8.0 ELECTRICAL POWER SYSTEMS

8.1 Summary Description

The Browns Ferry plant is connected into the TVA system network by seven 500-kV lines. One line is to Madison substation, two to Trinity substation, one line each to the West Point, Maury and Union substations, and one line to the Limestone 500-kV Substation.

Normal station power is from the unit station service transformers connected between the generator breaker and main transformer of each unit. Startup power is from the TVA 500-kV system network through the 500 to 22-kV main and 20.7- to 4.16-kV unit station service transformers (USST 3A is rated 22-kV - 4.16-kV). Auxiliary power is available through the two common station service transformers which are fed from two 161-kV lines supplying the 161-kV switchyard, one line each from the Athens and Trinity substations.

The standby source of auxiliary power is from eight diesel-driven generators. These units start automatically on an accident signal, loss of voltage, or degraded voltage on the associated shutdown board from self-contained starting air systems.

250-V DC Battery Systems

There are eleven 250-V DC battery systems for the station, each of which consists of a battery, battery charger, and distribution equipment. Three 250-V DC systems (the unit batteries) provide power for unit control functions and operative power for unit motor loads. Three 250-V DC systems (the station batteries) provide power for common plant and transmission system control functions, drive power for a 120/240-V AC plant preferred motor-generator set, emergency drive power for certain unit large motor loads, and alternate drive power for two 120/240-V AC unit preferred motor-driven generator sets for Units 2 and 3, and alternate power for one 120/240-V AC unit preferred UPS system. The five remaining 250-V DC systems (the shutdown board batteries) deliver control power to five of the eight 4160-V shutdown boards and four of the six 480-V shutdown boards. The unit and shutdown board batteries supply Engineered Safeguard System (ESS) loads. The station batteries supply only non-safety loads.

48-V DC Battery Systems

There are three 48-V DC battery systems, each of which consists of a battery, battery charger, and distribution panel. Two of these systems provide power to the three MCR annunciator systems including the OP's Recorder and the third is the power source for part of the plant communication system.

120/240-V AC Unit Preferred Systems

The Units 2 and 3, 120/240-V single phase AC unit preferred systems are each supplied by its associated motor-generator set which is normally driven by a low slip induction motor supplied from a 480-V AC shutdown board. An alternate 250-V DC drive motor with two 250-V DC sources is provided on the common shaft to provide a continuous 120/240-V AC single phase power source through an automatic transfer from the AC drive motor to the DC drive motor.

The Unit 1, 120/240-V single phase AC unit preferred system is supplied by an uninterruptible power supply (UPS) system normally supplied from the 480-V RMOV Board 1A. Two alternative 250-V DC sources are provided via a manual transfer switch to the inverter. The DC source of power is normally floating and will automatically pick up the load upon loss of the normal AC power.

This Unit Preferred Power system provides reliable power to non-safety related loads.

120/208-V AC Instrument and Control Power Buses

There are two 120/208-V AC instrument and control power buses for each of the three generating units. The instrument and control power bus for each unit is supplied through a 208-208/120-V AC regulating transformer by its associated 480- to 120/208-V transformer which, in turn, is also supplied from an independent 480-V shutdown board. This provides an independent 120/208-V Class 1E 3-phase AC control power bus for each of the redundant control and instrumentation channels for each unit.

120/240-V AC Plant Preferred System

A 120/240-V single phase AC plant preferred system is supplied from plant AC with an alternate from a motor-generator set with a 250-V DC drive motor that is started upon loss of normal plant AC power. This system supplies the plant non-safety related loads such as, chart drives, clocks, and certain communications equipment.

120/208-V AC Plant Computer Power System

The 120/208-V AC plant computer power system is a computer power distribution panel supplied by an uninterruptible power supply (UPS). The UPS receives input power from a 480-V AC Non-Class 1E common board. The output of the UPS provides normal and alternate 120/208-V AC power to the plant computer distribution panel through a static transfer switch. A 250-V DC non-1E battery board provides back-up power to the UPS.

120-V Reactor Protection System

There are two 120-V RPS buses for each of the three generating units. Each RPS bus is supplied by a motor-generator set which is normally powered from a 480-V Reactor MOV Board. Each bus has an alternate source from a single 480-120-V regulating transformer that may supply either bus. Each RPS bus also has redundant class 1E isolators to protect from low voltage, high voltage, and under frequency.

120/240-V AC Non-Safety Related Lighting Power System

This system provides power to non-safety related loads and is available from cabinets throughout the plant.

24-V DC Power Systems

The 24-V DC power system for each unit consists of two separate and independent 24-V DC channels. Each channel has a +24-V DC and a -24-V DC battery charger connected in series with a common ground. The two battery chargers are connected in parallel with two 24-V batteries having a common ground. The prime source of power is from the battery chargers with the batteries serving as a backup source of power. Each channel has an independent local distribution panel.

The 24-V DC power system supplies 24-V DC power to various monitoring instrumentation during all modes of plant operation.

Power System Display Information

The design of the control boards provides adequate display of power sources and distribution system status to Units 1 and 2 operators and to the Unit 3 operator.

The unit information displayed to the Unit 3 operator is equivalent to that displayed to the Units 1 and 2 operators. Each operator has a complete mimic bus showing the operator unit bus and the shutdown system. The operator also has control of the unit station service transformer and the start bus feeds to the unit boards.

The operator can control the unit board feed to the common supply system. These unit board breakers are manual breakers that supply power to the shutdown buses or boards. The automatic breakers at the shutdown buses or boards would determine which unit boards were feeding the shutdown system. Voltmeter selector switches and voltmeters provide 4-kV and 480-V bus voltage display. Major 4-kV feeder currents are displayed.

Shutdown system loading for Units 1, 2, or 3 is either automatic or coordinated through an operator. Manual loading of the system, utilizing either onsite or offsite

power, including those postulated for design basis events, will require coordination (two units requiring operation of RHR systems simultaneously). The main control room controls and instrumentation for common station service transformers including temperature alarms are located in the Unit 1 and Unit 2 control room area. Normal and backup communication between the operators is available.

Control power display and control are essentially the same for all three units. There is no common control point for control power that is analogous to the diesel control boards in the Units 1 and 2 control room area.