

TITLE: MEANS OF ESTIMATING FISSION PRODUCT RELEASE FROM CORE

<u>Procedures</u>	<u>Titles</u>
4.4.7.1	CONTAINMENT RMS READING VERSUS TIME FOLLOWING ACCIDENTS
4.4.7.2	POST-ACCIDENT CONTAINMENT ATMOSPHERE SAMPLING AND ANALYSIS
4.4.7.3	POST-ACCIDENT REACTOR COOLANT SAMPLING
4.4.7.4	<u>POST-ACCIDENT REACTOR COOLANT ANALYSIS</u>
4.4.7.5	POST-ACCIDENT HYDROGEN ANALYSIS
4.4.7.6	POST-ACCIDENT SAMPLING SYSTEM & ANALYSIS

**TITLE: POST-ACCIDENT CONTAINMENT ATMOSPHERE SAMPLING****1.0 RESPONSIBLE INDIVIDUAL**

The Radiation Protection Director (RPD) is responsible for determining the need for performing post-accident containment atmosphere sampling.

Members of the Liquid Release Monitoring Team are responsible to the RPD for obtaining post-accident sample(s) (very high level radioactive samples) of containment atmosphere and for taking them to the Radiochemistry Laboratory (first priority), Calvert Cliffs Mobile Laboratory No. 1 (second priority), or those laboratories listed on ERPIP Exhibit 4.2-D.

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 RPD. (Reference ERPIP 4.3.1, Emergency Work Permits and Exposure Control).

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 Containment Radiation Monitoring System (RE 5316 (range 10E-4 to 10 R/h); RE 5317 (range 1 to 1E8 R/h)) indicate 200 m R/h.

- 2.2 When directed by RPD.
- 2.3 Hydrogen analysis samples taken pursuant to this procedure are to be repeated on a routine basis as necessary, to determine activity levels and trends.
- 2.4 Very high level radioactive samples are so designated, if exposure rate level is greater than 2.0 R/h on contact.

- NOTE -

Lead lined gloves, finger rings, lapel samples, plastic hoods, SCBA, and High Range gamma exposure rate meter and pocket dosimeter shall be worn to take the RCS samples (Reference EWP #003 ERPIP Exhibit 4.8.1-D).

- 2.5 Obtaining a containment atmosphere sample shall be planned to be performed promptly (within one hour) under accident conditions without incurring a radiation exposure to individual(s) in excess of 3 and 18.75 rem (10 CFR 20) to the whole body or extremities, respectively. Exposures shall not exceed 5 rem and 75 rem (Appendix A, 10 CFR 50) to the whole body or extremities, respectively.

### 3.0 ACTIONS AND LIMITATIONS

RPD Name	Date	Time ERPIP INITIATED

- 3.1 Based on anticipated radiation exposure levels or gross area monitor readings (RMS), the RPD shall specify:
  - 3.1.1 The use of Emergency Work Permit, EWP #003, for post-accident sampling.

- 3.1.3 Alternate routes if necessary.
  - 3.1.4 Designated doors to open and shut to retrieve samples, existing radiation barriers, and maximum stay times.
  - 3.1.5 Authorized personnel radiation exposure limits for each entry on EWP #003.
  - 3.1.6 Labeling of samples performed prior to entry. Sample data to be recorded on EXHIBIT 4.4.7.3-A, "Accident Sample and Analysis Data Sheet."
  - 3.1.7 The collection of the following:
    - 3.1.7.1 Accident Sampling Kit (Located in Radiochemistry Laboratory),
    - 3.1.7.2 Lead Pig, and
    - 3.1.7.3 Transport Cart.
- 3.2 The ERMT member and LRMT member shall jointly carry out monitoring and collection of very high, level sample(s) as follows and document on EXHIBIT 4.4.7.3-A, "Accident RCS Sample and Analysis Data Sheet," as appropriate, upon completion of reentry sampling.

ERMT Member

LRMT Member

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

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

3.2.2.2 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

3.2.2.3 Collect the following material from the Emergency Reentry Equip. 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 PAHAS #75 ( )
2. Accident Coolant Sampling Kit ( )
3. Inventory prior to entry ( )
4. Lead Gloves ( )
5. Lead Pig for Sample ( )
6. Transport Cart ( )

\_\_\_\_\_/\_\_\_\_\_  
ERMT Name Time

\_\_\_\_\_/\_\_\_\_\_  
LRMT Name Time

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

3.2.2.5 Don protective clothing, dosimetry and respiratory protection devices, label air samples as specified on EWP #003. (Clothing and monitoring equipment located in the Emergency Reentry Equipment Locker, 69<sup>th</sup> Aux. Building for preaugmentation use).

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

\_\_\_\_\_/\_\_\_\_\_  
Initial Time

ERMT Member

LRMT Member

- 3.2.2.7 When directed by the RPD, proceed to the Post-Accident Hydrogen Analyzer System access area on the 45' elevation of the Aux. Building west side.
- 3.2.2.8 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.

**-CAUTION-**

**PERMANENT LEAD SHIELDING HAS BEEN PLACED IN THE HYDROGEN ANALYZER. MAXIMUM EFFORT SHOULD BE MADE BY THE INDIVIDUAL PERFORMING THE ANALYSIS TO UTILIZE THIS SHIELDING TO REDUCE HIS RADIATION EXPOSURE. DO NOT ENTER BEHIND THE SHIELDS.**

**- NOTE -**

The following sections (3.2.2.9 and 3.2.2.11) of the procedure deal with the operation of the Post Accident Hydrogen Analyzer System. In order to sample the containment atmosphere, the hydrogen analyzer must be in service. Therefore, every effort should be made to obtain the required containment atmosphere sample during the hydrogen analysis whenever practical.

- 3.2.2.9 Operation of the Post Accident Hydrogen Analyzer to enable containment atmosphere grab sampling.
- 3.2.2.10 Containment Atmosphere Sample Grab in the Respective Units Chemistry Sample Room (See Attachment 4).

Ensure sampling area has been prepared as follows:

Ensure that all sample lines are isolated by turning all the sample flow cells OFF except for DI-6450 (PS-169).

ERMT Member

LRMT Member

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

2. PIC-6A and RO-7 (0-20K R/h scale probe) turned on to high scale and placed on transport cart behind shield.

2a. Provide continuous monitoring coverage during remaining sample steps. Ensure lapel air samplers are turned on.

2b. Record exposure rates and time during each step performed.

R/h \_\_\_ Time \_\_\_

2c. R/h \_\_\_ Time \_\_\_

2d. R/h \_\_\_ Time \_\_\_

2e. R/h \_\_\_ Time \_\_\_

2f. R/h \_\_\_ Time \_\_\_

2g. R/h \_\_\_ Time \_\_\_

2h. R/h \_\_\_ Time \_\_\_

Perform the following to obtain a containment atmosphere sample: (Ensure sample sink hood ventilation fan is ON and operating).

Using the remote handling tool OPEN the isolation valves to the sample point (See Attachment 4).

Permit the sample point to be purged a minimum of two minutes. Stand behind the shield during the purging.

Quickly, obtain atmosphere sample by placing syringe (5 cc) into the sample point and filling.

After filling the syringe, place it in the lead container. Close the lid.

Close the Sample Point Isolation Valves. Depart with ERMT member and shielded sample.

ERMT Member

LRMT Member

3. Promptly exit Sample Room with LRMT member and sample cart and radiac instrumentation.

3.2.2.11 After containment atmosphere grab sampling has been obtained, place the hydrogen analyzer in **STANDBY** mode.

- a. Switch the functional selector switch back to **STANDBY**.
- b. Close all key operated gas sample valves.
- c. Turn all switches on the sequencer to **OFF**.
- d. Close the containment or plant vent discharge line.

3.2.2.12 **EXIT THE AREA AS SOON AS POSSIBLE.**

1. 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.

Deposit sample in Chemistry Hot Laboratory or as directed by RPD for analysis in accordance with ERPIP 4.4.7.4.

2. Ensure personnel exposure data has been recorded on EXHIBIT 4.8.1.

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 4.4.7 with the sample for analysis.



## 4.0 PROCEDURE

### 4.1 Apparatus

- 4.1.1 The control panel, IC139, located on the -5' elevation of the Auxiliary Building contains all alarm indications, flow meters, and calibration controls.
- 4.1.2 The control panel, IC101, located on the 45' elevation of the Auxiliary Building contains all of the valve controls and the sample sequences necessary to analyze a sample (See Attachment 1).

### 4.2 Method

- 4.2.1 Proceed to the control panel IC101 on the 45' elevation of the Auxiliary Building with key #75 to analyze a sample of containment air for hydrogen content.
- 4.2.2 Verify that the power is "ON" and the analyzer is in the "STANDBY" mode.

#### - NOTE -

If the analyzer is not in "STANDBY" or analyze, then it will be necessary to wait six (6) hours to allow the heater blocks to be at the correct temperature.

#### - NOTE -

If the panel is in an alarm condition, press the reset button. If it does not reset, reset control to the panel by depressing the remote button and push reset button. Repeat at least three (3) times. If it still does not reset, notify the RPD that entry into the -5 elevation may be required to determine the cause of the alarm.

- 4.3 Place the purge selector switch to ON.
- 4.4 To obtain a sample from containment, it will be necessary to open both the inboard and outboard key operated valves of the intended sample point. These are listed on Attachment 3. In addition, the inboard and outboard (sample key operated valves on the return to U-1 Containment (1-HS-6540G) must also be opened.
- 4.5 If any other point is to be analyzed, only the sample sequencer switch and the discharge to the plant vent valves must be open.
- 4.6 Place the Sequencer Switch to manual and purge the system for 15 minutes (minimum). Remain in a low dose rate area while purging is in progress.

- CAUTION

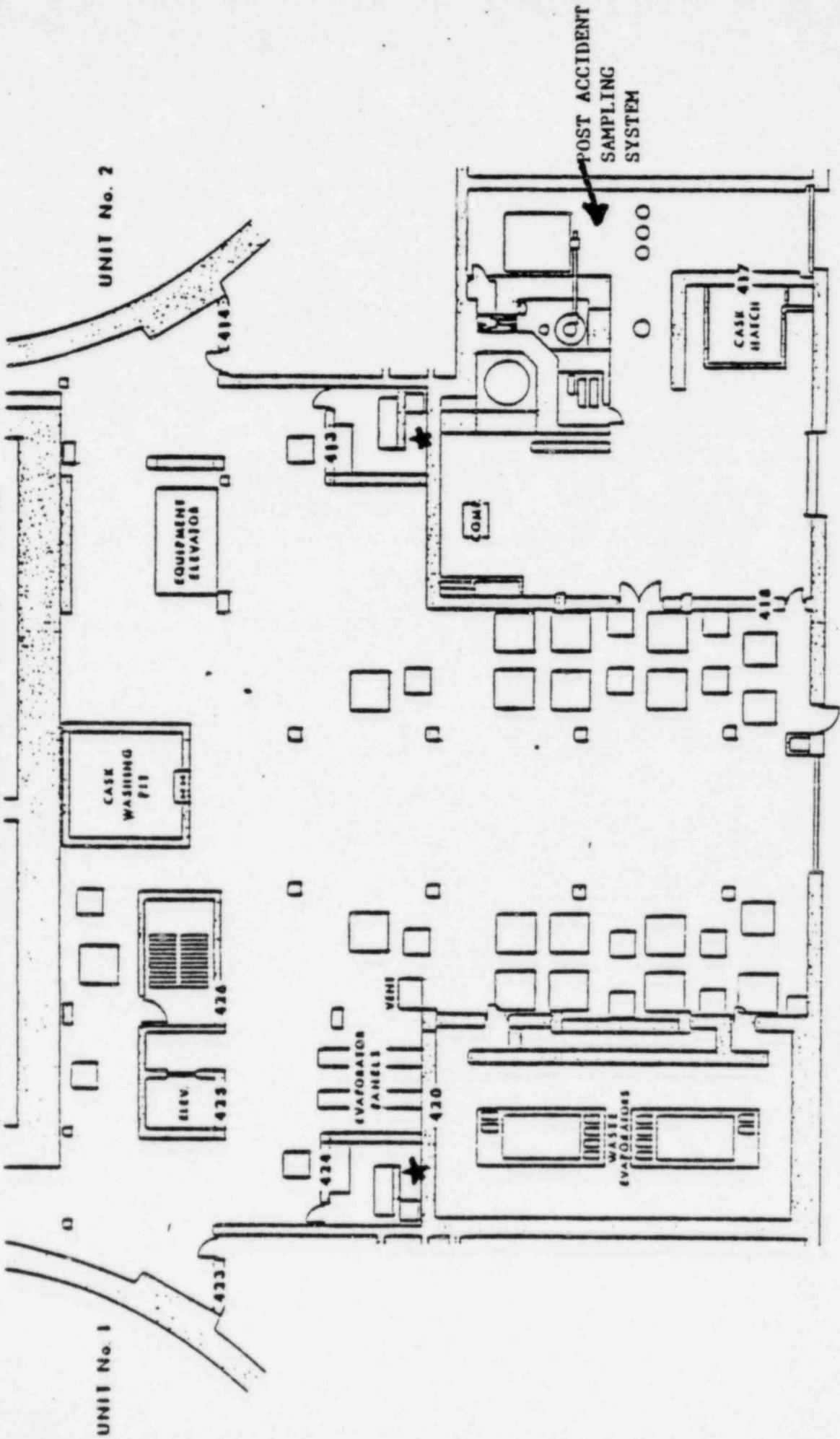
The containment gas pump can only operate  
for 200 hours of continuous duty.

5.0 REPORTING

- 5.1 Report promptly and verbally preliminary data obtained during entry to the RPD. Brief RPD on the following as a minimum.
  - 5.1.1 Exposures received by reentry personnel (SRD-type data)
  - 5.1.2 Exposure rates measured enroute to sample room & maximum exposure rates measured within sample room during entry.
- 5.2 Collect lapel air samples & send to counting laboratory for analysis.
- 5.3 Report to RPD for full debriefing and provide copy of completed data shown on Attachment 4.4.7.3-

ATTACHMENT 1

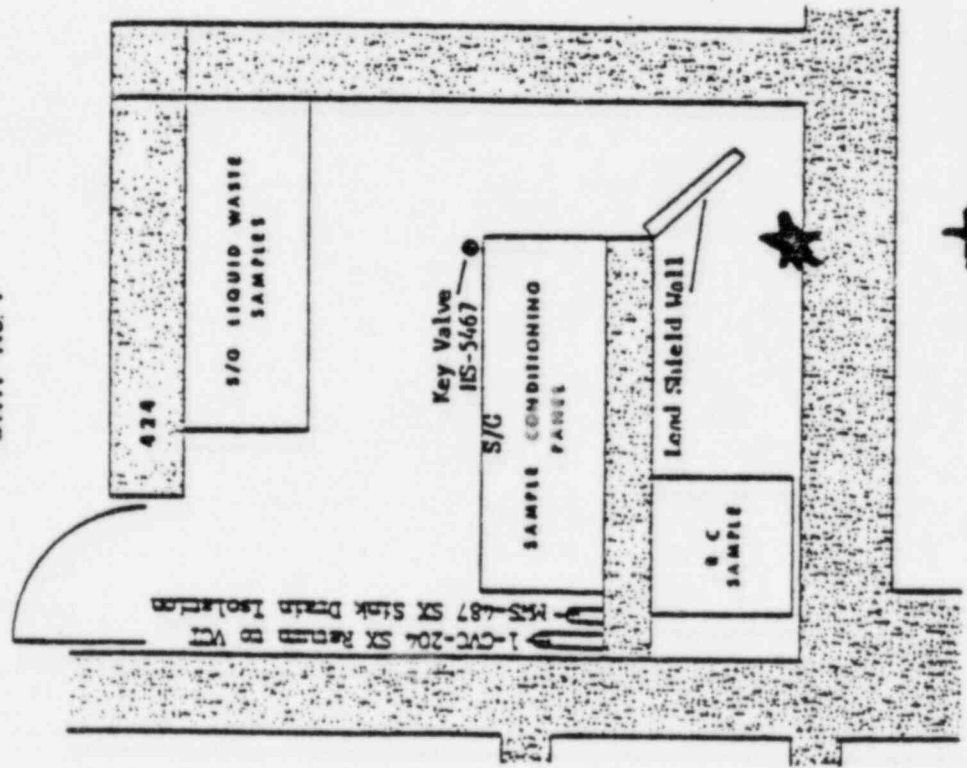
45 FT. ELEVATION AUXILIARY BUILDING: SIFTING SAMPLING RIGS NO. 424 & 413



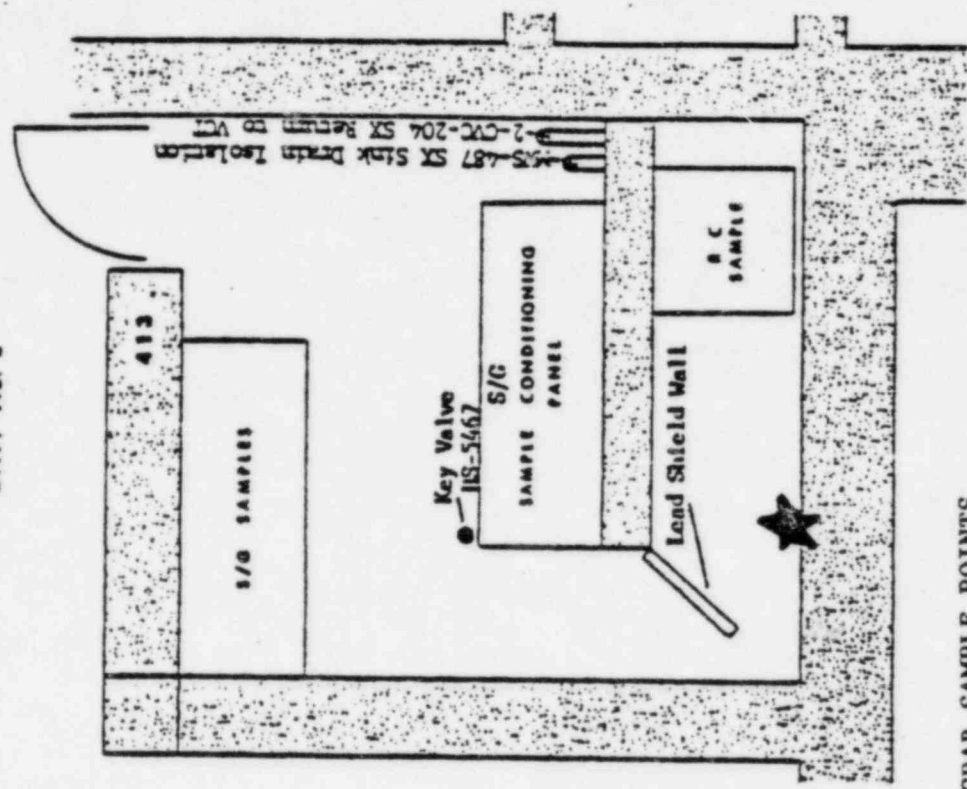
★ CONTAINMENT ATMOSPHERE GRAB SAMPLE POINTS

ATTACHMENT 2

UNIT No. 1



UNIT No. 2



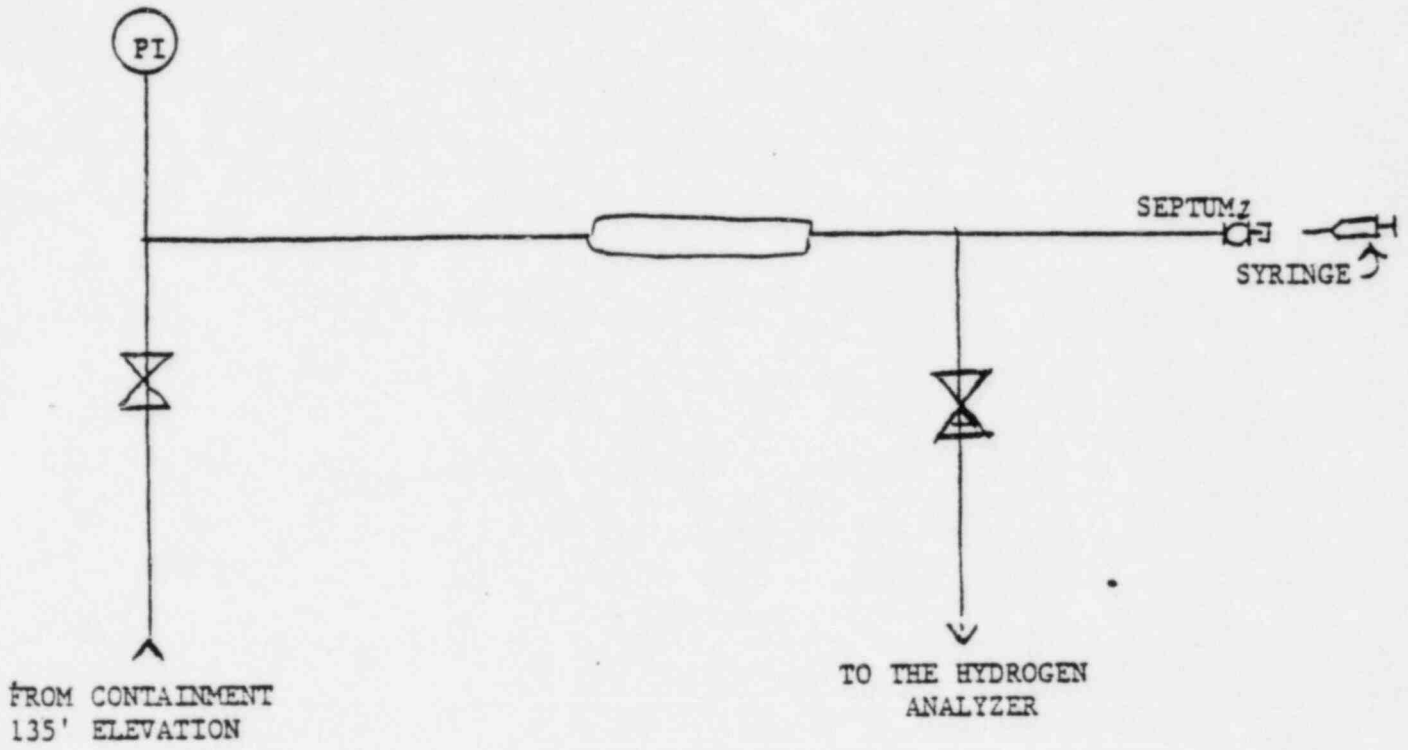
CONTAINMENT ATMOSPHERE GRAB SAMPLE POINTS

ATTACHMENT 3KEY OPERATED VALVES

<u>SAMPLE POINT</u>	<u>INBOARD</u>	<u>OUTBOARD</u>
CNTMT 1 SOUTH PRIMARY SHIELD	6507B	6540B
CNTMT 1 PRESSURIZER	6507C	6540C
CNTMT 1 135' ELEVATION	6507D	6540D
CNTMT 2 NORTH PRIMARY SHIELD	6507A	6540A
CNTMT 2 WEST 135' ELEVATION	6507E	6540E
CNTMT 2 DOME 189' ELEVATION	6507F	6540F
CNTMT 1 RETURN	6507G	6540G

ATTACHMENT 4

SAMPLE POINT VALVE ARRANGEMENT





CALVERT CLIFFS NUCLEAR POWER PLANT  
EMERGENCY RESPONSE PLAN  
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES

<u>ERPIP PAGE</u>	<u>REV</u>
4.4.7.2-1	9
4.4.7.2-2	9
4.4.7.2-3	9
4.4.7.2-4	9
4.4.7.2-5	9
4.4.7.2-6	9
4.4.7.2-7	9
4.4.7.2-8	9
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4.4.7.2-10	9
4.4.7.2-11	9
4.4.7.2-12	9
4.4.7.2-13	9



TITLE: POST-ACCIDENT HYDROGEN ANALYSIS1.0 RESPONSIBLE INDIVIDUAL

The Radiation Protection Director (RPD) is responsible for determining the need for performing post-accident hydrogen analysis.

Members of the Liquid Release Monitoring Team are responsible to the RPD for measuring hydrogen in various systems using the Post-Accident Hydrogen Analyzer System (PAHAS).

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 RPD. (Reference ERPIP 4.8.1, Emergency Work Permits and Exposure Control).

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  $1 \times 10^5$  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 When directed by RPD.
- 2.3 Hydrogen analysis samples taken pursuant to this procedure are to be repeated on a routine basis as necessary, to determine trends.
- 2.4 While utilizing the Post-Accident Hydrogen Analyzer, the Hydrogen Analysis shall be planned to be performed promptly (~ one hour) under accident conditions without incurring a radiation exposure to individual(s) in excess of 3 and 18.75 rem (10CFR20) to the whole body or extremities, respectively. Exposures shall not exceed 5 rem and 75 rem (Appendix A, 10CFR50) to the whole body or extremities, respectively.

### 3.0 ACTIONS AND LIMITATIONS

RPD Name	Date	Time ERPIP INITIATED
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- 3.1 Based on anticipated radiation exposure levels or gross area monitor readings (RMS), the RPD shall specify:
  - 3.1.1 The use of Emergency Work Permit, EWP #003, for post-accident sampling.
  - 3.1.2 Entries made for Hydrogen Analysis are to be made in accordance with ERPIP 4.8.1.
  - 3.1.3 Alternate routes if necessary.
  - 3.1.4 Designated doors to open and shut during access and egress, existing radiation barriers, and maximum stay times.
  - 3.1.5 Authorized personnel radiation exposure limits for each entry on EWP #003.
- 3.2 The ERMT member and LRMT member shall jointly carry out monitoring and hydrogen analysis activities.

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

3.2.1.1 Receive briefing by RPD, per items 3.1.1 thru 3.1.5 above.

3.2.1.2 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

3.2.1.3 Collect the following material from the Emergency Reentry Equip. Locker: (check when performed)

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

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

1. Key for the PAHAS #75 ( )

\_\_\_\_\_/\_\_\_\_\_  
ERMT Name Time

\_\_\_\_\_/\_\_\_\_\_  
LRMT Name Time

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

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

3.2.1.6 When directed by the RPD, proceed to the Post-Accident Hydrogen Analyzer System access area on the 45' elevation of the Aux. Building west side.

3.2.1.7 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.

Follow directions of ERMT member to ensure your exposure is maintained ALARA.

ERMT Member

LRMT Member

-CAUTION-

PERMANENT LEAD SHIELDING HAS BEEN PLACED IN THE PAHAS. MAXIMUM EFFORT SHOULD BE MADE BY THE INDIVIDUAL PERFORMING THE ANALYSIS TO UTILIZE THIS SHIELDING TO REDUCE HIS RADIATION EXPOSURE.

#### 4.0 PROCEDURE

##### 4.1 Apparatus

- 4.1.1 The control panels, IC139 and IC140, located on the -5' elevation of the Auxiliary Building contains all alarm indications, flow meters, calibration gases, and flow controls.
- 4.1.2 The control panels, IC101 and IC102, located on the 45' elevation of the Auxiliary Building contains all of the valve controls and the sample sequences necessary to analyze a sample.

##### 4.2 Method

- 4.2.1 Proceed to the control panel IC101 and IC102 located on the 45' elevation of the Auxiliary building.
- 4.2.2 Verify that the power is "ON" and the Control Modul is in the "STANDBY" mode on both IC101 and IC102.

- NOTE -

If the analyzer is not in "STANDBY" or analyze, then it will be necessary to wait six (6) hours to allow the heater blocks to be at the correct temperature.

- NOTE -

If the panel is in an alarm condition, press the reset button. If it does not reset, reset establish control to the panel by depressing the remote selector button and then push the reset button. If necessary, repeat at least three (3) times. If it still does not reset, notify the RPD that entry into the -5 elevation will be required to determine the cause of the alarm.

- 4.2.3 Check the response of the hydrogen monitor by the following steps (Record all response data on Attachment 1):
- 4.2.3.1 On the H<sub>2</sub> Sequencer Panels place the purge selector switch to "ON".
  - 4.2.3.2 Using the key #75 open the discharge plant vent valves O-SV-6513 and O-SV-6522 on control panels IC101 and IC102, respectively.
  - 4.2.3.3 On the H<sub>2</sub> Control Moduals
    - (a) Verify H<sub>2</sub> dual range switch is at 0-10% range
    - (b) Set function selector switch to zero
    - (c) Adjust control switch from "STANDBY" to "ANALYZE"

- NOTE -

At this time the light indicators for the sequencer and the H<sub>2</sub> Control Module should light. If the function selector switch and indicator do not agree, press the REMOTE SELECTOR to gain control. Also press the reset alarm button to clear any alarms.

- 4.2.3.4 Egress from the area and allow the instrument to stabilize for 10 minutes minimum.

- 4.2.3.5 Return to the control panels and record the hydrogen meter values.
- 4.2.3.6 Adjust the function selector for "ZERO" to "SPAN".

- NOTE -

The high Hydrogen alarm will alarm at 4%. After span check is complete, set function selector to zero, reset alarm and continue with the procedure.

- 4.2.3.7 Egress from the area and allow the instrument to stabilize for 10 minutes minimum.
- 4.2.3.8 Return to the control panels and record the hydrogen meter values.

- NOTE -

The zero and span should have read 0 and 10%, respectively  $\pm 1\%$ . If the values observed were outside the tolerance, the instruments should be considered as being out of calibration. If this condition exists, report to the RPD the data recorded.

- 4.2.4 On the H<sub>2</sub> Control Module adjust the function selector to "STANDBY".
- 4.2.5 On the H<sub>2</sub> sequencers adjust the purge selector to "OFF".
- 4.2.6 "SHUT" the main vent key operated discharge valves O-SV-6513 and O-SV-6522.
- 4.2.7 Unit #1 Containment Sample Valve Line-Up (See attachment #2).
  - 4.2.7.1 Unless otherwise directed, "OPEN" all the key operated in board and out board valves listed below.

PANEL 1C101

Containment #1 S. Primary Shield	6507 B/6540 B
Containment #1 Pressurize Compartment	6507 C/6540 C
Containment #1 E. 135" EL.	6507 D/6540 D
Containment #1 H <sub>2</sub> Sample Return	6507 G/6540 G

PANEL 1C102

Containment #1 N. Primary Shield	6507 A/6540 A
Containment #1 W. 135' EL.	6507 E/6540 E
Containment #1 DOME 189" EL.	6507 F/6540 F

4.2.7.2 Position the Sequencer Sample points listed below in the "AUTO-ON" position.

PANEL 1C101

Sample #5 U-1 Containment E. 135' EL.  
 Sample #6 U-1 Containment Pressurizer  
 Sample #7 U-1 Containment S. Primary Shield

PANEL 1C102

Sample #5 U-1 Containment N. Primary Shield  
 Sample #6 U-1 Containment W. 135' EL.  
 Sample #7 U-1 Containment DOME 189' EL.

4.2.8 Unit #2 Containment Sample Valve Line-UP (See attachment # )

4.2.8.1 Unless otherwise directed, "OPEN" all the key operated in board and out board valves listed below.

PANEL 1C101

Containment #2 North Primary Shield	6507 A/6540 A
Containment #2 W. 135' EL.	6507 E/6540 E
Containment #2 DOME 189' EL.	6507 F/6540 F

PANEL IC102

Containment #2 S. Primary Shield	6507 B/6540 B
Containment #2 Pressurizer Compartment	6507 C/6540 B
Containment #2 E. 135' EL.	6507 D/6540 D
Containment #2 H <sub>2</sub> Sample Return	6507 G/6540 G

4.2.8.2 Position the sequencer sample points listed below in the "AUTO-ON" position.

PANEL IC101

Sample #8 U-2 Containment DOME 189' EL.  
 Sample #9 U-2 Containment W. 135' EL.  
 Sample #10 U-2 Containment N. Primary Shield

PANEL IC102

Sample #8 U-2 Containment S. Primary Shield  
 Sample #9 U-2 Containment Pressurizer  
 Sample #10 U-2 Containment E. 135' EL.

- 4.2.9 On the H<sub>2</sub> Control Modules adjust the control from "STANDBY" to "ANALYZE".
- 4.2.10 On the H<sub>2</sub> Control Module(s) adjust the function selector to "SAMPLE" and egress the area as soon as possible.

- NOTE -

If necessary, clear the communication alarm indication before leaving the area by pressing the alarm-reset button. The sequencer will not function if the purge selection is in the "ON" position.



- NOTE -

If the selector is placed in Auto-On, then the sequencer will purge and sample for fifteen (15) minutes and proceed to the next point. If the selector is placed in manual, then the sequencer will hold on that point when the sequencer advances to that point. The Control room recorders will provide the data printout of the H<sub>2</sub> analyzer results.

- CAUTION -

The containment gas pump should only operated for 200 hours before maintenance is required.

- 4.2.11 When the RPD no longer requires hydrogen analysis place the unit in "STANDBY" mode. Record all steps on Attachment I.
- (a) Switch the functional selector switch on the H<sub>2</sub> Control Module back to "STANDBY".
  - (b) Close all key operated gas sample valves.
  - (c) Turn all switches on the sequencer to "OFF".
- 4.2.12 Close the containment or plant vent discharge line. Egress the area as soon as practical.

5.0 REPORTING

- 5.1 Report promptly and verbally preliminary data obtained during entry to the RPD. Brief RPD on the following as a minimum.
- 5.1.1 Exposures received by reentry personnel (SRD-type data)
  - 5.1.2 Exposure rates measured enroute to sample room & maximum exposure rates measured within sample room during entry.
- 5.2 Collect lapel air samples & send to counting laboratory for analysis.
- 5.3 Report to RPD for full debriefing and provide copy of completed data shown on Attachment I.
- 5.4 If the control room recorders are not functioning manual data collection may be requested. Manual data should be recorded on attachment #4.

ATTACHMENT 1

I. Hydrogen Monitor Response Check

INITIALS/TIME

- |   |                  |                  |               |
|---|------------------|------------------|---------------|
| 1. Purge Selector Placed "ON"                       |                  |                  | _____ / _____ |
| 2. Open Valve 0-SV-6513 and 0-SV-6522               |                  |                  | _____ / _____ |
| 3. Place Hydrogen Analyzer Selector to 0-10% range: |                  |                  |               |
| Zero Value as found                                 | IC101<br>_____ % | IC102<br>_____ % | _____ / _____ |
| Span Value as found                                 | _____ %          | _____ %          | _____ / _____ |

II. Placing the Hydrogen Analyzer in STANDBY Mode after Sampling.

- |  |               |
|--|---------------|
| 1. Switch Functional Selector Switch to STANDBY        | _____ / _____ |
| 2. Close all key operated valves                       | _____ / _____ |
| 3. Close the Containment or Plant Vent Discharge Lines | _____ / _____ |

Comments:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

PERFORMED BY \_\_\_\_\_ / \_\_\_\_\_  
 Signature Date

ATTACHMENT 2VALVE LINE UP CHECK LIST

U-1

Key Operated Valves

<u>SAMPLE POINT</u>		<u>INBOARD</u>	<u>OUTBOARD</u>
	— CNTMT # SOUTH PRIMARY SHIELD	6507B	6540B
1C101	— CNTMT # PRESSURIZER	6507C	6540C
	— CNTMT # 135' ELEVATION	6507D	6540D
	— CNTMT # NORTH PRIMARY SHIELD	6507A	6540A
1C102	— CNTMT # WEST 135' ELEVATION	6507E	6540E
	— CNTMT # DOME 189' ELEVATION	6507F	6540F

Sequencer Line-Ups (Auto-ON)

— Samples 5  
 — Samples 6 on 1C101 AND 1C102  
 — Samples 7

Initials  
\_\_\_\_\_Time/Date  
\_\_\_\_\_ / \_\_\_\_\_

ATTACHMENT 3

VALVE LINE UP CHECK LIST

U-2

Key Operated Valves

	<u>SAMPLE POINT</u>	<u>INBOARD</u>	<u>OUTBOARD</u>
1C101	— CNTMT # SOUTH PRIMARY SHIELD	6507B	6540B
	— CNTMT # PRESSURIZER	6507C	6540C
	— CNTMT # 135' ELEVATION	6507D	6540D
	— H <sub>2</sub> SX RETURN	6507G	6540G
1C102	— CNTMT # NORTH PRIMARY SHIELD	6507A	6540A
	— CNTMT # WEST 135' ELEVATION	6507E	6540E
	— CNTMT # DOME 189' ELEVATION	6507F	6540F

Sequencer Line-Ups (Auto-ON)

- Samples 8
- Samples 9 on 1C101 AND 1C102
- Samples 10

Initials

Time/Date

ATTACHMENT 4  
SEQUENCER SAMPLE POINTS

<u>POINT #</u>	<u>SAMPLE POINT</u>	<u>HYDROGEN READING</u>	<u>INITIAL/TIME</u>
1	RC Monitor Tank #11	_____ %	_____ / _____
2	RC Receiver Tank #12	_____ %	_____ / _____
3	RC Monitor Tank #12	_____ %	_____ / _____
4	RC Receiver Tank #11	_____ %	_____ / _____
5	U-1 CNTMT 135' EI	_____ %	_____ / _____
6	U-1 CNTMT PRZR	_____ %	_____ / _____
7	U-1 CNTMT South Primary Shield	_____ %	_____ / _____
8	U-2 CNTMT Dome 139' EI	_____ %	_____ / _____
9	U-2 CNTMT West	_____ %	_____ / _____
10	U-2 CNTMT North Primary Shield	_____ %	_____ / _____

PERFORMED BY: \_\_\_\_\_ / \_\_\_\_\_  
Signature Date

CALVERT CLIFFS NUCLEAR POWER PLANT  
EMERGENCY RESPONSE PLAN  
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES

<u>ERPIP PAGE</u>	<u>REV</u>
4.4.7.6-1	0
4.4.7.6-2	0
4.4.7.6-3	0
4.4.7.6-4	0
4.4.7.6-5	0
4.4.7.6-6	0
4.4.7.6-7	0
4.4.7.6-8	0
4.4.7.6-9	0
4.4.7.6-10	0
4.4.7.6-11	0
4.4.7.6-12	0
4.4.7.6-13	0
4.4.7.6-14	0
4.4.7.6-15	0
4.4.7.6-16	0
4.4.7.6-17	0
4.4.7.6-18	0
4.4.7.6-19	0
4.4.7.6-20	0
4.4.7.6-21	0
4.4.7.6-22	0
4.4.7.6-23	0
4.4.7.6-24	0
4.4.7.6-25	0
4.4.7.6-26	0
4.4.7.6-27	0
4.4.7.6-28	0
4.4.7.6-29	0
4.4.7.6-30	0
4.4.7.6-31	0
4.4.7.6-32	0
4.4.7.6-33	0
4.4.7.6-34	0
4.4.7.6-35	0
4.4.7.6-36	0
4.4.7.6-37	0
4.4.7.6-38	0
4.4.7.6-39	0
4.4.7.6-40	0
4.4.7.6-41	0
4.4.7.6-42	0







CALVERT CLIFFS NUCLEAR POWER PLANT  
EMERGENCY RESPONSE PLAN  
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES

<u>ERPIP PAGE</u>	<u>REV</u>
4.4.7.5-1	0
4.4.7.5-2	0
4.4.7.5-3	0
4.4.7.5-4	0
4.4.7.5-5	0
4.4.7.5-6	0
4.4.7.5-7	0
4.4.7.5-8	0
4.4.7.5-9	0
4.4.7.5-10	0
4.4.7.5-11	0
4.4.7.5-12	0
4.4.7.5-13	0

TITLE: POST-ACCIDENT SAMPLING SYSTEM AND ANALYSIS1.0 RESPONSIBLE INDIVIDUAL

The Radiation Protection Director (RPD) is responsible for determining the need for performing post-accident reactor coolant sampling using the Post Accident Sampling System (PASS).

Members of the Liquid Release Monitoring Team are responsible to the RPD for obtaining post-accident sample(s) (very high level radioactive samples) of reactor coolant and analyzing them with the PASS. The LRMT is responsible for obtaining Diluted Reactor Coolant Samples with the PASS and for taking them to the Radiochemistry Laboratory (first priority), Calvert Cliffs Mobile Laboratory No. 1 (second priority), or those laboratories listed on ERPIP Exhibit 4.2-D.

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 RPD. (Reference ERPIP 4.3.1, Emergency Work Permits and Exposure Control).

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  $1 \times 10^5$  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 When directed by RPD.

- 2.3 RCS samples taken pursuant to this procedure are to be repeated on a routine basis every hour as necessary, to determine activity levels and trends.

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

- NOTE -

Lead lined gloves, finger rings, lapel samples, plastic hoods, SCBA and High Range gamma exposure rate meter and pocket dosimeter shall be worn to take the RCS samples (Reference EWP #003 ERPIP Exhibit 4.8.1-D).

- 2.5 Obtaining a reactor coolant sample shall be planned to be performed promptly (~one hour) under accident conditions without incurring a radiation exposure to individual(s) in excess of 3 and 18.75 rem (10CFR20) to the whole body or extremities, respectively. Exposures shall not exceed 5 rem and 75 rem (Appendix A, 10CFR50) to the whole body or extremities, respectively.

3.0 ACTIONS AND LIMITATIONS

RPD Name	Date	Time ERPIP INITIATED
----------	------	----------------------

- 3.1 Based on anticipated radiation exposure levels or gross area monitor readings (RMS), the RPD shall specify:

- 3.1.1 The use of Emergency Work Permit, EWP #003, for post-accident sampling of reactor coolant.
- 3.1.2 Entries made for RCS coolant samples are to be made in accordance with ERPIP 4.8.1.
- 3.1.3 Alternate routes if necessary.
- 3.1.4 Designated doors to open and shut to retrieve samples, existing radiation barriers, and maximum stay times.
- 3.1.5 Authorized personnel radiation exposure limits for each entry on EWP #003.
- 3.1.6 Label samples to be performed prior to entry. Sample data to be recorded on Attachment 2, "Accident Coolant Sample and Analysis Data Sheet."
- 3.1.7 The collection of the following:
  - 3.1.7.1 Post Accident Coolant Sampling Kit (Located in Radiochemistry Laboratory)
  - 3.1.7.2 Lead Pig
  - 3.1.7.3 Transport cart
- 3.2 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 2, "Post Accident Sample and Analysis Data Sheet," as appropriate, upon completion of reentry sampling.

ERMT Member

LRMT Member

3.2.1 Upon direction by the RPD, contact the Control Room and request that the Post Accident System Reactor Coolant Sample Isolation Valves be OPENED. (PS-519/PS-520 for Unit 1 and PS-523/PS-524 for Unit 2).

Request the Containment Sample Return Line Isolation Valves be opened.  
Control Rm Contacted: \_\_\_\_\_ / \_\_\_\_\_  
Initial Date

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

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

3.2.2.2 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

3.2.2.3 Collect the following material from the Emergency Reentry Equip. Locker: (check when performed)

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

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

1. Keys for the PASS RCS & H<sub>2</sub> System ( )
2. Accident Coolant Sampling Kit ( )
3. Inventory prior to entry ( )
4. Lead gloves ( )
5. Lead pig for sample ( )
6. Transport cart ( )

\_\_\_\_\_/\_\_\_\_\_  
ERMT Name Time

\_\_\_\_\_/\_\_\_\_\_  
LRMT Name Time

ERMT Member

LRMT Member

- 3.2.2.4 Prepare map showing route and expected radiological conditions - attach to EWP #003
- 3.2.2.5 Don protective clothing, dosimetry and respiratory protection devices, label air samples as specified on EWP #003. (Clothing and monitoring equipment located in the Emergency Reentry Equipment Locker, 69' Aux. Building for preaugmentation use).
- 3.2.2.6 Ensure personnel monitoring equipment and operational radiac instruments are placed on transport cart prior to entry.

Initial	Time

- 3.2.2.7 When directed by the RPD, proceed to the Post Accident Sampling System access area on the 45' elevation of the Aux. Building west side.
- 3.2.2.8 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.
- 3.2.2.9 Prior to entry into the Post Accident Sampling area, review section 3.2.2.10, 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.**

- 3.2.2.10 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 are in the "ON" position.

## ERMT Member

## LRMT Member

- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Transport cart carrying open lead container and equipment located outside of shield wall and easily accessible for receipt of the very high level coolant sample.</li> <li>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.</li> <li>3. Ensure that Lapel Air Samplers are turned on.</li> </ol> | <ol style="list-style-type: none"> <li>2. Verify that the valve switch positions and manual valves are in "NORMAL" line-up positions and energized per Attachment I.</li> <li>3. Perform Sample Analysis and obtain samples as per Section 4.0.</li> </ol> |
|--|--|

4.0

PASS OPERATING PROCEDURES

NOTE: Sections 4.1 - 4.3 are operational checks of the system.

4.1 Nitrogen Purge and Fill of the Gas Sample Vessel

- 4.1.1 Open CV-5015, CV-5018, and CV-5023 at the PASS control panel.
- 4.1.2 Open CV-5002 (rotate and push the switch), CV-5026, CV-5010, and position CV-5013 to GAS SAMPLE position.
- 4.1.3 Open CV-5030, CV-5025, and slowly open CV-5044 (via PS-125 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.
- 4.1.4 Turn the Sample Circulation Pump "ON" to purge and establish a nitrogen blanket for this portion of the system.
- 4.1.5 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.



- 4.1.6 Purge system for 2 to 3 minutes, then open CV-5014, CV-5016, and close CV-5015.
- 4.1.7 Verify flow as above (4.1.6).
- 4.1.8 After five minutes of purge flow, switch the sample circulation pump "OFF" and close CV-5044. Position PS-519/PS-520 (for Unit 1) or PS-523/PS-524 (for Unit 2) to BOTH VALVES SHUT position and slowly reopen PI-5044 to obtain 5 to 10 psig on PI-5025.
- 4.1.9 Close CV-5014 and CV-5015. The Gas Sample Vessel is now charged.
- 4.1.10 Verify that all valves controlled from the control panel are returned to their normal line-up positions given in Attachment I.

#### 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. Open 1-SV-6529 (for Unit 1) or 2-SV-6529 (for Unit 2) CV-5011, CV-5010, and fully open CV-5012.
- 4.2.2 Open 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 levels are observed on LI-5031 or LI-5028, skip the following sections 4.3 and 4.4, respectively, return all valves to normal line-up (Attachment I) and proceed to 4.5.

4.2.5 Close the liquid return line to the containment. Close 1-SV-6529 (for Unit 1) or 2-SV-6529 (for Unit 2).

4.3 Demineralized Water Fill of the Loop Seal and Burette

4.3.1 Vent the Surge Vessel by slowly opening PS-108 (located below funnel at the left rear side of the sample station).

4.3.2 From the control panel, slowly open CV-5031 to fill the loop seal and the burette to a level of between 0 and 5% as read on LI-5031. Then close CV-5031.

- 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%).

- NOTE -

If no level is observed on LI-5028, (Depressurized Liquid Sample Vessel), proceed to Section 4.4.

4.3.3 Close PS-108.

- NOTE -

If a level is observed, then verify that all valves are positioned to their Normal Valve Line-up and proceed to Section 4.5.

4.4 Demineralized Water Fill of the Depressurized Liquid Sample Vessel

- 4.4.1 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).
- 4.4.2 Position CV-5028 to SAMPLE PATH position and open CV-5032 to vent the vessel (LI-5028 will stabilize after satisfactory venting).
- 4.4.3 On the control panel, close CV-5032 and CV-5006.
- 4.4.4 Close PS-108 (located below the funnel at the left rear side of the sample station).

- NOTE -

Return all valves to the normal line-up as given in Attachment I 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 their normal line-up as given in Attachment I.

- 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 PS-127 and/or PS-129 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 pressure condition prior to attempting to sample.

- CAUTION (B) -

If during sampling, PS-504 high pressure alarm occurs, verify that CV-5002 closes (light control panel), isolate liquid sampling inlet lines, check LI-5032 level to determine if PS-128 has lifted. 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 1-HS-5105 or 2-SV-5107 (for Unit 2).

- 4.5.2 Open 1-SV-6529 (for Unit 1) or 1-SV-6529 (for Unit 2).
- 4.5.3 Open CV-5001 and open CV-5003 to approximately midposition.
- 4.5.4 To sample RCS hot leg, position 1-HS-5105/1-CV-5105 (for Unit 1) or 2-HS-5105/2-CV-5105 (for Unit 2) switch to PASS SYS. To sample the LPSI pump discharge, open 1-SV-5107 (for Unit 1) or 2-SV-5107 (for Unit 2).

- 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.

- 4.5.5 Fully open CV-5033. Open CV-5011, CV-5040, CV-5007, and CV-5004 (rotate and push switch). Contact the Control Room to open the containment RCS hot leg valves (or start the LPSI pump).
- 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 120° F (maximum).
- 4.5.7 Purge liquid in this manner for approximately five 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.
- 4.6.2 Close CV-5040 and 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 burette pressure from PI-5031 ( $P_{RCS}$ ).
- 4.6.5 Verify the TI-5001 reads less than 120°F, then slowly crack open CV-5031. Open CV-5002 (rotate and push switch), and CV-5026.
- 4.6.6 Fully open CV-5031.

- 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 (initial) and pressure PI-5031 ( $P_b$ ).

- 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 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 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.  $P_{RCS}$ , psig
4.  $P^B$ , psig
5. Final Temperature, °F

4.7 Dissolved H<sub>2</sub> and O<sub>2</sub> 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<sub>2</sub> and O<sub>2</sub> 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<sub>2</sub>% and O<sub>2</sub>%, the T (final), P(B) and V 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 sample analysis is 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 for three minutes to dilute the gas sample with nitrogen.
- 4.8.3 Stop the Sample Circulation Pump and record pressure at PI-5025 (P<sub>GS</sub>) 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.



If not already open,

- (a) From the Control Room position PS-519/PS-520 (for Unit 1) or PS-523/PS-524 (for Unit 2) to PASS SYS position.
- (b) If PI-5025 reading is greater than 0 psig, open CV-5018 and start the Containment Sample Pump and open Cv-5023. Close CV-5018 and stop the Containment Sample Pump when PI-5025 pressure reaches 0 psig. Close CV-5023.
- (c) Check open CV-5030 and slowly open CV-5044 to obtain a PI-5025 reading of 10 psig. Then close CV-5044.
- (d) Run the Sample Circulation Pump for three minutes to mix the added nitrogen with the sample. Stop the pump. Record PI-5025 ( $P_{G_s}$ ) 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 4.3.5 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.

4.3.5 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 4.3.4.(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 I.

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.
- 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 and CV-5003 as required to keep PI-5025 reading 2 psig higher than PI-5004 reading; adjust TI-5001 at 120°F (or other desired nominal operating temperature not to exceed 150°F)  $\pm$  10°F.
- 4.9.6 Open CV-5029 and then close CV-5011.
- 4.9.7 Adjust CV-5044 and CV-5003 as required to maintain PI-5025 reading 2 psig higher than PI-5004 reading and 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.

- 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 ( $\text{Na}_3\text{PO}_4 \cdot 12 \text{H}_2\text{O}$ ). (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 detector should 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, the proper conditions exist to conduct the required radioisotopic analysis as per RCP 2-105. The PASS RCS sample parameters at step 4.9.7 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.
- 4.11.2 Close CV-5040 and 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 3 psig, open CV-5031, 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-5031, 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:

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

- 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 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 5.12.5 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. (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.

- NOTE -

This sample should not be withdrawn until the remainder of the system is purged 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, position 1-HS-5015/1-CV-5105 (for Unit 1) or 2-HS-5015/2-CV-5105 (for Unit 2) to NORM SYS. 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, 4.3, 4.9, and 4.11 are prerequisites to this purging.

If not already open,

- (a) From the Control Room position PS-517/PS-518 (for Unit 1) or PS-521/PS-522 (for Unit 2) to NORM SYS position and close CV-5024.
- (b) Check CV-5013 in the TOTAL GAS position, open CV-5025, CV-5015, 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<sub>2</sub>.
- (d) After two minutes, close CV-5015 and open CV-5017 to purge this branch for thirty seconds.
- (e) Close CV-5044, CV-5017, 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, and CV-5005. Purge demineralized water in this manner for two minutes.
- (g) Fully open CV-5033, open CV-5011, close CV-5004, and slowly open 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. Purge in this manner for two minutes. Then close CV-5005 and



CV-5031. Turn off the Surge Vessel  
Pump and close CV-5034.

## 4.12.3 Diluted Sample Withdrawal

ERMT Member	LRMT Member
(a) Record dose rate in sample area prior to shield port removal	(a) This portion of the procedure addresses the withdrawal of the "diluted" reactor <u>coolant gas sample</u> obtained in step 4.8 and the "diluted" reactor coolant liquid sample obtained in step 4.11. The required materials for diluted sample withdrawal are three syringes (capacity of 5 ml (each) minimum and of length such that sample vessels can be sampled through the shield wall).
Dose Rate = _____ R/h	
Date/Time _____ / _____	
(b) Dose rate at Sample Port	(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 upper right hand port is for the Containment Sample Vessel; the lower port is for Depressurized Liquid Sample Vessel.
_____ R/hr	
Date/Time _____ / _____	
Dose Rate of Sample	
_____ R/hr	
Date/Time _____ / _____	
(c) Dose rate on outside of shield.	(c) Place the sample into lead container. Close container lid.
_____ R/hr	

ERMT Member

LRMT Member

(d) Promptly exit sample room with LRMT member and sample cart, and Radiac Instrumentation. Return to 69' Controlled Area.

RPD Notified          /          h

(d) Depart with ERMT member, taking sample cart and shielded sample

Time exited          /          h

(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.

(d) Contact Control Room and request that the PASS Sample Isolation Valves are SHUT.

Deposit sample in Chemistry Hot Laboratory or as directed by RPD for analysis in accordance with ERPIP 4.4.7.4.

(f) Ensure personnel exposure data has been recorded on EXHIBIT 4.8.1.

(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 2 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 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 CV-5033 and opening CV-5034 and running the Surge Vessel Pump.

- 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 Drain the burette by opening CV-5036 until a level of between 0 and 5% is obtained (as read on LI-5028). Close CV-5036.
- 4.13.5 Return all control panel valves to the position given in Attachment I, "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:  
 $V = \text{final ml} - \text{initial ml}$

#### - NOTE -

If burette level approached or reached 100% during sampling resulting in burette drain, the  $V$  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:

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

Where:

- TG = Total Gas Concentration :(cc/kg @ STP)  
 T = Final TI-5001 Temperature (°F)  
 V = 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 =  $3.2 \times 10^{-6}$   
 $P_B$  = Final PI-5031 pressure (psig)

## 5.2 Hydrogen (H<sub>2</sub>) and Oxygen (O<sub>2</sub>) Concentration Calculations

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

5.2.1.1 H<sub>2</sub> (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<sub>2</sub> (cc/kg at STP)

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

Where:

%H<sub>2</sub> = AI-5001 reading (Volume % H<sub>2</sub>)

%O<sub>2</sub> = AI-5002 reading (Volume % O<sub>2</sub>)

F = High Total Gas Factor

If V Step 5.1.1.(c) 611 ml, F = 1.0

If V 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<sub>B</sub> = PI-5031 Pressure (psig)

T = TI-5001 Temperature (°F)

V<sub>g</sub> = Volume of Gas initially in the system = 1310 ml

V<sub>IS</sub> = 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 ( $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$ ). Presently Calvert Cliffs has  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$  for a pH control.

5.3.1 If  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$  is used for sump pH control, correction is made as follows:

- (a) Use Attachment 6 to obtain the ratio of ppm  $\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$  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<sub>c</sub>) 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<sub>c</sub>) 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 ( $^{\circ}$ 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
- $V$  = 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

REPORTING

- 6.1 Report promptly and verbally preliminary data obtained during entry to the RPD. Brief RPD 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 RPD for full debriefing and provide copy of completed data shown on Attachment II.

## ATTACHMENT I

PASS NORMAL VALVE LINE-UP

<u>Valve</u>	<u>Position</u>	<u>Valve</u>	<u>Position</u>	<u>Valve</u>	<u>Position</u>
*PS-100	OPEN	CV-5005	CLOSED	CV-5040	CLOSED
*PS-101	OPEN	CV-5006	CLOSED	CV-5041	CLOSED
*PS-102	OPEN	CV-5007	CLOSED		
*PS-103	OPEN	CV-5008	CLOSED	CV-5044	CLOSED
*PS-108	CLOSED	CV-5010	CLOSED	CV-5045	CLOSED
		CV-5011	CLOSED	CV-5046	CLOSED
		CV-5012	CLOSED		
*PS-119	OPEN	CV-5013	TOTAL GAS	1-HS-5105/	NRML SYS
*PS-120	OPEN	CV-5014	CLOSED	1-CV-5105	
*PS-121	OPEN	CV-5015	CLOSED	2-HS-5105	NRML SYS
*PS-122	OPEN	CV-5016	CLOSED	2-CV-5105	
*PS-123	OPEN	CV-5017	CLOSED		
*PS-124	OPEN	CV-5018	CLOSED	1-SV-5107	CLOSED
*PS-130	CLOSED	CV-5021	CLOSED	2-SV-5107	CLOSED
*PS-131	CLOSED	CV-5022	TOTAL GAS	1-SV-6529	CLOSED
*PS-132	CLOSED	CV-5023	CLOSED	2-SV-6529	NRML SYS
*PS-133	CLOSED	CV-5024	CLOSED		
*PS-134	OPEN	CV-5025	CLOSED	PS-517/PS-518	NRML SYS
		CV-5026	CLOSED	PS-523/PS-524	NRML SYS
		CV-5028	SMPL PATH		
1-HS-5105/	NRML SYS	CV-5029	CLOSED	PS-519/PS-520	NRML SYS
1-CV-5105		CV-5030	CLOSED	PS-523/PS-524	NRML SYS
		CV-5031	CLOSED		
CV-5001	CLOSED	CV-5032	CLOSED	1-CV-5016	CLOSED
CV-5002	CLOSED	CV-5033	CLOSED	0-CV-5005A	CLOSED
CV-5003	CLOSED	CV-5034	CLOSED	0-CV-5043	CLOSED
CV-5004	CLOSED	CV-5036	CLOSED	0-HS-5100	CLOSED
		CV-5037	CLOSED	0-SV-5042	CLOSED
		CV-5038	CLOSED		
		CV-5039	CLOSED		

## NOTE:

- \* Manual valves located in Sample Station.
- \* Located in Control Room

ATTACHMENT II

POST 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 RPD as soon as practical.  
 (2) Retain all samples for future use.

Storage Location \_\_\_\_\_  
Placed in storage area by: \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_  
Date Time

REMARKS: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

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)      | _____ | $^{\circ}F$ |
| 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) \_\_\_\_\_

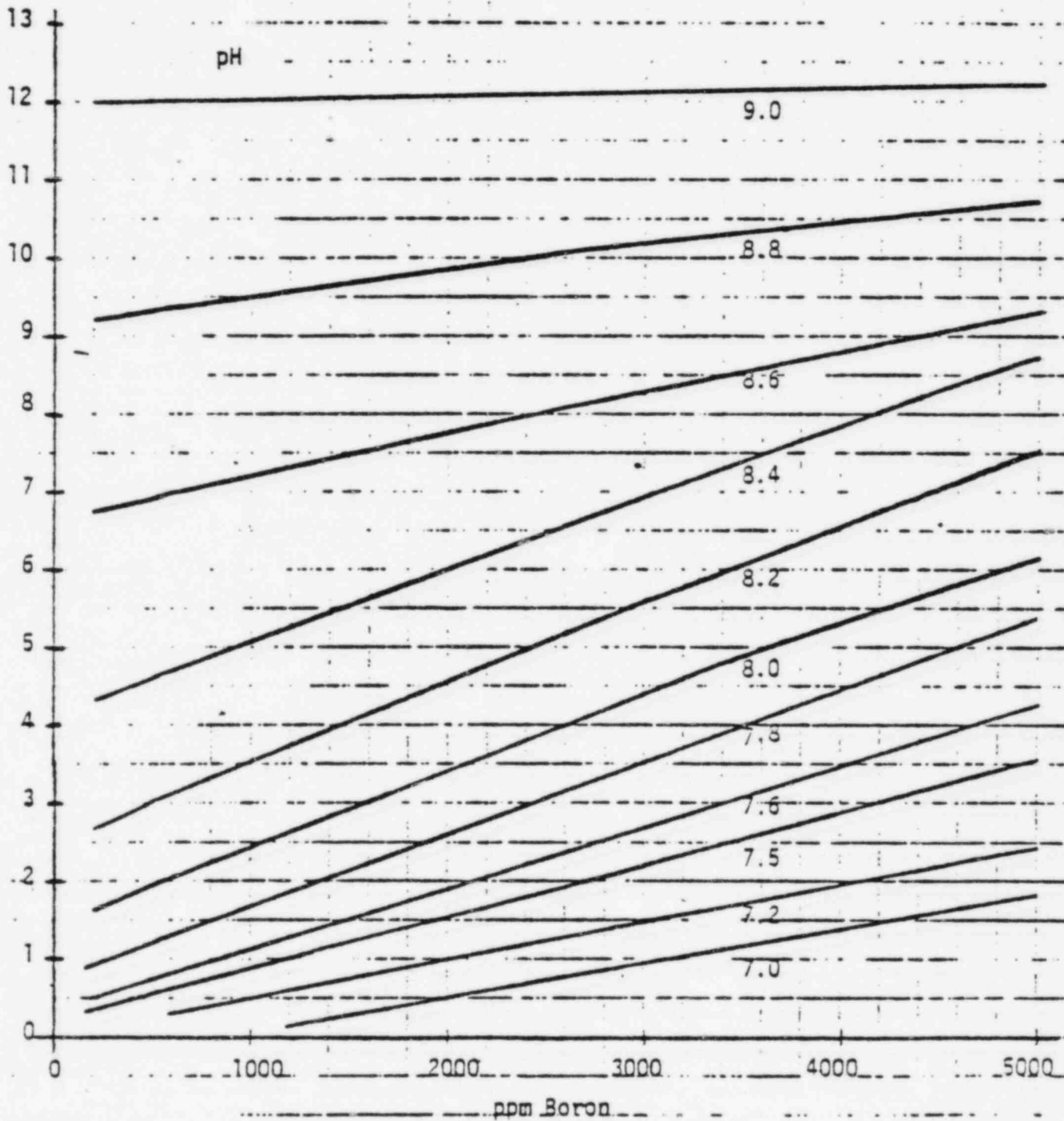
3. Boron (A-502) \_\_\_\_\_ ppm

4. Final Temperature (TI-5001) \_\_\_\_\_ °F

5. Final Volume (LIL-5028) \_\_\_\_\_

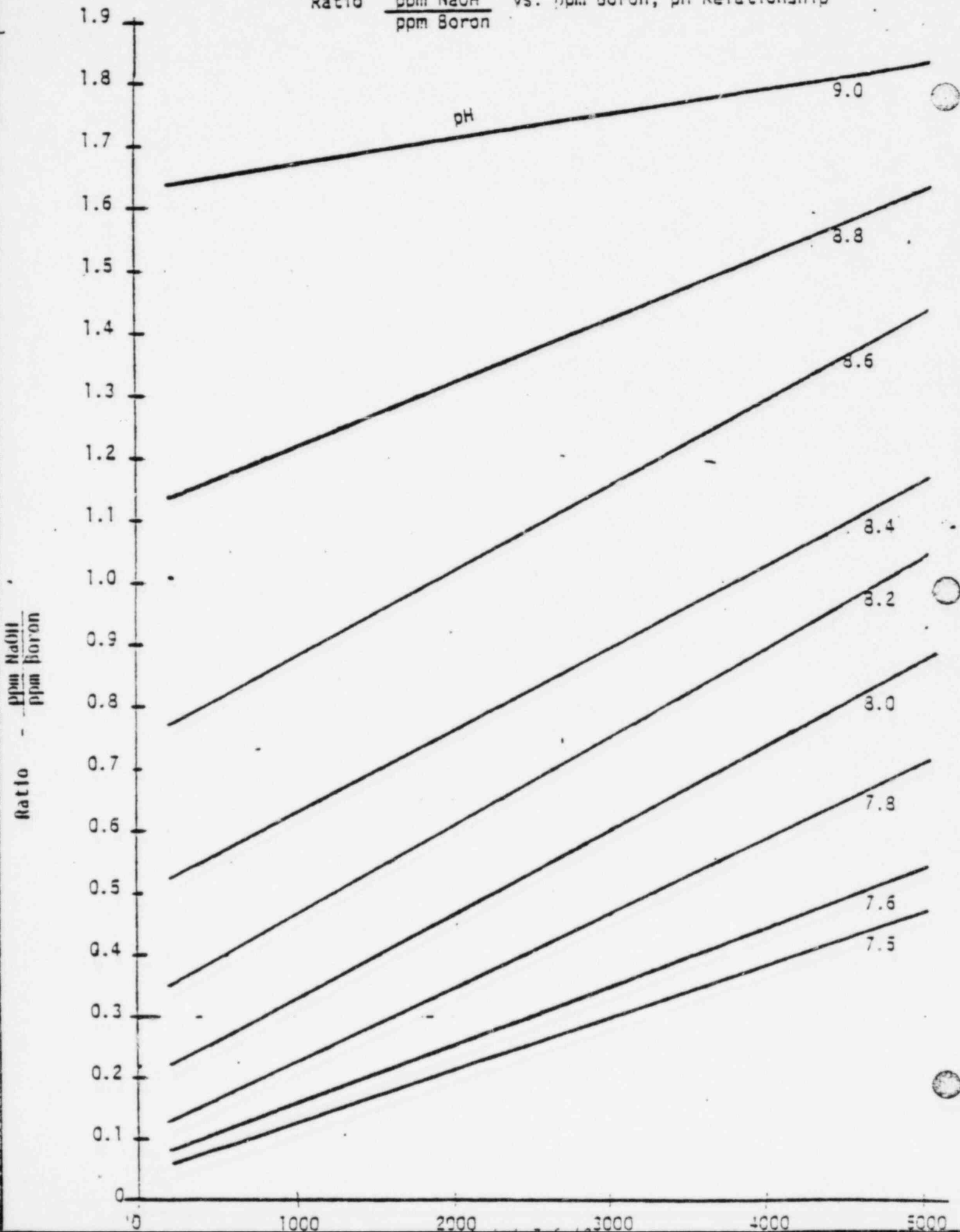
ATTACHMENT 6

Ratio  $\frac{\text{ppm Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}}{\text{ppm Boron}}$  vs. ppm Boron, pH Relationship



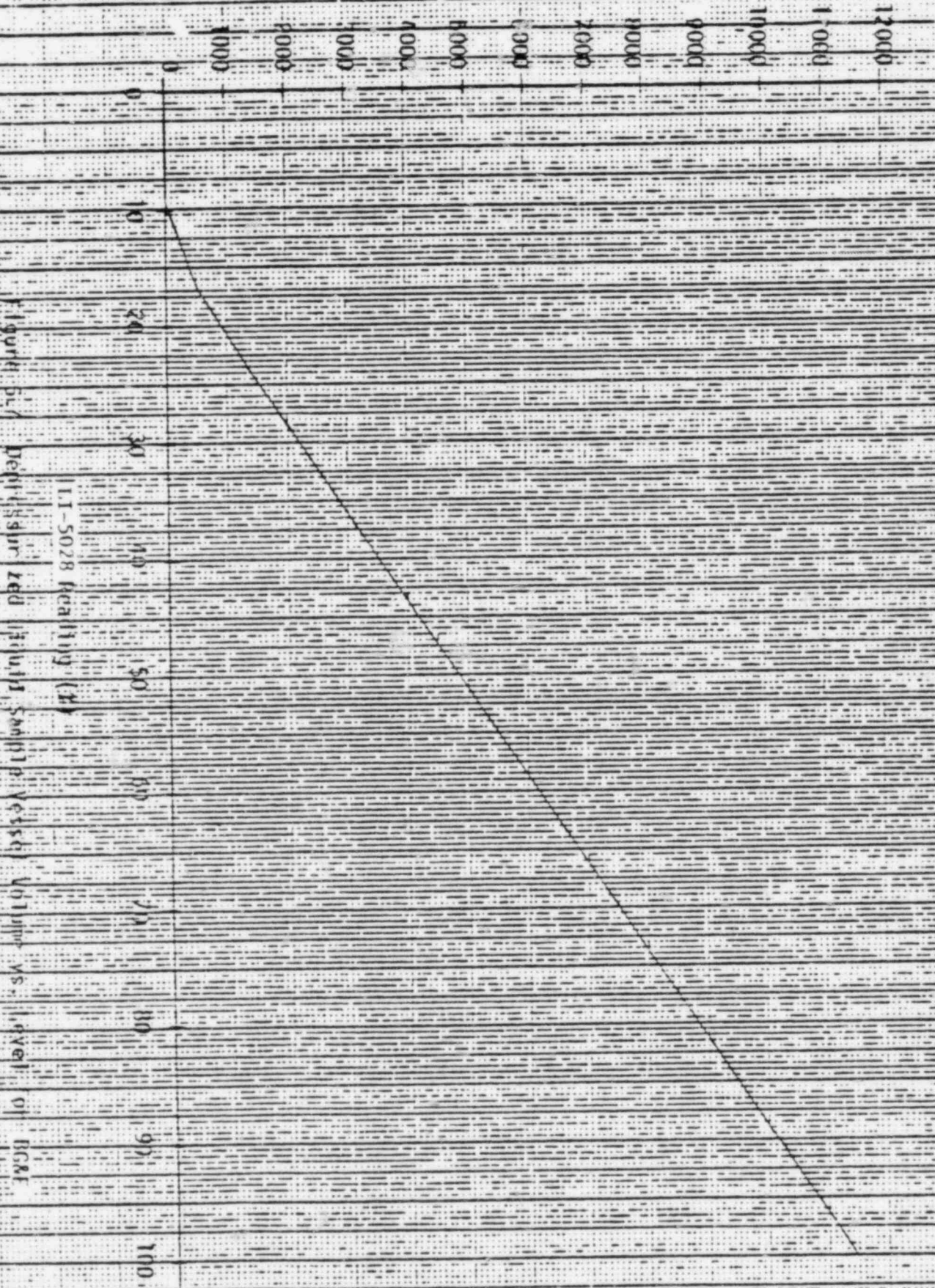


Ratio  $\frac{\text{ppm NaOH}}{\text{ppm Boron}}$  vs. ppm Boron, pH Relationship



ATTACHMENT 8

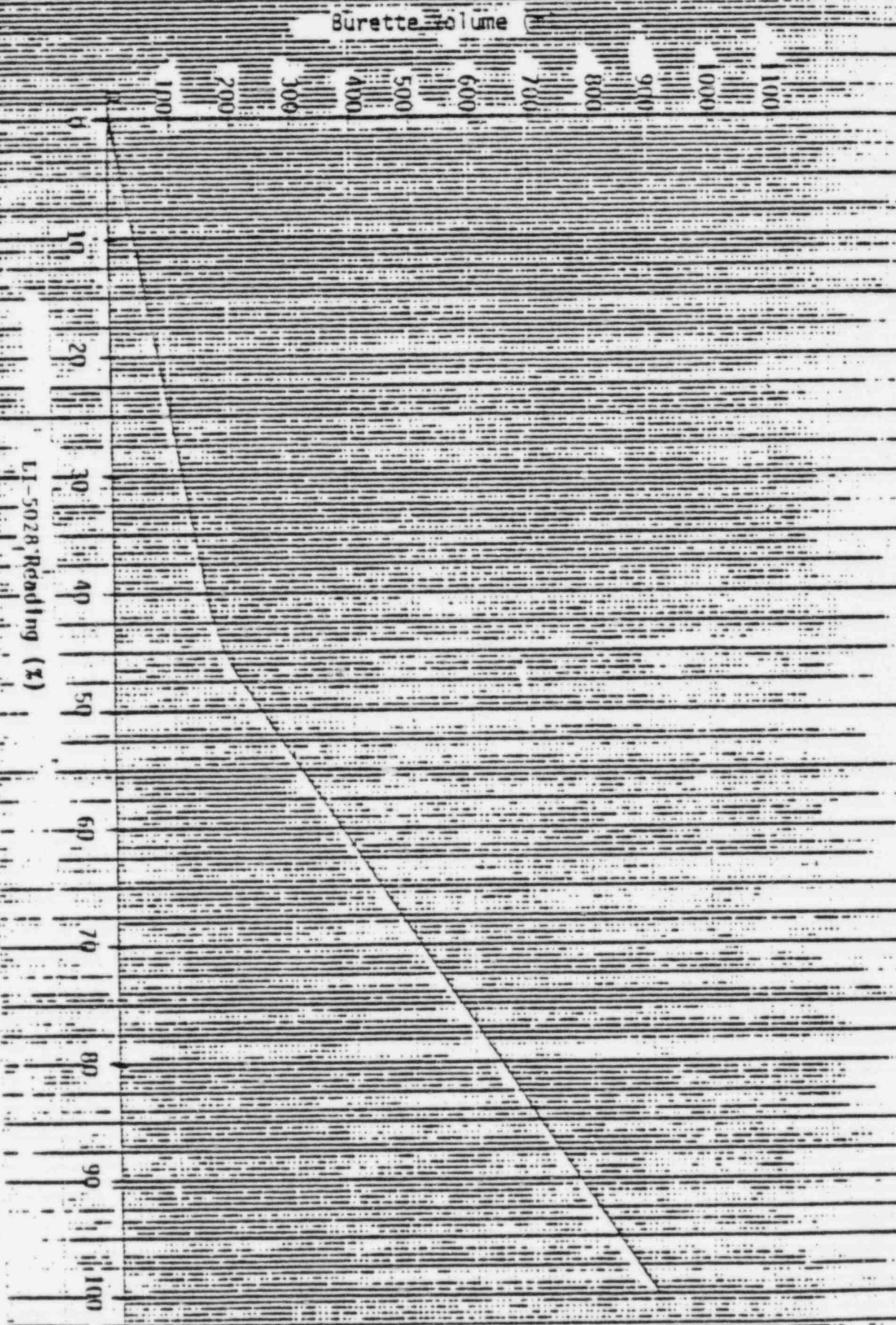
Volume of Liquid in Depressurized  
Liquid Sample Vessel (ml.)



II-5028 Reading (ft)

Figure 5.7 Depth of Liquid Sample Vessel Volume vs. Level of BGL

Figure 5.1 Burette Volume vs. Level



46 15 13

LI-5028 Reading (X)

Burette Volume