pressure and then conducting hot functional tests on many of the systems listed above. These tests will include verification and calibration of instrumentation and controls at operating temperature, capacity testing and adjustment of heat removal equipment, and flow capacities and characteristics of appropriate systems. Among the systems involved in the hot functional tests are:

1. Bypass Valve and Steam Dump Valves Systems

2. Chemical and Volume Control System

3. Component Cooling System

4. Condensate System

5. Engineered Safeguards (Emergency Core Cooling)

6. Feedwater System

7. Heating, Ventilating and Air Conditioning Systems

8. Main Turbine and Auxiliaries

9. Main Turbine Lube Oil System

10. Moisture Separator and Heater Drain Systems

11. Nuclear Steam Supply System (Reactor, Pressurizer, Primary Coolant Pumps, Piping and Valves, Quench Tank)

12. Process Instrumentation

13. Reactor Shield Cooling System

14. Sampling System

15. Service Water System

16. Shutdown Cooling System

17. Steam Generator Level Control

These hot functional tests in conjunction with the preoperational system test program will assure that all systems will operate at design temperatures and pressures.

13.2 REACTOR FUELING AND PHYSICS TESTS

13.2.1 CORE LOADING

The initial core loading will be conducted following the completion of the preoperational test program and verification that necessary systems are in an operable condition. Detailed step procedures will be prepared for the loading operation to assure proper alignment of all auxiliary systems and proper conduct of incore operations. The following general procedures will be utilized to ensure that the initial loading is conducted in a safe manner:

1. The reactor water is borated (1,720 ppm) and valve checklists are prepared to minimize the possibility of the occurrence of a change in boron concentration. Periodically, samples of reactor water will be withdrawn and analyzed for boron content during the loading operation.

2. Source range neutron detectors will be installed in the core with readouts available at both the loading area and main control room. A communications link will be established between the control room and loading area.

3. The initial neutron source will be installed in the core with the first element and verification of the source range instrumentation made. Equipment will be provided to conduct inverse count rate monitoring of the core effective multiplication during loading.

4. A tag board will be provided in the control room for identifying the location of all movable core components. These include sources, neutron detectors, fuel assemblies and control rods.

5. The actual core loading will be conducted according to a predetermined sequence which prescribes locations of fuel bundles, sources, temporary incore neutron detectors and control rods.

6. Continuous monitoring of source range instrumentation will be conducted and operations halted if any unusual increase in count rate is observed or if the inverse count rate plot indicates criticality prior to full core loading.

13.2.2 POST-LOADING TESTS

Following core loading, the upper reactor internals and vessel head will be installed and a primary system hydro leak test performed. Complete control rod drive checkouts will then be performed to ensure proper functioning of both mechanical and electrical components. Both cold and hot flow tests will then be carried out to determine the mechanical response of the assembled reactor internals to full flow conditions. Control rod drive performance including rod drop times will also be evaluated in the hot pressurized condition.

13.2.3 INITIAL CRITICALITY

Initial criticality will be achieved by withdrawing control rods and then slowly diluting the boron concentration in the reactor water until a chain reaction is sustained. The approach to criticality will be monitored by the source range instrumentation, and inverse count rate ratio plots will be provided to predict the critical condition. Detailed procedures will be prepared and followed to ensure proper alignment of relevant systems and correct sequential operations during the initial approach to criticality. These procedures will also define responsibilities and authority for safe conduct of the operations.

13.3 POST-CRITICALITY AND POWER ESCALATION

13.3.1 ZERO POWER TESTING

Following criticality, a detailed program of reactor physics measurements will be made in both the cold and hot zero-power conditions. These tests will verify physics parameters used in the safeguards analysis and also obtain information of importance required for Plant operations. These tests will include measurements of the following parameters:

1. Control rod worths under varying rod configurations and determination of shutdown margin.

2. Measurements of temperature coefficients of reactivity from cold to hot standby conditions.

3. Measurements of boron concentration effect on reactivity under varying temperature and rod configuration conditions.

4. The primary coolant pumps will be operated and tripped in various sequences to determine the system response to steady-state and transient flow conditions.

In addition, the source and full range nuclear instrumentation will be calibrated during this testing.

13.3.2 POWER ESCALATION

After verification of reactor operating characteristics at zero-power conditions, a detailed power escalation program will be conducted. This program will include incremental increases in power levels up to 25% with appropriate testing conducted at each power level. Results of the analyses of testing at each level will be utilized in conducting the tests at each subsequent level. The test program will include the following, but not necessarily at each increment of power:

1. Measurements of physics parameters including temperature, pressure and power coefficients. Control rod worth and boron concentration worth as a function of power.

2. Primary coolant pump trips to determine response of system to transient conditions.

3. Operation and calibration check of Chemical and Volume Control System.

4. Adjustment and verification of nuclear instrumentation.

5. Verification of reactor protection system tripping functions.

6. Adjustment and calibration of the secondary steam system including steam generator level indicators, feedwater control system, Condensate System, turbine generator and bypass valve.

7. Calorimetric tests of the steam generator steam supply system to verify reactor output and performance of secondary system.

8. Response and adjustment of the reactor control system to step and ramp load changes.

9. Adjustment of pressurizer heater and spray control system.

10. Turbine generator and reactor trips to verify stability and response to load transients.

11. Radiation level monitoring during power escalation to demonstrate shielding adequacy.

The conclusion of the power escalation program will be a 100-hour full-power test to demonstrate reliability and satisfy guaranty considerations. Detailed test procedures will be prepared for all phases of the power escalation test program.

13.3.3 ESCALATION TO 2,650 MWT

Testing during power escalation to 2,650 MWt will be conducted in a manner similar to that described in Subsection 13.3.2.

13.4 OPERATION RESTRICTIONS

13.4.1 SAFETY PRECAUTIONS

During initial tests and operations, the normal Plant safety procedures and Technical Specifications limitations will be in effect. In addition to these, special safety precautions will be included in the test procedures and more restrictive operating limitations than those in the Technical Specifications will be imposed from initial criticality through the power escalation program. These limitations will include such items as reactor protection system power level trip points which will be initially set at low values and raised as the power escalation program progresses. Also, periodic checks and sampling such as the boron concentration of the reactor water will be conducted at more frequent intervals during the initial testing program. The detailed safety limitations will be incorporated in the specific procedures for each portion of the test program.

During initial operation as with normal operation, the ultimate responsibility for safety rests with the Applicant. The initial fuel loading and power escalation procedures will be prepared by Combustion Engineering and Consumers Power Company, respectively, with assistance from Bechtel where required. These will be subject to review and comment by all parties concerned. All safety considerations will be resolved to the agreement of all parties prior to the conduct of any tests. In the event of a safety question arising during the performance of a test, all testing will halt and will not resume until the matter has been resolved to the mutual satisfaction of the concerned parties.

13.4.2 SUMMARY

Special procedures will be prepared to cover testing from the preoperational through the power escalation phases. These procedures will be prepared and reviewed as a joint effort between Consumers Power Company, Combustion Engineering and Bechtel. These procedures will contain the appropriate detail, restrictions and safety precautions which pertain to the specific test in progress. These procedures will contain the sequence of operations, system alignments and appropriate precautions which are to be observed during the tests. As evidenced by the previous discussions in this chapter, special test procedures will be in effect to supplement normal operating procedures from initial system checkout up to and including the 100-hour full-power test.