REGULATORY INFORMATION DISTRIBUTION SYSTEM (RIDS)

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SUBJECT: Forwards addl response to NRC 820924 ltr re NUREG-0737, Item II.B.3, "Post-Accident Sampling Sys." W/six oversize diagrams of sampling sys. Aperture cards are available in PDR.

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Carolina Power & Light Company

SERIAL: LAP-83-379

AUG 12 1983

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 forwarded to Carolina Power & Light Company (CP&L) questions concerning the detailed design of the Post-Accident Sampling System to be installed at the H. B. Robinson Steam Electric Plant Unit No. 2 (HBR2). By letter dated July 27, 1983, CP&L submitted for your review the sections of the Updated Final Safety Analysis Report (FSAR) which were recently revised to include a description of the Sampling System. However, the Updated FSAR sections do not fully address your detailed questions concerning PASS design. A complete response to your questions concerning HBR2, including diagrams of the Sampling System, is attached to this letter.

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

Yours very truly,

S. R. Zimmerman /1/1

S. R. Zimmerman
Manager
Licensing & Permits

ONH/lcv (7646ONH)

Attachments

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

411 Fayetteville Street • P. O. Box 1551 • Raleigh, N. C. 27602

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DRAWINGS TO B.C.

POST-ACCIDENT SAMPLING SYSTEM

Criterion (1):

The licensee shall have the capability to promptly obtain reactor coolant samples and containment atmosphere samples. The combined time allotted for sampling and analysis should be three (3) hours or less from the time a decision is made to take a sample.

Clarification (1):

Provide information on sampling(s) and analytical laboratories locations including a discussion of relative elevations, distances and methods for sample transport. Responses to this item should also include a discussion of sample recirculation, sample handling and analytical times to demonstrate that the three-hour time limit will be met (see (6) below relative to radiation exposure). Also describe provisions for sampling during loss of off-site power (i.e., designate an alternative backup power source, not necessarily the vital (Class IE) bus, that can be energized in sufficient time to meet the three-hour sampling and analysis time limit).

RESPONSE (1):

The counting room is on the same level and about 50 feet away from the Post Accident Sample Sink (PASS). The Chemistry lab is about 20 feet from the PASS. Diluted samples will be transported by sample bottle or gas vial either by hand, in a container, or lead pig depending on the activity level of the sample. Undiluted liquid samples will be transported in a lead cask on a pallet lift hand truck. The undiluted liquid sample will be stored in the MG Set Room or the Cable Vault Room about 100 feet from the PASS on the same level.

The PASS, supplied by Combustion Engineering, is designed to obtain and analyze both reactor coolant and containment atmosphere samples within three (3) hours of the time a decision is made to obtain a sample. However, preoperational testing showed that it takes approximately three (3) hours to fill and flush this system including the warm-up of the in-line chemistry instrumentation. In order to minimize the overall time required for analysis results, the PASS is procedurally kept filled and the in-line chemistry instrumentation is left energized. Preoperational testing indicates that once the system is full and flushed, it may take as much as three and one half (3 1/2) hours to draw and analyze the samples in the chemistry lab. Training on the PASS emphasizes timely yet accurate results. This continuing training should result in times closer to the design criterion.

All valves supporting PASS operation, and the PASS itself, are powered from the existing emergency diesels on a loss of off-site power.

Criterion (2):

The licensee shall establish an onsite radiological and chemical analysis capability to provide, within three-hour time frame established above, quantification of the following:

(a) certain radionuclides in the reactor coolant and containment atmosphere that may be indicators of the degree of core damage (e.g., noble gases, iodines and cesiums, and non-volatile isotopes);

(b) hydrogen levels in the containment atmosphere;

(c) dissolved gases (e.g., H_2), chloride (time allotted for analysis subject to discussion below), and boron concentration of liquids.

(d) Alternatively, have in-line monitoring capabilities to perform all or part of the above analyses.

Clarification (2):

(a) A discussion of the counting equipment capabilities is needed, including provisions to handle samples and reduce background radiation to minimize personnel radiation exposures (ALARA). Also a procedure is required for relating radionuclide concentrations to core damage. The procedure should include:

1. Monitoring for short and long lived volatile and non-volatile radionuclides such as ^{133}Xe, ^{131}I, ^{137}Cs, ^{124}Cs, ^{85}Kr, ^{140}Ba, and ^{88}Kr (see Volume II, Part 2, pp. 524-527 of Rogovin Report for further information).

2. Provisions to estimate the extent of core damage based on radionuclide concentrations and taking into consideration other physical parameters such as core temperature data and sample location.

(b) Show a capability to obtain a grab sample, transport and analyze for hydrogen.

(c) Discuss the capabilities to sample and analyze for the accident sample species listed here and in Regulatory Guide 1.97, Rev. 2.

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RESPONSE (2)

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through a septum plug mounted in the vessel. This sample can be transferred to the laboratory for subsequent radioisotope quantification and hydrogen analysis using a gas chromatograph. Prior to sample withdrawal, additional dilution, which may be necessary for this quantification, can be performed by further nitrogen addition, circulation, and venting.

RESPONSE (2)(c):

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 pressures, RCS samples can be drawn via a RHR system . A containment atmosphere sample can be drawn with containment pressure between 10 and 75 psia.

The system permits the operator to remotely purge the reactor coolant hot leg or containment sump samples (through RHR) through in-line instruments for the measurement of boron and pH. The sample purge flow is returned to the 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 and oxygen 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 primary demineralized water so that existing radioanalysis equipment can be used to determine the radioisotopes within the liquid sample. The system is then purged with nitrogen and demineralized water and placed in standby for the next sample.

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 analysis of hydrogen, oxygen and radiological content can be performed with minimum exposure.

The Grab Sample Facility, an accessory of the PASS, provides the capability to collect an undiluted reactor coolant liquid grab sample for Chloride, pH, Boron and Radionuclide analysis. The Grab Sampling Facility consists of an undiluted depressurized liquid sample vessel enclosed in a shielded cask, isolation and bypass valves with stem extensions penetrating the shielding for connection to the PASS, a

pallet lift hand truck, and double end shut-off quick disconnects for interface connections to the PASS sample station liquid sample return line. Sampling is performed as follows:

The hand truck containing the cask is maneuvered to the PASS sample station liquid sample return line tees and the assembly is connected to the system by means of the double ended shut-off quick disconnects. Once connected, the grab sampling assembly is flushed with primary demineralized water via the PASS sample station connection. The liquid sample path pressure indicator PCH-4158 can be used to check for leaks before any contaminated fluid is allowed to enter. Following satisfactory pressurization, an undiluted sample is purged through the PASS. When a representative reactor coolant sample is available, the sample vessel and connection tee isolation valves are opened to allow flow through the Undiluted Liquid Sample Vessel and the Grab Sampling Facility bypass valve is closed. When purging of the sample vessel is complete, the sample is isolated by opening the bypass valve and closing the isolation valves. Sample purge flow through the PASS is secured. Prior to disconnecting the cask, a demineralized water flush is accomplished by establishing flow via the PASS sample station connection through the normal liquid sample return line path. The connection tee isolation valves are opened and the Grab Sampling

Facility bypass valve is closed, allowing a primary demineralized water flush of all tubing except for the sample vessel and isolation valves.

This minimizes radiation exposures and the possibility of contamination when the cask is disconnected. The cask is disconnected from the system by means of manually detaching the double end shut-off quick disconnects. The cask is then transported on the hand truck to a safe storage location prior to subsequent chloride or other analysis of the collected sample.

RESPONSE (2)(d):

The PASS provides the capability to calibrate remotely the hydrogen and oxygen meters and to perform calibration checks for boron, pH, total gas, hydrogen, and oxygen measurements. Individual components were designed and selected for their performance in a post accident chemistry environment and design integral radiation environment. The boron, pH, H_2, and O_2 instruments are calibrated on a refueling interval.

Criterion (3):

Reactor coolant and containment atmosphere sampling during post accident conditions shall not require an isolated auxiliary system (e.g., the letdown system, reactor water cleanup system [RWCUS]) to be placed in operation in order to use the sampling system.

Clarification (3):

System schematics and discussions should clearly demonstrate that post accident sampling, including recirculation, from each sample source is possible without use of an isolated auxiliary system. It should be verified that valves which are not accessible after an accident are environmentally qualified for the conditions in which they must operate.

RESPONSE (3):

Containment atmosphere isolation valves RMS-1, 2, 3, and 4 are automatic isolation valves. Key operated control switches in the Control Room can override the automatic closure feature and allow these valves to be operated to take a PASS sample. Primary coolant sample isolation valves 956E and 956F shut automatically on receipt of a Phase A containment isolation signal. Key operated control switches in the Control Room can override the automatic closure

feature and allow these valves to be operated to take a PASS sample. These valves are located outside of containment and therefore are not required to be environmentally qualified to a harsh environment. The primary coolant sample isolation valves 955A and 955B are automatic isolation valves. Key operated control switches near the post-accident sample sink can override the automatic closure feature and allow these valves to be operated to take a PASS sample. These valves are located inside containment and have been environmentally qualified. Primary water isolation valve 519C to the pressurizer relief tank is an automatic isolation valve. This valve is located inside containment and is presently not environmentally qualified. Plans are to environmentally qualify this valve during the upcoming steam generator replacement outage. In the interim, an alternate return path to the chemical drain tank does exist, so a primary liquid sample can be taken even if valve 519C should fail.

The other systems associated with PASS (component cooling water, primary water, instrument air, and ventilation systems) do not become isolated.

Criterion (4):

Pressurized reactor coolant samples are not required if the licensee can quantify the amount of dissolved gases with unpressurized reactor coolant samples. The measurement of either total dissolved gases or H_2 gas in reactor coolant samples is considered adequate. Measuring the O_2 concentration is recommended, but is not mandatory.

Clarification (4):

Discuss the method whereby total dissolved gas or hydrogen and oxygen can be measured and related to reactor coolant system concentrations. Additionally, if chlorides exceed 0.15 ppm, verification that dissolved oxygen is less than 0.1 ppm is necessary. Verification that dissolved oxygen is less than 0.1 ppm by measurement of a dissolved hydrogen residual of greater than or equal to 10 cc/kg is acceptable for up to 30 days after the accident. Within 30 days, consistent with minimizing personnel radiation exposures (ALARA), direct monitoring for dissolved oxygen is recommended.

RESPONSE (4):

The PASS provides both the capability to obtain a pressurized reactor coolant sample and the capability to quantify the amount of hydrogen, oxygen, and total dissolved gases in the reactor coolant.

The method used to measure and relate reactor coolant hydrogen, oxygen, and total dissolved gas is as follows:

Sampling of the Reactor Coolant System is initiated by opening system isolation valves (including containment isolation valves using the containment isolation override, if necessary) and purging a reactor coolant sample through the PASS sample vessel/heat exchanger, where it is cooled, and then through a throttle valve to reduce the pressure, and finally through the in-line chemistry analysis equipment, to the pressurizer relief tank. At reactor coolant pressures less than 200 psig, containment sump sample flow is purged in the same manner using the RHR pump discharge connection. After sufficient purging, a pressurized sample is then collected by isolating the sample vessel/heat exchanger. Total dissolved gas concentration is determined by degassing the sample. This is accomplished by depressurization and circulation by alternate operation of the burette isolation valve and the sample circulation pump. The resulting displacement of liquid into the burette is used to calculate

the dissolved gas concentration. The collected gases, which have been stripped from the liquid, are then directed through a float valve for moisture separation and circulated through hydrogen and oxygen analyzers. 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. The O_2 analyzer determines and indicates the volume percent of O_2 present in the sample fluid gas taken out of the liquid solution. After recording the hydrogen and oxygen gas concentrations, the gas sample vessel, which contains nitrogen, is placed on-line to dilute the gas volume. This dilution operation reduces the radiation levels such that a sample can be drawn from the gas sample vessel by injection of a syringe through a septum plug mounted in the vessel. This sample can be transferred to the chemistry lab for subsequent radioisotope quantification. Prior to sample withdrawal, additional dilution, which may be necessary for this quantification, may be performed by further nitrogen addition, circulation, and venting. The radiochemistry and gaseous measurement portions of the system are flushed with primary demineralized water and purged with N_2, respectively, to reduce personnel exposure during withdrawal of the sample and to reduce contamination plateout between samples.

Criterion (5):

The time for a chloride analysis to be performed is dependent upon two factors: (a) if the plant's coolant water is seawater or brackish water, and (b) if there is only a single barrier between primary containment systems and the cooling water. Under both of the above conditions, the licensee shall provide for a chloride analysis within 24 hours of the sample being taken. For all other cases, the licensee shall provide for the analysis to be completed within four (4) days. The chloride analysis does not have to be done onsite.

Clarification (5):

BWR's on sea or brackish water sites, and plants which use sea or brackish water in essential heat exchanger (e.g., shutdown cooling) that have only single barrier protection between the reactor coolant are required to analyze chloride within 24 hours. All other plants have 96 hours to perform a chloride analysis. Samples diluted by up to a factor of one thousand are acceptable as initial scoping analysis for chloride, provided (1) the results are reported as _____ ppm Cl (the licensee should establish this value; the number in the blank should be no greater than 10.0 ppm Cl) in the reactor coolant system and (2) that dissolved oxygen can be verified at less than 0.1 ppm, consistent with the guidelines above in clarification no. 4.

Additionally, if chloride analysis is performed on a diluted sample, an undiluted sample need also be taken and retained for analysis within 30 days, consistent with ALARA.

RESPONSE (5):

The H. B. Robinson Plant does not use sea or brackish water for cooling. A double barrier exists between primary coolant and the cooling water. Please refer to answer (2)(c) for a discussion for chloride sampling.

Criterion (6):

The design basis for plant equipment for reactor coolant and containment atmosphere sampling and analysis must assume that it is possible to obtain and analyze a sample without radiation exposures to any individual exceeding the criteria of GDC 19 (Appendix A, 10 CFR Part 50)(i.e., 5 rem whole body, 75 rem extremities). (Note that the design and operational review criterion was changed from the operational limits of 10 CFR Part 2Q (NUREG-0578) to the GDC 19 criterion (October 30, 1979 letter from H. R. Denton to all licensees).

Clarification (6):

Consistent with Regulatory Guide 1.3 or 1.4 source terms, provide information on the predicted personnel exposures based on person-motion for sampling, transport, and analysis of all required parameters.

RESPONSE (6):

The evaluation of the Post Accident Sample Sink Shield wall was performed with the PATH Gamma Shielding Code. Total exposure at the control panel will be less than 200 mr/hr.

Criterion (7):

The analysis of primary coolant samples for boron is required for PWRs. (Note that Rev. 2 of Regulatory Guide 1.97 specifies the need for primary coolant boron analysis capability at BWR plants.)

Clarification (7):

PWRs need to perform boron analysis. The guidelines for BWRs are to have the capability to perform boron analysis but they do not have to do so unless boron was injected.

RESPONSE (7):

The PASS provides the capability to perform in-line boron analysis. In addition, the PASS provides the capability of obtaining diluted and undiluted grab samples for backup boron analysis.

Criterion (8):

If in-line monitoring is used for any sampling and analytical capability specified herein, the licensee shall provide backup sampling through grab samples, and shall demonstrate the capability of analyzing the samples. Established planning for analysis at offsite facilities is acceptable. Equipment provided for backup sampling shall be capable of providing at least one sample per day for seven (7) days following onset of the accident, and at least one sample per week until the accident condition no longer exists.

Clarification (8):

A capability to obtain both diluted and undiluted backup samples is required. Provisions to flush in-line monitors to facilitate access for repair is desirable. If an offsite laboratory is to be relied on for the backup analysis, an explanation of the

capability to ship and obtain analysis for one sample per week thereafter until accident condition no longer exists should be provided.

RESPONSE (8):

The capabilities of the PASS system to provide backup sampling through grab samples was discussed in conjunction with in-line sampling capabilities in the response to Criterion (2)(c). The PASS provides depressurized grab samples with lead shielded containers for undiluted samples and multiple dilution capability for diluted samples for radiation protection. The PASS provides the following backup grab sample capability: (1) undiluted reactor coolant, (2) diluted reactor coolant, (3) diluted reactor coolant off gas, and (4) diluted containment atmosphere gas.

The undiluted reactor coolant sample is obtained via the Grab Sample Facility (see response to Criterion (2)(c) for description). The diluted samples are obtained through septum plugs located behind a small penetration in the shield wall using a syringe for sample withdrawal. All gas samples are diluted before withdrawal for the purpose of radiation protection. Although it is possible to obtain undiluted gas samples, radiation protection is ensured by

procedures and mechanical arrangements which deliberately prevent possible accidental exposure to undiluted radioactive gas.

Criterion (9):

The licensee's radiological and chemical sample analysis capability shall include provisions to:

(a) Identify and quantify the isotopes of the nuclide categories discussed above to levels corresponding to the source terms given in Regulatory Guide 1.3 or 1.4 and 1.7. Where necessary and practicable, the ability to dilute samples to provide capability for measurement and reduction of personnel exposure should be provided. Sensitivity of onsite liquid sample analysis capability should be such as to permit measurement of nuclide concentration in the range from approximately 1 uCi/g to 10 Ci/g.

(b) Restrict background levels of radiation in the radiological and chemical analysis facility from sources such that the sample analysis will provide results with an acceptably small error (approximately a factor of 2). This can be accomplished through the use of sufficient shielding around samples and outside sources, and by the use of a ventilation system design which will control the presence of airborne radioactivity.

Clarification (9):

(a) Provide a discussion of the predicted activity in the samples to be taken and the methods of handling/dilution that will be employed to reduce the activity sufficiently to perform the required analysis. Discuss the range of radionuclide concentration which can be analyzed for, including an assessment of, the amount of overlap between post accident and normal sampling capabilities.

(b) State the predicted background radiation levels in the counting room, including the contribution from samples which are present. Also provide data demonstrating what the background radiation levels and radiation effect will be on a sample being counted to assure an accuracy within a factor of 2.

RESPONSE (9):

(a) The PASS provides the capability to obtain diluted samples for the purpose of identifying and quantifying the isotopes present in the reactor coolant and containment building atmosphere samples. Responses to Criterion (2)(c) and (8) discuss the method employed during sampling and the safeguards employed in obtaining backup grab samples, respectively.

(b) Three points in the chemistry laboratory were used to calculate dose rate attributed by the sources terms inside the PASS skid. These points are at equipment locations used in counting PASS samples.

Point 1 - 8.20×10^{-4} mR/hr

Point 2 - 7.38×10^{-4} mR/hr

Point 3 - 2.81×10^{-7} mR/hr

Criterion (10):

Accuracy, range, and sensitivity shall be adequate to provide pertinent data to the operator in order to describe radiological and chemical status of the reactor coolant systems.

Clarification (10):

The recommended ranges for the required accident sample analyses are given in Regulatory Guide 1.97, Rev. 2. The necessary accuracy within the recommended ranges are as follows:

- Gross activity, gamma spectrum: measured to estimate core damage, these analyses should be accurate within a factor of 2 across the entire range.

- Boron: measure to verify shutdown margin.

In general, this analysis should be accurate within ±5% of the measured value (i.e., at 6,000 ppm B the tolerance is ±300 ppm while at 1,000 ppm B the tolerance is ±50 ppm). For concentrations below 1,000 ppm, the tolerance band should remain at ±50 ppm.

- Chloride: measured to determine coolant corrosion potential.

For concentrations between 0.5 and 20.0 ppm chloride, the analysis should be accurate within ±10% of the measured value. At concentrations below 0.5 ppm, the tolerance band remains at ±0.05 ppm.

- Hydrogen or Total Gas: monitored to estimate core degradation and corrosion potential of the coolant.

An accuracy of ±10% is desirable between 50 and 2,000 cc/kg but ±20% can be acceptable. For concentration below 50 cc/kg, the tolerance remains at ±5.0 cc/kg.

- Oxygen: monitored to assess coolant corrosion potential.

For concentrations between 0.5 and 20.0 ppm oxygen, the analysis should be accurate within ±10% of the measured value. At concentrations below 0.5 ppm, the tolerance band remains at ±0.05 ppm.

- pH: measured to assess coolant corrosion potential.

Between a pH of 5 to 9, the reading should be accurate within ±0.3 pH units. For all other ranges ±0.5 pH units is acceptable.

To demonstrate that the selected procedures and instrumentation will achieve the above listed accuracies, it is necessary to provide information demonstrating their applicability in the post accident water chemistry and radiation environment. This can be accomplished by performing tests utilizing the standard test matrix provided below or by providing evidence that the selected procedure or instrument has been used successfully in a similar environment.

STANDARD TEST MATRIX

FOR

UNDILUTED REACTOR COOLANT SAMPLES IN A POST-ACCIDENT ENVIRONMENT

Constituient	Nominal Concentration (ppm)	Added as (chemical salt)
I-	40	Potassium Iodide
Cs+	250	Cesium Nitrate
Ba+2	10	Barium Nitrate
La+3	5	Lanthanum Chloride
Ce+4	5	Ammonium Cerium Nitrate
Cl-	10	

B	2000	Boric Acid
Li^+	2	Lithium Hydroxide
NO_3^-	150	
NH_4^+	5	
K^+	20	
Gamma Radiation (Induced Field)	10^4 Rad/gm of Reactor Coolant	Absorbed Dose

NOTES:

(1) Instrumentation and procedures which are applicable to diluted samples only, should be tested with an equally diluted chemical test matrix. The induced radiation environment should be adjusted commensurate with the weight of actual reactor coolant in the sample being tested.

(2) For PWRs, procedures which may be affected by spray additive chemicals must be tested in both the standard test matrix plus appropriate spray additives. Both procedures (with and without spray additives) are required to be available.

(3) For BWRs, if procedures are verified with boron in the test matrix, they do not have to be tested without boron.

(4) In lieu of conducting tests utilizing the standard test matrix for instruments and procedures, provide evidence that the selected instrument or procedure has been used successfully in a similar environment.

All equipment and procedures which are used for post accident sampling and analyses should be calibrated or tested at a frequency which will ensure, to a high degree of reliability, that it will be available if required. Operators should receive initial and refresher training in post accident sampling, analysis and transport. A minimum frequency for the above efforts is considered to be every six months if indicated by testing. These provisions should be submitted in revised Technical Specifications in accordance with Enclosure 1 of NUREG-0737. The staff will provide model Technical Specifications at a later date.

RESPONSE (10):

The Gross Activity is measured with GeLi gamma spectrophotometer whose accuracy is cross checked annually by the NRC Region II mobile laboratory, and with a CP&L cross check program.

With the RCS at 307 ppm (manual sample) the PASS boron meter was reading 300 ppm. Therefore, the PASS boron indication is considered acceptable.

A liquid sample is drawn at the PASS cabinet and then is taken to the lab for analysis. The lab equipment is capable of accuracy within the 10% of measured value requirement.

Two H_2 samples were taken during preoperational testing with the RCS at approximately 23 cc/kg. Although the first sample read 33 cc/kg, the second was 27 cc/kg; this was within the recommended accuracies.

The PASS O_2 meter reads out in percent oxygen. The oxygen meter indicated during preoperational testing but could not be cross checked with actual RCS samples because of the low O_2 concentration in the RCS.

The PASS instrumentation will be calibrated at a refueling interval. Present plans are to train/retrain selected individuals on the PASS quarterly consistent with plant operability. (Meaningful testing cannot be done with the Plant in a refueling shutdown.)

Criterion (11):

In the design of the post accident sampling and analysis capability, consideration should be given to the following items:

(a) Provisions for purging sample lines, for reducing plateout in sample lines, for minimizing sample loss or distortion,

for preventing blockage of sample lines by loose material in the RCS or containment, for appropriate disposal of the samples, and for flow restrictions to limit reactor coolant loss from a rupture of the sample line. The post accident reactor coolant and containment atmosphere samples should be representative of the reactor coolant in the core area and the containment atmosphere following a transient or accident. The sample lines should be as short as possible to minimize the volume of fluid to be taken from containment. The residues of sample collection should be returned to containment or to a closed system.

(b) The ventilation exhaust from the sampling station should be filtered with charcoal absorbers and high-efficiency particulate air (HEPA) filters.

Clarification (11):

(a) A description of the provisions which address each of the items in Clarification (11)(a) should be provided. Such items, as heat tracing and purge velocities, should be addressed. To demonstrate that samples are representative of core conditions a discussion of mixing, both short and long term, is needed. If a given sample location can be rendered inaccurate due to the accident (i.e., sampling from

a hot or cold leg loop which may have a steam or gas pocket) describe the backup sampling capabilities or address the maximum time that this condition can exist.

BWRs should specifically address samples which are taken from the core shroud area and demonstrate how they are representative of core conditions.

Passive flow restrictors in the sample lines may be replaced by redundant, environmentally qualified, remotely operated isolation valves to limit potential leakage from sampling lines. The automatic containment isolation valves should close on containment isolation or safety injection signals.

(b) A dedicated sample station filtration system is not required, provided a positive exhaust exists which is subsequently routed through charcoal absorbers and HEPA filters.

RESPONSE (11):

(a) The design of the PASS includes many features which serve to maintain sample integrity and limit radiological exposure or release. Many of these features were explained in responses to earlier questions, namely dilution capabilities, operability independence with respect to isolated auxiliary systems, sample

disposal via returning the sample to containment thereby precluding unnecessary contamination of external environments and remote calibration sampling and purging capabilities. The PASS provides additional features which serve to maintain sample integrity and limit radiological exposure or release. Piping lengths are kept as short as possible thus limiting plateout in sample lines. Pipe diameter downstream of existing sample paths are 1/2" to 3/8" thus providing high velocity turbulent sample and purge flow at achievable flow rates. Sample and purge flow velocity and Reynolds number for the reactor coolant sample at the recommended flow rate of .5 to 1 gpm are of the order of 1.5 ft/sec and 10^4, respectively. Sample purge and sample velocity for the containment atmosphere sample at recommended flow rates are 7.5 to 10 ft/sec and 2.5 ft/sec, respectively.

A strainer upstream of the sample vessel heat exchanger 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.

(b) Flow through the ventilation stack on the cabinet has been shown to be greater than fourteen (14) standard cubic feet per minute (SCFM).

Immediately above the ventilation exit from the PASS skid is an enclosure which contains an activated charcoal absorber. The skid exhaust must pass through the charcoal absorber and into the Auxiliary Building HVAC system. The exhaust then passes through prefilters and HEPA filters prior to being pumped to the stack. This air flow precludes any buildup of radioactive gas or hydrogen gas and provides for removal of heat generated by internal components.

POST-ACCIDENT SAMPLING SYSTEM DRAWINGS (attached)

Drawing No.	Rev.	Title
CP-200-5379-353	Rev. 8	Sampling System - Engineering Flow Diagram
G-190304 Sh. 1 of 2	Rev. 16	HVAC-Turb., Fuel, Aux., and Reactor Buildings - Engineering Flow Diagram
HBR2-8256 Sh. 1 of 1	Rev. 0	Post Accident Sampling System
G-190234 Sh. 1 of 3	Rev. 14	Steam Generator Blow - Down System Flow Diagram
HBR2-8261 Sh. 1 of 2	Rev. 0	Post Accident Sample Station Flow Diagram
HBR2-8261 Sh. 2 of 2	Rev. 0	Post Accident Sample Station Flow Diagram

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