TITLE: POST-ACCIDENT SAMPLING SYSTEM AND ANALYSIS

1.0 RESPONSIBLE INDIVIDUAL

The Chemistry Director (CD) is responsible for insuring proper plant and site samples are drawn and analyzed to support operational, environmental, and material concerns following an accident.

Members of the Liquid Release Monitoring Team are responsible to the CD for obtaining post-accident sample(s) as directed by the CD. These samples may include very highly radioactive reactor coolant samples. The LRMT is responsible for sampling and analysis via the Post Accident Sampling System (PASS).

The Liquid Release Monitoring Team Leader is responsible for utilizing the proper sample equipment, protective clothing, etc., and collection methods for obtaining and handling very high level samples, as directed by the CD and the Radiation Protection Director (RPD).

The Emergency Reentry Monitoring Team member is responsible to the RPD for ensuring exposure control in accordance with the Emergency Work Permit as specified in this procedure.

2.0 CONDITIONS AND PREREQUISITES

2.1 In-line failed-fuel detector (Process Radiation Monitor - R202) (CVCS Control Board 1C07 or 2C07) of affected unit under accident conditions gives an indication of an increased level of Iodine-135 in the reactor coolant system as follows:

RI-202-1 Gross Rate Meter-Alert $1x10^5$cpm

RI-202-2 Linear Rate Meter (Failed Fuel Monitor) (Analysis for I-135)

High Alarm - 70% Fuel Scale (Amber Light), and

High High Alarm - 90% Fuel Scale (Red Light), or

when this monitor is inoperative, under accident conditions.

2.2 RCS samples taken pursuant to this procedure are to be repeated on a routine basis to determine activity levels and trends.

2.3 Very high level radioactive samples are so designated if exposure rate level is greater than 2.0R/h on contact.

2.4 Obtaining a reactor coolant sample shall be planned to be performed promptly as directed by the Plant Superintendent.

3.0 ACTIONS AND LIMITATIONS

3.1 The ERMT member and LRMT member shall jointly carry out monitoring and collection of very high level sample(s) as follows and document on Attachment 1, "Accident Sample and Analysis Data Sheet," as appropriate, upon completion of reentry sampling.

ERMT Member	LRMT Member

3.1.1 Upon direction by the RPD, contact the Control Room and request the Hot Leg sample valves be open 2-CV-5464 (Unit 2), or 1-CV-5464 (Unit 1) if the RCS pressure is > 200 psig.

Also, request the Control Room to verify if the manual RCS Hot Leg valves are in the open position.

Control Rm Contacted: _____ / _____ / _____
Initial Date Time

- **NOTE** -

IF RCS PRESSURE OBSERVED IN THE CONTROL ROOM IS GREATER THAN 200 PSIG, A SAMPLE CAN BE TAKEN FROM THE RCS HOT LEG, OTHERWISE, A SAMPLE IS TAKEN FROM THE LPSI PUMP DISCHARGE.

3.1.2 Upon direction by the RPD, prepare for reentry according to Emergency Work Permit, EWP #003 as follows:

3.1.2.1 Receive briefing by RPD, per items 3.1.1 thru 3.1.7 above.

3.1.2.2 Read, understand, and sign EWP #003 and receive briefing by the ERMTL as to stay time limitation, protective clothing, specific route to work locations, and radiological conditions expected.

Briefing Conducted: _____ / _____
Initial Date

3.1.2.3 Collect the following material from the Emergency Reentry Equipment Locker: (check when performed)

1. Radiac Monitoring Equipment per EWP #003 ( )
2. Maps, stop watch, portable radio, air sampler and dosimeter. ( )

Collect the following materials from the Radiochemistry Laboratory: (check when performed)

1. Key for the CIS Override (RC Hot Leg Sx) ( )
2. Key for the H_2 Analyzer (#75) ( )
3. Accident Coolant Sampling Kit ( )
4. Inventory Prior to Entry
5. Lead Gloves ( )
6. Lead Pig for Samples ( )
7. Transport Cart ( )
8. Copy of ERPIP 4.4.7.6 ( )

_____ / _____
ERMT Name Time

_____ / _____
LRMT Name Time

	ERMT Member	LRMT Member

3.1.2.4 Prepare map showing route and expected radiological conditions - attach to EWP #003

3.1.2.5 Don protective clothing, dosimetry and respiratory protection devices, lapel air samples as specified on EWP #003. (Clothing and monitoring equipment located in the Emergency Reentry Equipment Locker, 69' Auxiliary Building for preaugmentation use).

3.1.2.6 Ensure personnel monitoring equipment and operational radiac instruments are placed on transport cart prior to entry.

_____ / _____
Initial Time

3.1.2.7 When approved by the RPD, proceed to the sample location (Post Accident Sampling System access area on the 45' elevation of the Auxiliary Building west side.)

3.1.2.8 Supervise and provide continuous radiation protection coverage for LRMT member, control stay times, and use portable radio to notify RPD of procedure steps performed and exposures rates detected.

3.1.2.9 Prior to entry into the Post Accident Sampling area, review Section 3.1.2.10, Step 1 thru 3 with LRMT member.

- CAUTION -

PERMANENT LEAD SHIELDING HAS BEEN PLACED IN THE PASS AREA. MAXIMUM EFFORT SHOULD BE MADE BY THE INDIVIDUAL PERFORMING THE SAMPLING TO UTILIZE THIS SHIELDING TO REDUCE HIS RADIATION EXPOSURE. DO NOT ENTER AREAS BEHIND THE SHIELDS.

3.1.2.10 Ensure sampling area has been prepared as follows:

1. Verifying that the system is energized by checking the control panel circuit breakers (CV)1-19 and the main are in the "ON" position.

(OBSERVE NOTE ON FOLLOWING PAGE)

ERMT Member	LRMT Member

- NOTE -

IF AFTER OPERATING THE CIRCUIT BREAKERS NO POWER IS OBSERVED, THROW MAIN SYSTEM BREAKER (2599) TO BREAKER #52-21464 OR BREAKER #52-20459.

1. Transport cart carrying open lead container and equipement located outside of shield wall and easily accessible for receipt of the very high level coolant sample.

2. Perform continuous monitoring during all steps of the procedure. PIC-6A and RO-7 (0-20 R/h Scale Probe) turned to high scale and placed between the shield wall and the PASS Control Panel.

3. Ensure that Lapel Air Samplers are turned on.

2. Verify that the valve switch positions and manual valves are in "NORMAL" line-up positons and energized per Attachment 2.

3. Perform Sample Analysis and obtain samples as per Section 4.0.

- NOTE -

The CD has the option of directing LRMT to conduct any or all sections of this procedure concerning analytical operations.

4.0 PASS OPERATING PROCEDURES

- NOTE -

Sections 4.1 - 4.4 are operational checks of the system and can be skipped as directed by the CD.

4.1 Nitrogen Purge and Fill of the Gas Sample Vessel

4.1.1 Open Containment Atmosphere Return Valves 6540G or 6507G located on Hydrogen Analyzer Control Panel.

4.1.2 Open CV-5015, CV-5018, CV-5041, and CV-5023 at the PASS control panel.

4.1.3 Open CV-5002 (rotate and push the switch), CV-5026, CV-5010, and position CV-5013 to **GAS SAMPLE** position.

4.1.4 Open CV-5030, CV-5025, and slowly open CV-5044 (Nitrogen regulator supply on the control panel). Verify pressure indication on PI-5025, then continue to open CV-5044 until a pressure of 5 psig on PI-5025 is obtained.

4.1.5 Turn the Sample Circulation Pump (HS-5027) "**ON**" to purge and establish a nitrogen blanket for this portion of the system.

4.1.6 Verify flow indication on FI-5019, then continue to open CV-5044 until flow rate of 0.6 to 0.8 cfm (as read on FI-5019) is obtained.

4.1.7 Purge system for 2 to 3 minutes, then open CV-5014, CV-5016, and close CV-5015.

4.1.8 Verify flow as above (4.1.6).

4.1.9 After five minutes of purge flow, switch the sample circulation pump "**OFF**" and close CV-5044. Position 6540G valves (for Unit 1) or 6507G valves (for Unit 2) to **SHUT** position and slowly reopen CV-5044 to obtain 5 to 10 psig on PI-5025.

4.1.10 Close CV-5014 and CV-5016. The Gas Sample Vessel is now charged.

4.1.11 Verify that all valves controlled from the control panel are returned to their normal line-up positions given in Attachment 2.

4.2 Demineralized Water Purge and Fill of the Reactor Coolant Liquid Sample Path

4.2.1 Open the liquid return line valves to the containment by opening 1-SV-6529 (for Unit 1) or 2-SV-6529 (for Unit 2) located on the H_2 Analyzer Panel. Then open CV-5011, CV-5010, and fully open CV-5012.

4.2.2 Open CV-5005A, CV-5005, and slowly open CV-5033. Verify flow indication on FI-5011, then, continue to open CV-5033 until a flow rate of 1 gpm on FI-5011 demineralized water flow is established for purging.

4.2.3 After approximately 2 minutes, open CV-5029, and then close CV-5011. Adjust CV-5033, as necessary, to maintain 1 gpm (as read on FI-5011) for demineralized water flushing of the pH and boron meters.

- NOTE -

If radioisotopic analyses are to be conducted, an energy calibration check of the system should be conducted at this time. The 2-minute purge will be extended long enough to conduct the calibration as detailed in RCP-2-105.

4.2.4 After approximately 2 minutes, close CV-5029, CV-5012, and CV-5010. Then close CV-5033.

- NOTE -

If specified levels are observed on LI-5031 or LI-5028, skip the following Sections 4.3 and

(NOTE CONT'D ON FOLLOWING PAGE)

4.4 respectively, return all valves to normal line-up (Attachment 2) and proceed to 4.5.

4.2.5 Close the liquid return line to the containment by closing 1-SV-6529 (for Unit 1) or 2-SV-6529 (for Unit 2) located on H_2 Analyzer Control Panel.

4.3 Demineralized Water Fill of the Loop Seal and Burette

4.3.1 Vent the Surge Vessel by opening CV-5023, CV-5041, and (PS-259).

4.3.2 From the control panel, open PS-258 and slowly open CV-5031 to fill the loop seal. When a level change is seen on LI-5032 (Surge Vessel Level Indicator), close (PS-258).

4.3.3 Continue filling burette to a level between 0 and 5% as read on LI-5031. Then close CV-5031 and CV-5005.

- NOTE -

If the level as read on LI-5031 is greater than 5%, operate CV-5036 to lower the burette level into the acceptable range (0-5%).

4.3.4 Close (PS-259).

- NOTE -

If a level is observed on LI-5028, then verify that all valves are positioned to their Normal Valve Line-up as per Attachment 2 and proceed to Section 4.5.

4.4 Demineralized Water Fill of the Depressurized Liquid Sample Vessel

4.4.1 Check CV-5005A and (PS-259) are open and CV-5005 is closed.

4.4.2 Position CV-5028 to SAMPLE FLASK position and slowly open CV-5006 to fill the Depressurized Liquid Sample Vessel to a level of 20% (as read on LI-5028).

4.4.3 Position CV-5028 to **SAMPLE PATH** position and open CV-5032 to vent the vessel (LI-5028 will stabilize after satisfactory venting).

- NOTE -

If the level as read on LI-5028 is greater than 20%, operate CV-5037 to lower the level to an acceptable range (5-20%).

4.4.4 On the control panel, close CV-5032, CV-5006, and CV-5005A.

4.4.5 Close (PS-259).

- NOTE -

Return all valves to the normal line-up as given in Attachment 2 before proceeding to Section 4.5. **THE SYSTEM IS NOW READY FOR OPERATION.**

4.5 Reactor Coolant Sample (RCS) Purging

4.5.1 Ensure that all valves are in there normal line-up as given in Attachment 2.

- CAUTION (A) -

If during sampling, PIC-5004 high pressure alarm occurs, verify that CV-5004 closes (light on control panel), isolate liquid sampling inlet lines, check LI-5032 level to determine if relief valves RV-5002 and/or RV-5001 have lifted. Pump down the Surge Vessel, if necessary, by opening CV-5033, CV-5034, and running the Surge Vessel Pump. Correct the cause of high

(CAUTION CONT'D ON FOLLOWING PAGE)

pressure condition prior to attempting to sample.

- CAUTION (B) -

If during sampling, PS-5002 high pressure alarm occurs, verify that CV-5002 closes (light control panel), isolate liquid sampling inlet lines, check LI-5032 level to determine if RV-5000 has lifted. Verify on the H_2 Analyzer System Panel 1-SV-6529 or 2-SV-6529 are open. Pump down the Surge Vessel, if necessary, by opening CV-5033, CV-5034, and running the Surge Vessel Pump. Correct the cause of the high pressure condition prior to attempting to sample.

- CAUTION (C) -

Discharge liquid sample return line 1-SV-6529 or 2-SV-6529 must be open prior to opening 1-HS-5105 or 1-SV-5107 (for Unit 1); or 2-HS-5105 or 2-SV-5107 (for Unit 2).

4.5.2 Open 1-SV-6529 (for Unit 1) or 2-SV-6529 (for Unit 2).

4.5.3 Initiate cooling water flow to heat exchanger by opening CV-5001. Open CV-5003 to approximately midpositon.

4.5.4 To sample RCS hot leg, use CIS override key and operate appropriate (Unit 1 or Unit 2) HS-5467A RCS Hot Leg and position 1-CV-5105 (for Unit 1) or 2-CV-5105 (for Unit 2) to open. To sample the LPSI pump discharge, open 1-SV-5107 (for Unit 1) or 2-SV-5107 (for Unit 2).

4.5.5 Fully open CV-5033. Open CV-5011, CV-5040, CV-5008, and CV-5004 (rotate switch and push). If using LPSI system, contact the Control Room to verify the LPSI pump is operating.

4.5.6 Slowly throttle open CV-5012 to obtain a purge flow of 1 gpm (as read on FI-5011 and slowly adjust CV-5003 as required to keep TI-5001 at a constant temperature $<120^{\circ}$ F.

4.5.7 Purge liquid in this manner for approximately ten minutes prior to proceeding to analyses procedures.

4.6 Total Gas Concentration Analysis

- NOTE -

Procedure 4.5 is a prerequisite to this analysis.

4.6.1 Close CV-5012, CV-5011, and CV-5004 to trap a pressurized sample. (If sampling Hot Leg RCS, close 1-CV-5105 (Unit 1) or 2-CV-5105 (Unit 2).)

4.6.2 Close CV-5040 (If sampling Hot Leg RCS, close 1-CV-5105 (Unit 1) or 2-CV-5105 (Unit 2)). Open CV-5039 to depressurize upstream tubing.

4.6.3 Open CV-5010.

- NOTE -

Maintain cooling water to the Sample Vessel/ Heat Exchanger to ensure that any gas bubbles (high total gas samples) are cooled prior to opening CV-5031.

4.6.4 Record on Attachment 3 the initial burette pressure from PI-5031 (P_{RCS}) and initial level LI-5031.

4.6.5 Verify that TI-5001 reads less than 120°F, then slowly crack open CV-5031. Open CV-5002 (rotate switch and push) and CV-5026.

4.6.6 Fully open CV-5031.

- NOTE -

Carefully watch burette level at this step.

- NOTE -

The burette level may initially rise and then decrease in the event of high total gas concentrations due to high temperature gas bubble collapse. Allow the level to stabilize before proceeding.

- NOTE -

If the burette level approaches 100% (as read on LI-5031), close CV-5031 and thus record on Attachment 3 the burette level (LI-5031). Drain the burette to a level of between 0 and 5% by opening CV-5036. Close CV-5036 and record the burette level. Then reopen CV-5031, allow burette level to stabilize and again record the burette level (initial level) on Attachment 3.

If the burette level ever exceeds 100%, a new purge must be initiated (4.5) and the TGC procedure restarted.

4.6.7 Record on Attachment 3 the burette level LI-5031 burette level changes.

- NOTE -

If PI-5031 reading increases to greater than 0.5 psig, open CV-5034, check open CV-5033 and start the Surge Vessel Pump to pump down the Surge Vessel and lower the PI-5031 reading to between 0 and 0.5 psig. (Do not pump the Surge Vessel down below a level of 5% as read on LI-5032.) Stop the Surge Vessel Pump and close CV-5034 when PI-5031 reads as required. Record the new PI-5031 (P_B) value on Attachment 3.

4.6.8 Close CV-5031. Start the Sample Circulation Pump and run it for about 1/2 to 1 minute. Then stop the pump.

4.6.9 Repeat steps 4.6.6, 4.6.7, and 4.6.8 until burette level does not change. Then record the LI-5031 (final) level, the final pressure PI-5031 (P_B), and the TI-5001 (final) temperature on Attachment 3.

- NOTE -

Using the recorded information listed below, the Total Gas Concentration can be calculated (see Calculations Section 5.1).

1. Initial Burette Level, %
2. Final Burette Level, %
3. Initial Pressure (Pres), psig
4. P_B, psig - Final Pressure (P_B), psig
5. Final Temperature, ^{o}F

4.7 Dissolved H_2 and O_2 Analyses

- NOTE -

Procedures 4.5 and 4.6 are prerequisites to these analyses.

4.7.1 Adjust CV-5013 to **GAS SAMPLE** position.

4.7.2 Open CV-5015 and CV-5017 and select the high scale on AI-5001 and AI-5002.

4.7.3 Start the Sample Circulation Pump.

4.7.4 Reselect the lower scale of AI-5001 or AI-5002 if the reading falls within the lower scale range.

4.7.5 Allow H_2 and O_2 gas concentrations (volume %) as read on AI-5001 and AI-5002, respectively, to stabilize. Record these % readings on Attachment 3.

4.7.6 Shut off the Sample Circulation Pump.

- NOTE -

With the information above H_2% and O_2%, the T (final), P_B, and ΔV from 5.1 the cc/kg concentration of each gas can be calculated following the procedures listed in Section 5.2.

4.7.7 If required sample analyses are complete, proceed to Section 4.13.

4.8 Gas Sample Dilution Prior to Grab Sampling for Radioisotope Analysis

- NOTE -

Procedures 4.5, 4.6, and 4.7 are prerequisites to this dilution. The number of dilutions should be calculated "prior" to conducting the procedures below.

4.8.1 Open CV-5014, CV-5016, CV-5025, and close CV-5015. Open or check open CV-5017 and adjust CV-5013 in the GAS SAMPLE position.

4.8.2 Run the Sample Circulation Pump HS-5027 for three minutes to dilute the gas sample with nitrogen.

4.8.3 Stop the Sample Circulation Pump HS-5027 and record pressure at PI-5025 (P_{Gs}) on Attachment 4.

4.8.4 If it is determined by the initial sample taken following an accident, that further dilution is required for subsequent samples, this can be accomplished by performing the following steps:

- CAUTION -

DO NOT ATTEMPT THESE STEPS IF CONTAINMENT PRESSURE IS GREATER THAN 30 PSIG.

(a) On the Hydrogen Analyzer Control Panel, open the inboard and outboard valves for 6540G or 6507G (Unit 1) or (Unit 2).

(b) If PI-5025 reading is greater than 0 psig, open CV-5041, CV-5018, CV-5023, and start the Containment Sample Pump HS-5020. Stop the Containment Sample Pump when PI-5025 pressure reaches 0 psig and close CV-5041, CV-5023, and CV-5018.

(c) Check open CV-5030 and slowly open CV-5044 to obtain a PI-5025 reading of 10 psig. Then close CV-5044.

(CAUTION CONT'D ON FOLLOWING PAGE)

(d) Run the Sample Circulation Pump for three minutes to mix the added nitrogen with the sample. Stop the pump. Record PI-5025 (P_{Gs}) reading.

(e) Repeat above steps (b), (c), and (d) until desired dilution is obtained. Each time these steps are performed the dilution factor in step 4.8.5 below is multiplied by

$$\frac{\text{PI-5025 reading of above (psig)} + 14.7}{14.7}$$

(f) Close CV-5030 and position PS-519/PS-520 (for Unit 1) or PS-523/PS-524 (for Unit 2) to NORM SYS position.

4.8.5 Close CV-5014 and CV-5016. The Gas Sample Vessel now contains a nitrogen diluted sample. The dilution factor is calculated using the equation in above Section 4.8.4.(e), and the calculations in Section 5.4

- NOTE -

The sample should not be withdrawn until the remainder of the system is purged following the completed reactor coolant sampling evolutions.

4.8.6 Close CV-5025, CV-5002, CV-5026, CV-5010, and position CV-5013 to the Total Gas flow path.

- NOTE -

If the analyses are complete and no system purge is required, return all valves to their normal valve line-up per Attachment 2.

4.9 pH and Boron Concentration Analyses

- NOTE -

Procedure 4.5 is a prerequisite to these analyses.

4.9.1 Check closed or close CV-5039, and check open or open CV-5040 and CV-5008.

4.9.2 Verify that cooling water is flowing through the Sample Vessel/Heat Exchanger by observing TI-5001 to be 120°F.

4.9.3 Open CV-5030 and CV-5045. Slowly open CV-5044 to obtain pressure reading of 15 psig on PI-5025.

4.9.4 Open CV-5004 and CV-5011. Fully open CV-5033.

4.9.5 Slowly throttle open CV-5012 and slowly throttle down on CV-5033 (in small sequential steps) to obtain a flow of .2 gpm (as read on FI-5011) and a pressure reading on PI-5004 of between 40 psig and 80 psig and at least 20 psig greater than containment pressure. Between the incremental steps of adjusting these valves, adjust CV-5044, as required, to keep PI-5025 reading 2 psig higher than PI-5004 reading. Regulate CV-5003 to adjust TI-5001 at 120°F (or other desired nominal operating temperature not to exceed 150°F) ± 10°F.

4.9.6 Open CV-5029 and then close CV-5011.

4.9.7 Continue adjusting CV-5044 as required to maintain PI-5025 reading 2 psig higher than PI-5004 reading. Adjust CV-5003 to maintain the TI-5001 reading at the desired nominal operating temperature.

4.9.8 Allow the boron concentration (A-502) and pH (AI-5004) readings to stabilize. Then record the readings of A-502, AI-5004, and TI-5001 on Attachment 5.

(OBSERVE NOTE ON FOLLOWING PAGE)

- NOTE -

Temperature must be maintained nearly constant for 15 minutes prior to obtaining A-502 (boron meter) reading.

- NOTE -

If containment sump water is being recirculated through the reactor coolant system, the pH additives which may be present in the sump for chemistry control and iodine removal have a significant affect on the boron meter reading. Correlations are provided for the pH additives sodium hydroxide (NaOH) and trisodium phosphate ($Na_3PO_4 \cdot 12\ H_20$). (See Section 5.3.)

4.10 Radioisotope Analysis via Germanium Detector System

- NOTE -

An energy calibration procedure is conducted prior to sample analysis. The calibration shall be initiated in Section 4.2, "Demineralized Water Purge and Fill of the Reactor Coolant Liquid Sample Path" (See Section 4.2.3).

4.10.1 The operation of the reactor coolant (Ge) detector can be initiated with the PASS aligned to conduct pH and Boron analyses as detailed in Section 4.9. Specifically during the stabilization purge, Step 4.9.7-4.9.8, the proper conditions exist to conduct the required radioisotopic

analysis as per RCP-2-105. The PASS RCS sample parameters at Steps 4.9.7-4.9.8 are listed below:

4.10.1.1 Temperature: 120°F

4.10.1.2 Pressure: 40 to 80 psig

4.10.1.3 Flow: 0.2 gpm

4.11 Liquid Sample Dilution Prior to Grab Sampling for Radioisotope and Back-up Boron Analysis

- NOTE -

Procedures 4.2 thru 4.5, and 4.9 are prerequisites to this dilution.

4.11.1 Close CV-5004, CV-5001, and CV-5003, and if sampling a RCS Hot Leg, close 1-CV-5150 (Unit 1) or 2-CV-5105 (Unit 2).

4.11.2 Close CV-5040 and if sampling a RCS Hot Leg, close 1-CV-5150 (Unit 1) or 2-CV-5105 (Unit 2). Open CV-5039 to depressurize upstream tubing.

4.11.3 Close CV-5030, CV-5044, and CV-5045, and open CV-5046 to vent the electrolyte storage vessel. If PIC-5004 pressure is greater than 5 psig, open CV-5030, CV-5045, and slowly open CV-5044 to obtain a pressure reading on PI-5025 of 2 psig higher than on PIC-5004. Then close CV-5030, CV-5045, and CV-5044.

- NOTE -

The pressure on the Electrolyte Storage Vessel should be maintained slightly higher than process line pressure until process line pressure is depressurized to approximately atmospheric conditions. This is required to prevent back leakage of post-accident fluid into the electrolyte storage vessel.

4.11.4 Position CV-5028 to **SAMPLE FLASK** position and open CV-5032. This will drop 4.7 ml of sample fluid into the depressurized liquid sample vessel which is initially approximately 20% filled with demineralized water.

4.11.5 Add more demineralized water in incremental level changes (as read on LI-5028) by performing the following steps:

(a) Close CV-5032 and open CV-5006 to obtain a change in LI-5028 level not to exceed 20% increments.

(b) Close CV-5028 to **SAMPLE PATH** position when item (a) change is obtained.

(c) Open CV-5032 to vent the vessel (LI-5028 will stabilize after satisfactory venting).

(d) Close CV-5032 and CV-5006. Repeat the above steps until the desired dilution of the sample is achieved. Attachment 8 provides the "volume" in the vessel versus LI-5028, level %. The Depressurized Liquid Sample Vessel now contains a diluted liquid sample. The "dilution factor" is calculated using the following equation:

$$\frac{\text{Volume in the Vessel}}{\text{4.7 ml}}$$

- NOTE -

For the initial sample taken following an accident, the Depressurized Liquid Sample Vessel should be completely filled. Based on this sample, subsequent samples with either more or less dilution may be required for

(NOTE CONT'D ON FOLLOWING PAGE)

efficient counting during radioisotope analysis. If further dilution is required, this can be accomplished by performing the following steps:

(1) Open CV-5032 and slowly open CV-5037 to drain to a desired level (LI-5028) for further dilution.

(2) Close CV-5037.

(3) Fill the vessel to the desired level on LI-5028 by the method employed in the above Step 4.11.5. Record final LI-5028 level on Attachment 5.

(4) "Dilution factor" in Step 4.11.5 is then multiplied by the volume determined from Attachment 8 for the LI-5028 reading in above Step (3) divided by the volume determined from Attachment 8 for the LI-5028 reading in above Step (1).

- NOTE -

During the incremental filling procedure, if PI-5031 reading exceeds 3 psig following venting of the vessel, pump the surge vessel down until PI-5031 reading is reduced to between 0.5 and 3 psig by opening CV-5034, checking open CV-5033, and running the Surge Vessel Pump HS-5035. (Do not pump the surge

(NOTE CONT'D ON FOLLOWING PAGE)

vessel down below a level of 5% as read on LI-5032). Stop the Surge Vessel Pump HS-5035 and close CV-5034 when PI-5031 reads as required.

- NOTE -

This sample should not be withdrawn until the remainder of the system is purged with DI Water following the completed reactor coolant sampling evolutions.

4.12 Partial System Purge and Diluted Sample Withdrawl

4.12.1 Isolation of Liquid Sample Inlet Path

- NOTE -

Procedures 4.4 and 4.5 are prerequisites to this isolation.

(a) Close CV-5033, CV-5029, CV-5012, CV-5008, and CV-5039.

(b) If RCS hot leg is sampled, close 1-CV-5105 (for Unit 1) or 2-CV-5105 (for Unit 2). If LPSI pump discharge was sampled, close 1-SV-5107 (for Unit 1) or 2-SV-5107 (for Unit 2).

4.12.2 Partial System Purging Prior to Diluted Sample Withdrawl

- NOTE -

Steps 4.1, 4.8, 4.9, and 4.11 are prerequisites to this purging.

(NOTE CONT'D ON FOLLOWING PAGE)

(a) Open 6540G or 6507G inboard and outboard valves (Unit 1) or (Unit 2) on the Hydrogen Analyzer Control Panel and close CV-5024.

(b) Check CV-5013 in the TOTAL GAS position, open CV-5025, CV-5015, CV-5041, and CV-5018, and CV-5023.

(c) Open CV-5030 and slowly open CV-5044 until a flow rate of 0.6 and 0.8 cfm (as read on FI-5019) is obtained to purge this path with N_2.

(d) After two minutes, close CV-5015 and open CV-5017 to purge this branch for thirty seconds.

(e) Close CV-5044, CV-5015, CV-5017, CV-5018, CV-5041, and CV-5023.

(f) Purge the inlet line to the sample station and back-flush the strainer by opening CV-5039, CV-5008, CV-5004 (rotate and push switch) CV-5010, CV-5005, and CV-5005A. Purge demineralized water in this manner for two minutes.

(g) Fully open CV-5033, open CV-5011, close CV-5004, and slowly open

(NOTE CONT'D ON FOLLOWING PAGE)

CV-5012 to obtain a flow of 1 gpm (as read on FI-5011).

(h) After one minute, open CV-5029 and close CV-5011 to purge the pH and boron meter line. Adjust CV-5012, as necessary, to maintain 1 gpm (on FI-5011) for a period of two minutes.

(i) Close CV-5010, fully open CV-5031 to purge the burette. The Surge Vessel will begin to fill. Pump down the Surge Vessel while purging as necessary (level on LI-5032 should not exceed 90%) by opening CV-5034 and running the Surge Vessel Pump HS-5035. Purge in this manner for two minutes. Then close CV-5005, CV-5005A, and CV-5031. Turn off the Surge Vessel Pump HS-5031 and close CV-5034 after burette and surge vessel are adjusted to their preoperational level.

4.12.3 Diluted Sample Withdrawl

ERMT Member	LRMT Member
(a) Record dose rate in sample area prior to shield port removal Dose Rate = _____ R/h Date/Time _____/_____	(a) This portion of the procedure addresses the withdrawl of the "diluted" reactor coolant gas sample obtained in Step 4.8, and the "diluted" reactor coolant liquid sample obtained in Step 4.11. The required materials for diluted sample withdrawl are three syringes (capacity of 5 ml (each) minimum and of length such that sample vessels can be sampled through the shield wall).
(b) Dose rate at Sample Port _____ R/hr Date/Time _____/_____ Dose Rate of Sample _____ R/hr Date/Time _____/_____	(b) Remove the shield wall access ports and insert syringes through system plugs. Operate the syringe to remove the sample(s) of interest. The location of the samples are as follows: the upper left hand port is for the Gas Sample Vessel; the lower port is for Depressurized Liquid Sample Vessel.
(c) Dose rate on outside of shield. _____ R/hr	(c) Place the sample into lead container. Close container lid.
(d) Promptly exit sample room with LRMT member and sample cart, and Radiac Instrumentation. Return to 69' Controlled Area. _____/_____ RPD Notified Time	(d) Depart with ERMT member, taking sample cart and shielded sample. _____/_____ Time exited Time
(e) Provide continuous monitoring coverage during the transport of shield sample to the radiochemistry laboratory and minimize radiation exposures by effective use of barriers and minimum stay time.	(e) Contact Control Room and request that the **PASS** Sample Isolation Valves are **SHUT.** Deposit sample in Chemistry Hot Laboratory or as directed by CD for analysis.
(f) Ensure personnel exposure data has been recorded.	(f) Prepare sample tag with the following data, and tie to sample collection apparatus container. a. Name and type of material ( ) b. Time sample taken ( ) c. Sample #, if applicable ( ) d. Location of sample ( ) e. mR/h on contact after sample containment ( ) Leave Attachment 1 with samples for use in analysis.

4.13 Purging and Refilling Between Samples

This procedure is performed between sampling evolutions. Complete purging should be performed as specified below.

- NOTE -

This purging should not be attempted unless containment building pressure is less than 10 psig.

4.13.1 Perform Sections 4.1 through 4.4.

4.13.2 Verify that Section 4.12.2, Steps (f) through (i) have been completed.

4.13.3 If necessary, drain and flush the Depressurized Liquid Sample Vessel as follows:

(a) Open CV-5037 and CV-5032 to drain the sample vessel to a level of between 0 and 5% as read on LI-5028. Close CV-5037.

(b) Position CV-5028 to SAMPLE FLASK position.

(c) Fill the vessel to a level of 80% on LI-5028 by the method employed in Section 4.11.5. Then slowly open CV-5037 and CV-5006 to initiate flush of the vessel. Adjust CV-5006 and CV-5037 to maintain a level of between 60% and 80% on LI-5028 during this flushing.

(d) Pump down the surge vessel as necessary to prevent exceeding 90% level on LI-5032 by fully opening 1-SV-6529 (Unit 1) or 2-SV-6529 (Unit 2), CV-5033 and opening CV-5034 and running the Surge Vessel Pump HS-5035.

- NOTE -

Do not allow surge vessel level to decrease below 20% (as read on LI-5032).

(e) Purge in this manner for five minutes. Then close CV-5006 and CV-5037.

(f) Slowly reopen CV-5037 and CV-5032 to drain the liquid sample vessel down to a level of 20% (as read on LI-5028). Then close CV-5037 and CV-5032, and position CV-5028 to **SAMPLE PATH** position.

4.13.4 If necessary, drain the burette by opening CV-5036 until a level of between 0 and 5% is obtained (as read on LI-5031). Close CV-5036.

4.13.5 Return all control panel valves to the position given in Attachment 1, "Normal Valve Line-Up."

4.13.6 **THE SYSTEM IS NOW READY FOR COLLECTING AND ANALYZING A NEW SAMPLE.**

5.0 CALCULATION PROCEDURES

5.1 Total Gas Concentration Calculation

5.1.1 Calculate change in burette level as follows:

(a) Using Attachment 9, determine the initial volume (ml) in burette based on initial burette level on LI-5028.

(b) Using Attachment 9, determine the final volume (ml) in burette based on final burette level on LI-5028.

(c) Calculate change in burette level as follows:

$$\Delta V = \text{final ml} - \text{initial ml}$$

- NOTE -

If burette level approached or reached 100% during sampling resulting in burette drain, the ΔV is calculated by adding the change for the initial rise in level to the change in level following the drain.

5.1.2 Using the recorded reactor coolant system values obtained in Section 4.6, calculate the total gas concentration as follows:

$$TG = \left(\frac{P_B + 14.7}{14.7}\right)\left(\frac{492}{T + 460}\right)\left[V - (P_{RCS} \times V_{IS} \times C_W)\right]\left(\frac{1000}{V_{IS}}\right) + \frac{(P_B + 14.7)}{.9}$$

Where:

TG = Total Gas Concentration : (cc/kg @ STP)

T = Final TI-5001 Temperature ($^{\circ}F$)

ΔV = Change in burette level - from above Step 5.1.1., (c). (ml)

P_{RCS} = Pressure of reactor coolant system at sample time (psig)

V_{IS} = Volume of isolated sample = 580 ml

C_W = Decompression of water from elevated pressure = 3.2×10^{-6}

P_B = Final PI-5031 pressure (psig)

5.2 Hydrogen (H_2) and Oxygen (O_2) Concentration Calculations

5.2.1 Calculate the hydrogen and oxygen concentrations (cc/kg at STP) as follows:

5.2.1.1 H_2 (cc/kg at STP)

$$= \frac{\%\, H_2}{100} \times F \times \left[TG + \left(\frac{P_B + 14.7}{14.7}\right)\left(\frac{492}{T + 460}\right)(V_g)\left(\frac{1000}{V_{IS}}\right)\right]$$

5.2.1.2 O_2 (cc/kg at STP)

$$100 = \frac{\%\, O_2}{} \times F \times \left[TG + \left(\frac{P_B + 14.7}{14.7}\right)\left(\frac{492}{T + 460}\right)(V_g)\left(\frac{1000}{V_{IS}}\right)\right]$$

Where:

$\%H_2$ = AI-5001 reading (Volume % H_2)

$\%O_2$ = AI-5002 reading (Volume % O_2)

F = High Total Gas Factor

If ΔV Step 5.1.1.(c)611 ml, F =1.0

If ΔV Step 5.1.1.(c)611 ml, $F = \frac{\Delta V}{611}$

TG = Total Gas Concentration - from Step 5.1.2 (cc/kg STP)

P_B = PI-5031 Pressure (psig)

T = TI-5001 Temperature (^oF)

V_g = Volume of Gas initially in the system = 1310 ml

V_{IS} = Volume of Isolated Sample = 580 ml

5.3 Boron Meter Corrections for pH Additives

The procedures below provide calculation corrections of the A-502 Boron Meter in the event of a sump containing pH additives, sodium hydrozied (NaOH) or trisodium phosphate ($Na_3 PO_4 \cdot 12 H_2O$). Presently Calvert Cliffs has $Na_3 PO_4 \cdot 12 H_2O$ for a pH control.

5.3.1 If $Na_3 PO_4 \cdot 12 H_2O$ is used for sump pH control, correction is made as follows:

(a) Use Attachment 6 to obtain the ration of ppm $NA_3 PO_4 \cdot 12 H_20$ to ppm boron based on boron meter (A-502) and pH meter (AI-5004) readings.

(b) Using the A-502 reading and the ratio obtained from Attachment 6, calculate (ppm $Boron_C$) as follows):

$$\text{ppm Boron}_C = \frac{\text{A-502 reading}}{1 + (0.265 \times \text{ratio})}$$

(c) If the above corrected boron concentration is within 50 ppm of the original A-502 reading, record this value as the corrected boron concentration. Otherwise, proceed with the following steps.

(d) Using the above corrected value and the (AI-5004) readings, obtain a new ratio from Attachment 6.

(e) Using the new ratio, calculate a new corrected boron concentration using the equation in above Step (b).

(f) If the new corrected boron concentration is within 50 ppm of the previous iteration, record this value as the corrected boron concentration. Otherwise, using the new corrected boron concentration and AI-5004 reading, obtain a new ratio from Attachment 6 and then return to Step (e).

5.3.2 If NaOH is used for sump pH control, correction is made as follows:

(a) Use Attachment 7 to obtain the ratio of ppm NaOH to ppm Boron based on boron meter (AI-5004) readings.

(b) Using A-502 reading and the ratio obtained from Attachment 7, calculate a corrected boron concentration (ppm $Boron_C$) as follows:

$$\text{ppm Boron}_C = \frac{\text{A-502 reading}}{1 + (0.54078 \times \text{ratio})}$$

(c) If the above corrected boron concentration is within 50 ppm of the original A-502 reading, record this value as the corrected boron concentration. Otherwise, proceed with the following steps.

(d) Using the above corrected value and the AI-5004 reading, obtain a new ratio from Attachment 7.

(e) Using the new ratio, calculate a new corrected boron concentration using the equation in above.

(f) If the new corrected boron concentration is within 50 ppm of the previous iteration, record this value as the new corrected boron concentration and AI-5004 reading, obtain a new ratio from Attachment 7, and then return to above Step (e).

5.4 Gas Sample Dilution Factor of Grab Samples for Radioisotope Analysis

5.4.1 Dilution Factor =

$$\frac{\left(\frac{P_{GS} + 14.7}{14.7}\right)\left(\frac{492}{T + 460}\right)\left(V_{GS} + V_{DG} + \Delta V\right) \times F}{V_{IS}}$$

Where:

P_{GS} = PI-5025 Pressure Recorded in Step 4.8.3 (psig)

T = TI-5001 Temperature Recorded in Step 4.6.7 (^{o}F)

V_{GS} = Volume of Gas Sample Vessel = 12,500 ml

V_{DG} = Volume of Gas initially in the system including Gas Sample Vessel Branches = 1,345 ml

ΔV = Changes in burette level calculated in Step 5.1.1.(c). (ml)

F = High Total Gas Factor calculated in Step 5.2.1

V_{IS} = Volume of Isolated Sample = 580 ml

6.0 REPORTING

6.1 Report promptly and verbally preliminary data obtained during entry to the RPD and CD. Brief RPD and CD on the following as a minimum:

6.1.1 Exposures received by reentry personnel (SRD-type data).

6.1.2 Exposure rates measured enroute to sample room and maximum exposure rates measured within Sample Room during entry.

6.2 Collect lapel air samples and send to counting laboratory for analysis.

6.3 Report to CD and RPD for full debriefing and provide copy of completed data shown on Attachment I.

ATTACHMENT I

ACCIDENT SAMPLE AND ANALYSIS DATA SHEET

SAMPLE # _____

SAMPLE LOCATION: _____ UNIT 1 2

SAMPLE: DATE: _____ TIME: _____

DOSE RATE ON CONTACT: _____ mrem/hr

REMARKS: _____

_____

SAMPLED BY: _____
LMRT

ANALYSIS TO BE PERFORMED:	RESULTS
( ) Gross Beta/Gamma	_____
( ) Gamma Spectrum Analysis	_____
( ) Boron Analysis	_____
( ) Chloride Analysis	_____
( ) Other (Specify)	_____

ANALYSIS PERFORMED BY: _____ / _____ / _____
LRMT DATE TIME

NOTES: (1) Report results to CD as soon as practical.

(2) Retain all samples for future use.

Storage Location: _____

Placed in storage area by: _____ / _____
DATE TIME

REMARKS: _____

_____

_____ _____

ATTACHMENT 2

PASS NORMAL VALVE LINE-UP

Valve	Position
*PS-100	OPEN
*PS-101	OPEN
*PS-102	OPEN
*PS-103	OPEN
*PS-108	CLOSED
*PS-119	OPEN
*PS-120	OPEN
*PS-121	OPEN
*PS-122	OPEN
*PS-123	OPEN
*PS-124	OPEN
*PS-130	CLOSED
*PS-131	CLOSED
*PS-132	CLOSED
*PS-133	CLOSED
*PS-134	OPEN
1-CV-5105	CLOSED
2-CV-5105	CLOSED
1-CV-5107	CLOSED
2-CV-5107	CLOSED
CV-5001	CLOSED
CV-5002	CLOSED
CV-5003	CLOSED
CV-5004	CLOSED

Valve	Position
CV-5005	CLOSED
CV-5006	CLOSED
CV-5007	CLOSED
CV-5008	CLOSED
CV-5010	CLOSED
CV-5011	CLOSED
CV-5012	CLOSED
CV-5013	TOTAL GAS
CV-5014	CLOSED
CV-5015	CLOSED
CV-5016	CLOSED
CV-5017	CLOSED
CV-5018	CLOSED
CV-5021	CLOSED
CV-5022	CLOSED
CV-5023	CLOSED
CV-5024	CLOSED
CV-5025	CLOSED
CV-5026	CLOSED
CV-5028	SMPL PATH
CV-5029	CLOSED
CV-5030	
CV-5031	
CV-5032	CLOSED
CV-5033	CLOSED
CV-5034	CLOSED
CV-5036	CLOSED
CV-5037	CLOSED
CV-5038	CLOSED
CV-5039	CLOSED

Valve	Position
CV-5040	CLOSED
CV-5041	CLOSED
CV-5044	CLOSED
CV-5045	CLOSED
CV-5046	CLOSED
S1	ON
S2	ON
S3	ON
S4	ON
S5 (PS-258)	OFF
S6	ON
S7 (PS-259)	OFF
S8	ON
S9	ON
(PS-260)	OFF
**1-SV-6529	CLOSED
**2-SV-6529	CLOSED
6540G	U-1 & U-2 OFF
6507G	U-1 & U-2 OFF

* Manual valves located in Sample Station

** Located on Hydrogen Analyzer Panel

ATTACHMENT 3

CALCULATION FORM I

TOTAL GAS CONCENTRATION AND GAS ANALYSIS DATA SHEET

DATE/TIME: ___/___/___ _____

ANALYST: _____

1. RCS Burette Pressure (PI-5031) _____ psig

2. Initial Burette Levels (LI-5031) _____ %

   _____ %

   _____ %

3. P_b Burette Pressure (PI-5031) _____ psig

4. Final Burette Level (LI-5031) _____ %

5. Final Temperature (TI-5001) _____ ^{o}F

6. Hydrogen (AI-5001) _____ %

7. Oxygen (AI-5002) _____ %

ATTACHMENT 4

CALCULATION FORM II

GAS SAMPLE DILUTION

DATE/TIME: ___/___/___ _____

ANALYST: _____

1. P_{Gs} (PI-5025) _____ psig
2. P_{Gs} (PI-5025) _____ psig
3. P_{Gs} (PI-5025) _____ psig
4. P_{Gs} (PI-5025) _____ psig
5. P_{Gs} (PI-5025) _____ psig
6. P_{Gs} (PI-5025) _____ psig

COMMENTS:

ATTACHMENT 5

CALCULATION FORM III

pH & BORON ANALYSIS DATA SHEET

DATE/TIME: ___/___/___ _____

ANALYST: _____

1. Initial Temperature (TI-5001) _____ °F
2. pH (AI-5004) _____
3. Boron (A-502) _____ ppm
4. Final Temperature (TI-5001) _____ °F
5. Final Volume (LIL-5028) _____

ERPIP 4.4.7.6 REVIEW/APPROVAL

POST ACCIDENT SAMPLING SYSTEM AND ANALYSIS

REVISION	CHANGE	REVIEWER SIG/ DATE	SUPERVISOR EPU SIG/DATE	POSRC MTG	PLANT SUPERINTENDENT /DATE
0	—	[signature] 9/22/82	[signature] 9/22/82	82-124	J R Russell 9-24-82
1	—	Revised for B A Watson 12-27-82	[signature] 12/29/82	82-169	J R Russell 12/29/82
2	—	[signature] 6-1-83	[signature] 6.1.83	83-64	J R Russell 6/1/83

CALVERT CLIFFS NUCLEAR POWER PLANT
EMERGENCY RESPONSE PLAN
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES

ERPIP PAGE	REV.	ERPIP PAGE	REV.
1	2	19	2
2	2	20	2
3	2	21	2
4	2	22	2
5	2	23	2
6	2	24	2
7	2	25	2
8	2	26	2
9	2	27	2
10	2	28	2
11	2	29	2
12	2	30	2
13	2	31	2
14	2	32	2
15	2	33	2
16	2	34	2
17	2	35	2
18	2	36	2

50-317/318

June 16, 1983

To: U. S. NRC
Div. of Operating Reactors
Attn: Robert A. Clark, Chief
Washington, DC 20555

From: Supervisor - Emergency Planning

Emergency Response Plan Implementation Procedures attached are for inclusion in your manual. Please incorporate these changes and return this form, signed and dated.

Procedure 4.4.7.6 Revision 2
replace entire procedure
with attached

I have incorporated the above listed Emergency Response Plan Implementation Procedures into my manual.

Signed_____ Date_____

X005
1/1