10.6 REACTOR BUILDING CLOSED COOLING WATER SYSTEM

10.6.1 Power Generation Objective

The power generation objective of the Reactor Building Closed Cooling Water System (RBCCWS) is to provide a continuous supply of cooling water to designated plant equipment located in the primary and secondary containments.

10.6.2 Power Generation Design Basis

1. The RBCCWS shall be designed to cool auxiliary plant equipment over the full range of reactor power operation.

2. The RBCCWS shall be designed to limit the possibility of radioactive material release to the raw cooling water.

3. The RBCCWS shall be designed so that failure of the offsite power supply will not impair cooling water supply to equipment within the primary containment.

10.6.3 Safety Design Basis

The portion of the RBCCWS inside the drywell out to and including the containment isolation valves shall be designed so that an earthquake would not impair the System's ability to function as a primary containment pressure boundary.

The portion of the Unit 1 and Unit 3 RBCCW system from the Secondary Containment Boundary penetration to the Secondary Containment Isolation valves shall be designed so that an earthquake would not impair the system's ability to function as a secondary containment pressure boundary.

10.6.4 Description

The Reactor Building Closed Cooling Water System is shown in Figures 10.6-1a, -1b, and -1c. The system consists of pumps, heat exchangers, and necessary control and support equipment. The cooling water pumps, located in the Reactor Building, are centrifugal-type with mechanical seals. The materials used in construction are listed in Table 10.6-1. Each of the three cooling water pumps delivers 1700 gpm; two pumps can provide 100 percent of the flow requirements for a unit during normal plant operation. One pump is provided as a common spare for all three units and is located in the Unit 1 Reactor Building. Selected heat exchangers, which are located in the primary and secondary containments, are connected to the RBCCWS as indicated in Figures 10.6-1a, -1b, and -1c. The RBCCWS heat exchangers are of the straight tube type, with tubes rolled into the tube sheets. The heat exchangers are designed to allow for expansion and contraction of all parts and are constructed of the materials given in Table 10.6-1.

The heat exchangers are designed with raw-cooling-water flow on the tube side and corrosion-inhibited demineralized-water flow on the shell side. The two heat exchangers per unit can transfer 100 percent of the heat load requirements for the unit over the full range of reactor power operation. The heat load requirements for the RBCCWS are based on a RWCU flow of 270 gpm. RWCU flow can be increased up to 340 gpm under conditions when the RBCCWS can accommodate the additional heat load. One heat exchanger is provided as a common spare for all three units. Table 10.6-2 lists the operating conditions of the RBCCWS heat exchangers.

All equipment outside the primary containment is provided with manual flow-control valves (accessible during plant operation) or fixed orifices. They are located on the RBCCWS side of the heat exchangers for flow regulation. Fixed orifices are placed so that high velocity water from the orifice does not impinge on valves and fittings. Additionally, the non-regenerative heat exchangers have a TCV downstream of the heat exchangers to maintain RWCU temperatures within limits.

Suitable water level is maintained in the surge tank by manual control. Demineralized water is used for RBCCWS makeup to the surge tank to restore the level. High and low levels are alarmed in the control room to indicate a leak into or out of the System. The surge tank low level alarm occurs in time to permit manual refilling.

Each RBCCWS pump discharge is equipped with a pressure gauge. Low discharge pressure in the common discharge header closes the nonessential loop isolation valve and is alarmed in the Main Control Room. High common suction header temperature is also alarmed in the Main Control Room. Local temperature indicators, accessible during plant operation, are provided as shown in Figures 10.6-1a, -1b, and -1c.

The portion of the RBCCWS inside primary containment out to and including the containment isolation valves is seismic Class I to ensure that the system's ability to function as a primary containment pressure boundary is not compromised as a result of an earthquake. Cooling is maintained on all equipment inside primary containment during failure of offsite a-c power. At such times, cooling to the equipment outside primary containment can be stopped by closing the sectionalizing valve shown in Figures 10.6-1a, -1b, and -1c. Electrical power for operating the RBCCWS during such periods is supplied by the diesel generators. A list of the components cooled and their cooling requirements are given in Tables 10.6-3a and -3b.

Raw cooling water pumps are the normal supply to the RBCCW system. An alternate cooling water supply for the RBCCWS heat exchangers is provided from the Emergency Equipment Cooling Water System (see Subsections 10.7 and 10.10).

Following a 480-V shutdown board load shed in either Unit 1 or 2, cooling water is automatically restored to equipment in both drywells. Drywell cooling, which is accomplished by the drywell atmosphere cooling coil blowers, is automatically restored to the nonaccident Unit 1 or 2. On the accident-affected unit, four blowers may be manually restarted (all other accident unit blowers are locked out).

A Unit 3 480-V shutdown board load shed signal has no effect on Units 1 or 2. On Unit 3, cooling water is automatically restored and four drywell blowers may be manually restarted.

The RBCCWS is monitored by a process radiation monitor (see Subsection 7.12) to detect possible in leakage from the cooled systems. Early detection of any increase in radioactivity in the RBCCWS limits the possibility of radioactive material release to the raw cooling water System.

To maintain the Unit 1 and/or Unit 3 drywell at a comfortable temperature during plant outages, when the RBCCW will not facilitate personnel activities the drywell can be cooled with the drywell coolers supplied with chilled water via RBCCW piping. The chilled water is supplied from a chiller/pump combination located outside the Unit 3 Reactor Building. The chiller/pump combination contains two air cooled water chillers with two in-line circulating pumps.

The chiller/pump is operable only during plant outages, when cooling is not required for the Reactor Recirculation Pumps and the Drywell Sump Heat Exchangers. During plant operation the supply and return lines from the chiller will be isolated from the operating RBCCW system by closed isolation valves located between the chiller and RBCCW piping.

10.6.5 Safety Evaluation

As described in paragraph 10.6.4, the portion of the RBCCWS inside the primary containment isolation boundary meets the safety design basis by designing to Seismic Class I specifications.

10.6.6 Inspection and Testing

The spare RBCCWS pump and spare RBCCWS heat exchanger may be periodically placed on the line to assure operability. System components located outside the drywell are located where routine visual inspections may be conducted to verify system operability.

Flow measuring devices may be temporarily installed in all major equipment cooling water headers. The flow measuring devices can then be used to balance RBCCW

water flows, and with temperature indicators the heat load being removed from the drywell can be determined when necessary.