CHAPTER 10

STEAM AND POWER CONVERSION

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CHAPTER 10

STEAM AND POWER CONVERSION

10.1 SUMMARY DESCRIPTION

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

10.1.3 COMBINED LICENSE INFORMATION ON EROSION-CORROSION MONITORING

Add the following at the end of DCD Subsection 10.1.3.

10.1.3.1 Erosion-Corrosion Monitoring

STD COL 10.1-1 The flow accelerated corrosion (FAC) monitoring program analyzes, inspects, monitors and trends those nuclear power plant components that are potentially susceptible to erosion-corrosion damage such as carbon steel components that carry wet steam. In addition, the FAC monitoring program considers the information of Generic Letter 89-08, EPRI NSAC-202L-R3, and industry operating experience. The program requires a grid layout for obtaining consistent pipe thickness measurements when using Ultrasonic Test Techniques. The FAC program obtains actual thickness measurements for highly susceptible FAC locations for new lines as defined in EPRI NSAC-202L-R3. At a minimum, a Pass 1 analysis is used for low and highly susceptible FAC locations and a Pass 2 analysis is used for highly susceptible FAC locations when the Pass 1 analysis results warrant. To determine wear of piping and components where operating conditions are inconsistent or unknown, the guidance provided in EPRI NSAC-202L is used to determine wear rates.

10.1.3.1.1 Analysis

An industry-sponsored program is used to identify the most susceptible components and to evaluate the rate of wall thinning for components and piping potentially susceptible to FAC. Each susceptible component is tracked in a database and is inspected, based on susceptibility. Analytical methods utilize the results of plant-specific inspection data to develop plant-specific correction factors. This correction accounts for uncertainties in plant data, and for systematic discrepancies caused by plant operation. For each piping component, the analytical method predicts the wear rate, and the estimated time until it must be re-inspected, repaired, or replaced. Carbon steel piping (ASME III and B31.1) that is used for single or multi-phase high temperature flow are the most susceptible to erosion-corrosion damage and receive the most critical analysis.

10.1.3.1.2 Industry Experience

Review and incorporation of industry experience provides a valuable supplement to plant analysis. Industry experience is used to update the program by identifying susceptible components or piping features.

10.1.3.1.3 Inspections

Wall thickness measurements establish the extent of wear in a given component, provide data to help evaluate trends, and provide data to refine the predictive model. Components are inspected for wear using ultrasonic techniques (UT), radiography techniques (RT), or by visual observation. The initial inspections are used as a baseline for later inspections. Each subsequent inspection determines the wear rate for the piping and components and the need for inspection frequency adjustment for those components.

10.1.3.1.4 Training and Engineering Judgement

The FAC program is administered by both trained and experienced personnel. Task specific training is provided for plant personnel that implement the monitoring program. Specific non-destructive examination (NDE) is carried out by personnel qualified in the given NDE method. Inspection data is analyzed by engineers or other experienced personnel to determine the overall effect on the system or component.

10.1.3.1.5 Long-Term Strategy

This strategy focuses on reducing wear rates and performing inspections on the most susceptible locations.

10.1.3.2 Procedures

10.1.3.2.1 Generic Plant Procedure

The FAC monitoring program is governed by procedure. This procedure contains the following elements:

- A requirement to monitor and control FAC.
- Identification of the tasks to be performed and associated responsibilities.
- Identification of the position that has overall responsibility for the FAC monitoring program at each plant.
- Communication requirements between the coordinator and other departments that have responsibility for performing support tasks.
- Quality Assurance requirements.

- Identification of long-term goals and strategies for reducing high FAC wear rates.
- A method for evaluating plant performance against long-term goals.

10.1.3.2.2 Implementing Procedures

The FAC implementing procedures provide guidelines for controlling the major tasks. The plant procedures for major tasks are as follows:

- Identifying susceptible systems.
- Performing FAC analysis.
- Selecting and scheduling components for initial inspection.
- Performing inspections.
- Evaluating degraded components.
- Repairing and replacing components when necessary.
- Selecting and scheduling locations for the follow-on inspections.
- Collection and storage of inspections records.

10.1.3.3 Plant Chemistry

The responsibility for system chemistry is under the purview of the plant chemistry section. The plant chemistry section specifies chemical addition in accordance with plant procedures.

10.2 TURBINE-GENERATOR

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

10.2.2 SYSTEM DESCRIPTION

Add the following sentence at the end of the second paragraph of DCD Subsection 10.2.2.

STD SUP 10.2-1 Subsection 3.5.1.3 addresses the probability of generation of a turbine missile for AP1000 plants in a side-by-side configuration.

Add the following statement at the end of DCD Subsection 10.2.2.

STD SUP 10.2-4 Preoperational and startup tests provide guidance to operations personnel to ensure the proper operability of the turbine generator system.

10.2.3 TURBINE ROTOR INTEGRITY

Add the following statement at the end of DCD Subsection 10.2.3.

STD SUP 10.2-5 Operations and maintenance procedures mitigate the following potential degradation mechanisms in the turbine rotor and buckets/blades: pitting, stress corrosion cracking, corrosion fatigue, low-cycle fatigue, erosion, and erosion-corrosion.

10.2.3.6 Maintenance and Inspection Program Plan

Add the following at the end of DCD Subsection 10.2.3.6.

STD SUP 10.2-3 The inservice inspection (ISI) program for the turbine assembly provides assurance that rotor flaws that lead to brittle fracture of a rotor are detected. The ISI program also coincides with the ISI schedule during shutdown, as required by the ASME Boiler and Pressure Vessel Code, Section XI, and includes complete inspection of all significant turbine components, such as couplings, coupling bolts, turbine shafts, low-pressure turbine blades, low-pressure rotors, and high-pressure rotors. This inspection consists of visual, surface, and volumetric examinations required by the code.

10.2.6 COMBINED LICENSE INFORMATION ON TURBINE MAINTENANCE AND INSPECTION

Replace the text in DCD Subsection 10.2.6 with the following:

STD COL 10.2-1 A turbine maintenance and inspection program will be submitted to the NRC staff for review prior to fuel load. The program will be consistent with the maintenance and inspection program plan activities and inspection intervals identified in DCD Subsection 10.2.3.6. Plant-specific turbine rotor test data and calculated toughness curves that support the material property assumptions in the turbine rotor analysis will be available for review after fabrication of the turbine and prior to fuel load.

10.3 MAIN STEAM SUPPLY SYSTEM

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

10.3.2.2.1 Main Steam Piping

Add the following at the end of DCD Subsection 10.3.2.2.1.

STD SUP 10.3-1 Operations and maintenance procedures will include precautions, when appropriate, to minimize the potential for steam and water hammer, including:

- Prevention of rapid valve motion
- Process for avoiding introduction of voids into water-filled lines and components
- Proper filling and venting of water-filled lines and components
- Process for avoiding introduction of steam or heated water that can flash into water-filled lines and components
- Cautions for introduction of water into steam-filled lines or components
- Proper warmup of steam-filled lines
- Proper drainage of steam-filled lines
- The effects of valve alignments on line conditions

10.3.5.4 Chemical Addition

Add the following at the end of DCD Subsection 10.3.5.4.

STD SUP 10.3-2 Alkaline chemistry supports maintaining iodine compounds in their nonvolatile form. When iodine is in its elemental form, it is volatile and free to react with organic compounds to create organic iodine compounds, which are not assumed to remain in solution. It is noted that no significant level of organic compounds is expected in the secondary system. The secondary water chemistry, thus, does not directly impact the radioactive iodine partition coefficients.

10.3.6.2 Material Selection and Fabrication

Add the following at the end of DCD Subsection 10.3.6.2.

STD SUP 10.3-3 Appropriate operations and maintenance procedures will provide the necessary controls during operation to minimize the susceptibility of components made of stainless steel and nickel-based materials to intergranular stress-corrosion cracking by controlling chemicals that are used on system components.

10.4 OTHER FEATURES OF STEAM AND POWER CONVERSION SYSTEM

This section of the referenced DCD is incorporated by reference with the following departures and/or supplements.

10.4.2.2.1 General Description

Revise the first sentence of the third paragraph of DCD Subsection 10.4.2.2.1 to remove the brackets.

BLN CDI The circulating water system (CWS) or makeup water from the raw water system (RWS) provides the cooling water for the vacuum pump seal water heat exchangers.

10.4.2.2.2 Component Description

Revise the fourth sentence of the first paragraph of DCD Subsection 10.4.2.2.2 to remove the brackets.

BLN CDI Seal water flows through the shell side of the seal water heat exchanger and circulating water flows through the tube side.

Subsection 10.4.5 is modified using full text incorporation to provide site specific information to replace the DCD conceptual design information (CDI).

DCD

10.4.5 CIRCULATING WATER SYSTEM

10.4.5.1 Design Basis

10.4.5.1.1 Safety Design Basis

The circulating water system (CWS) serves no safety-related function and therefore has no nuclear safety design basis.

10.4.5.1.2 Power Generation Design Basis

BLN CDI The CWS supplies cooling water to remove heat from the main condensers. The CWS or makeup water from the RWS supplies cooling water to the turbine building closed cooling water system (TCS) heat exchangers and the condenser vacuum pump seal water heat exchangers under varying conditions of power plant loading and design weather conditions.

DCD 10.4.5.2 System Description

10.4.5.2.1 General Description

Classification of components and equipment in the circulating water system is given in Section 3.2.

BLN COL 10.4-1 The circulating water system and the cooling tower provide a heat sink for the waste heat exhausted from the steam turbine. Additional cooling is supplied from the circulating water system through a tap in the main supply header for the TCS heat exchangers and the condenser vacuum pump seal water heat exchangers. Circulating water system design parameters are provided in Table 10.4-201 and Table 10.4-202.

BLN CDI The circulating water system consists of three 33-1/3-percent-capacity circulating water pumps, one hyperbolic natural draft cooling tower (NDCT), and associated piping, valves, and instrumentation.

DCD Makeup water to the CWS is provided by the raw water system (RWS). In addition, water chemistry is controlled by a local chemical feed system.

10.4.5.2.2 Component Description

Circulating Water Pumps

BLN CDI The three circulating water pumps are vertical, wet pit, single-stage, mixed-flow pumps driven by electric motors. The pumps are mounted in a pump pit, which is attached to the cooling tower basin. The three pump discharge lines connect to a common header which connects to the two inlet water boxes of the condenser and may also supply cooling water to the TCS and condenser vacuum pump seal water heat exchangers. Each pump discharge line has a motor-operated butterfly valve located between the pump discharge and the main header. This permits isolation of one pump for maintenance and allows for two-pump operation.

Cooling Tower

The hyperbolic NDCT is designed to reject the full-load waste heat to the atmosphere by evaporation as the circulating water passes through the film-type heat exchanger section. The cooling tower is designed to cool the circulating water to 91°F based on a mean annual design wet bulb temperature of 77°F.

The cooling tower is located approximately 2500 ft. south of the plant and has a basin water level of 630 ft. Should a cooling tower basin wall break, little, if any, water would reach the plant because of the remote location of the tower and the grading of the site. The height of the cooling tower is 474 ft., thus, there is no potential for the cooling tower to fall and damage safety related structures or components. Because of the remote location, the cooling tower height, and the buoyant rise of the plumes, the plumes will dissipate before they interfere with the SWS cooling towers intake, any plant ventilation intake, or the plant switchyard. Because of the height of cooling tower it is unlikely there will be fogging near the plant as a result of the cooling tower plume.

An additional cooling tower bypass is installed for use during condenser draining and possible use in the event of freezing weather.

The existing pumps and pump house will not be used with the former units and must be isolated from the existing cooling tower basin.

The basin walls are fabricated to isolate the spillway from the basin without having to remove any of the existing spillway features. The angle between the columns for the NDCT is $\theta = 7.5°$. The radius of the NDCT is approximately 209 ft. and the length of the column to column is approximately 27 ft. Enclosing three bays bounded by the spillway requires the installation of approximately 52 ft. of basin wall.

The construction of the new pump pit spillway requires the removal of three sections of the basin wall and the plinths modified to reduce hydrodynamic drag. The pit has an approach approximately 45 ft. with a maximum slope angle of no more than 15°. The approach section terminates at the trash rack leading to a 50 ft. long by 45 ft. wide pump pit providing a pump submergence of 23 ft. The pit is a concrete encased structure designed to support three 6000 hp pumps weighing approximately 80,000 lb.

Cooling Tower Makeup and Blowdown

DCD The circulating water system makeup is provided by the raw water system.

BLN CDI Makeup to and blowdown from the CWS is controlled by the makeup control valves. The makeup control valves maintain the cooling tower basin level, which controls blowdown by maintaining basin level above a weir built into the basin wall. This fixed level regulates blowdown or discharge flow. This control scheme, along with a local chemical feed system, provides chemistry control in the circulating water in order to maintain a noncorrosive, nonscale-forming condition and limit biological growth in CWS components.

Evaporation, drift, and blowdown losses from the NDCT are replaced by makeup flow from the RWS. Blowdown water flows from the cold water basin of each cooling tower directly to the Guntersville Reservoir through a system of multiport diffusers. The normal concentrations of dissolved solids in the circulating water will range from three to four cycles of concentration. The blowdown rate is determined by makeup water flow and the height of the water level in the basin over the crest of the weir.

DCD **Piping and Valves**

BLN CDI The underground portions of the CWS piping are constructed of prestressed concrete pressure piping. The remainder of the piping is carbon steel and is coated internally with a corrosion-resistant compound.

BLN COL 10.4-1 Condenser water box drains allow the condenser to be drained to the cooling tower basin. Piping is routed from each water box to the condenser water box drain pump which in turn pumps the water back to the cooling tower. Each water box contains drain valves and vents so that a water box can be drained individually. Piping is sized to support an adequate drain down in the event of emergency maintenance.

DCD Motor-operated butterfly valves are provided in each of the circulating water lines at their inlet to and exit from the condenser shell to allow isolation of portions of the condenser.

BLN CDI Control valves provide regulation of cooling tower makeup.

DCD The circulating water system is designed to withstand the maximum operating discharge pressure of the circulating water pumps.

Piping includes the expansion joints, butterfly valves, condenser water boxes, and tube bundles.

BLN CDI The piping design pressure of the CWS is 65 psig.

DCD **Circulating Water Chemical Injection**

Circulating water chemistry is maintained by a local chemical feed system skid at the CWS cooling tower.

BLN CDI Circulating water system chemical feed equipment injects the required chemicals into the circulating water downstream at the CWS cooling tower basin area.

DCD This maintains a noncorrosive, nonscale-forming condition and limits the biological film formation that reduces the heat transfer rate in the condenser and the heat exchangers supplied by the circulating water system.

BLN COL 10.4-1 The specific chemicals used within the system are determined by the site water conditions and are monitored by plant chemistry personnel.

DCD The chemicals can be divided into six categories based upon function: biocide, algaecide, pH adjuster, corrosion inhibitor, scale inhibitor, and a silt dispersant. The pH adjuster, corrosion inhibitor, scale inhibitor, and dispersant are metered into the system continuously or as required to maintain proper concentrations. The biocide application frequency may vary with seasons.

BLN CDI

The algaecide is applied, as necessary, to control algae formation on the cooling tower.

BLN COL 10.4-1

The following chemicals are used to control circulating water chemistry:

- Biocide - Sodium hypochlorite (continuous)
- Algaecide – Quaternary amine
- pH Adjuster – Sulfuric acid
- Corrosion Inhibitor – Ortho/polyphosphate
- Scale Inhibitor – Phosphonate
- Silt Dispersant – Polyacrylate

DCD

Addition of biocide and water treatment chemicals is performed by local chemical feed injection metering pumps and is adjusted as required.

BLN CDI

Chemical concentrations are measured through analysis of grab samples from the CWS.

DCD

Residual chlorine is measured to monitor the effectiveness of the biocide treatment.

10.4.5.2.3 System Operation

BLN CDI

The three circulating water pumps take suction from the circulating water pump pit and circulate the water through the tube side of the main condenser, with smaller flows to the TCS, the condenser vacuum pump seal water heat exchangers, and back through the piping discharge network to the NDCT. See Figures 10.4-201, 10.4-202 and 10.4-203. The NDCT cools the circulating water by discharging the water through nozzles in the tower distribution headers. The water is then diffused through fill material to the basin beneath the tower and, in the process, rejects heat to the atmosphere. Provisions are made during freezing weather to direct circulating water through the use of slidegates in each of the central flume sections. When these gates are closed, the total hot water load is routed to the tower perimeter. Isolation of the central portion of the tower reduces the working fill surface by approximately 17 percent while maintaining the normal water flow to the tower. Consequently, the water flow to the remaining fill surface is increased; this condition raises the water temperature and minimizes the possibility of ice accumulation.

A 60 percent capacity bypass system has also been provided on the warm water inlet to prevent icing of the fill during a freezing weather start-up. When the tower is started during freezing weather, the warm water flow should bypass the fill into the cold water basin through the bypass line. The bypass is normally used only during plant startup in freezing weather or to maintain CWS temperature above 40°F while operating at partial load during periods of freezing weather.

BLN CDI

The raw water system supplies makeup water to the cooling tower basin to replace water losses due to evaporation, wind drift, and blowdown. Separate connections are provided between the RWS and CWS and to the TCS heat exchanger to fill the CWS and supply cooling for the TCS heat exchanger and the vacuum pump seals when the CWS is not in operation.

DCD

A condenser tube cleaning system is installed to clean the circulating water side of the main condenser tubes.

BLN CDI

Blowdown from the CWS is taken from the discharge weir of the cooling tower and is discharged to the plant outfall.

DCD

The circulating water system is used to supply cooling water to the main condenser to condense the steam exhausted from the main turbine.

BLN CDI

If the circulating water pumps, the cooling tower, or the circulating water piping malfunction such that condenser backpressure rises above the maximum allowable value, the main condenser will no longer be able to adequately support unit operation.

DCD

Cooldown of the reactor may be accomplished by using the power-operated atmospheric steam relief valves or safety valves rather than the turbine bypass system when the condenser is not available.

Passage of condensate from the main condenser into the circulating water system through a condenser tube leak is not possible during power generation operation, since the circulating water system operates at a greater pressure than the condenser.

BLN CDI

Turbine building closed cooling water in the TCS heat exchangers is maintained at a higher pressure than the circulating water to prevent leakage of the circulating water into the closed cooling water system.

Cooling water to the condenser vacuum pump seal water heat exchangers is supplied from the circulating water system. Cooling water flow from the circulating water system is normally maintained through all four heat exchangers to facilitate placing the spare condenser vacuum pump in service.

DCD

Isolation valves are provided for the condenser vacuum pump seal water heat exchanger cooling water supply lines to facilitate maintenance.

Small circulating water system leaks in the turbine building will drain into the waste water system. Large circulating water system leaks due to pipe failures will be indicated in the control room by a loss of vacuum in the condenser shell. The effects of flooding due to a circulating water system failure, such as the rupture of an expansion joint, will not result in detrimental effects on safety-related equipment since there is no safety-related equipment in the turbine building and the base slab of the turbine building is located at grade elevation. Water from a system rupture will run out of the building through a relief panel in the turbine building west wall before the level could rise high enough to cause damage. Site grading will carry the water away from safety-related buildings.

BLN CDI

The cooling tower is located so that collapse of the tower has no potential to damage equipment, components, or structures required for safe shutdown of the plant.

DCD

10.4.5.3 Safety Evaluation

The circulating water system has no safety-related function and therefore requires no nuclear safety evaluation.

10.4.5.4 Tests and Inspections

Components of the circulating water system are accessible as required for inspection during plant power generation.

BLN CDI

The circulating water pumps are tested in accordance with standards of the Hydraulic Institute.

DCD

Performance, hydrostatic, and leakage tests associated with preinstallation and preoperational testing are performed on the circulating water system. The system performance and structural and leaktight integrity of system components are demonstrated by continuous operation.

10.4.5.5 Instrumentation Applications

BLN CDI

Instrumentation provided indicates the open and closed positions of motor-operated butterfly valves in the circulating water piping. The motor-operated valve at each pump discharge is interlocked with the pump so that the pump trips if the discharge valve fails to reach the full-open position shortly after starting the pump.

Local grab samples are used to periodically test the circulating water quality to limit harmful effects to the system piping and valves due to improper water chemistry.

Pressure indication is provided on the circulating water pump discharge lines.

DCD

A differential pressure transmitter is provided between one inlet and outlet branch to the condenser. This differential pressure transmitter is used to determine the frequency of operating the condenser tube cleaning system (CES).

BLN CDI

Temperature indication is supplied on the common CWS inlet header to the TCS heat exchanger trains. This temperature is also representative of the inlet cooling water temperature to the main condenser.

A flow element is provided on the common discharge line from the TCS heat exchangers to allow monitoring of the total flow through the TCS heat exchangers. Flow measurement for the raw water makeup to the cooling tower and for the cooling tower blowdown is also provided.

BLN CDI

Level instrumentation provided in the circulating water pump intake structure activates makeup flow from the RWS to the cooling tower basin when required. Level instrumentation also annunciates a low-water level in the pump structure and a high-water level in the cooling tower basin.

BLN COL 10.4-1

The circulating water chemistry is controlled by regulating cooling tower blowdown and by chemical addition, to maintain the circulating water with an acceptable Langelier Index and is maintained in range established by plant chemistry personnel.

BLN CDI

Cooling tower blowdown control is accomplished by the cooling tower basin level controller which operates the makeup control valve for the cooling tower.

DCD

The control approach is to allow the makeup water to concentrate naturally to its upper limit. Provisions are made to add chemicals for pH control.

BLN CDI

The cycles of concentration at which the cooling tower is operated is dependent on the quality of the cooling tower makeup water. Cooling tower blowdown is discharged to Guntersville Reservoir and is monitored for temperature before discharge.

DCD

Monitoring of the circulating water system is performed through the data display and processing system. Control functions are performed by the plant control system. Appropriate alarms and displays are available in the control room. See Chapter 7.

10.4.7.2.1 General Description

Replace the last sentence of the sixth paragraph of DCD Subsection 10.4.7.2.1 as follows.

BLN COL 10.4-2 The oxygen scavenger agent is hydrazine and the pH control agent is ammonia/ monoethylamine. During shutdown conditions, carbohydride may be used in place of hydrazine.

STD SUP 10.4-2 Oxygen scavenging and ammoniating agents are selected and utilized for plant secondary water chemistry optimization following the guidance of NEI-97-06, "Steam Generator Program Guidelines" (Reference 201). The EPRI Pressurized Water Reactor Secondary Water Chemistry Guidelines are followed as described in NEI 97-06.

Add new paragraph at the end of the DCD Subsection 10.4.7.2.1:

STD SUP 10.4-1 Operations and maintenance procedures will include precautions, when appropriate, to minimize the potential for steam and water hammer, including:

- Prevention of rapid valve motion
- Process for avoiding introduction of voids into water-filled lines and components
- Proper filling and venting of water-filled lines and components
- Process for avoiding introduction of steam or heated water that can flash into water-filled lines and components
- Cautions for introduction of water into steam-filled lines or components
- Proper warmup of steam-filled lines
- Proper drainage of steam-filled lines
- The effects of valve alignments on line conditions

10.4.12.1 Circulating Water System

BLN COL 10.4-1 This COL Item is addressed in Subsection 10.4.5.2.

10.4.12.2 Condensate, Feedwater and Auxiliary Steam System Chemistry Control.

BLN COL 10.4-2 This COL Item is addressed in Subsection 10.4.7.2.1.

10.4.12.3 Potable Water

Replace the entire paragraph for DCD Subsection 10.4.12.3 with the following.

BLN COL 10.4-3 Potable water is supplied by the local municipal water system. No additional onsite treatment is being provided for this supply of water.

10.4.13 REFERENCES

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201. Nuclear Energy Institute, "Steam Generator Program Guidelines," NEI 97-06, Revision 2, May 2005.

TABLE 10.4-201
SUPPLEMENTAL MAIN CONDENSER DESIGN DATA

	Condenser Data	
BLN COL 10.4-1	Design operating pressure (average of all shells)	3.8 in.-Hg
BLN CDI	Circulating water flow	500,000 gpm
BLN COL 10.4-1	Tube-side inlet temperature	90.9°F
BLN COL 10.4-1	Approximate Tube-side temperature rise	30.2°F
BLN COL 10.4-1	Condenser outlet temperature	121.1°F

Note: This table supplements DCD Table 10.4.1-1.

BLN COL 10.4-1

TABLE 10.4-202
SUPPLEMENTAL DESIGN PARAMETERS FOR MAJOR CIRCULATING WATER SYSTEM COMPONENTS

Circulating Water Pump	
Flow rate (gal/min)	177,000
Quantity	Three per unit
Natural Draft Cooling Tower	
Approach temperature (°F)	13.9
Inlet temperature (°F)	121.1
Outlet temperature (°F)	90.9
Approximate Temperature range (°F)	30.2
Flow rate (gal/min)	531,100
Quantity	One per unit
Heat transfer (Btu/hr)	$7{,}628 \times 10^6$
Wind velocity design (mph)	110
Seismic design criteria per Uniform Building Code	

Note: This table supplements DCD Table 10.4.5-1.