10.10 EMERGENCY EQUIPMENT COOLING WATER SYSTEM

10.10.1 Safety Objective

The safety objective of the Emergency Equipment Cooling Water (EECW) System is to provide cooling water to the Standby Diesel engine coolers, the Residual Heat Removal (RHR) pump seal coolers and pump room coolers, the Core Spray pump room coolers, the Unit 3 CB chillers, Unit 3 Shutdown Board Room Chillers, Unit 3 Electrical Board Room Air Conditioning Units, and additional makeup for the fuel pool.

In addition the system provides, as a backup to the Raw Cooling Water (RCW) System, cooling water for the Reactor Building Closed Cooling Water (RBCCW) heat exchangers and the Control Air compressors. The system can be aligned to provide cooling water to the Unit 1/2 Emergency Condensing Unit (ECU), if required.

10.10.2 Safety Design Basis

1. The system shall be capable of operating automatically to maintain sufficient cooling water to all essential components (users) listed below:

    Unit 1/2 Standby Diesel engine coolers
    Unit 3 Standby Diesel engine coolers
    Units 1,2,3 Core Spray pump room coolers
    Units 1,2,3 RHR pump room coolers
    Units 1,2,3 RHR pump seal coolers*
    Unit 3 Electric Board Room ACU Condensers
    Unit 3 Electric Board Room chillers
    Unit 3 Control Bay chillers

    * When EECW is isolated from the shell side of a RHR pump seal cooler, the operability of the affected RHR pump is not compromised provided that the seal water flow is maintained.

2. Piping and equipment, including support structures, are designed to withstand effects of the design basis earthquake without failure.

10.10.3 Description

The Emergency Equipment Cooling Water System has automatic actuation to distribute cooling water supplied by the RHR Service Water System pumps which have been assigned as the principal supply to the EECW System (RHRSW pumps A3, B3, C3 and D3). Flow diagrams for this shared system are shown in Figures 10.10-1a, -1b, -1c, and -1d. System instrumentation is shown in Figures 10.10-2 and 10.10-3 sheets 1, 2, 3, and 4.

The required design EECW flow for the three unit plant is satisfied by RHRSW pumps rated at 400-hp with a capacity of 4500 GPM at a 275-foot head. This includes cooling non-essential components (i.e., the RBCCW heat exchangers and Control Air compressors). Three of the four RHRSW pumps assigned to EECW are necessary to supply the EECW System maximum design flow requirements. Two pumps feed each EECW supply header. There are two completely redundant and independent headers (north and south headers) in a loop arrangement inside and outside the Reactor Building. These headers also provide additional makeup for the fuel pool via normally closed fire hose connections. Also, the north header and south header have a connection to the RCW and Raw Service Water (RSW) Systems, respectively, for charging purposes. To insure absence of air voids in the EECW piping, each header is maintained flooded by the continuous operation of an assigned RHRSW pump. The piping system is shown on Figures l0.l0-1a, -1b, -1c, and -1d. These figures provide the design pressure and temperature conditions of the various portions of the system. The two RHRSW pumps (A3 and C3) assigned to EECW and powered from shutdown boards in Unit 3 will start automatically within specified limits after starting of a diesel generator or a core spray pump in Unit 3.

Similarly, the two RHRSW pumps (B3 and D3) assigned to EECW and powered from shutdown boards in Units 1 and 2 will start automatically within specified limits after starting of a diesel generator or a core spray pump in Units 1 and 2. When a high drywell pressure plus low reactor vessel pressure or low-low-low reactor water level signal is received in any unit, all four RHRSW pumps will start. In addition, the signals that start the A3 and C3 pumps and the B3 and D3 pumps also start the B1 and D1 pumps and the A1 and C1 pumps, respectively, when they are valved into the EECW header and the associated mode switch is selected for EECW operation.

Each EECW supply header from the intake station has a continuous self-cleaning strainer to prevent clogging of the various coolers. The straining media is selected with a nominal 1/8 inch diameter hole mesh design that may include manufac turing anomalies (i.e., elongated holes at bends and conjoined holes at seams). In all cases, the holes will prevent intrusion of particles which are larger in diameter than the smallest tube or orifice serving downstream users.

Each EECW supply header is provided with manual motor-operated sectionalizing valves to permit isolation of leaking equipment in a unit area, while retaining flow to the essential components. Branch runouts and equipment configuration are arranged for complete redundancy, with the exceptions of specific branch lines supplying specific non-essential components normally cooled by the Raw Cooling Water (RCW) system.

These exceptions are (i) a single available branch line to each unit's set of RBCCW heat exchangers, and (II) a single installed branch line for the control air compressors. The air compressors, located in a Class II structure, are not essential to shutdown. Each compressor may be isolated in case of an accident. Fire Protection restrictions identified in the NFPA 805 DCD result in the availability of only one supply branch line to each RBCCW heat exchanger. FSAR Section 5.2 and FSAR Appendix F describe design features addressing alternative means of heat removal for specific RBCCW supplied components during failure of a unit's RBCCW system.

Branch runouts, except the ones to the RBCCW heat exchangers and the normally isolated Unit 1/2 CB ECU, are fitted with double-check valves to prevent back or cross flow into alternate headers. Protection against excess flow is provided at the larger branches in the event of a piping or equipment failure.

During normal operation, the RCW System provides cooling water to the RBCCW heat exchangers and the Control Air compressors. If the pressure in the RCW system falls below a predetermined minimum level, the aligned RHRSW pumps receive auto-start signals. In this manner the Class I EECW System provides an automatic backup supply for the closed cooling water heat exchangers and the air compressor coolers. The runouts to the Reactor Building Closed Cooling Water heat exchangers are provided with pneumatically operated flow control valves controlled by EECW and RCW header pressure. The runout to the control air compressors is provided with a pneumatically operated flow control valve controlled by EECW and RCW header pressure.

These valves are designed to shut off flow to the equipment on low header pressure in order to guarantee adequate flow to the essential components.

The design provides multiple paths for the return of water from the coolers to a point outside the Reactor Building.

The EECW System has the capability of utilizing the FLEX (Flexible and Diverse Coping Mitigation Strategies) system to provide make-up water to the SFP and cooling water to essential equipment such as the Unit 3 Chiller and Core Spray Room Coolers. This additional capability is provided in the event of a loss of all the RHRSW pumps due to a Loss of Off-Site Power, and site Emergency Diesel Generators are inoperable.

10.10.4 <u>Safety Evaluation</u>

To assure power to the RHR service water pumps serving the Emergency Equipment Cooling Water System, two pumps (A3 and C3) are connected to 4160-V shutdown boards in Unit 3 and two pumps (B3 and D3) to boards in Units 1 and 2. Each shutdown board is supplied by its individual standby diesel generator in the event of failure of the normal auxiliary power system.

The Emergency Equipment Cooling Water System is designed as a Class I system for withstanding the specified earthquake loadings (see Appendix C). The system piping and equipment are designed, installed, and tested in accordance with USAS B31.1.0, Section I, 1967 edition. The Emergency Equipment Cooling Water System is chemically treated consistent with NPDES permit limitations. In accordance with NRC Bulletin 81-03, the Emergency Equipment Cooling Water System is also chemically treated during peak clam spawning periods to ensure clam control.

10.10.5 Inspection and Testing

The Emergency Equipment Cooling Water System will be tested periodically to verify operability.

The system was tested during initial startup by simulating the breach of Wheeler Dam. The flow through each cooler is regulated by a manual throttling or self-regulating valve to maintain required minimum flow under all operating conditions. Each manual throttling valve will remain under administrative control as initially adjusted unless future testing indicates inadequate flow is being received by the equipment; at which time, necessary throttle valves will be readjusted.

The Emergency Equipment Cooling Water System piping and components are monitored by routine inspections, general housekeeping practices, and system operability testing which maintains system leakage to an as-low-as-possible level.

The Unit 2 Emergency Equipment Cooling Water System has stainless steel butt welds which have exhibited the presence of Microbiologically Induced Corrosion (MIC). As a result of MIC, the Unit 2 EECW System will be monitored for MIC progress each operating cycle to ensure structural integrity of the system.