9.2.10 Turbine Building Closed Cooling Water System

The turbine building closed cooling water system (TBCCWS) is a closed loop system, which provides water to non-safety-related secondary side Conventional Island (CI) equipment coolers and heat exchangers (HX). The TBCCWS removes heat generated by components in the conventional part of the plant and transfers it to the non-safety-related auxiliary cooling water system (ACWS) for rejection to the normal heat sink.

9.2.10.1 Design Bases

The TBCCWS performs no safety function and has no safety design basis. The system is not required to operate during or after a design basis event (DBE).

9.2.10.2 System Description

9.2.10.2.1 General Description

The TBCCWS provides cooling to several secondary side CI power generation components. The system has adequate margin in its heat removal capacity to accommodate the highest user heat loads with the maximum expected cooling water temperature in the ACWS.

The TBCCWS includes three 50 percent capacity pumps supplying a common header, which in turn, supplies three 50 percent capacity TBCCWS cooled HXs and one bypass line, which supply a common piping system that delivers cooling flow to various component coolers throughout the CI and returns the heated water to the common suction of the TBCCWS pumps. An expansion tank connected to the pump suction header maintains the system filled, thereby providing protection against cavitation and water hammer. During cold weather or low load operations, the TBCCWS minimum temperature is maintained through HX bypass flow control by a temperature-controlled bypass line flow control valve. Components and piping in the system are designed for ambient conditions in the TB.

9.2.10.2.2 Component Description

Table 3.2.2-1 provides the seismic and other design classifications for the TBCCWS structures, systems and components (SSC).

Turbine Building Closed Cooling Water Pump

The TBCCWS pumps provide the motive circulation force for the system. During normal operation, any two of the three 50 percent capacity cooling water pumps discharge water to any two of the three 50 percent TBCCWS HXs.

Turbine Building Closed Cooling Water Heat Exchanger

Two of three 50 percent capacity TBCCWS HXs operate under plant normal load conditions to remove heat from secondary side component coolers and HXs. The heat sink for the HXs is the ACWS. The heat exchangers are ASME Section VIII pressure vessels that are supplied with a relief valve sized for thermal expansion.

Turbine Building Closed Cooling Water Expansion Tank

The TBCCWS expansion tank provides volumetric and pressure control for the TBCCWS during normal operation. The expansion tank is sized to accommodate level change based on expected pump suction conditions and thermal expansion and contraction. The expansion tank also provides pump net positive suction head (NPSH) protection by maintaining an elevated system pressure using nitrogen on one side of a diaphragm within the tank.

9.2.10.3 System Operation

During normal full load operation, two TBCCWS pumps and two HXs are in service to provide cooling to CI heat loads. In the event of a failure of one TBCCWS pump, the standby pump automatically starts. In the event of a failure of a TBCCWS HX, the standby HX is placed in service. High temperatures of the cooled components may require a load reduction or potential TG shutdown. The following loads are serviced by the TBCCWS:

- Turbine lube oil coolers and other turbine equipment, as required.
- Generator, excitation system and bus duct coolers.
- Condensate and feedwater system equipment coolers.
- Main condensate evacuation system coolers.
- Auxiliary boiler equipment coolers, as required.
- CI process auxiliary equipment coolers, as required.
- Turbine Island (TI) operational chilled water system coolers.

A connection from the demineralized water distribution system (DWDS) to the suction header accommodates system fill and makeup. There is also a connection on the suction header to accommodate injection of chemicals for TBCCWS water chemistry control, which is monitored through an additional connection from the sampling system. A safety valve on the suction header protects the system from overpressure.

9.2.10.4 Safety Evaluation

The TBCCWS does not perform any safety function and it does not interface with any safety-related system. The system is not important to safety and is not required to operate during or after a DBE. Therefore, the requirements of GDC 4, 44, 45 and 46 do not apply.

The TBCCWS complies with GDC 2 by adhering to the guidance of Regulatory Position C.2 of RG 1.29 for confirming that failures of the TBCCWS during seismic events will not affect the performance of any safety-related systems or components. The TBCCWS equipment is located entirely within the TB. Cooling loads are primarily in the TB. As required, cooling loads in non-safety-related outdoor areas and in the Electric Switchgear Building may be served. No safety-related equipment is located in the Turbine Building or in non-safety-related outdoor areas. Since the system is physically separated from the NI by multiple structural barriers, a malfunction of the TBCCWS does not adversely affect the safe shutdown of the plant or impact the performance of any required safety function. Therefore, the failure of the non-seismic TBCCWS (including the effects of jet impingement and flooding) cannot lead to the failure of any safety-related systems, structures and components. Flooding of the TB due to failure of the TBCCWS is bounded by the failure of the site-specific circulating water system (CWS). Refer to U.S. EPR Combined License Information Item No. 10.4-5.

The TBCCWS has no connection to systems having the potential for containing radioactive materials.

The TBCCWS is designed for a single unit and is not shared with other units.

9.2.10.5 Inspection and Testing Requirements

System components are designed to permit appropriate preservice and startup testing in conformance with conventional good operating practices and component supplier recommendations. The pressure relief valves will be tested and maintained in accordance with the manufacturer's recommendation.

9.2.10.6 Instrumentation Requirements

Installed instrumentation provides adequate information, displayed locally and in the main control room (MCR), for determination of system status.

Specific system setpoint logic is based on system or component functions and conditions. One TBCCWS pump is normally in standby and automatically starts on the trip of an operating pump without interrupting normal plant operation.

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