10.16 EQUIPMENT AND FLOOR DRAINAGE SYSTEMS

10.16.1 Power Generation Objective

The objective of the drainage systems is to collect and remove from the plant all liquid wastes from their points of origin to the river directly, or, if necessary, to the Radioactive Waste Building (see Subsection 9.2), where they are treated and returned for reuse or discharged to the river.

10.16.2 Power Generation Design Basis

1. Liquid wastes shall be collected and discharged in a manner such that the operation or availability of the plant is not limited thereby.

2. The Reactor Building floor and equipment drain, and drywell floor drain sump pumps shall be powered from diesel-backed power sources to allow operation in a loss of normal auxiliary power situation.

10.16.3 Safety Design Basis

The drainage systems shall be designed to prevent the inadvertent release of significant quantities of liquid radioactive material from the restricted area of the plant so that resulting radiation exposures are within the guideline values of 10 CFR 20.

10.16.4 Description

10.16.4.1 General

The plant drainage is handled through two completely separate drainage systems of the following categories:

a. Radioactive drainage, and
b. Nonradioactive drainage.

The Reactor Building floor drainage system (Radioactive Drainage) is shared in respect to the common drain header into which the unitized Reactor Building floor drainage pumps discharge. Two Reactor Building floor drainage pumps are provided for each unit. These are powered from diesel-backed power sources to allow operation in a loss of normal auxiliary power situation. They are designed to accommodate several times the maximum expected drainage flow. Each pump has a capacity of 160 gpm at 90 ft of head, and both pumps may operate concurrently.

10.16.4.2 Radioactive Drainage

Radioactive drainage consists of both equipment and floor drainage. Equipment drainage consists of waste leakage from equipment such as rotating shaft glands, miscellaneous line drains, and equipment drains for maintenance. With the exception of Turbine Building equipment drains, these drains are collected in closed piping systems which terminate in closed and shielded sumps located where necessary to accommodate a gravity drainage system. In the Turbine Building, equipment drains from equipment that might contribute to airborne contamination are connected into closed headers (no funnels) and routed to equipment drain sumps. Equipment drains that are not considered to have this potential for airborne contamination are collected into open headers and routed separately to equipment drainage sumps. From these sumps the waste is pumped to the Radwaste Building, where it enters the waste collector tank to be held for treatment.

The radioactive floor drainage system drains areas which may contain radioactive materials. These are collected and piped to shielded sumps in a manner similar to equipment drains. Floor drains are separated into individual systems according to the level of contamination from a higher to a lower contaminated level area. Each separate drain header is terminated below minimum water level in the sump to effectively seal it from other drains. From these sumps, waste liquid is pumped to radwaste, where it enters the floor drain collector tank to be held for treatment.

10.16.4.3 Nonradioactive Drainage

The nonradioactive floor drains or drains from unlimited access areas are further divided into two collection systems:

a. Nonradioactive, noncontaminated drains, and
b. Nonradioactive drains of possible contamination.

The nonradioactive, noncontaminated drains are collected in drain sumps located conveniently throughout the plant where level controlled sump pumps pump this drainage into the condenser circulating water discharge tunnels.

Drains of possible nonradioactive contamination, such as floor drains installed below oil-filled transformers or lubricating oil tanks where accidental oil spills could take place, are collected in a separate drainage system and sump. A very small amount of potentially radioactive drainage may be directed to this sump. However, radioactive drainage to sump is removed from sump on a

noncontinuous basis and may be disposed of by the liquid radwaste system which ensures that all plant releases are within the limits specified in 10 CFR 20.

10.16.4.4 Power Supply

All Reactor Building drainage system pumps are fed from the reactor 480-V MOV boards and are immediately available in a loss of normal auxiliary power situation. The Turbine Building drainage system pumps are fed from the turbine 480-V MOV boards and are available for operation by manual backfeed when power is available.

10.16.4.5 Diagrams

For flow diagrams of the radwaste drainage, refer to Subsection 9.2, "Liquid Radwaste System."

10.16.4.6 Evaluation for Flooding due to Failure of Low Energy Piping Systems Outside Primary Containment

The following is TVA's response to the letter from Roger S. Boyd of the AEC to James E. Watson of TVA, dated August 11, 1972, requesting an evaluation of Browns Ferry nuclear facility and systems to determine (1) whether the failure of any non-class I equipment, particularly in the circulating water system and fire protection system, could result in flooding which would adversely affect Class I equipment, and (2) whether failure of any equipment could cause flooding such that common mode failure of redundant equipment would result.

It has been revised to reflect guidance for pipe failure evaluation provided later by the AEC in a letter from A. Giambusso of the AEC to James E. Watson of TVA dated December 18, 1972, and errata provided by letter from the AEC dated January 19, 1973 and a letter from John F. Stolz of the AEC to James E. Watson of TVA, dated May 22, 1973, that summarized discussions between the AEC and TVA at a meeting held May 3, 1973. These letters are identified in Supplement 3 to the Safety Evaluation Report for BFN Units 1, 2, and 3.

Failures in the pressure boundaries of the water systems in either Diesel Generator Building will not prevent a safe shutdown of a unit because penetrations, including the large equipment access doors into the Diesel Generator Buildings, are sealed except the personnel access hatch into the Control Building at EL 593. An emergency drainage system exists that has sufficient capacity to prevent the accumulation of water to a level that would adversely affect safety related systems, structures, and components in the Diesel Generator Buildings.

Failures in the pressure boundaries of any water system (including fire protection systems) in a Reactor Building or inadvertent leakage into a building (most likely from the Turbine Building) will not prevent a safe shutdown of the unit. The reasons are given below:

1. All penetrations between Reactor Buildings below plant grade (EL 565) are sealed; therefore, flooding is confined to one building.

2. All penetration into the periphery of the Reactor Buildings are sealed and made watertight to EL 578, including the personnel locks and equipment accesses.

3. Flooding in the lower portion of each building will be detected by the following three mechanisms: 1) automatic initiation of the Reactor Building floor and drain system sump pumps; 2) the water level switches which actuate when the water level is approximately two inches on the EL 519 floor in the torus area, the HPCI room, and the four corner rooms, and/or; 3) inspection. Evidence of a break will alert the control room operator to take corrective measures.

4. There are a number of ways of interrupting the power to the affected system(s).

5. Also, two RHR pump-heat exchanger combinations and two RHRSW pumps from an adjacent unit can be used to provide reactor cooling in an emergency.

Loss of the engineered safety systems pumps, RHRSW, on the intake structure cannot prevent the shutdown of a unit because of the following:

1. The high walls forming the four compartments around the RHRSW pumps provide protection against natural phenomena such as tornadoes and wind waves in conjunction with floods (probable maximum flood plus waves from 45 mph winds).

2. Failure of the pressure boundaries of the water systems inside one compartment will not cause the water to overflow into an adjacent compartment because the wall design is such that the water preferentially overflows the rear wall (rear walls are one foot lower than other walls).

Failures in the pressure boundaries of any water system in the Turbine, Service, Radwaste, and Offgas Buildings and the Stack will not prevent a safe shutdown of a unit because of the following reasons:

1. There are no engineered safety systems located inside these areas.

2. Sumps are included in each area with high level alarms that annunciate in the Radwaste Building, which will be manned continuously, so that any necessary corrective actions can be initiated.

3. All penetrations between these areas and the Reactor Building below EL 572.5 are sealed, including the personnel accesses which are watertight, bulkhead-type doors. (This allows at least 20 minutes to detect the worst failure, a condenser intake culvert open-ended break in the Turbine Building, and to stop the main condenser circulating water pumps.) This is 7.5 feet above plant grade, and the water would be drained to the plant yard through the outside doors.

10.16.5 Safety Evaluation

For the safety evaluation of safety design basis , refer to Subsection 9.2.

10.16.6 Inspection and Testing

No special tests are required. Routine visual inspection of the system components, instrumentation, and trouble alarms is adequate to verify system reliability.