10.21 POSTACCIDENT SAMPLING SYSTEM

10.21.1 Power Generation Objective

The power generation objective of the postaccident sampling system for BFN Unit 2 and Unit 3, is to provide representative samples of reactor coolant, torus liquid, drywell atmosphere, torus atmosphere and secondary containment atmosphere after a LOCA and during testing and training.

The power generation objective of the postaccident sampling system for BFN Unit 1 is to provide representative samples of reactor coolant, torus liquid, drywell atmosphere, and torus atmosphere after a LOCA and during testing and training.

10.21.2 Power Generation Design Basis

PASS is designed to fulfill the requirements of NUREG-0737, Item II.B.3 (Units 2 and 3 only), and to be able to obtain and analyze the required samples at any time without exceeding the personnel exposure limits of GDC 19 in Appendix A of 10CFR50 (Units 1, 2, and 3). In addition, the PASS shall be available to perform the following tasks:

1. To safely cope with and obtain fluid samples contaminated by a Regulatory Guide 1.3 release and using source terms determined by TID-14844 methodology,

2. To allow the safe transport of grab fluid samples to the on-site laboratory,

3. To provide for the required analysis of fluid samples in accordance with the requirements of Regulatory Guide 1.97, and to provide pertinent data to the operator with adequate accuracy, range and sensitivity to describe the radiological and chemical status of the reactor coolant and containment systems,

4. To safely dispose of the sampling and flushing fluids by returning those to the torus, with the exception of the secondary containment atmosphere which is returned back to secondary containment (Units 2 and 3); to safely dispose of sampling fluids by returning the gas to the torus and the liquid to a floor drain in the residual heat removal (RHR) heat exchanger room (Unit 1).

5. To reduce activity following sampling, by using nitrogen gas to purge gas sample return lines and demineralized water to flush liquid sample return lines (Units 2 and 3),

6. To provide for the packaging of the samples for shipment to an offsite facility for additional or backup analyses,

7. To ensure obtaining representative fluid samples, by maintaining turbulent flow through the lines,

8. To minimize the volume of fluid to be taken from containment, by keeping sample line lengths as short as reasonably achievable, and

9. To provide adequate cooling and ventilation of the sample station, by connecting to a two-inch valved vent pipe included in the penetration and exhausting to the secondary containment for processing through the standby gas treatment system (Units 2 and 3); to provide adequate ventilation of the sample station, by connecting a one and one half-inch valved vent pipe included in the penetration exhausting to the secondary containment (Unit 1).

10.21.3 Description

10.21.3.1 Units 2 and 3

As shown on Figures 10.21-1, 10.21-2, 10.21-3, and 10.21-4, grab samples can be obtained from the reactor coolant, RHR liquid, drywell gas, torus gas and secondary containment atmosphere. From the various sources in the reactor building, the samples are routed to the piping station, through a seismically qualified secondary containment penetration and to the sampling station installed in the turbine building.

Located nearby the sampling station is the PASS control panel which provides readouts for conductivity and radiation level; indications for flow, pressure and temperature; and switches for the various control valves. A graphic display is also provided on the control panel to show the status of the pumps and valves (except for the isolation valves). The control panel is designed for sequential and manual operation. A selector switch is provided which allows selection of either liquid or gas sampling mode. Table 10.21-1 provides a listing of PASS in-line instrumentation.

The sample station consists of a wall mounted frame and enclosures which includes an upper gas sampler and a lower liquid sampler. Lead shielding is provided for the gas and liquid sampling compartments.

The piping station, which is installed in the reactor building, consists of sample coolers and control valves serving the liquid samples.

Primary containment isolation valves with isolation signals from the PCIS are provided for the RHR liquid sample line and the liquid/gas return line to the torus. System isolation valves are also furnished for the torus gas, drywell gas and the RBCCW cooling supply lines. These isolation valves are remote manually controlled from the main control room using 1E control power and 1E qualified components.

Although the reactor coolant sample is taken from the jet pump instrument line downstream from an orifice and an excess flow check valve, a system isolation valve is also provided as a precautionary measure and to allow ease in component maintenance. This isolation valve is remote manually controlled from the main control room using non-1E power.

10.21.3.2 Unit 1

As shown on Figures 10.21-5 and 10.21-6, manual grab samples can be obtained from the RHR liquid, drywell gas, and torus gas. From the various sources in the reactor building, the samples are routed through a seismically qualified secondary containment penetration and to the sampling station installed in the turbine building.

The RHR liquid sample is reactor coolant when the RHR system is in shutdown cooling mode and torus liquid when the RHR system is in suppression pool cooling mode.

The gas sample is obtained via the H_2O_2 analyzer sample return in the containment inerting system. A selector switch on the H_2O_2 analyzer control panel is provided which allows selection of either a drywell or torus gas sample.

The sample station consists of a wall mounted frame and enclosures which includes an upper gas sampler and a lower liquid sampler. Lead shielding is provided for the gas and liquid sampling compartments.

Primary containment isolation valves with isolation signals from the PCIS are provided for the RHR liquid sample line. System isolation valves are also furnished for the gas supply and return lines. These isolation valves are remote manually controlled from the main control room using 1E control power and 1E qualified components.

10.21.4 Safety Evaluation

10.21.4.1 Units 2 and 3

The PASS is not required to support safe shutdown of the plant. Thus, the PASS does not perform a safety function, with the exception of providing primary containment isolation and meeting the requirements for the interface points with the drywell/torus gas sample lines tied-in to the H2/02 analyzer system, RBCCW and the secondary containment penetration. A system isolation valve is provided for the reactor coolant sample line, as an additional safety feature, even though the tie-in point is downstream from an orifice and an excess flow check valve. This design meets the requirements of NUREG 0737, Item II.B.3 and Regulatory Guide 1.97.

10.21.4.2 Unit 1

The PASS is not required to support safe shutdown of the plant. Thus, the PASS does not perform a safety function, with the exception of providing primary containment isolation and meeting the requirements for the interface points with the H_2O_2 analyzer gas sample return line and the secondary containment penetration.

10.21.5 Inspections and Tests

PASS equipment is to be operated at least semiannually (+25%) to ensure the capability to obtain and analyze reactor coolant and primary containment atmosphere samples under accident conditions. This semiannual operation provides adequate familiarity and training for plant personnel to assure operational skills when required.