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SUBJECT: Forwards revised sections of updated FSAR to include description of post-accident sampling sys in compliance w/ NUREG-0737,Item II.B.3, "Post-Accident Sampling Sys." Further details will be provided by 830812.

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Carolina Power & Light Company

JUL 27 1983

SERIAL: LAP-83-328

Director of Nuclear Reactor Regulation
Attention: Mr. Steven A. Varga, Chief
Operating Reactors Branch No. 1
Division of Licensing
United States Nuclear Regulatory Commission
Washington, DC 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
NUREG-0737 ITEM II.B.3
POST-ACCIDENT SAMPLING SYSTEM

Dear Mr. Varga:

Your letter dated September 24, 1982 requested a schedule for the submittal of detailed design information concerning the Post-Accident Sampling System (PASS) for the H. B. Robinson Steam Electric Plant Unit No. 2 (HBR2). By letter dated December 15, 1982, Carolina Power & Light Company (CP&L) responded that the scope of information requested was similar to that which is normally provided in the Final Safety Analysis Report (FSAR). The PASS is presently in its initial testing phase and is scheduled to be operational by July 31, 1983. Results of this testing phase will provide accurate information to address your detailed questions concerning PASS design. The details of the PASS not included in the Updated FSAR will be provided by August 12, 1983.

For your convenience, the sections of the Updated FSAR which have been revised to include a description of the Sampling System, including the PASS, are attached to this letter for your review.

If you have any further questions on this subject, please contact a member of the Nuclear Licensing Staff.

Yours very truly,

S. R. Zimmerman
Manager
Licensing & Permits

ONH/ccc (7447ONH)

Attachment

cc: Mr. J. P. O'Reilly (NRC-RII)
Mr. G. Requa (NRC)
Mr. Steve Weise (NRC-HBR)

A046
1/1

9.3.2 PROCESS SAMPLING SYSTEM

Process Sampling Systems are provided for both normal operation and post-accident conditions. The Operational Sampling System, described in Section 9.3.2.1 below, provides samples for laboratory analysis to evaluate reactor coolant and other reactor auxiliary systems' chemistry during normal operation. The Post-Accident Sampling System, described in Section 9.3.2.2 below, provides capability for collecting samples of reactor coolant and containment atmosphere under accident conditions. It also provides means for remotely analyzing the samples and indicating results and for diluting samples for subsequent radiological analysis. 1

9.3.2.1 Operational Sampling System

9.3.2.1.1 Design Basis

The design basis for the Operational Sampling System are:

a) The system is capable of providing reactor coolant samples during both normal reactor operating conditions and cooldown when the system pressure is low and the residual heat removal loop is in operation

b) Access to the containment is not a requirement

c) Sampling of other process coolants, such as tanks in the waste Disposal System, can be accomplished locally, and

d) Equipment for sampling secondary and nonradioactive fluids is separated from the equipment provided for reactor coolant samples.

The system component code requirements are given in Section 3.2.

9.3.2.1.2 System Description

9.3.2.1.2.1 General Description 1

The Sampling System, shown in Figure 9.3.2-1, provides the representative samples for laboratory analysis. Analysis results provide guidance in the operation of the Reactor Coolant, Auxiliary Coolant, Steam, and Chemical and Volume Control Systems (CVCS). Analyses show both chemical and radiochemical conditions. Typical information obtained includes reactor coolant boron and chloride concentrations, fission product radioactivity level, hydrogen, oxygen, and fission gas content, corrosion product concentration, and chemical additive concentration.

The information is used in regulating boron concentration adjustments, evaluating fuel element integrity and mixed bed demineralizer performance, and regulating additions of corrosion controlling chemicals to the systems. The Sampling System is designed to be operated manually, on an intermittent basis. Samples can be withdrawn under conditions ranging from full power to cold shutdown.

Reactor coolant liquid lines, which are normally inaccessible and require frequent sampling, are sampled by means of permanently installed tubing leading to the sampling room.

Sampling System equipment is located inside the Auxiliary Building with most of it in the sampling room. The delay coil and sample lines with remotely operated valves are located inside the reactor containment.

Reactor coolant hot leg liquid, accumulator liquid, pressurizer liquid and pressurizer steam samples originating inside the reactor containment flow through separate sample lines to the sampling room. Each of these connections to the Reactor Coolant System (RCS) has a remotely operated isolation valve located close to the sample source. The samples pass through the reactor containment compartment, to the Auxiliary Building, and into the sampling room, where they are cooled (pressurizer steam samples are condensed and cooled) in the sample heat exchangers. The sample stream pressure is reduced by a manual throttling valve located downstream of each sample pressure vessel. The sample stream is purged to the volume control tank in the CVCS until sufficient purge volume has passed to permit collection of a representative sample. After sufficient purging, the sample pressure vessel is isolated and then disconnected for laboratory analysis of the contents.

Alternately, liquid samples may be collected by bypassing the sample pressure vessels. After sufficient purge volume has passed to permit collection of a representative sample, a portion of the sample flow is diverted to the sample sink where the sample is collected.

The reactor coolant sample originating from the residual heat removal loop of the Auxiliary Coolant System has a remotely operated, normally closed isolation valve located close to the sample source. The sample line from this source is connected into the sample line coming from the hot leg at a point ahead of the sample heat exchanger. Samples from this source can be collected either in the sample pressure vessel or at the sample sink as with hot leg samples.

Liquid samples originating at the CVCS letdown line at demineralizer inlet and outlet pass directly through the purge line to the volume control tank. Samples are obtained by diverting a portion of the flow to the sample sink. If the pressure is low in the letdown line, the purge flow is directed to the chemical drain tank. The sample line from the gas space of the volume control tank delivers gas samples to the volume control tank sample pressure vessel in the sampling room. Purge flow for these samples is discharged to the vent header in the Waste Disposal System.

Because samples from the pressurizer steam phase, the reactor coolant dissolved gas and volume control tank gas phase may contain accumulated radioactive gases, the respective sample vessel stations are located in small, well ventilated and shielded cubicles within the sampling room.

Samples of the steam generator liquid are obtained from the blowdown lines. A
1 separate sample line is provided from each steam generator blowdown line into the sample room. These lines are each equipped with two remotely operated isolation valves immediately outside the containment. These valves are automatically closed upon receipt of a signal from the blowdown sample radiation
1 monitor or the containment isolation system. A key switch is provided for each valve to over-ride the isolation signals and allow the valve to be opened.

The sample lines are routed to the sample room where the liquid is cooled and the pressure reduced. Individual sample lines go to the sample sink to provide periodic samples for chemical analysis. The remaining sample flow from each steam generator is routed to a common line where the three samples are mixed. The common line, which goes to a radiation monitor and then to the blowdown flash tank, handles a continuous flow for constant monitoring for radiation. A sample from this common line is taken upstream of the radiation monitor and routed to the Post-Accident Sample System. 1

The sample sink, which is contained in the laboratory bench as a part of the sampling hood, contains a drain line to the Waste Disposal System.

Two types of samples are obtained by the system: high temperature-high pressure RCS samples which originate inside the reactor containment, and low temperature-low pressure samples from the Chemical and Volume Control and Auxiliary Coolant Systems. These samples are taken as follows:

a) High Pressure - High Temperature Samples: A sample connection is provided from each of the following high pressure-high temperature samples:

1) The pressurizer steam space
2) The pressurizer liquid space
3) Hot legs of loops 2 and 3
4) Blowdown lines from each steam generator

b) Low Pressure - Low Temperature Samples: A sample connection is provided from each of the following low pressure-low temperature samples:

1) The mixed bed demineralizer inlet header
2) The mixed bed demineralizer outlet header
3) The residual heat removal loop, just downstream of the heat exchangers
4) The volume control tank gas space
5) The accumulators

The high pressure, high temperature samples and the residual heat removal loop samples leaving the sample heat exchangers are held to a temperature of 130°F to minimize the generation of radioactive aerosols. 1

9.3.2.1.2.2 Components

A summary of principal component data is given is Table 9.3.2-1.

9.3.2.1.2.2.1 Sample Heat Exchangers 1

Six sample heat exchangers reduce the temperature of samples from the pressurizer steam space, pressurizer liquid space, each steam generator and the reactor coolant to 130°F before samples reach the sample vessels and sample sink. The tubes of the heat exchangers are austenitic stainless steel, and the shells are carbon steel.

The inlet and outlet tube sides have socket-weld joints for connections to the high presure sample lines. Connections to the component cooling water lines are socket-weld joints. The samples flow through the tube side and component cooling water from the Auxiliary Coolant System circulates through the shell side.

1 9.3.2.1.2.2.2 Delay Coil

The sample line contains a delay coil, consisting of coiled tubing, which has sufficient length to provide at least a 40 second sample transit time within the containment and an additional 20 seconds transit time from the reactor containment to the sampling hood. This allows for decay of short lived isotopes to a level that permits normal access to the sampling room.

1 9.3.2.1.2.2.3 Sample Pressure Vessels

The high pressure sample trains, the residual heat removal loop sample train and the volume control tank gas space sample train each contain sample pressure vessels which are used to obtain liquid or gas samples. The hot leg and the residual heat removal loop sample lines have a single sample pressure vessel in common. Integral isolation valves are furnished with the vessel and quick disconnect coupling valves containing poppet-type check valves are connected to nipples extending from the valves on each end. The vessels, valves and couplings are austenitic stainless steel.

1 9.3.2.1.2.2.4 Sample Sink

The sample sink is located in a hooded enclosure which is equipped with an exhaust ventilator. The work area around the sink and the enclosure is large enough for sample collection and storage for radiation monitoring equipment. The sink perimeter has a raised edge to contain any spilled liquid.

1 9.3.2.1.3 Safety Evaluation

The Sampling System is not required for safe shutdown nor to mitigate the consequences of an accident and is therefore designated as a non-safety related system. However, since the system does contain potentially radioactive material, the following discussion indicates the precautions taken to insure safe operation of the plant.

Isolation valves are provided outside the reactor containment which trip closed upon actuation of the containment isolation signal.

The system operates on an intermittent basis, and under administrative manual control.

Leakage of radioactive reactor coolant from this system within the containment is evaporated to the containment atmosphere and removed by the cooling coils of the Containment Air Recirculation and Cooling System. Leakage of radioactive material from the most likely places outside the containment is collected by placing the entire sampling station under a hood provided with an offgas vent to waste gas processing. Liquid leakage from the valves in the hood is drained to the chemical drain tank.

To evaluate system safety, failures or malfunctions were assumed concurrent with a loss-of-coolant accident (LOCA), and the consequences were analyzed. The results are presented in Table 9.3.2-2. From this evaluation it is concluded that proper consideration has been given to station safety in the system.

All liquid and gas sample lines are austenitic stainless steel tubing and are designed for high pressure service. With the exception of the sample vessel quick-disconnect couplings and compression fittings at the sample sink, socket welded joints are used throughout the Sampling System. Lines are so located as to protect them from accidental damage during routine operation and maintenance.

Remotely-operated stop valves are used to isolate all sample points and to route sample fluid flow inside the reactor containment. Manual stop valves are provided for component isolation and flow path control at all normally accessible Sampling System locations. All valves in the system are constructed of austenitic stainless steel or equivalent corrosion resistant material. Manual throttle valves are provided to adjust the sample flow rate as indicated on Figure 9.3.2-1.

Check valves prevent gross reverse flow of gas from the volume control tank (VCT) into the sample sink.

9.3.2.1.4 Testing and Inspection 1

Since the Sampling System is in use during plant operation, no special testing or inspection is required.

9.3.2.1.5 Instrumentation Requirements 1

The liquid sample flow indicator (FI-903) indicates the sample line flow rate when purging the sample lines to the VCT. The normal rate is 0.42 gpm.

The gas sample flow indicator (FI-904) from the VCT gas space indicates purging flow to the vent header. The normal flow through this line is 1 cfm.

There are local pressure gauges (PI-902, 906, 908) on the sample lines from the pressurizer steam space, pressurizer liquid space, and the hot leg sample line. The pressure in these lines is regulated to 75 psig or less.

There are local temperature indicators (TI-901, 905, 907) on the sample lines from the pressurizer steam space, the pressurizer liquid space and the hot leg sample line. The flow in these lines is throttled so that the sample temperature out of the heat exchanger is 130°F or less.

There are switches for all remotely-operated valves. Valve position indicating lights are also on this panel, located above the switch for the valve.

The valves used for containment isolation purposes, 2 valves per line, are operated by a single switch for both valves.

9.3.2.2 Post-Accident Sampling System

The Post-Accident Sampling System (PASS) provides a means to remotely collect reactor coolant and containment atmosphere samples following a nuclear accident, to remotely indicate results of chemical analyses of these samples, and to 1 dilute these samples for subsequent radiological analysis. The information obtained from analyses of these samples will improve efforts to assess and control the course of the accident.

9.3.2.2.1 System Design Bases

The PASS provides a means to obtain pressurized and unpressurized reactor coolant liquid and containment atmosphere samples. A reactor coolant sample can be drawn directly from the Reactor Coolant System (RCS) whenever the RCS pressure is between 200 psig and 2485 psig. At lower pressure, RCS samples can be drawn via the Residual Heat Removal (RHR) system. A containment atmosphere sample can be drawn with containment pressure between 10 and 75 psia.

The PASS provides a means to quantify the following parameters within an hour of obtaining samples:

a) certain isotopes that are indicators of the degree of core damage (i.e. noble gases, iodine, cesiums, and non-volatile isotopes);

b) dissolved gases (i.e., H_2), boron concentration, and pH of the reactor coolant. Total gas concentrations of up to approximately 2000 cc/kg at STP can be measured.

The PASS allows post-accident sampling with resulting personnel radiation exposure not exceeding 3 and 18 3/4 Rem to the whole body and extremities, respectively.

1 The PASS is capable of accommodating an initial reactor coolant radiochemistry spectrum corresponding to Regulatory Guide 1.4, Rev. 2 or 1.3, Rev. 1.

During accident conditions all sample flow is returned to the containment to preclude unnecessary contamination of other auxiliary systems and to ensure that high level waste remains isolated within the containment.

Outside of the containment isolation valves and safety injection system isolation valve to the sampling system, components and piping were designed to Safety Class 4, non-seismic requirements. This complies with NUREG-0578 for equipment downstream of the second isolation valve from safety coded systems.

The PASS consists of piping, tubing, valves, components, and instrumentation mounted in a sample station with an accompanying control panel. This equipment enables remote analysis of the reactor coolant chemistry and remote collection and dilution of the reactor coolant and containment atmosphere samples for subsequent radiological analysis using existing equipment. System components are all non-IE, non-seismic, non-code. System parameters are given in Table 9.3.2-3. The system is divided into two basic sections described below:

a) Reactor Coolant Sampling

The system permits the operator to remotely purge the reactor coolant hot leg samples through in-line instruments for the measurement of boron and pH. The sample purge flow is returned to the pressurizer relief tank or containment, thereby precluding a buildup of highly contaminated fluid outside the containment. A sample of the pressurized reactor coolant is collected, and degassed via depressurization and circulation. When degassing of the sample is completed, burette level is recorded for total gas concentration determination and the gas is circulated through in-line instruments to determine hydrogen concentrations. The gas is then diluted with nitrogen so that the existing radioanalysis equipment can be used to quantify the radioisotopes in the gas sample. A volume of degassed liquid sample is likewise diluted with demineralized water so that existing radioanalysis equipment can be used to determine the radioisotopes within the liquid samples. The system is then purged with nitrogen and demineralized water and placed in standby for the next sample.

b) Containment Air Sampling System

The system permits the operator to remotely purge the containment atmosphere sample using an air pump. A containment atmosphere sample is then isolated and diluted with nitrogen so that the existing radioanalysis equipment can be used to determine the radiological quantification of the gas.

9.3.2.2.2 Component Description

9.3.2.2.2.1 Mechanical Components

a) Sample Station

The sample station is a free standing, totally enclosed metal panel measuring 6 ft (L) x 6 ft (H) x 4 ft (D). The enclosure contains system tubing, valves, components, and instrumentation necessary to provide chemistry and radiochemistry analysis capability for reactor coolant and containment atmosphere sampling per NUREG-0578, Section 2.1.8.a. Louvers are provided in the cabinet to pass airflow from the surrounding room to the ventilation system exhaust connection in the upper portion of the enclosure. This airflow precludes any possible buildup of radioactive gas or H_2 gas and provides for removal of heat generated by internal components. The station is skid-mounted and is provided with removable panels or doors on all four sides to ensure easy accessibility for any necessary maintenance on system components. 1

b) Components Contained Inside the Sample Station

1) Sample Circulation Pump

The sample circulation pump is a peristaltic type positive displacement pump. This pump is capable of pumping liquids and/or gases.The pump will be used in the total gas, hydrogen, and oxygen gas analyses operations to strip the gases out of solution in the sample fluid and circulate them through the hydrogen and oxygen analyzers.

2) Surge Vessel Pump

The surge vessel pump is a progressing cavity (helical) positive displacement pump. The pump is used to pump down the surge vessel contents to the Chemical Drain Tank.

3) Containment Sample Pump

The containment sample pump is a vacuum pump/compressor unit that operates as a positive displacement compressor using a stainless steel diaphragm. The pump is used to collect a containment atmosphere sample and to dilute the sample via circulation through the containment sample vessel.

4) Gas Sample Vessel

The gas sample vessel is a 12,000 ml sample vessel initially filled with nitrogen gas. The vessel supplies the gas analysis loop with nitrogen gas to dilute the radioactive gases present in the sample line. The vessel is equipped with a septum plug which allows the operator to withdraw a diluted gaseous sample with a syringe for radiological analysis.

5) Depressurized Liquid Sample Vessel

The depressurized liquid sample vessel is 12,000 ml sample vessel. This vessel collects a 4.7 ml liquid sample trapped in the four-way valve located above the sample vessel. The vessel is partially filled with demineralized water before the sample is drained into the vessel. Additional demineralized water is then added to obtain the proper dilution factor so that a liquid sample can be withdrawn for
1 radiological analysis. This vessel is equipped with a septum plug for sample withdrawal using a syringe.

6) Containment Sample Vessel

The containment sample vessel is a 12,000 ml sample vessel that is initially filled with nitrogen gas for dilution. The containment air pump draws a sample from containment and circulates it through the sample vessel where the nitrogen gas dilutes the sample so that it can be withdrawn for radiological analysis. This vessel is equipped with a septum plug for sample withdrawal.

7) Surge Vessel

The surge vessel has a 10 gallon capacity and serves as a vent and drain tank for the depressurized liquid sample vessel and the total gas analysis burette.

8) Sample Vessel/Heat Exchanger

The sample vessel/heat exchanger is a vertically mounted, shell and tube type heat exchanger. The heat exchanger uses component cooling water to cool the reactor coolant sample flow from a maximum RCS temperature of 650°F to 120°F or below, to allow low temperature sample analysis. The tube side of the heat exchanger serves as a sample vessel for collection of a pressurized reactor coolant sample.

9) Stainless Steel Burette

The stainless steel burette has a 1,000 ml capacity. The burette is used to determine the amount of total gas present in the sample fluid by measuring a difference in the fluid level of the burette upon degassification of the pressurized reactor coolant sample.

c) Components Located Outside Sample Station

1) Strainer

The strainer is designed to remove insoluble particles which may cause sample station chemistry instrumentation to become plugged. The strainer can be backflushed with demineralized water remotely by operation of valves at the control panel.

9.3.2.2.2.2 Instrument and Control Description

The system is designed to be controlled remotely from a designated post-accident sample control area. This area will include the control panel and the stem extension handwheels from the system throttling valves. The control panel is a free-standing, straight front, vertical, metal panel measuring 5 ft (L) x 7 ft (H) x 2-1/2 ft (D). The panel is designed to meet NEMA 12 requirements. All sample system non-code isolation valves and pumps are controlled from this panel. Indication of all process parameters and 1
chemistry readouts are displayed on the panel. To facilitate system operability all controls and indications are arranged in a mimic of the system. The following is a description of the instrumentation and controls for the system.

a) The depressurized liquid sample vessel, surge vessel, and stainless steel burette are equipped with level indication instrumentation to monitor for total gas, dilution, flushing and calibration operations.

b) The sample vessel/heat exchanger tube side outlet is equipped with a temperature measuring device to indicate adequate sample cooling for downstream instrumentation protection.

c) All of the containment atmosphere sample piping is heat traced to limit plateout of radioisotopes which would result from condensation of containment atmosphere vapor.

d) The containment sample pump discharge and liquid sampling lines are equipped with flow measuring devices to monitor proper sample purging flow rate.

e) All PASS pumps are equipped with handswitches at the control panel.

f) The boron meter is a specific gravity measuring device which determines and indicates the amount of boron (ppm) present in the liquid sample fluid.

g) The pH meter determines and indicates pH in the liquid sample fluid.

h) The H_2 analyzer is a thermal conductivity device that determines and indicates the volume percent of H_2 present in the gas removed from the liquid sample.

i) The O_2 analyzer is a para-magnetic device that determines and indicates
1 the volume percent of O_2 present in the sample fluid gas.

j) All pneumatically operated valves have hand switches at the control panel.

k) Control switches are provided to automatically isolate the high pressure reactor coolant inlet to prevent system overpressurization.

TABLE 9.3.2-3

POST-ACCIDENT SAMPLING SYSTEM PARAMETERS

Normal Reactor Coolant Sample Flow..........................1 gpm

Normal Containment Atmosphere Sample Flow................0.3 scfm

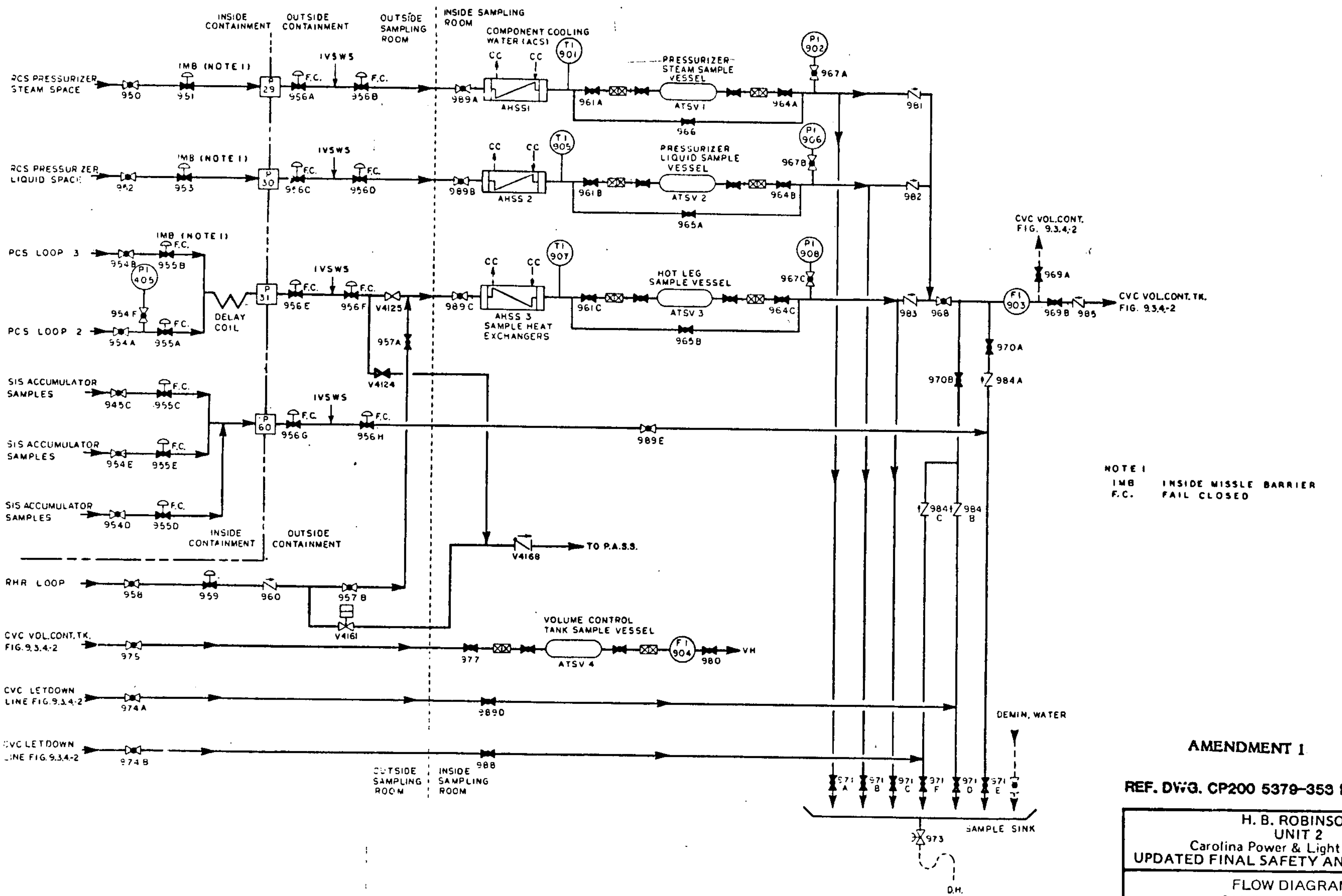
Normal Reactor Coolant Inlet Temperature.............120 to 621°F 1

Normal Reactor Coolant Sample Temperature..................120°F

Normal Containment Atmosphere Temperature.............60 to 290°F

Normal Reactor Coolant Pressure..........Atmosphere to 2,235 psig

Normal Containment Sample Pressure..................10 to 75 psia



AMENDMENT 1

REF. DWG. CP200 5379-353 REV. 8

H. B. ROBINSON
UNIT 2
Carolina Power & Light Company
UPDATED FINAL SAFETY ANALYSIS REPORT

FLOW DIAGRAM
SAMPLING SYSTEM

FIGURE 9.3.2 - 1

11.3.2 SYSTEM DESCRIPTION

11.3.2.1 Gaseous Radioactive Waste Processing

During plant operations, gaseous wastes will originate from:

a) Degassing reactor coolant discharged to the Chemical and Volume Control System (CVCS)

b) Displacement of cover gases as liquids accumulate in various tanks

c) Miscellaneous equipment vents and relief valves

d) Sampling operations and automatic gas analysis for hydrogen and oxygen in cover gases

The flow diagrams for the system are shown in Figures 11.3.2-1 and 11.3.2-2.

Radioactive gases are collected at a slight positive pressure in a vent header. From there, they are pumped by compressors through a manifold to one of the gas decay tanks where they are held a suitable period of time for decay. Cover gases in the nitrogen blanketing system are reused to minimize gaseous wastes. During normal operation, gases are discharged intermittently at a controlled rate from these tanks through the monitored plant vent. The system is provided with holdup capacity and discharge controls for gaseous wastes such that plant operations will not be limited by environmental conditions.

During normal operation the Waste Disposal System supplies nitrogen and hydrogen from standard cylinders to primary plant components. This operation is identical for both the nitrogen supply and the hydrogen supply. For each, two headers are provided, one for operation and one for backup. The pressure regulator in the operating header is set for 100 psig discharge and that in the backup header for 90 psig discharge. When the operating header is exhausted, its discharge pressure will fall below 100 psig and an alarm will alert the operator. The second bank will come into service automatically at 90 psig to ensure a continuous supply of gas. After the exhausted header has been recharged, the operator manually sets the operating pressure back to 100 psig and the backup pressure at 90 psig.

Most of the gas received by the Waste Disposal System during normal operation is cover gas displaced from the CVCS holdup tanks as they fill with liquid. The pressure of cover gases are maintained within a narrow range. As the tanks are filled displacing cover gas, the pressure rises. When the upper limit of the range is approached, the waste gas compressors pump the displaced gas to the gas decay tanks. As the tanks are emptied, the cover gas pressure approaches the lower limit of the range and additional gas is supplied. Since the gas displaced during filling must be replaced when the tanks are emptied, facilities are provided to return gas from the decay tanks to the holdup tanks. A backup supply from the nitrogen header is provided for makeup if return flow from the gas decay tanks is not available. To prevent hydrogen concentration from exceeding the combustible limit during this type of operation, components discharging to the vent header system are restricted to those containing no air or aerated liquids and the vent header itself is designed to operate at a slight positive pressure (0.5 psig minimum to 2.0 psig maximum) to prevent in-leakage. On the other hand, out-leakage from the system is minimized by using Saunders patent diaphragm valves, bellows seals, self contained pressure regulators and soft-seated packless valves throughout the radioactive portions of the system.

Gases vented to the vent header flow to the waste gas compressor suction header. One of the two compressors is in continuous operation with the second unit instrumented to act as backup for peak load conditions or failure of the first unit. From the compressors, gas flows to one of the gas decay tanks. The control arrangement on the gas decay tank inlet header allows the operator to place one tank in service and to select one tank for backup if the tank in operation becomes fully pressurized. When the tank in service becomes pressurized to 110 psig, a pressure transmitter automatically closes the inlet valve to that tank, opens the inlet valve to the backup tank and sounds an alarm to alert the operator of this event so that he may select a new backup tank. Pressure indicators are supplied to aid the operator in selecting the backup tank.

Gas held in the decay tanks can either be returned to the CVCS holdup tanks, or discharged to the atmosphere if it has decayed sufficiently for release. Generally, the last tank to receive gas will be the first tank emptied back to the holdup tanks in order to permit the maximum decay time before releasing gas to the environment. However, the header arrangement at the tank inlet gives the operator freedom to fill, reuse or discharge gas to the environment simultaneously without restricting operation of the other tanks. During degassing of the reactor coolant prior to a refueling shutdown, it may be desirable to pump the gas purged from the volume control tank into a particular tank and isolate that tank for decay rather than reuse the gas in it. This is done by aligning the control to open the inlet valve to the desired tank and closing the outlet valve to the reuse header. However, one of the other tanks can be opened to the reuse header at this time if desired, while still another might be discharged to atmosphere.

Before a tank can be emptied to the environment, it must be sampled and analyzed to determine and record the activity to be released, and only then discharged to the plant vent at a controlled rate through a radiation monitor. Samples are taken manually by opening the isolation valve to the plant vent discharge line and permitting gas to flow to the gas analyzer where it can be collected in one of the sampling system gas sample vessels. In the event of a gas analyzer failure, the Containment Post-Accident Sampling System (PASS) has been connected to the gas analyzer sample line so that the PASS
1 removable sample bombs can be used to obtain grab samples for laboratory analysis. After sampling, the isolation valve is closed until the tank contents are released. During release a trip valve in the discharge line is closed automatically by a high activity level indication in the plant vent.

When waste gases are being released to the environment, the release is automatically terminated if the radioactivity level exceeds a predetermined level (the radiological monitoring and control instrumentation is described in Section 11.5).

During operation, gas samples are drawn periodically from tanks discharging to the waste gas vent header as well as from the particular gas decay tank being filled at the time, and automatically analyzed to determine their hydrogen and oxygen content. The hydrogen analysis is for surveillance since the concentration range will vary considerably from tank to tank. There should be no significant oxygen content in any of the tanks, and an alarm will warn the operator if any sample shows 2 percent by volume of oxygen. This allows time to take the required action before the combustible limit is reached. Another tank is placed in service while the operator locates and eliminates the source of oxygen.

11.3.2.2 Components

Component data are given in Table 11.3.2-1.

Nitrogen Manifold

A dual manifold supplies nitrogen to purge the vapor space of various components to reduce the hydrogen concentration or to replace fluid that has been removed. A pressure controller, which automatically switches from one manifold to the other, assures a continuous supply of gas.

Hydrogen Manifold

A dual manifold supplies hydrogen to the volume control tank to maintain the hydrogen partial pressure as hydrogen dissolves in the reactor coolant. A pressure controller, which automatically switches from one manifold to the other, assures a continuous supply of gas.

Gas Analyzer

An automatic gas analyzer is provided to monitor the concentrations of oxygen and hydrogen in the cover gas of the Waste Disposal System, CVCS tanks, boric acid evaporators and gas stripper. The containment PASS can be used as an alternative method of obtaining gas samples for analysis. Upon indication of a high oxygen level, provisions are made to purge the equipment to the gaseous waste system with an inert gas. 1

Piping

All gas piping is carbon steel. Piping connections are welded except where flanged connections are necessary to facilitate equipment maintenance. No threaded fittings are used in waste piping.

Valves

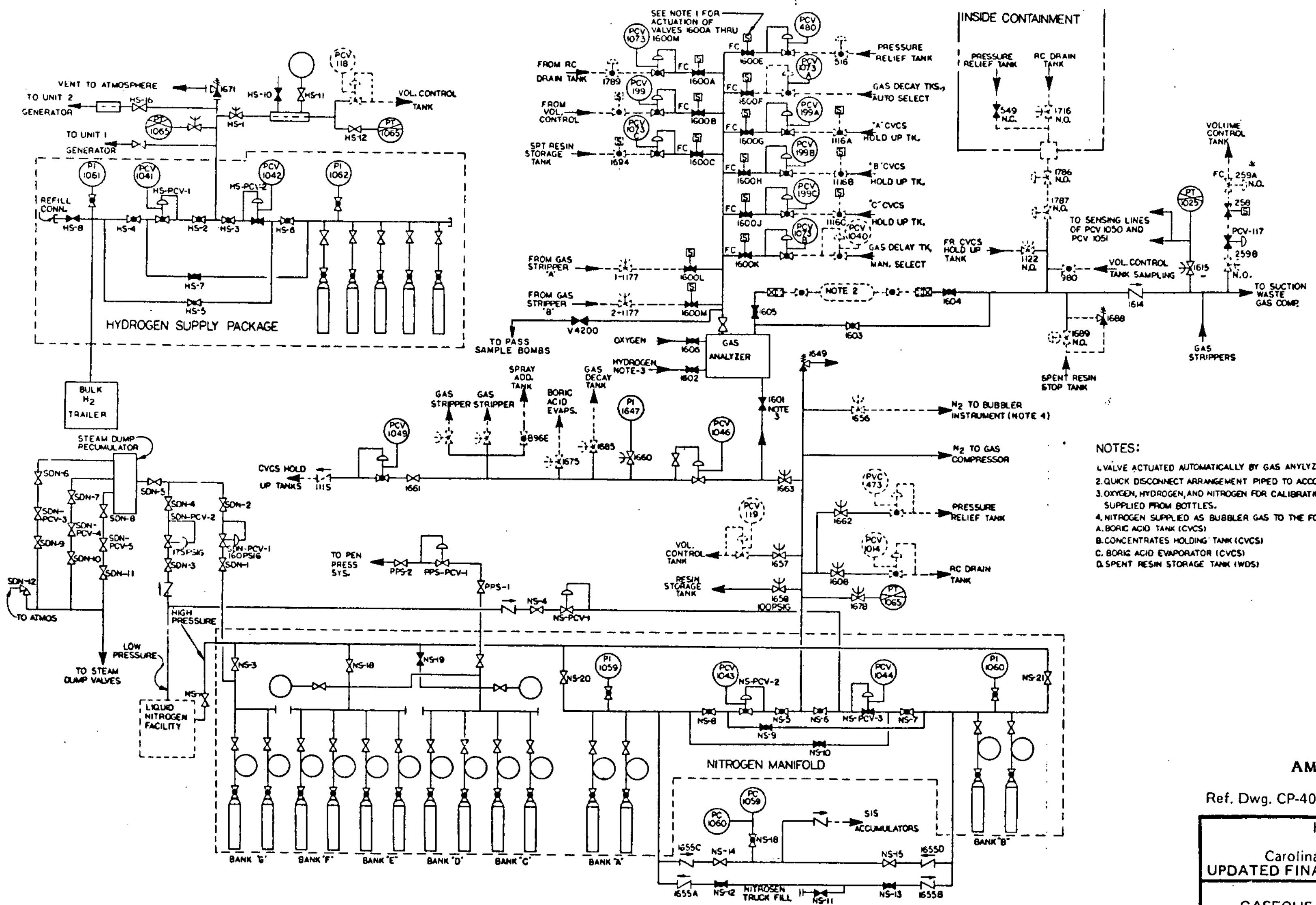
All valves exposed to gases are carbon steel. All valves have stem leakage control. Globe valves are installed with flow over the seats when such an arrangement reduces the possibility of leakage.

Gas Compressors

Two compressors are provided for removal of gases to the gas decay tanks from all equipment that contains or can contain radioactive gases. These compressors are of the water sealed centrifugal displacement type. The operation of the compressors is automatically controlled by the gas manifold pressure. While one unit is in operation, the other serves as a standby for unusually high flows or failure of the first unit.

Gas Decay Tanks

Four welded carbon steel tanks are provided to contain compressed waste gases (hydrogen, nitrogen, oxygen and fission gases). After a period for radioactive decay, these gases may be released at a controlled rate to the atmosphere through the plant vent. All discharges to the atmosphere will be monitored.



NOTES:

1. VALVE ACTUATED AUTOMATICALLY BY GAS ANYLYZER I AND C CHAN. NO. AO-1067
2. QUICK DISCONNECT ARRANGEMENT PIPED TO ACCOMMODATE GAS SAMPLE.
3. OXYGEN, HYDROGEN, AND NITROGEN FOR CALIBRATING GAS ANALYZER SUPPLIED FROM BOTTLES.
4. NITROGEN SUPPLIED AS BUBBLER GAS TO THE FOLLOWING COMPONENTS.
   A. BORIC ACID TANK (CVCS)
   B. CONCENTRATES HOLDING TANK (CVCS)
   C. BORIC ACID EVAPORATOR (CVCS)
   D. SPENT RESIN STORAGE TANK (WDS)

AMENDMENT 1

Ref. Dwg. CP-406 5379-921 Sheet 1 Rev. 7

H. B. ROBINSON
UNIT 2
Carolina Power & Light Company
UPDATED FINAL SAFETY ANALYSIS REPORT

FLOW DIAGRAM
GASEOUS WASTE DISPOSAL SYSTEM
SHEET 1
FIGURE 11.3.2 - 1