6.6 INSPECTION AND TESTING

Each active component of the Emergency Core Cooling Systems provided to operate in a design basis accident is designed to be tested during normal operation of the nuclear system. The inboard isolation check valves can only be tested during cold shutdown (MODE 4 or 5). ASME Section XI, "Inservice Pump and Valve Test and System Pressure Test Requirements" are discussed in Subsection 4.12, "Inservice Inspection and Testing."

The High Pressure Coolant Injection System (HPCIS), Automatic Depressurization, and Core Spray System have no normal process uses and, therefore, are tested periodically to provide assurance that the Emergency Core Cooling Systems will operate to effectively cool the reactor core in an accident. The four LPCI pumps may be placed in use as part of the Residual Heat Removal System during shutdown cooling, thus their status is known from normal process uses. However, the LPCI pumps are tested no less frequently than the rest of the ECCS. Other parts of the LPCI, such as the two check valves inside the primary containment drywell and the four shutoff valves outside the drywell, are also tested periodically.

Note:
For Units 1, 2, and 3, the RHR check valve actuator, controls and indication functions have been deleted.

Preoperational tests of the Emergency Core Cooling Systems were conducted during the final stages of plant construction prior to initial startup. Testing of the HPCI turbine may be done using auxiliary boiler steam prior to nuclear system heatup (see Section 13, "Conduct of Operations"). These tests assured the proper functioning of all controls and instrumentation, pumps, piping, and valves. System reference characteristics such as pressure differentials and flow rates were documented during the preoperational tests and were used as the initial base points for measurements obtained in the subsequent operational tests.

During plant operations, the pumps, valves, piping, instrumentation, wiring and, other components outside the primary containment can be visually inspected at any time. Components inside the primary containment can be inspected when the drywell is open for access. When the reactor vessel is open, for refueling or other purposes, the spargers and other internals can be inspected. The testing frequencies of most components, and its associated controls and instrumentation of the Emergency Core Cooling Systems are contained in the technical specifications and tested per approved site procedures.

When the system is tested, the operation of most of the components are indicated in the control room. There are exceptions which require local observation at the component and may require special tests for which there are special provisions and methods.

Pressure operated relief valves may be removed for maintenance, bench checks, and setting adjustments during normal plant shutdown. Bench tests of the Automatic Depressurization valves are discussed in Subsection 4.4, "Nuclear System Pressure Relief System."

A pressure operated control valve such as the one upstream of the HPCIS gland seal condenser can be functionally tested and adjusted in place.

Flow operated check valves for reverse flow or excess flow are tested periodically in place by simulating the functional conditions.

The proper position of manual valves for the accident mode is verified every 31 days by the technical specifications.

Test lines are provided between pairs of containment isolation valves in the Emergency Core Cooling Systems to perform containment leak rate tests as specified in Table 5.2-2.

Pumps for the Emergency Core Cooling Systems are equipped with face-type mechanical shaft seals. Normal leakage for these seals are 0 to 0.1 gph at operating conditions.

The portions of the Emergency Core Cooling Systems requiring pressure integrity are designed to specifications for inservice inspection to detect defects which might affect the cooling performance. The reactor vessel nozzles, the core spray, and feedwater spargers receive particular attention.

A design flow functional test of the HPCI, up to the normally closed pump discharge valve, is performed during normal plant operation by pumping water from the condensate supply header and back through the full flow test return line to the condensate tanks. The HPCIS turbine-pump is driven by steam from the reactor. The suction valves from the pressure suppression pool and discharge valves to the reactor feedwater line remain closed.

HPCI test requirements are given in the Technical Specifications, Section 3.5.1. During a HPCIS flow test, if an initiation signal occurs, the system returns to the automatic startup mode; however, operator action may be required to adjust the flow demand setting.

The HPCI may be tested at full flow with condensate at any time except when the reactor vessel water level is low, the drywell pressure is high, the condensate supply header level is low, or the valves from the pressure suppression pool to the pump are open.

To conduct the full flow test, the test return line valves to the condensate storage tank are opened. The turbine steam valves are open. The pump delivers bypass flow to the pressure suppression pool to provide minimum flow protection.

To test the pump discharge valve, it is operated with the remote control switch, observing the valve position lights.

The containment isolation check valve must be tested during cold shutdown (MODE 4 or 5). If the differential pressure is too high, equalization of the pressure across the valve may be accomplished by pressurizing upstream of the valve using the test connections.

Each loop of the Core Spray System may be tested during reactor operation. The test conditions are tabulated in the Technical Specifications, Section 3.5.1. The normal system test does not inject cold water into the reactor because the inboard injection check valve is held closed by the reactor pressure which is higher than core spray pump pressure, and the inboard injection valve remains closed.

To test the core spray pumps at rated flow, the pump suction valves from the pressure suppression pool remain open, the pumps are started using the remote manual switches in the control room, then the test bypass valve to the pressure suppression pool is opened. Proper operation is determined by observing the instruments in the control room. If an initiation signal occurs during the test, the Core Spray System is signaled to start and the system returns to the automatic startup mode.

The two motor-operated injection valves are tested by cycling and observing the position indicator lights.

The inboard injection check valve inside the drywell is tested during periods of cold shutdown (MODE 4).

Similarly, LPCI pumps and valves are tested periodically during reactor operations. With the injection valves closed and the return line open to the pressure suppression pool, full flow pumping capability is demonstrated. The injection valves and the check valves are operated, as described previously for the core spray valves. Controls and instrumentation are tested as described in Subsection 7.4, "Emergency Core Cooling Systems Control and Instrumentation."

Upon receipt of an LPCI initiation signal during tests, the valves in the test bypass lines are closed automatically to assure that the LPCI pump discharge is routed properly to the reactor vessel.

The ECCS piping and components in the Reactor Building are monitored by routine inspections, general housekeeping practices, and system operability testing which maintains system leakage to an as-low-as-possible level.

It is concluded that safety design basis 7 is satisfied.