9.3 CIRCULATING WATER SYSTEM

9.3.1 DESIGN BASIS

The condensers for both of the electrical generating units have been designed such that the increase in temperature of the Chesapeake Bay water passing through them is not more than 10°F at maximum expected, not guaranteed, operating conditions. Under guaranteed operating conditions, i.e., that maximum operating condition at which both the reactor supplier and the turbine generator suppliers guarantee their equipment, the temperature increase of the Bay water is no more than 9.6°F. A test program allowing a temperature increase up to 12°F has been completed by the State of Maryland. Current limits allow use of a 12°F increase on a permanent basis.

Circulating water pumps and piping conduits are designed to fulfill the design basis requirements described above.

9.3.2 SYSTEM DESCRIPTION

The circulating water system (CWS) is shown in Figures 9-8 (Unit 1) and 9-26 (Unit 2). The intake and discharge are shown on Figures 1-3A and 1-3B.

9.3.2.1 Circulating Water System

The CWS incorporates design information developed from the model testing discussed in Section 2.8.2. The full width of the intake channel (which serves both units) is 560'. The Intake Structure houses a total of 24 circulating water screens, 12 for each unit, consisting of single-flow or dual-flow designs. The purpose of these screens is to prevent debris larger than 3/8" or 10 mm from passing into the circulating water pumps, condenser, saltwater pumps, and the saltwater-to-fresh-water heat exchangers. The Screen Wash Systems provide a high pressure spray to remove debris from the water screens. The screen wash systems consist of eight submersible screen wash pumps including two installed spares and two submersible trough wash pumps. The screen wash pumps serve four screens each and the trough wash pumps serve the trough for each unit.

The Circulating Water Chemical Addition System serves both the Unit 1 and Unit 2 Circulating Water Systems to minimize the marine fouling of piping and heat exchanger surfaces. This system has the ability to inject approved chemicals into each of the Circulating Water System intake and discharge conduits, as necessary.

The CWS has six vertical centrifugal pumps per unit. These pumps provide the motive force required to circulate bay water through the system and back into the bay.

9.3.2.2 Condensers

The condensers for each unit consist of three separate shells, each with the same capacity, to condense exhaust steam from the power generating turbine. The condensers are of the single-pass or once-through design with divided water boxes to permit one-half of each shell to be opened and manually cleaned during plant operation, if necessary.

Each condenser has approximately 49,500 tubes, each being 1-1/4" in diameter and 28' long. The tube material is austenitic stainless steel and titanium (Unit 1), and titanium (Unit 2).

Each condenser is equipped with a mechanical cleaning system utilizing small sponge rubber balls which are injected at the condenser inlet, passed through the tubes, collected at the condenser outlet, and returned for recycling.

A butterfly valve equipped with a perforated disc instead of a solid disc is installed in each circulating water pipe at the inlet to the condenser water boxes. It is possible to close this valve when its corresponding circulating water pump is shut down. Marine growth that may have been pumped against the condenser tube sheet should fall off and be caught by this strainer-type valve instead of falling further down and out of reach in the pipes. Conveniently located manhole doors can then be opened and the marine growth manually removed from the condenser.

Two temperature sensors are provided in each discharge pipe. These temperatures are monitored by the computer in the Control Room. Since each unit has six discharge pipes, circulating water discharge is monitored by twelve independent temperature readings prior to being discharged into the bay.

9.3.2.3 Bay Water Systems Discharges

At mean low tide level, the top of the discharge conduits is approximately 6 feet below the surface of the water. The entire discharge structure is composed of four separate conduits, two for each unit.

The effluent from the WPS may be discharged into any one or more of these four separate conduits, thus providing a means to ensure a maximum dilution of the effluent under all operating conditions. Discharge from the condensate system, the steam generator blowdown recovery system, the storm water system, the yard oil interceptor, and the auxiliary blowdown tank are also directed to the discharge conduits.

9.3.3 COMPONENTS

The component description for the CWS is contained in Table 9-15.

9.3.4 TESTING AND INSPECTION

Each component is inspected and cleaned prior to installation into the system.

Instruments are calibrated during testing. Automatic controls are tested for actuation at the proper setpoints. Alarm functions are checked for operability and limits during preoperational testing. The relief valve setpoints are checked.

The system was operated and tested initially with regard to flow paths, flow capacity and mechanical operability.

Data will be taken periodically during normal plant operation to confirm heat transfer capabilities.

9.3.5 SYSTEM RELIABILITY

The CWS is similar to other systems operating in conventional and nuclear power plants. The equipment in this system is designed to applicable codes and standards as listed in Table 9-15. Adequate redundancy, protective devices, and controls are provided to assure reliable and safe operation.

TABLE 9-15

CIRCULATING WATER SYSTEM COMPONENT DESCRIPTION

Traveling Water Screen	
Types	Vertical, single flow through and dual flow through
Quantity	12 (per unit)
Speed (ft/min)	10 (single flow through) 16.5/50 (dual flow through)
Temperature range (F)	0 – 100
Screen Wash Pumps	
Type	Submersible, vertical, centrifugal
Quantity	3 per unit and 2 spares
Capacity each (gpm)	1560
Head (ft)	220
Motor	150 hp, 460 Volt, 3 phase, 60 Hz, 1700 RPM
Codes	National Electrical Manufacturers Association (NEMA), Standards of the Hydraulic Institute, ASME Boiler and Pressure Vessel (B&PV) Codes, Section VIII ANSI B16.5
Trash Trough Wash Pumps	
Type	Submersible, vertical, centrifugal
Quantity	1 per unit
Capacity (gpm)	400
Head (ft)	25
Motor	6.2 hp, 460 Volt, 3 phase, 60 Hz, 1700 RPM
Code	NEMA; Standards of the Hydraulic Institute; ASME B&PV Codes, Section VIII, ANSI B16.5
Circulating Water Pumps	
Type	Vertical, dry pit
Quantity	6 (per unit)
Capacity each (gpm)	200,000
Head (ft)	19.5
Motor	Synchronous 1250 hp, 4160 Volt, 60 Hz, 3 phase, 150 RPM
Codes	NEMA, Standards of the Hydraulic Institute, ASME B&PV Code, Section VIII, Pressure Vessels, ANSI B16.5