6.3 SUMMARY DESCRIPTION - EMERGENCY CORE COOLING SYSTEMS

During normal operations, when normal electrical power for the plant auxiliaries is available, heat is removed from the reactor core through the boiling-water, steam-turbine, condenser-feedwater cycle during power operation, or during shutdown through use of the Residual Heat Removal System (RHRS). For postulated accident conditions, coolant is lost from a breach in the nuclear process system. The reactor is shut down by a low reactor water level or high drywell pressure scram. High drywell pressure plus low reactor vessel pressure, or various reactor vessel low-water-level signals, will automatically start one or more Emergency Core Cooling Systems to maintain core cooling. As the water level in the reactor vessel continues to drop, the main steam line isolation valves are automatically closed on a low-low-low reactor water level signal.

The Emergency Core Cooling Systems are filled at all times to prevent the possibility of water-hammer. The LPCI and Core Spray Systems are filled from the head tank which has ties to the pressure suppression chamber water-transfer pumps for pumping power, or from the condensate transfer system. The HPCI System is filled from the condensate storage tank. The head tank to ECCS to torus to transfer pumps back to head tank system assures that the proper torus water level is maintained. Two Class D check valves exist between the ECCS and the head tank and between the ECCS and the Condensate Storage and Supply System to prevent loss of ECCS flow. The transfer pumps are redundant and have separate power supplies. The instrumentation associated with the system is redundant. Also, the discharge piping of the RHRS and Core Spray are periodically vented from the high point of the system and water flow determined in accordance with technical specifications surveillance frequency requirements. Verification that the systems are vented and filled is also required by plant procedures following periods of inoperability or maintenance on these systems as required to demonstrate system operability.

The Emergency Core Cooling Systems (ECCS) consist of the following:

High Pressure Coolant Injection System (HPCI),
Automatic Depressurization System,
Core Spray System, and
Low Pressure Coolant Injection System (LPCI), an operating mode of the RHR.

The Emergency Core Cooling Systems are designed to limit clad temperature over the complete spectrum of possible break sizes in the nuclear system process barrier, including the design basis break. The design basis break is defined as the complete and sudden circumferential rupture of the largest pipe connected to the reactor vessel (i.e., one of the recirculation loop pipelines) with displacement of the ends so that blowdown occurs from both ends.

The individual Emergency Core Cooling Systems (HPCI, Automatic Depressurization System, Core Spray System, and LPCI) are described in the following paragraphs. A summary of the principal design parameters of the ECCS--core cooling capacity, flow, pressure, and backup systems--is given in Table 6.3-1. See Section 6.5 for system flow requirements utilized in the ECCS analyses.

Section 6.0 gives the safety analysis of the Emergency Core Cooling Systems from the integrated system operation viewpoint. Other sections of this report which give further specific details are the following:

Reactor Vessel Internals (Core Spray), Subsection 3.3,
Nuclear System Pressure Relief System (depressurization valves), Subsection 4.4,
Residual Heat Removal System (RHRS), Subsection 4.8, and
Emergency Core Cooling Control and Instrumentation, Subsection 7.4.

The system flow diagrams, along with the functional control diagrams, are included in Subsection 7.4, "Emergency Core Cooling Control and Instrumentation," which also evaluates the controls and instrumentation for all of the ECCS.

The equipment and operation of each of the ECCS are discussed, followed by an evaluation of the capability of the integrated ECCS operation to meet the safety design bases for the ECCS.

The section concludes with a discussion of the testing and inspection which are performed to provide assurance that the ECCS will operate as required.