10.5 TURBINE-GENERATOR AND CONDENSER SYSTEM

10.5.1 DESIGN BASIS

The turbine-generator is designed to receive steam from the steam generators and convert it into electric energy. The condenser transfers unusable heat to the condenser cooling water and deaerates the condensate. The closed regenerative turbine cycle heats the condensate and returns it to the steam generators. Component design data is contained in Table 10-1.

10.5.2 SYSTEM DESCRIPTION

10.5.2.1 Turbine-Generator

The turbines are 1800 rpm tandem compound, six-flow exhaust, indoor units. Saturated steam is supplied to the turbine throttle from the steam generators through four stop valves and four governing control valves. The steam flows through a two-flow, high-pressure turbine and then through combination moisture separator-reheaters (two in parallel for Unit 1, four in parallel for Unit 2) to three double-flow, low-pressure turbines which exhaust to the main condenser system.

Unit 1 is a General Electric turbine and Unit 2 is a Westinghouse turbine. The two units are similar in construction and type, and have similar performance characteristics and generating capacity.

Each turbine is equipped with an automatic stop and emergency trip system which trips the stop and control valves to a closed position for various conditions, including turbine overspeed, low bearing oil pressure, low vacuum, or thrust bearing failure. Upon occurrence of a turbine trip from any of the above causes, and when above a fixed reactor power level, a signal is supplied to the Reactor Protective System to automatically trip the reactor.

Each turbine lubricating oil system supplies oil for lubricating the bearings. A bypass stream of turbine lubricating oil flows continuously through an oil conditioner to remove impurities.

Each generator has the capability to accept the gross rated output of the turbine at rated steam conditions. The generator shafts are oil-sealed to prevent hydrogen leakage. Each generator has its own shaft-driven excitation equipment.

10.5.2.2 Condenser

Each unit has one three-shell, single-pass, deaerating-type condenser with divided water boxes. The condenser is capable of condensing the exhaust steam from the main turbine and the SGFP turbines under full plant load. Each of the three shells is internally equipped to provide for dumping main steam equal to 20% of the Nuclear Steam Supply System thermal capacity. However, only two shells are presently connected to the dump system, thus yielding a heat equivalent absorbing capacity of 40% or 1080 MW(t).

The condenser shells are connected to the turbine exhaust by a belt type, rubber expansion joint. Two low pressure feedwater heaters are installed in the neck of each condenser. The condenser vacuum is maintained by means of mechanical vacuum pumps.

The Condenser Air Removal and Priming System, shown on Figures 10-7 (Unit 1) and 10-12 (Unit 2), removes noncondensable gases from the condenser to the

plant vent. A radiation detector located in each vacuum pump suction line continuously monitors these gases for the presence of radioactivity which would indicate a reactor-coolant-to-secondary-system leak in the steam generators. All noble gases due to a leak will pass by these detectors, which are part of the condenser off-gas radiation monitoring system. The condenser off-gas radiation monitoring system has an alarm setpoint that results in alarm actuation at a primary-to-secondary system leak rate of less than 100 gpd from either Unit.

The monitor alarm setpoint is low enough to ensure detection and monitoring of a sudden and/or rapid increase in reactor-coolant-to-secondary-system leakage. The alarm setpoint provides warning to the plant operators of such an occurrence but has sufficient margin to minimize spurious alarms.

In addition, N-16 activity of the main steam lines upstream of the isolation valves is also monitored and recorded. These radiation monitors will provide annunciation when activity has increased to levels approaching 3.00E-05 µCi/cc. The alarm setpoints provide warning to the plant operators, and the recorded data is available for trending of the activity changes.

Circulating saltwater for condenser cooling for each unit is supplied by six pumps with a capacity of 200,000 gpm each.

The deep intake of cooling water, together with a mechanical condenser tube cleaning system (Section 9.3.2.2), precludes the need for use of chlorine to minimize fouling in the condenser tubes.