9.6 SAMPLING SYSTEMS

9.6.1 DESIGN BASIS

The sampling systems are designed to permit the sampling of liquids, steam, and gases for radioactive and chemical control of the plant primary and secondary fluids.

9.6.2 SYSTEM DESCRIPTION

The sampling system consists of six subsystems; reactor coolant sampling, steam generator blowdown sampling, radioactive miscellaneous waste sampling, turbine plant sampling, gas analyzing sampling, and post-accident sampling systems (PASS). Figure 9-10 shows the reactor coolant, the steam generator blowdown, PASS and the waste process sample systems. Figure 9-30 shows the turbine plant sample system. Figure 9-11 shows the gas analyzing system.

9.6.2.1 Reactor Coolant Sampling

Each reactor coolant sampling system consists of one stainless steel sink enclosed inside a hood. The hood is ventilated by an individual blower through a high-efficiency filter and located inside the sample room (Auxiliary Building). Interlocking high-density concrete block shielding separates the hood from the rest of the sample room, which also contains the steam generator blowdown system. The reactor coolant hood is used to determine the chemical and radiochemical condition of the reactor coolant and related auxiliary systems. The hood contains piping, valves, coolers, instrumentation, and sample bombs necessary to take liquid and gaseous samples from various systems. Two samples from the pressurizer (liquid, vapor) and one from the reactor coolant hot leg system can be controlled by three handswitches located on the steam generator blowdown panel. Should any one of the remotely-operated sampling valves fail to close after a sample is taken, a second remotely-operated valve can be shut from the Control Room. These valves are also closed by SIAS. The remotely-operated valves are backed up by manually-operated valves at the reactor coolant sampling hood. High-pressure samples flow through metering valves in order to reduce their pressure. One high-temperature sample is cooled in a sample cooler supplied with CC. All analyses on these samples are performed in the laboratory located in the Auxiliary Building.

9.6.2.2 Post-Accident Sampling

If needed (see Section 1.8.1, Item II.B.3), post-accident samples can be obtained in Unit 1 or Unit 2 Nuclear Steam Supply System Sample Room in the 45' Auxiliary Building. The Unit 1 or Unit 2 Nuclear Steam Supply System Sample Room contains piping, valves, coolers, and instrumentation necessary to sample either Unit 1 or Unit 2 RCS via either the normal RCS sampling line, or Unit 1 or Unit 2 Containment sump via the LPSI system header. A grab sample is used to obtain a liquid sample from the RCS. In the Chemistry Lab, the grab sample is depressurized, degassed, and diluted as necessary to enable handling the sample without excessive radiation exposure. This grab sample capability can be used to obtain samples from the RCS or the SI system. Sample purge waste is sent to the Reactor Coolant Drain Tank of the Unit being sampled, or alternatively to the Unit 1 or Unit 2 VCT. There is a provision to analyze the dissolved gasses in the liquid sample as well as chloride and boron. The gases from the degassed coolant are vented to atmosphere via Unit 2 Plant Vent via the Chemistry Lab hoods.

9.6.2.3 Steam Generator Blowdown Sampling

Each steam generator blowdown sampling system consists of one conditioning rack-panel unit and one ventilating hood, and is located inside the same sample room as the reactor coolant hood.

The conditioning rack section of the steam generator blowdown system contains isolation valves, primary coolers, rod-in-tube devices, an isothermal bath and chiller. High pressure samples are passed through a pressure-reducing valve (rod-in-tube type) located downstream of the primary coolers and upstream of the isothermal bath. High temperature samples first pass through a primary cooler (supplied with CC) and then through the isothermal bath. All samples pass through the isothermal bath which is capable of maintaining each sample at 77°F at the coil outlet. The chiller is supplied with cooling water from the component cooling system. Sample outlets from the conditioning rack are connected to the hood.

The panel section of the steam generator blowdown system contains conductivity and pH monitors, three hand switches for pressurizer sample selection, chiller controls, and an annunciator. The pH and conductivity samples are continuously monitored and alarmed on high conductivity. In addition, pH and conductivity are trended on the computer-based display in the chemistry laboratory. High sample temperature (downstream of the isothermal bath) actuates a common alarm point. Any point alarming on the local annunciator will actuate a master alarm in the Control Room (trouble alarm).

The ventilating hood contains two stainless steel sinks and is ventilated by an individual blower through a high-efficiency filter. The ventilating hood is used to obtain samples for determining the chemical and radiochemical content of the steam generator blowdown system. The radioactive miscellaneous sample system is also located inside the steam generator blowdown hood for Unit 1. The steam generator blowdown part of the hood contains all piping, grab sample valves, instrumentation including pH cells and conductivity analyzers, and all equipment necessary for this system.

9.6.2.4 Radioactive Miscellaneous Waste Sampling

The radioactive miscellaneous waste sampling is located inside the ventilating hood for the steam generator blowdown (Unit 1) and is used to obtain samples from which the chemical and radiochemical content of miscellaneous waste is determined. This system is common to both units. All samples are low pressure and are cooled, as necessary, in sample coolers (supplied with CC). This part of the hood contains isolation valves, piping, valves, and instrumentation necessary for obtaining liquid samples from both units. The analyses of these samples are performed in the laboratory located in the Auxiliary Building.

9.6.2.5 Turbine Plant Sampling System

Each turbine plant sampling system is used to obtain samples for determining the chemical condition of the steam, feed, and condensate systems associated with the turbine plant. The system consists of one sampling station per unit (stainless steel sink and panel) and one mechanical chiller as a separate unit. These sampling systems are located in the Turbine Building. The sink contains the isolation valves, piping, instrumentation, coolers, and grab valves necessary to take samples from the steam, condensate, and feedwater systems. High-pressure samples pass through a pressure-reducing valve (rod-in-tube device). All samples pass through individual primary coolers supplied with SRW. Every sample then passes through cooling coils immersed in the isothermal bath that maintains each sample at 77°F at the coil outlet. The mechanical chiller circulates chilled water in the isothermal bath and is supplied with SRW. Each sample is provided with one grab sample valve for taking liquid samples as necessary. The steam generator feed pump headers are continuously monitored and recorded for hydrazine, oxygen and pH, any of which can cause an alarm on the annunciator. All samples are continuously monitored for conductivity and an alarm occurs when an abnormal condition is reached. In addition, samples are trended on the computer-based display in the Chemistry Laboratory. The turbine plant system contains conductivity, pH, and oxygen recorders, oxygen analyzers, handswitches (to control the hotwell sample pumps and the chiller circulating pump), and an annunciator. The annunciator alarms on high conductivity, high pH, high oxygen, high hotwell temperature, and low hotwell sample pump discharge pressures. Any annunciator alarm will activate a master alarm in the Control Room.

9.6.2.6 Gas Analyzing System

Control of hydrogen in Containment during and following a Design Basis Event is no longer required. On March 2, 2004, the NRC issued a license amendment that allows removal of the hydrogen recombiners and hydrogen analyzers from the Technical Specifications. The NRC has required retention of the hydrogen analyzers as non-safety-related equipment for recording hydrogen concentrations in a beyond Design Basis Event.

The gas analyzing system is used to determine the hydrogen concentration of six points inside the containment and of four samples from the reactor coolant waste tanks (receiver and monitor tanks), as well as the oxygen concentration of several samples from the reactor coolant and miscellaneous waste systems. The gas analyzing system is installed in the sample room located in the Auxiliary Building (Elevation-10') and consists of two hydrogen analyzer cabinets and separate manifolds for the isolation valves and sample selection solenoid valves and one oxygen analyzer cabinet with a manifold for the isolation valves. Two of the analyzer cabinets are for hydrogen measurement and include a sample pump, cooler, piping, valves, and instrumentation. Each hydrogen cabinet panel contains one hydrogen analyzer, one multipoint recorder for recording each measured sample, one programmer for random selection of individual readout, and alarm contacts for activation of a master alarm in the Control Room. The third analyzer cabinet is for oxygen grab sample measurement and includes a sample pump, cooler, piping, valves and sample syringe. An exhaust system on the oxygen analyzer cabinet purges any hydrogen that may leak into this cabinet.

The H_2 and 0_2 sample points are routed to the analyzer in accordance with the following table:

Sample Point	H_2 Analyzer 0-AE-6519	H_2 Analyzer 0-AE-6527	0_2 Grab Sample
Containment 1 - North of Primary Shield	No	Yes	No
Containment 1 - South of Primary Shield	Yes	No	No
Containment 1 – Pressurizer Compartment	Yes	No	No
Containment 1 - East at Elevation 135’	Yes	No	No
Containment 1 - West at Elevation 135’	No	Yes	No
Containment 1 - Dome at Elevation 189’(b)	No	Yes	No
Containment 2 - N	Yes	No	No
Containment 2 - S	No	Yes	No

Sample Point	H_2 Analyzer 0-AE-6519	H_2 Analyzer 0-AE-6527	0_2 Grab Sample
Containment 2 - Press	No	Yes	No
Containment 2 - E	No	Yes	No
Containment 2 - W	Yes	No	No
Containment 2 - Dome	Yes	No	No
RC Waste Rec Tank 11[(a)]	Yes	Yes	No
RC Waste Rec Tank 12[(a)]	Yes	Yes	No
RC Waste Mon Tank 11[(a)]	Yes	Yes	No
RC Waste Mon Tank 12[(a)]	Yes	Yes	No
Waste Gas Decay Tank 11	No	No	Yes
Waste Gas Decay Tank 12	No	No	Yes
Waste Gas Decay Tank 13	No	No	Yes
Waste Gas Surge Tank	No	No	Yes
Degasifier Accumulator 11	No	No	Yes
Degasifier Accumulator 21	No	No	Yes
Evaporators Discharge Gas Cooler	No	No	Yes
Przr. Quench Tank 11	No	No	Yes
Przr. Quench Tank 21	No	No	Yes
Misc. Waste Evap (Retired in place)	No	No	Yes

(a) These samples would normally be routed to either analyzer.

(b) The 189' sample line in Unit 1 is inoperable because it is no longer seismically supported. For this reason it is not credited for post-accident sampling.

The six containment samples of the hydrogen analyzer cabinets and two samples of the oxygen analyzer cabinet can be controlled through remotely-operated solenoid valves.

To provide a post-accident containment air sampling capability, a sample vessel was placed into the sampling lines from containment 1 and 2 west at Elevation 135' to allow a syringe sample to be taken and analyzed in the laboratory. This sample vessel is located on the 45' Elevation of the Auxiliary Building.

9.6.3 SYSTEM RELIABILITY

All piping, tubing, fitting, and valves (exception listed under d and e below) in contact with fluids is 316 stainless steel and complies with the following codes:

a. ASME B&PV Code, Section III, Class 3 (Nuclear Power Plant Components) for the gas analyzing system.

b. ANSI B31.1 for turbine plant, steam generator blowdown, post-accident sampling, reactor coolant, and miscellaneous waste sampling systems. The exception to this is the normally-closed isolation valves located in the cabinets which constitute the boundary from ASME Section III piping to non-Class piping. These valves are listed below. (**NOTE**: The reactor coolant, the miscellaneous waste, and steam generator blowdown sampling systems, originally designed to meet Seismic Category I requirements, were downgraded to Category II via FCR 88-0074).

c. ASTM 450-68 which requires an eddy-current test for all tubing.

d. Pressure relief valves that are in contact with fluid shall be made of 304 or 316 stainless steel material.

e. Pressure reducing valves for the turbine plant and steam generator blowdown sample systems shall be constructed of Types 303, 304, or 316 stainless steel.

All applicable valves, piping, and coolers are designed to accept full steam pressure and temperature.

The gas analyzing system, the component cooling portion of the sample coolers in the reactor coolant hood, and the valves listed below are designed to meet Seismic Category I requirements. The reactor coolant, miscellaneous waste, and steam generator blowdown sampling systems (within the hoods and excluding those portions delineated above) are designed to meet Seismic Category II requirements. (**NOTE**: The reactor coolant, the miscellaneous waste, and the steam generator blowdown sampling systems, originally designed to meet Seismic Category I requirements, were downgraded to Category II via FCR 88-0074).

The following valves must be normally closed and will retain their current ASME Section III Seismic Category I classifications.

Post-Accident Sampling

1-PS-172	2-PS-172
1-PS-193	2-PS-193

Miscellaneous Waste

0-PS-226
0-PS-229

The following valves were Seismic Category I and designed in accordance with ANSI B31.1.

Steam Generator Blowdown

1-PS-126	2-PS-126
1-PS-128	2-PS-128
1-PS-129	2-PS-129
1-PS-137	2-PS-137
1-PS-139	2-PS-139
1-PS-140	2-PS-140

The turbine plant (Turbine Building) is designed to meet Seismic Category II requirements.

9.6.4 TESTING AND INSPECTION

Each component is inspected and cleaned prior to installation into the system. Instruments were calibrated during testing. Automatic controls were tested for actuation at the proper setpoints. Alarm functions were checked for operability and limits during preoperational testing period. The system will be operated and tested for flow, capacity, and mechanical operability.