TITLE: CONTAINMENT RMS READING VERSUS TIME FOLLOWING ACCIDENTS

1.0 RESPONSIBLE INDIVIDUAL

The Radiological Assessment Director is supported as necessary by the Chemistry Director, Radiation Protection Director, Technical Support Center Director and the Site Emergency Coordinator. The RAD is responsible for determination of the size of the radioactive release into the containment.

2.0 CONDITIONS AND PREREQUISITES

2.1 Containment Radiation Monitors are operable.

2.2 As directed by the SEC or as necessary to determine the scope of the radiological accident.

3.0 ACTIONS AND LIMITATIONS

3.1 Immediate estimate of core damage.

3.1.1 Determine and record the Containment Radiation Monitor exposure rate (R/h) and the time subsequent to the Reactor Shutdown (t) when the exposure rate was measured on Attachment I.

3.1.2 If the Time After Reactor Shutdown (t, .s 96 hours or less, to estimate core damage, refer to Attachment II, GAMMA EXPOSURE RATES AT CONTAINMENT CENTER.

3.1.2.1 Divide the exposure rate determined from RMS, by the Exposure Rate (R/h) listed on Attachment II at the time (h) subsequent to Reactor Shutdown.

- NOTE -

Interpolate, as necessary, recognizing values are not linear.

3.1.2.2 The nondimensioned value determined is the fraction of core inventory released to the containment atmosphere and is thus an approximation of the percent of core damage based on the assumptions listed on Attachment II.

3.2 Determination of the size of the radioactive release into the containment.

3.2.1 Use the information recorded in Step 3.1.1 and Attachment III (a plot of Attachment V).

3.2.1.1 Plot the point corresponding to Time after Reactor Shutdown (days) and Containment Exposure Rate (R/h).

- NOTE -

This point provides a conservative reference from which estimates of release of Coolant Activity (inventory), Gap Activity, and Fuel Inventory can be made.

3.2.1.2 Read and record the fraction released of Coolant activity, Gap Activity, and Fuel Inventory based on the relationship between the plotted point and the intersection of its day line with each of the fraction - released lines.

Fraction Release of Coolant Activity : _____

Fraction Release of Gap Activity : _____

Fraction Release of Fuel Inventory : _____

- NOTE -

All vertical distances are on a logarithmic scale. Also, if the release line intersects the day line below the plotted point, assume the information on the release line has occurred (if a 100% line) or has been exceeded (if a 1% or 10% line).

3.2.2 If the Time After Reactor Shutdown (t) is greater than 4 days refer to Attachment V.

- NOTE -

Information presented on Attachment V assumes zero decay time Time (d) = 0 on Attachment II and Attachment III. Therefore, values in the EXPOSURE RATE columns of the Table must be decayed based on days since accident and HALF LIFE (right hand column) of each radionuclide.

3.2.2.1 To calculate the activity of specific radionuclides decay the activities using the formula:

$$A = A_0 EXP\left[(-0.693)\,(t/t_{1/2} \text{ in days})\right]$$

Where:

T = Time (in days) after Reactor Shutdown

$T_{1/2}$ = Half-life (in days) of the specified Nuclide

A_0 = Activity at Time (T) = 0

A = Activity at Time (T)

3.3 Compare the calculated values with those obtained in ERPIP 4.4.7.2, containment atmosphere sampling and those of ERPIP 4.4.7.3 or 4.4.7.6, Reactor Coolant Activity Sampling.

3.4 Based upon results of comparisons and consultation with the CD, RPD and TSC personnel, when necessary revise estimates of core damage, RCS status, then review EALs and advise the SEC of any recommendations to reclassify the emergency.

ATTACHMENT I

CONTAINMENT RADIATION MONITOR LOG SHEET

Date/Time of Accident (T=0): _____/_____ Unit 1 ☐ 2 ☐

MONITOR READINGS (R/h)

Initials	Time After Accident (h)	Low Range (10^{-4}–10^{1}) RI-5316A RI-5316C	Low Range (10^{-4}–10^{1}) RI-5316B RI-5316D	High Range (10^{0}–10^{3}) RI-5317A RI-5317C	High Range (10^{0}–10^{3}) RI-5317B RI-5317D	% Failed Fuel

ATTACHMENT II

GAMMA EXPOSURE RATES AT CONTAINMENT CENTER

Time (h) after Reactor Shutdown		Exposure Rate (R/h)
0		3.3×10^6
0.03	(1.8 min)	2.9×10^6
0.5	(30 min)	9.3×10^5
0.75	(45 min)	8.7×10^5
1		7.4×10^5
2		5.5×10^5
8		1.8×10^5
24		4.3×10^4
60		1.5×10^4
96		1.1×10^4

Assumptions: (1) Power level - 2700 Mwt

(2) Release at T = 0, (at Reactor Shutdown) 100% of core inventory of noble gases, 50% of the iodines (Chemical form of iodine 91% I_2, 5% particulate bound, 4% organic).

(3) Containment sprays actuate removing elemental iodine at rate of 27%/h, and particulate iodine at rate of 43%/h.

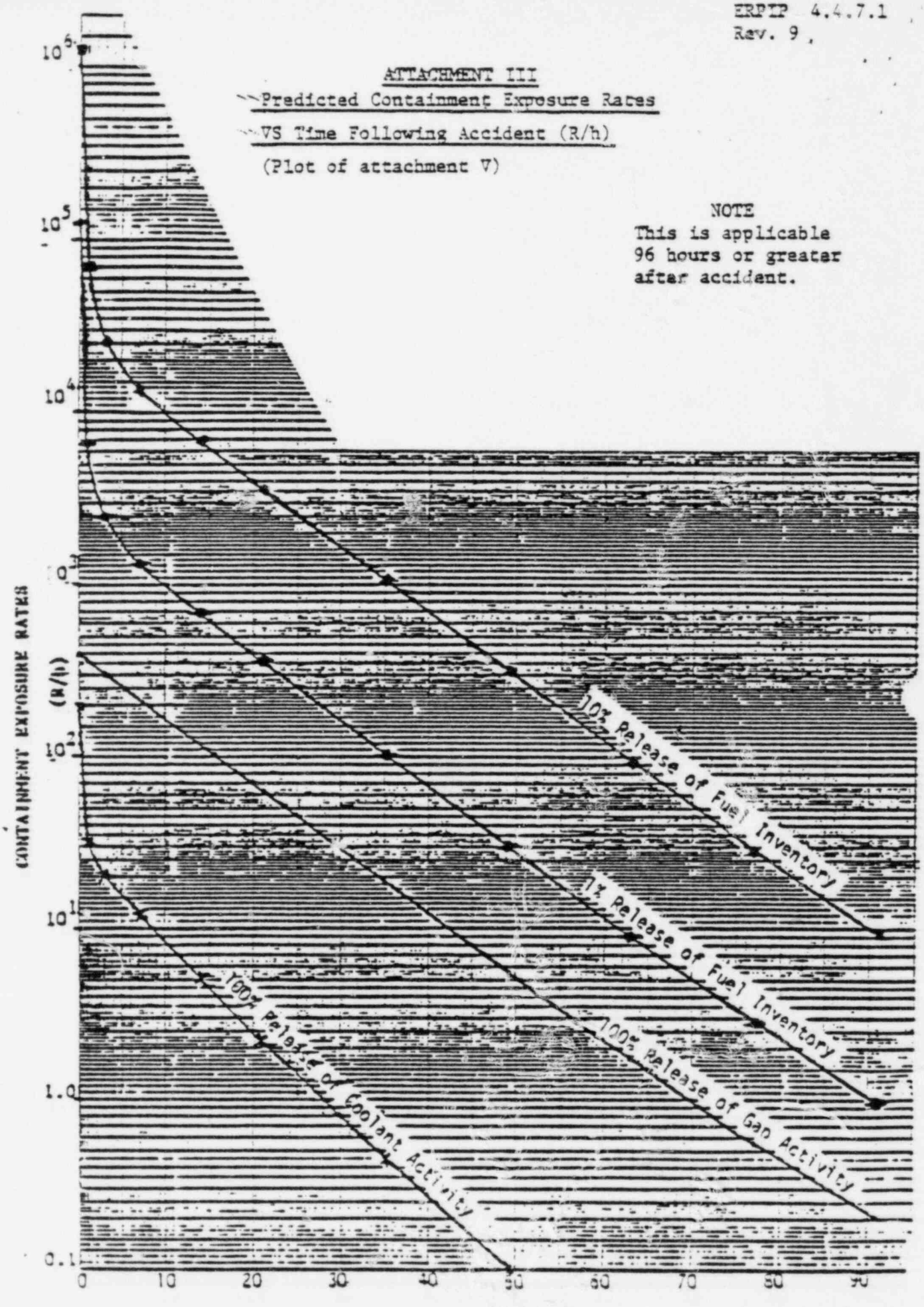
ATTACHMENT III

Predicted Containment Exposure Rates

VS Time Following Accident (R/h)

(Plot of attachment V)

NOTE
This is applicable 96 hours or greater after accident.



ATTACHMENT IV

PREDICTED CONTAINMENT EXPOSURE RATES VS TIME

Time (d)	100% RELEASE REACTOR COOLANT ACTIVITY	10% RELEASE FUEL INVENTORY	1% RELEASE FUEL INVENTORY	100% RELEASE GAP ACTIVITY
0	2.74E+02	1.26E+06	1.26E+05	4.00E+02
1	3.18E+01	6.78E+04	6.78E+03	3.66E+02
3	2.07E+01	2.52E+04	2.52E+03	3.07E+02
7	1.21E+01	1.35E+04	1.35E+03	2.15E+02
14	5.16E+00	6.90E+03	6.90E+02	1.16E+02
21	2.22E+00	3.63E+03	3.63E+02	6.26E+01
35	4.47E-01	1.03E+03	1.03E+02	1.86E+01
49	1.05E-01	3.03E+02	3.03E+01	5.59E+00
63	———	9.05E+01	9.05E+00	1.71E+00
77	———	2.79E+01	2.79E+00	5.49E-01
91	———	9.60E+00	9.60E-01	2.05E-01

ATTACHMENT V

ACCIDENT RELEASE INSIDE CONTAINMENT (DATA)

ACCIDENT RELEASE INSIDE CONTAINMENT DATA

(PREDICTED CONTAINMENT EXPSOURE RATES FOLLOWING INITIAL RELEASE OF REACTOR COOLANT ACTIVITY, FUEL INVENTORY, AND GAP ACTIVITY)

	100 PERCENT RELEASE OF REACTOR COOLANT ACTIVITY				10% AND 1 % RELEASE OF FUEL INVENTORY				100% RELEASE OF GAP ACTIVITY			
RADIONUCLIDE	ACTIVITY CONC. RCS ($\mu Ci/cm^3$)	TOTAL ACTIVITY RELEASED (Ci)	RESULTANT ATMOS. ACTIVITY (Ci/m^3)	EXPOSURE RATE (R/h)	10% FAIL. FUEL TOTAL ACTIVITY RELEASED (Ci)	10% F.F. (1) RESULTANT ATMOS. ACTIVITY (Ci/m^3)	10% F.F. EXPOSURE RATE (R/h)	1% F. F. EXPOSURE RATE (R/h)	TOTAL ACTIVITY RELEASED (Ci)	RESULTANT ATMOS. ACTIVITY (Ci/m^3)	EXPOSURE RATE (R/h)	HALFLIFE (d)
Krypton-85m	1.49E+00	5.08E+02	8.98E-03	1.06E+00	1.92E+06	3.39E+01	3.98E+03	3.98E+02	-	-	-	1.83E-01
Krypton-85	8.85E-01	3.03E+02	5.34E-03	8.83E-03	6.09E+04	1.08E+00	1.78E+00	1.78E-01	1.98E+03	3.50E-02	5.79E-02	3.93E+03
Krypton-87	8.10E-01	2.76E+02	4.88E-03	2.57E+00	3.53E+06	6.24E+01	3.29E+04	3.29E+03	-	-	-	5.28E-02
Krypton-88	2.60E+00	8.87E+02	1.57E-02	1.22E+02	5.04E+06	8.90E+01	1.73E+05	1.73E+04	-	-	-	1.17E-01
Iodine-129	7.21E-08	2.46E-05	2.17E-10	4.26E-09	Negligible	-	-	-	-	-	-	5.73E+09
Iodine-131	3.97E+00	1.35E+03	1.19E-02	3.51E+00	7.47E+06	6.60E+01	1.96E+04	1.96E+03	7.00E+04	1.24E+00	3.70E+02	8.06E+00
Xenon-131m	1.48E+00	5.05E+02	8.29E-03	2.29E-02	5.27E+04	9.31E-01	2.39E+00	2.39E-01	2.92E+02	5.16E-03	1.32E-02	1.18E+01
Iodine-132	1.09E+00	3.72E+02	3.29E-03	5.89E+00	1.08E+07	9.54E+01	1.70E+05	1.70E+04	-	-	-	9.58E-02
Iodine-133	5.66+00	1.93E+03	1.70E-02	7.83E+00	1.52E+07	1.34E+02	6.17E+04	6.17E+03	-	-	-	8.67E-01
Xenon-133	1.81E+02	6.17E+04	1.09E+00	2.55E+01	1.52E+07	2.69E+02	6.33E+03	6.33E+02	7.34E+04	1.30E+00	3.04E+01	5.31E+00
Iodine-134	6.20E-01	2.11E+02	1.86E-03	3.29E+00	1.64E+07	1.45E+07	2.55E+05	2.55E+04	-	-	-	3.61E-02
Iodine-135	2.70E+00	9.21E+02	8.14E-03	1.13E+01	1.41E+07	1.25E+02	1.74E+05	1.74E+04	-	-	-	2.78E-01
Xe-135m	-	-	-	-	3.05E+06	5.39E+01	1.82E+04	1.82E+03	-	-	-	1.06E-02
Xe-135	7.53E+00	2.57E+03	4.54E-02	8.77E+01	2.65E+06	4.68E+01	9.05E+03	9.05E+02	-	-	-	3.80E-01
Xe-138	3.60E-01	1.23E+02	2.17E-03	3.45E+00	1.22E+07	2.16E+02	3.41E+05	3.41+04	-	-	-	9.86E-03
	$\sum$ = 2.74E+02				$\sum$ =1.26E+06		$\sum$ =1.26E+05					$\sum$ = 4.00E+02

(1) Failed Fuel (FF)

NOTE: THIS TABLE PRESENTS THE CALCULATED RADIONUCLIDES CONTRIBUTING TO THE CONTAINMENT ATHOSPHERE ACTIVITY IMMEDIATELY SUBSEQUENT TO AN ACCIDENT

ERPIP 4.4.7.1 REVIEW/APPROVAL

REVISION	CHANGE	REVIEWER SIG/ DATE	SUPERVISOR EPU SIG/DATE	POSRC MTG	PLANT SUPERINTENDENT /DATE
9	-	[signature] 12/28/92	[signature] 12/28/92	82-171	[signature] 12/31/92

CALVERT CLIFFS NUCLEAR POWER PLANT
EMERGENCY RESPONSE PLAN
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES

ERPIP PAGE	REV.	ERPIP PAGE	REV.
1	9		
2	9		
3	9		
4	9		
5	9		
6	9		
7	9		
8	9		

TITLE: POST-ACCIDENT CONTAINMENT ATMOSPHERE SAMPLING

1.0 RESPONSIBLE INDIVIDUAL

The Chemistry Director (CD) is responsible for determining the need for performing post-accident containment atmosphere sampling.

Members of the Liquid Release Monitoring Team are responsible to the CD 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 as directed by the CD.

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.

The Emergency Reentry Monitoring Team member is responsible to the Radiation Protection Director (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)) indicat · 200 m R/h.

2.2 When directed by CD.

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 (~ 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.

3.1.2 Entries made for Containment Atmosphere 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 retreive 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 Attachment I, "Accident Sample and Analysis Data Sheet."

3.1.7 The collection of the following:

3.1.7.1 Accident Sampling Kit (Located in Radiochemistty 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 Attachment I, "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. ( )

_____ / _____
ERMT Name Time

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 ( )

_____ / _____
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, lapel 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

ERMT Member	LRMT Member

3.2.2.7 When approved 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** -

FAILURE TO USE THE LEAD SHIELDING PLACED IN THE HYDROGEN ANALIZER, TO THE FULLEST EXTENT POSSIBLE, MAY RESULT IN UNDUE RADIATION EXPOSURE.

- **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. Location of the Sample Rooms are shown in Attachments II and III. The sample valve arrangement is shown in Attachment IV.

ERMT Member	LRMT Member
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).
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.	Perform the following to obtain a containment atmosphere sample: (Ensure sample sink hood ventilation fan is ON and operating).
2a. Provide continuous monitoring coverage during remaining sample steps. Ensure lapel air samplers are turned on.	Using the remote handling tool OPEN the isolation valves to the sample point (See Attachment IV).
2b. Record exposure rates and time during each step performed. R/h___ Time ___	Permit the sample point to be purged a minimum of two minutes. Stand behind the shield during the purging.
2c. R/h___ Time ___	Quickly, obtain atmosphere sample by placing syringe (5 cc) into the sample point and filling.
2d. R/h___ Time ___	After filling the syringe, place it in the lead container. Close the lid.
2e. R/h___ Time ___	Close the Sample Point Isolation Valves. Depart with ERMT member and shielde sample.
2f. R/h___ Time ___	
2g. R/h___ Time ___	
2h. R/h___ Time ___	

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 CD for analysis in accordance with Attachment I.
2. Ensure personnel exposure data has been recorded on EXHIBIT 4.8.1.	Prepare sample tag with the following data, and 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 I with the sample for analysis.

4.0 PROCEDURE

4.1 Appartus

4.1.1 The control panel, 1C139, located on the -5' elevation of the Auxiliary Building contains all alarm indications, flow meters, and calibration controls.

4.1.2 The control panel, 1C101, 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 V).

4.2 Method

4.2.1 Proceed to the control panel 1C101 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 conditon, 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 V. 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 CD and RPD. Brief CD and 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 CD 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: _____

_____

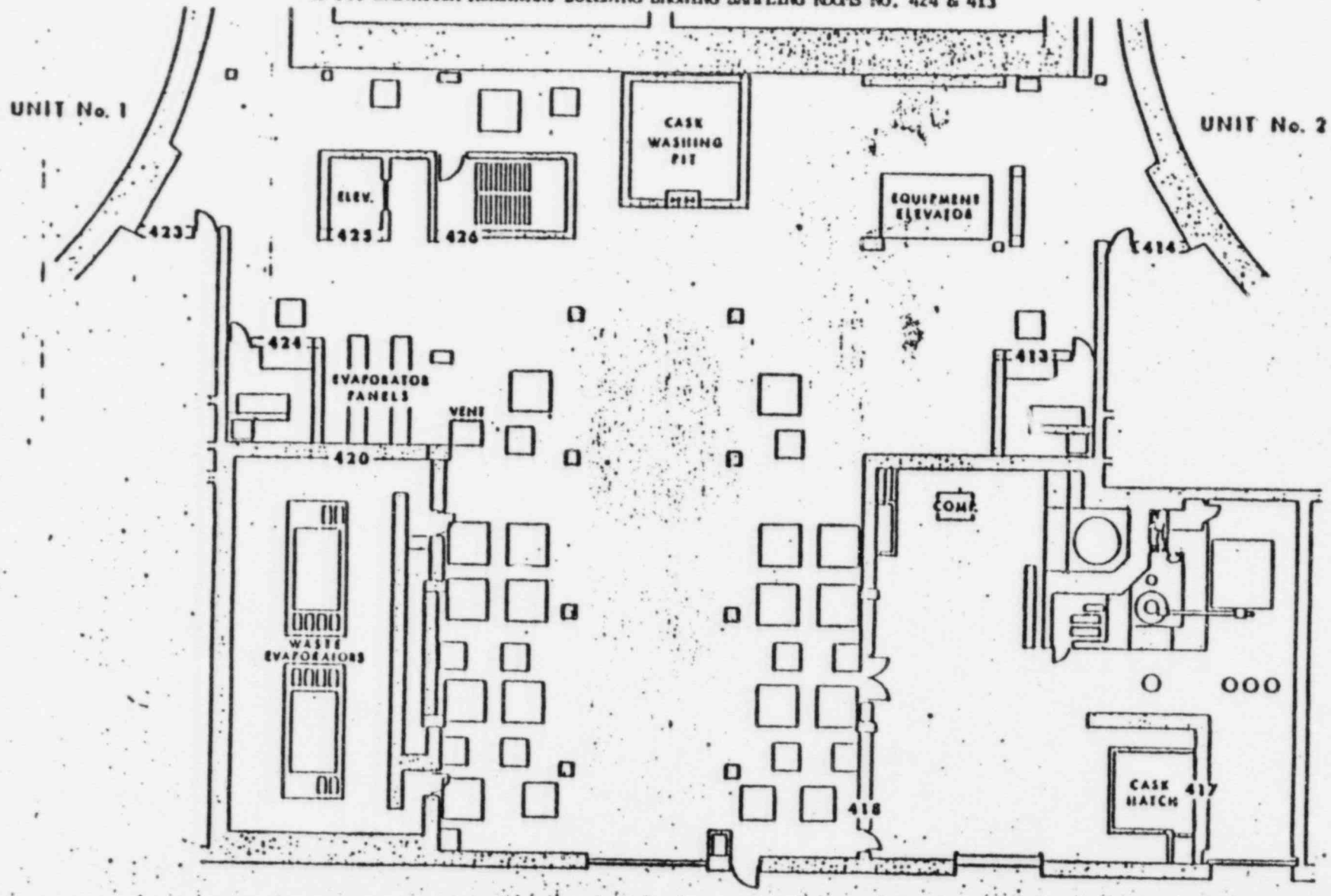
_____

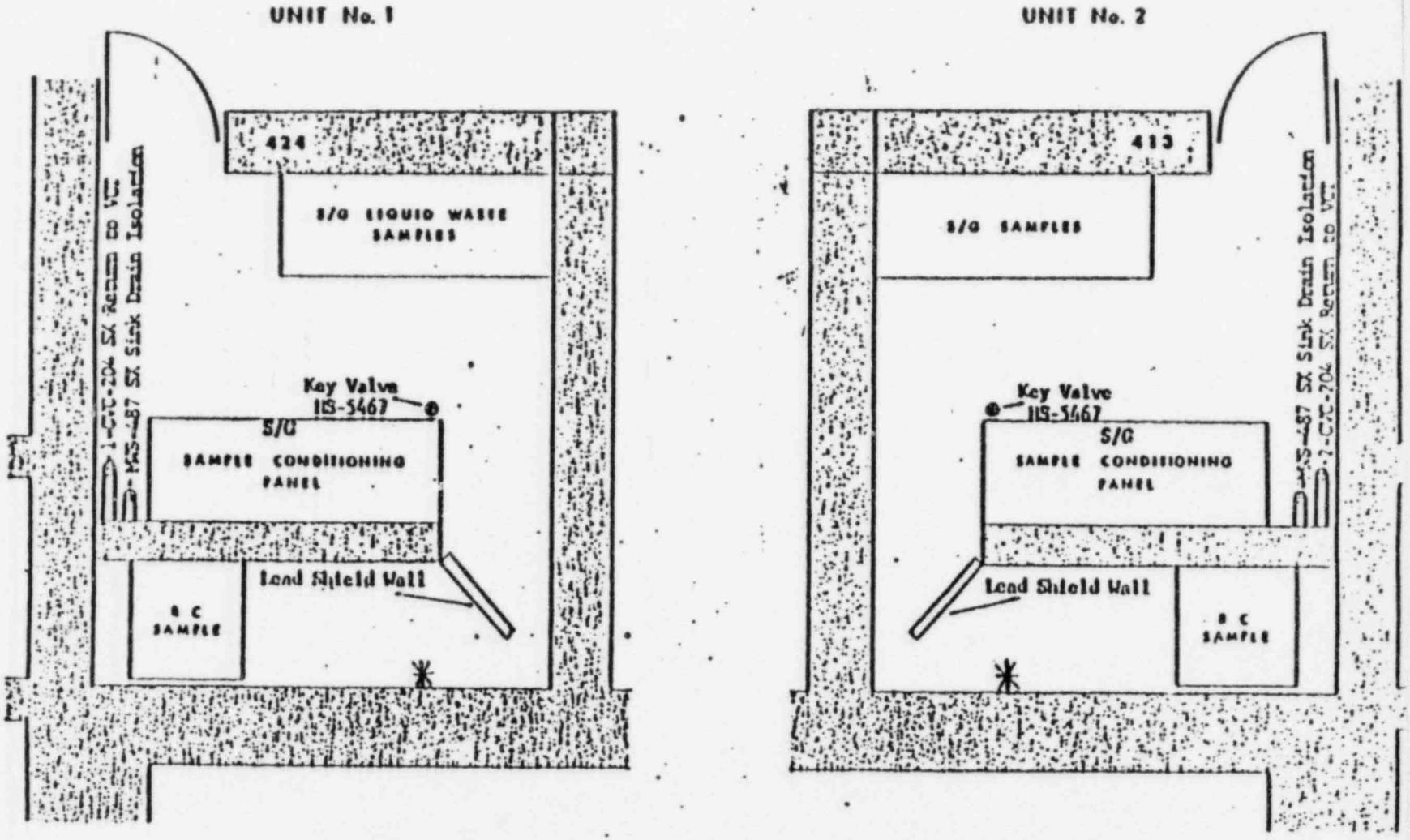
_____

_____

(ATTACHMENT II)

45 FT. ELEVATION AUXILIARY BUILDING SHOWING SAMPLING ROOMS NO. 424 & 413

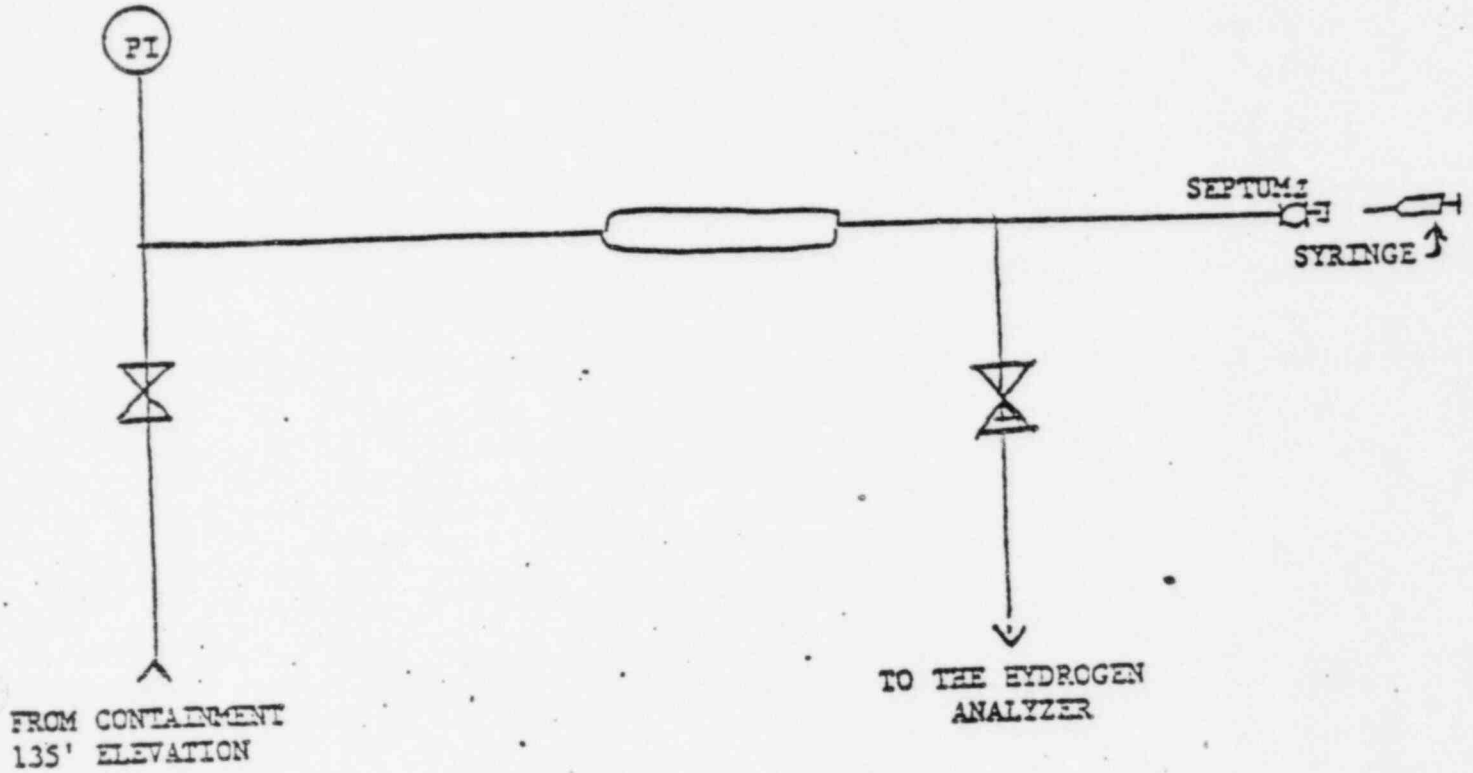




✱ Containment atmosphere grab sample points.

ATTACHMENT IV

SAMPLE POINT VALVE ARRANGEMENT



ATTACHMENT V

KEY OPERATED VALVES

SAMPLE POINT	INBOARD	OUTBOARD
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

ERPIP 4.4.7.2 REVIEW/APPROVAL

POST ACCIDENT CONTAINMENT ATMOSPHERE SAMPLING

REVISION	CHANGE	REVIEWER SIG/ DATE	SUPERVISOR EPU SIG/DATE	POSRC MTG	PLANT SUPERINTENDENT /DATE
9	—	[signature] 9/23/82	[signature] 9/24/82	82-124	[signature] 9-24-82
10	—	For B.A. Watson 12-28-82	[signature] 12/28/82	82-169	[signature] 12/29/82

CALVERT CLIFFS NUCLEAR POWER PLANT
EMERGENCY RESPONSE PLAN
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES

ERPIP PAGE	REV.	ERPIP PAGE	REV.
1	10		
2	10		
3	10		
4	10		
5	10		
6	10		
7	10		
8	10		
9	10		
10	10		
11	10		
12	10		
13	10		
14	10		

TITLE: POST-ACCIDENT REACTOR COOLANT SAMPLING

1.0 RESPONSIBLE INDIVIDUAL

The Chemistry Director (CD) is responsible for determining the need for performing post-accident reactor coolant sampling.

Members of the Liquid Release Monitoring Team are responsible to the CD for obtaining post-accident sample(s) (very high level radioactive samples) of reactor coolant and for taking them to the Radiochemistry Laboratory (first priority), Calvert Cliffs Mobile Laboratory No. 1 (second priority), or as directed by the CD.

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.

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

—NOTE—

This procedure is to only applicable if the Post Accident Sampling System is not OPERABLE. If the PASS is in service, use ERPIP 4.4.7.6.

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 When directed by CD.

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 if exposure rate level is greater than 2.0 R/h on contact.

(OBSERVE NOTE ON FOLLOWING PAGE)

- NOTE -

Lead lined gloves, finger rings, lapelsamples, plastic hoods, SCBA and High Range gamma exposure rate meter and pocket dosimeter shall be worn to take the RCS samples.

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

_____ / ____ / _____

CD 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 Alternate routes if necessary.

3.1.3 Designated doors to open and shut to retrieve samples, existing radiation barriers, and maximum stay times.

3.1.4 Authorized personnel radiation exposure limits for each entry on EWP #003.

3.1.5 Labeling of samples performed prior to entry. Sample data to be recorded on Attachment L "Accident Coolant Sample and Analysis Data Sheet."

3.1.6 The collection of the following:

3.1.6.1 Accident Coolant Sampling Kit (Located in Radiochemistry Laboratory)

3.1.6.2 Lead Pig

3.1.6.3 Transport cart

ERMT Member	LRMT Member

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 I, "Accident RCS Coolant Sample and Analysis Data Sheet," as appropriate, upon completion of reentry sampling.

3.2.1

Upon direction by the CD, contact the Control Room and request that the Reactor Coolant Sample Isolation Valve be OPENED.

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

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 Time

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. ( )

____ / ____
ERMT Name Time

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

1. Key for the HS-5467 (CV-5467) ( )
2. Accident Coolant Sampling Kit ( )
3. Inventory prior to entry ( )
4. Lead gloves ( )
5. Lead pig for sample ( )
6. Transport cart ( )

____ / ____
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, lapel air samples as specified on EWP #003. (Clothing and monitoring equipment located in the Emergency Reentry Equipment Locker, 69' Aux. Building for preaugmentation use).

	ERMT Member	LRMT Member
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 approved by the RPD, proceed to the affected unit's reactor coolant sample sink 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 Reactor Coolant Sampling Room, review section 3.2.2.10, step 1 thru 3 with LRMT member.	

- CAUTION -

FAILURE TO USE LEAD SHIELDING, MIRRORS AND MECHANICAL EXTREMITY EXTENSIONS PLACED IN THE SAMPLE SINK AREA, TO THE FULLEST EXTENT POSSIBLE, MAY RESULT IN UNDUE RADIATION EXPOSURE.

3.2.2.10	Ensure sampling area has been prepared as follows: 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.	Ensure that all sample lines are isolated by turning all the sample flow cells OFF except for DI-6450 (PS-169). Fully OPEN TI-6450.

ERMT Member	LRMT Member
2. PIC-6A and RO-7 (0-20K R/h scale probe) turned on to high scale and placed on transport cart behind shield. Use Attachments II and III for dose rates observed enroute.	Perform the following to obtain a RCS Coolant sample: Turn on the sample hood ventilation fan.
2a. Provide continuous monitoring coverage during remaining sample steps. Ensure lapel air samplers are turned on.	Connect the Post-Accident Coolant Sample Collection Apparatus (PASCA) to make fittings in the RCS sample hood. (See Attachments IV and V for valve connection locations.)
2b. Record exposure rates and time during each step performed. R/h _____ Time _____	OPEN valve labeled "ISOLATION VALVE 11/21 PRESSURIZER SAMPLE COLLECTION APPARATUS and FILTER DOWNSTREAM."
2c. R/h _____ Time _____	OPEN valve labeled "ISOLATION VALVE 11/21 PRESSURIZER SAMPLE COLLECTION APPARATUS DOWNSTREAM."
2d. R/h _____ Time _____	OPEN valve labeled "ISOLATION VALVE 11/21 PRESSURIZER SAMPLE COLLECTION APPARATUS UPSTREAM."
2e. R/h _____ Time _____	OPEN valve labeled "ISOLATION VALVE 11/21 PRESSURIZER SAMPLE COLLECTION BY-PASS" only two 360° turns.
2f. R/h _____ Time _____	OPEN drag valve labeled "PRESSURIZER LIQUID HOT LEG."
2g. R/h _____ Time _____	SHUT the RCS sample hood to the level of the top of the sample collection apparatus.

- NOTE -

EXTREMELY HIGH DOSE RATES (1000 R/h) MAY RESULT IN THE HOOD VICINITY FROM REACTOR COOLANT FLOW THROUGH THE SAMPLE COLLECTION APPARATUS WHEN VALVE HS-5467 (CV-5467) IS OPENED.

ERMT Member	LRMT Member
2h. R/h _____ Time _____	OPEN key operated valve HS-5467 (CV-54[illegible]) located on the S/G sample conditioning panel and immediately leave the area.
3. Ensure SRD readings, exposure rates are observed and stay times are not exceeded.	

-NOTE-

DO NOT REENTER THE SAMPLE HOOD AREA UNTIL IT IS NECESSARY

4. Return with the LRMT member to ingress area of the Controlled Area 69' Elevation Aux. Bldg. or other low background area designated previously by RPD.	Allow the sample to recirculate for 30 minutes. Follow ERMT member to low background area during recirculation period
5. While waiting to reenter sampling room per step 6, review steps 7 thru 11 with LRMT member.	
Reenter Controlled Area to arrive at Reactor Coolant Sampling Room at end of 30 minutes recirculation time. R/h _____ Time _____	

-NOTE-

AVOID EXPOSURE IN UNSHIELDED AREA. RATES OF 1000 R/h (280 mR/s)

POSSIBLE EXPOSURE

7. Remain behind shield while LRMT member performs steps 7 thru 9 and commence constant monitoring of LRMT members and your own exposure rates and exposure times. R/h _____ Time _____	Reenter Sampling Room, SHUT key operated valve HS-5467 on "S/G Sample Conditioning Panel" to isolate the sample.

ERMT Member	LRMT Member
8. R/h _____ behind shield, Time _____	Enter behind lead shield in R/C Sample Area and observe the sink area by use of installed mirror.
9. R/h _____ at LRMT Location, Time _____	Quickly approach Reactor Coolant Sample sink, disconnect the quick release fittings on the sample collection apparatus, tilt the apparatus down into the hood sink to drain any remaining liquid from fittings and return behind shield wall.
10.	Place the sample collection apparatus into lead container. Close container lid.
11. Promptly exit sample room with LRMT member and sample cart, and Radiac Instrumentation. Return to 69' Elevation Controlled Area	Depart with ERMT member, taking sample cart and shielded sample.
_____ / _____ RPD notified Time	_____ / _____ Time exited Time
12. 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.	Contact Control Room and request that the Reactor Coolant Sample Isolation Valve be SHUT. Deposit sample in Chemistry Hot Laboratory or as directed by RPD for analysis.
13. Ensure personnel exposure data has been recorded.	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 ( )

ERMT Member	LRMT Member
14.	Leave Attachment I with RCS sample for use in analysis.
3.3 REPORTING	
3.3.1 Report promptly and verbally preliminary data obtained during entry to the CD and RPD. Brief CD and RPD on the following as a minimum.	
3.3.1.1 Exposures received by reentry personnel (SRD-type data)	
3.3.1.2 Exposure rates measured enroute to sample room & maximum exposure rates measured within sample room during entry.	
3.3.1.3 Dose rate contact with the Sample.	
3.3.2 Collect lapel air samples & send to counting laboratory for analysis.	
3.3.3 Report to CD for full debriefing & 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.

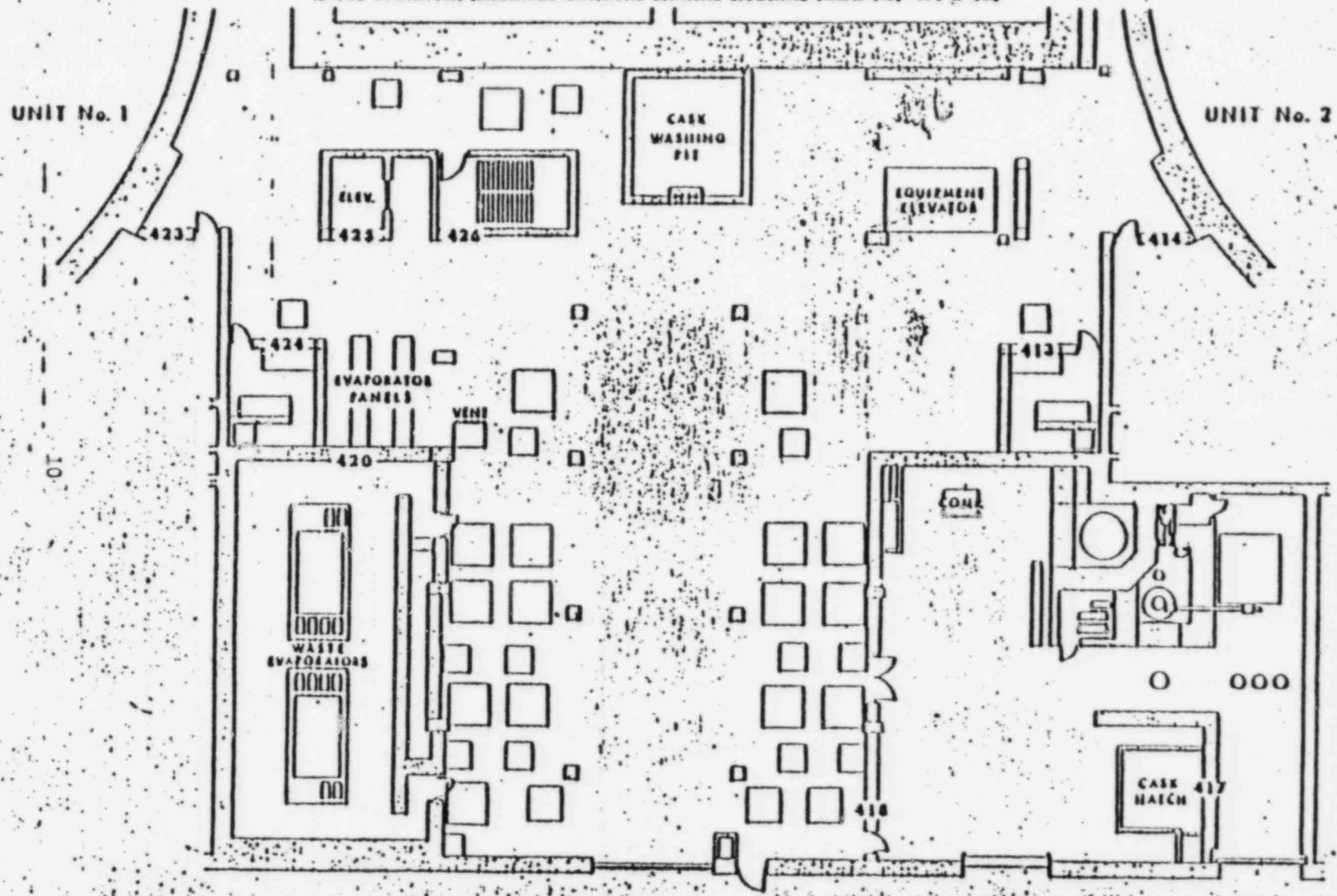
Storage Location _____

Placed in storage area by: _____ / _____
Date Time

REMARKS: _____

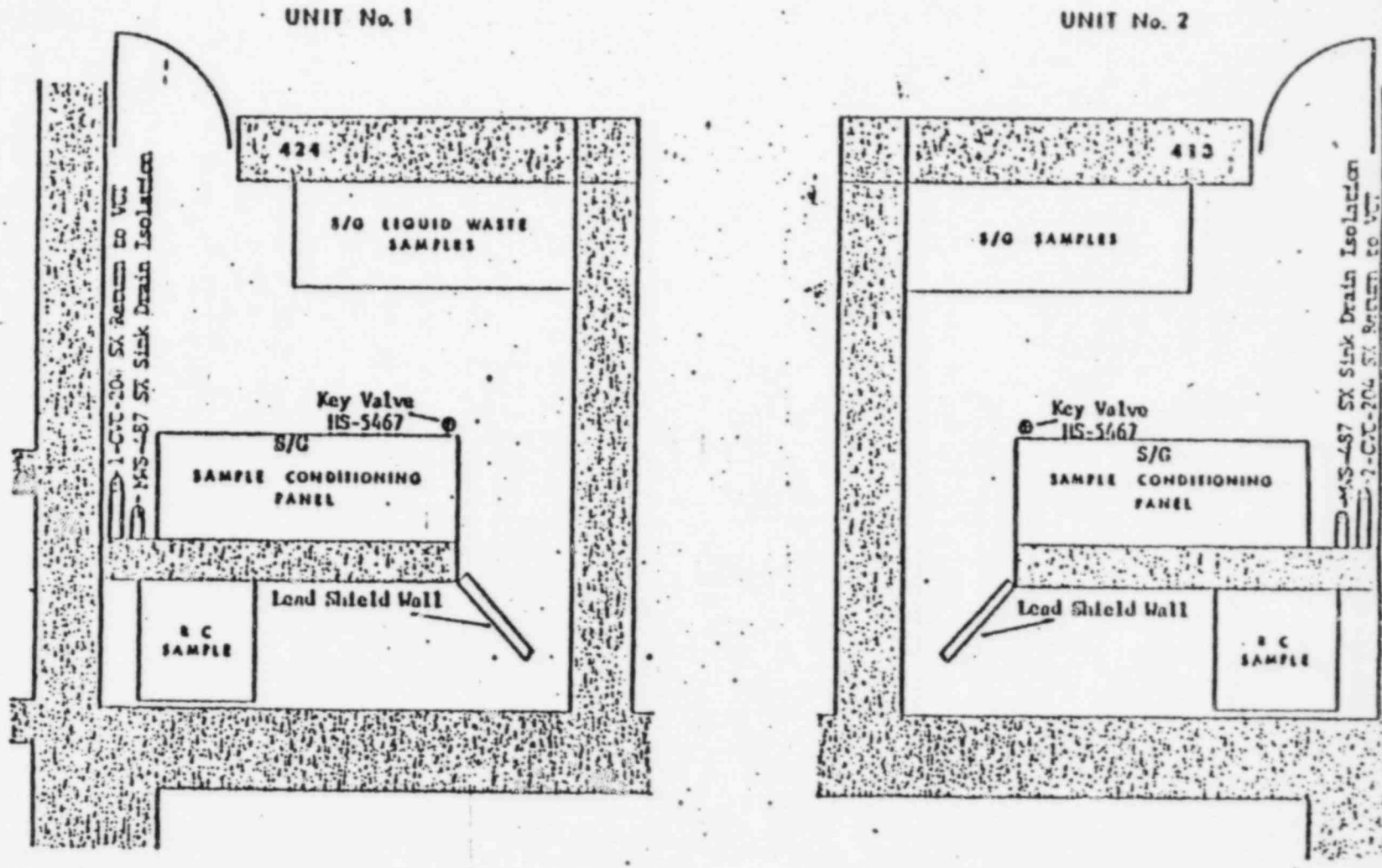
(ATTACHMENT II)

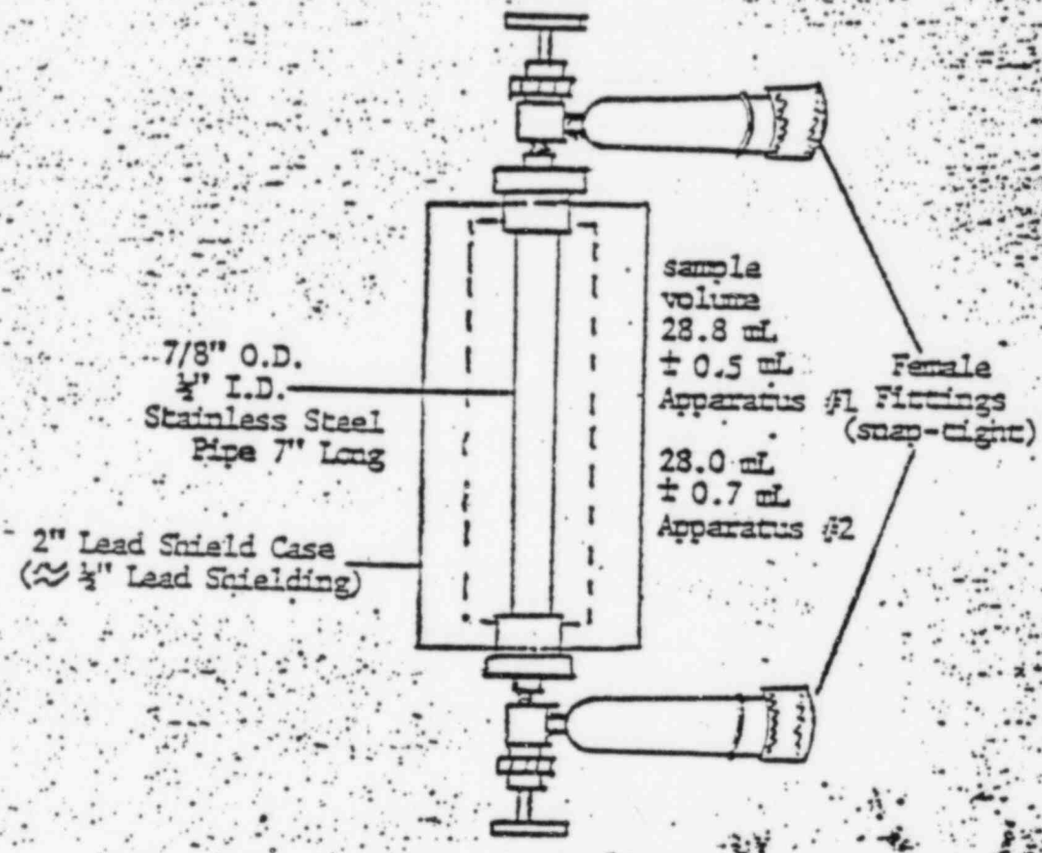
45 FT. ELEVATION AUXILIARY BUILDING SHOWING SAMPLING ROOMS NO. 424 & 413



(ATTACHMENT III)

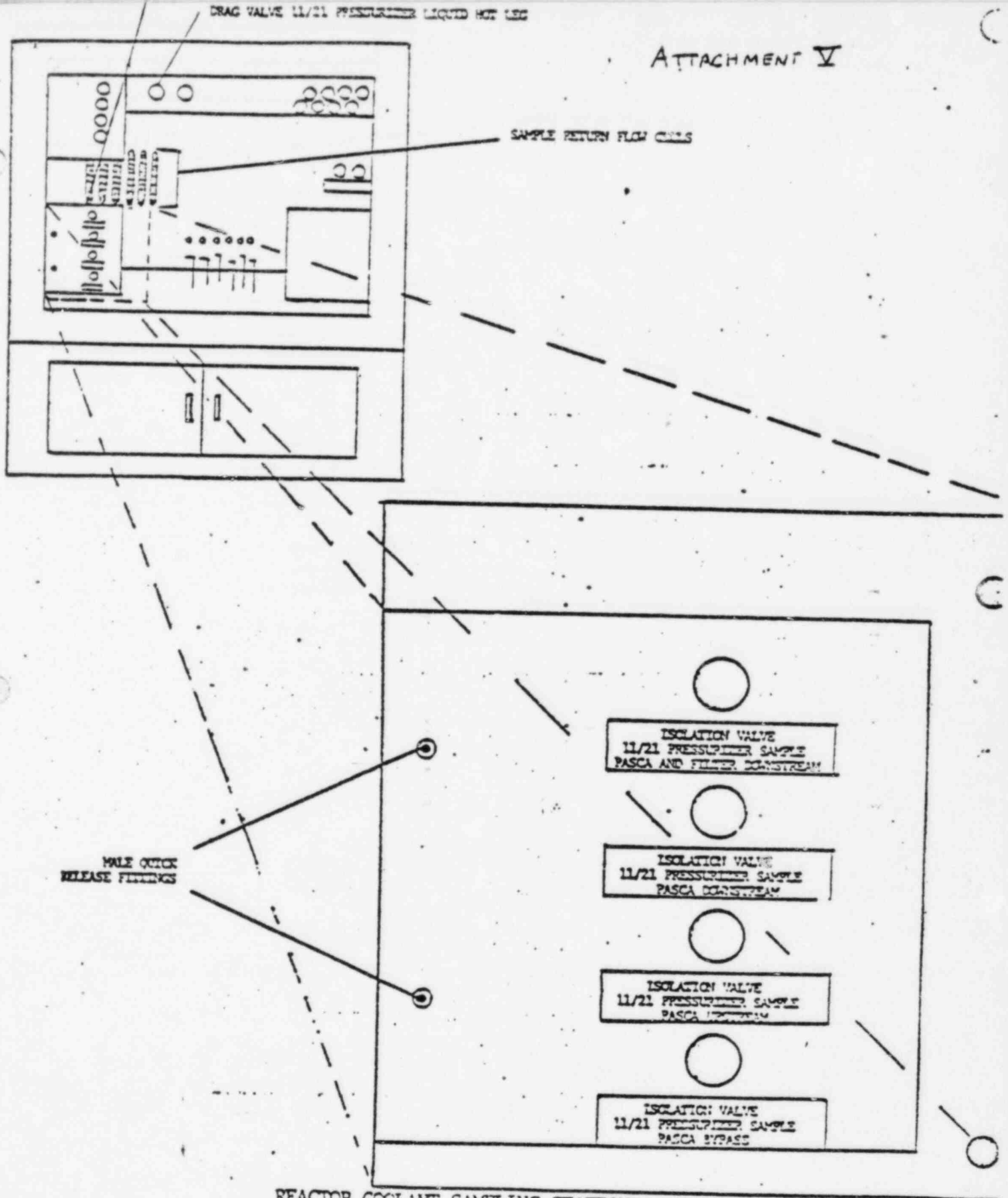
SAMPLE ROOM AUXILLIARY BUILDING, 45 FT. ELEVATION





POST-ACCIDENT RCS COOLANT
SHIELDED COOLANT SAMPLE COLLECTION APPARATUS

ATTACHMENT V



REACTOR COOLANT SAMPLING STATION
(Showing Accident Sampling Equipment)

ERPIP 4.4.7.3 REVIEW/APPROVAL

REVISION	CHANGE	REVIEWER SIG/ DATE	SUPERVISOR EPU SIG/DATE	POSRC MTG	PLANT SUPERINTENDENT /DATE
9	—	[signature] for BA Watson 12-28-82	[signature] 12/28/82	82-171	W. S. Wilson 12/31/82

CALVERT CLIFFS NUCLEAR POWER PLANT
EMERGENCY RESPONSE PLAN
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES

ERPIP PAGE	REV.	ERPIP PAGE	REV.
1	9		
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10	9		
11	9		
12	9		
13	9		

TITLE: POST ACCIDENT REACTOR COOLANT ANALYSIS

1.0 RESPONSIBLE INDIVIDUALS AND OBJECTIVES

The Chemistry Director (CD) is responsible for determining the need for performing any post-accident reactor coolant analysis.

The Liquid Release Monitoring Team (LRMT) member is responsible to the CD for assuring that very high level reactor coolant samples are properly analyzed for radiological spectrum and for boron and chloride when directed by the CD.

The LRMT member is responsible for utilizing the proper chemistry/radiochemistry equipment, protective clothing and equipment as directed by the Emergency Work Permit.

Onsite Monitoring Team member is responsible to the RPD for providing continuous radiation protection coverage during the performance of all post-accident reactor coolant samples.

-NOTE-

This procedure is only applicable if the Post Accident Sampling System is not OPERABLE. If the PASS is in service, use ERPIP 4.4.7.6.

2.0 CONDITIONS AND PREREQUISITES

2.1 In-line failed-fuel detector (Process Radiaiton 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-	Alarm $1x10^{6}$cpm Alert $1x10^{5}$cpm
RI-202-2	Linear Rate Meter	(Failed Fuel Monitor) (Analysis for I-135)

High Alarm - 70% Fuel Scale (Amber Light)
High High Alarm - 90% Fuel Scale (Red Light)

or, when this monitor is inoperative, under accident conditions.

2.2 When directed by CD.

2.3 RCS samples analyzed 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 2.0 R/h on contact.

(OBSERVE NOTE ON FOLLOWING PAGE)

- NOTE -

Lead lined gloves, lead apron, finger rings, lapel samples, plastic hoods, SCBA and High Range gamma exposure rate meter and pocket dosimeter shall be utilized to perform the RCS analysis.

2.5 Analyzing a coolant sample shall be planned to be performed promptly under accident conditions within the following periods from the time a decision is made to take a sample:

2.5.1 Radiological spectrum analysis in less than 2 hours;

2.5.2 Boron analysis in less than 2 hours;

2.5.3 Dissolved gases in less than 2 hours, (measurement of either total dissolved gases or H_2 gas is adequate); and

2.5.4 Combined time of 3 hours or less for sampling and analysis for steps 2.5.1, 2.5.2, and 2.5.3 above.

2.5.5 Chloride analysis

2.5.5.1 Within 24 hours of sample being taken, (a) if plant coolant water is baywater or brackish water, and (b) if there is only a single barrier between primary containment system and the cooling water.

2.5.5.2 For all other cases, analysis to be completed within 4 days.

2.5.5.3 The chloride analysis does not have to be done onsite.

2.6 All analysis on very high activity samples are to be performed under the exhaust hood.

2.7 Analyzing a reactor coolant sample shall be planned to be performed 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

3.1 Based on anticipated radiation exposure levels, the RPD shall specify:

3.1.1 The use of Emergency Work Permit for post-accident sampling of reactor analysis.

3.1.2 Authorized personnel exposure limits for each analysis.

3.1.3 Labeling of samples and data to be recorded.

3.1.4 Specific data to be obtained (form of results).

3.1.5 Persons to whom results must be communicated in addition to the Chemistry Director and Radiation Protection Director.

3.2 Liquid Release Monitoring Team shall carry out very high level reactor coolant analysis as follows and document on Attachment I, "Accident Coolant Sample and Analysis Data Sheet".

3.2.1 Upon direction by the CD, perform the analysis by priority in steps 3.3 through 3.6.

-NOTE-

STANDARD LABORATORY ANALYSIS PROCEDURES MAY BE INADEQUATE FOR PROCESSING SAMPLES SUBSEQUENT TO GROSS CLADING FAILURE AS LARGE QUONTITIES OF NOBLE GASSES OR OTHER VOLATILES AND FISSION PRODUCTS MAY BE PRESENT IN THE SAMPLE MEDIA IN LARGE (mCi/ml) CONCENTRATIONS.

3.2.2 Utilize procedures for analysis unless directed otherwise by the CD.

3.2.3 Follow special handling precautions and disposal techniques as directed by the Onsite Monitoring Team Member.

3.2.4 Deliver the completed Attachment I with any verbal reports deemed necessary or requested to the individual designated by the Chemistry Director and Radiation Protection Director.

3.2.5 If the local facilities become contaminated or otherwise unusable:

3.2.5.1 Contact the RPD and request notification of the Mobile Laboratory No. 1 or the offsite labs listed in Section 1.0 and/or a contracted radioactive material shipper, to assist in analysis and shipping.

- NOTE -

Inform the CD of required schedule for results.

3.2.5.2 Containerize the sample in accordance with RCP 3-506 for shipping radioactive samples.

3.2.5.3 Ship sample and required sample information, shipping documents and required results to the selected offsite lab.

3.3 Radiological Spectrum Analysis

3.3.1 Preparation for Analysis

3.3.1.1 Read and sign EWP on "Post-Accident Reactor Coolant Analysis".

1. Don protective clothing and respiratory protection equipment delineated in EWP and this procedure.

2. ONMT member available in laboratory to provide continuous radiation protection coverage during the performance of analysis on post-accident reactor coolant samples.

3.3.1.2 Required equipment

1. Post-accident Reactor Coolant apparatus (PASCA). (See Attachment II.)

2. Post-accident Sampling apparatus (PASA). (See Attachment III.)

3. 20 mL scintillation vial.

4. Gamma Spectrometer System.

5. Exposure rate measuring system (PIC-6A or RO-1,2,4A, or 5A as appropriate).

3.3.1.3 Operation of PASCA/PASA (See Attachment III).

1. Install equipment and perform below actions within exhaust hood. Ensure exhaust fan is on and operating.

2. Connect the PASCA to the PASA. Ensure that all valves on the PASCA and PASA are SHUT.

3. Connect the vent rig to the PASCA.

4. OPEN bottom valve on PASCA.

5. OPEN top valve on PASCA.

-NOTE-

HIGH AIRBORNE ACTIVITY MAY OCCUR AT THIS POINT AND EXPOSURE RATES UP TO 1000 mR/h MAY BE PRESENT.

6. Place a 20 mL scintillation vial under the burette.

7. OPEN three-way valve on the PASA and allow a set volume to enter the burette as determined previously by the CD based on a function of exposure rate of the sample.
Volume:_____mL.

8. Drain the specific volume into the vial.

9. SHUT three-way valve on PASA after the sample has drained into the vial.

10. Dilute the vial, if necessary, to 10 mL with demineralized water and cap the vial.

3.3.2 Analysis

1. Place the scintillation vial in a low background area and obtain a dose rate reading at exactly one foot.

2. Report the dose rate reading and the dilution performed to the CD and RPD immediately.

3. Since the gamma ray spectrometer cannot effectively count sources with dose rates greater than 30 mR/h (on contact), dilute the sample with demineralized water in a hood to achieve this level.

4. Count and analyze the sample in the remote counting geometry (approximately 15 inches off the detector) on the gamma ray spectrometer as per RCP-2-102 or RCP-2-103.

5. For the Nuclear Data System, user #30 will be assigned for emergency plan purpose and on the Tracor Northen System, sequence file #40 will be assigned.

6. These systems will analyze the sample for total dissolved noble gases and for liquid analyses.

3.3.3 Reporting

1. Report results promptly to the CD and RPD and forward a copy of Attachment I to the RPD and CD.

3.4 Boron Analysis

3.4.1 Preparation for Analysis

3.4.1.1 Read and sign EWP on "Post-Accident Reactor Coolant Analysis"

1. Don protective clothing and respiratory protection equipment delineated on EWP.

2. ONMT member available in laboratory to provide continuous radiation protection coverage during the performance of Boron analysis on post-accident coolant reactor coolant samples.

3.4.1.2 Required Equipment

1. Post-Accident Reactor Coolant Sample Collection Apparatus (PASCA) Attachment II.
2. Post-Accident Sampling Apparatus (PASA) Attachment III.
3. pH Meter
4. Magnetic stirring apparatus.
5. Burette (5 mL micro with automatic fill).
6. 100 mL Beaker
7. Lead bricks (2" x 4" x 8").
8. Reagents
   a. Mannitol, ACS Reagent Grade
   b. Standard Sodium Hydroxide Solution (dissolve 2g of NaOH (ACS Reagent Grade) in demineralized water and dilute to 1 L.)
   c. Hydrochloric Acid Solution (add 1 mL of concentrated HCl to 999 mL of demineralized water.)

3.4.1.3 Operation of PACSA/PASA (Attachment III).

1. Connect the PASCA to the PASCA- Ensure that all valves on PASCA and PASA are SHUT.
2. Connect the vent rig to the PASCA.
3. OPEN the bottom valve on the PASCA.
4. OPEN the top valve on the PASCA.

-NOTE-

HIGH AIRBORNE ACTIVITY MAY OCCUR AT THIS POINT AND EXPOSURE RATES UP TO 1000 mR/h MAY BE PRESENT.

5. OPEN three-way valve on PASA and allow 1 mL to enter burette.
6. Place a 100 mL beaker, which contains a magnetic stirring bar, under the burette and drain the 1 mL into the beaker.
7. SHUT the three-way valve on the PASA after the sample has drained into the beaker.

8. Remove the beaker to the boron stand behind the lead bricks located within the hood.

3.4.2 Analysis

-NOTE-

THE ADDITION OF MANITOL TO THE COOLANT SAMPLE WILL LIBERATE RADIOACTIVE IODINE INTO THE AIR, PROPER PRECAUTIONS SHALL BE OBSERVED. SCBA MUST BE WORN PRIOR TO ADDITION OF MANITOL.

1. Dilute the sample with 25 mL of demineralized water.

2. Stir sample continuously throughout the analysis.

3. Add 1 scoop ($\sim$ 2g) of mannitol to the sample such that some undissolved mannitol remains in the beaker while the solution is stirring.

4. Insert the pH probes into the breaker and titrated with NaOH to a pH of 8.0.

5. Continue the titration until a pH of exactly 8.5 is obtained.

6. Record the quantity of NaOH required for the titration as mL NaOH (B).

7. Determine the ppm boron using the following equation:

$$\text{ppm B} = \frac{\text{mL NaOH(B)} \quad \text{N KAP} \quad 54{,}055}{\text{mL NaOH (KAP)} \quad \text{mL of sample}}$$

- NOTE -

This assumes that the KAP has already been determined for the day. In the event this must be determined refer to RCP-1-903.

3.4.3 Reporting

1. Report results promptly to RPD and forward a copy of Attachment I to the RPD.

3.5 Chloride Analysis

3.5.1 Preparation for analysis.

3.5.1.1 Read and sign EWP on "Post-Accident Reactor Coolant Analysis."

1. Don protective clothing and respiratory protection equipment delineated in EWP

2. ONMT member available in laboratory to provide continuous radiation protection coverage during the performance of chloride analysis on post-accident reactor coolant samples.

3.5.1.2 Required equipment

1. Post-Accident Reactor Coolant Collection Apparatus (PASCA) Attachment II.

2. Post-Accident Sampling Apparatus (PASA) (See Attachment III).

3. Two (2) 40 mm cells

4. Klett-Summerson Photoelectric Colorimeter

5. Filter, #42

6. Reagents

   a. Ferric Alum Solution
   b. Mercuric Thiocyanate

3.5.1.3 Operation of PASCA/PASA. See Attachment III.

1. Connect the PASCA to the PASA. Ensure that all valves on PASCA are SHUT.

2. Connect the vent rig to the PASCA.

3. OPEN the bottom valve on the PASCA.

4. OPEN the top valve on the PASCA.

-NOTE-

HIGH AIRBORNE ACTIVITY MAY OCCUR AT THIS POINT.

EXPOSURE RATES UP TO 5000 mrem/h MAY BE PRESENT.

5. OPEN three-way valve on the PASA and allow 5 mL to enter the burette.

6. Place a 40 mm cell which contains 45 mL of demineralized water, 10 mL of ferric alum solution, and 5 mL of mercuric thiocyanote solution under the burette and drain the 5 mL reactor coolant into the cell.

7. SHUT the three-way valve on the PASA after the sample has drained into the cell.

8. Place the cell behind the lead bricks to minimize exposure.

3.5.2 Analysis

1. Prepare a reagent blank for the chloride analysis using 50 mL of demineralized water, 10 ml of ferric alum solution, and 5 mL of mercuric thiocyanote solution. Mix and let stand for 10 minutes.
2. Zero the Klett-Summerson Colorimeter by using demineralized water.

3. Measure the intensity of the color of the reagent blank with a #42 filter. Record this as Reagent Blank Reading.

4. Measure the intensity of the color of the sample with a #42 filter after it has been allowed to stand for ten minutes. Record this as the Sample Reading.

5. Determine the chloride reading from the "working" curve using the following equation:

Klett Reading = Sample Reading - Reagent Blank Reading

3.5.3 Reporting

1. Report results promptly to CD and RPD and forward Attachment I to the CD and RPD.

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

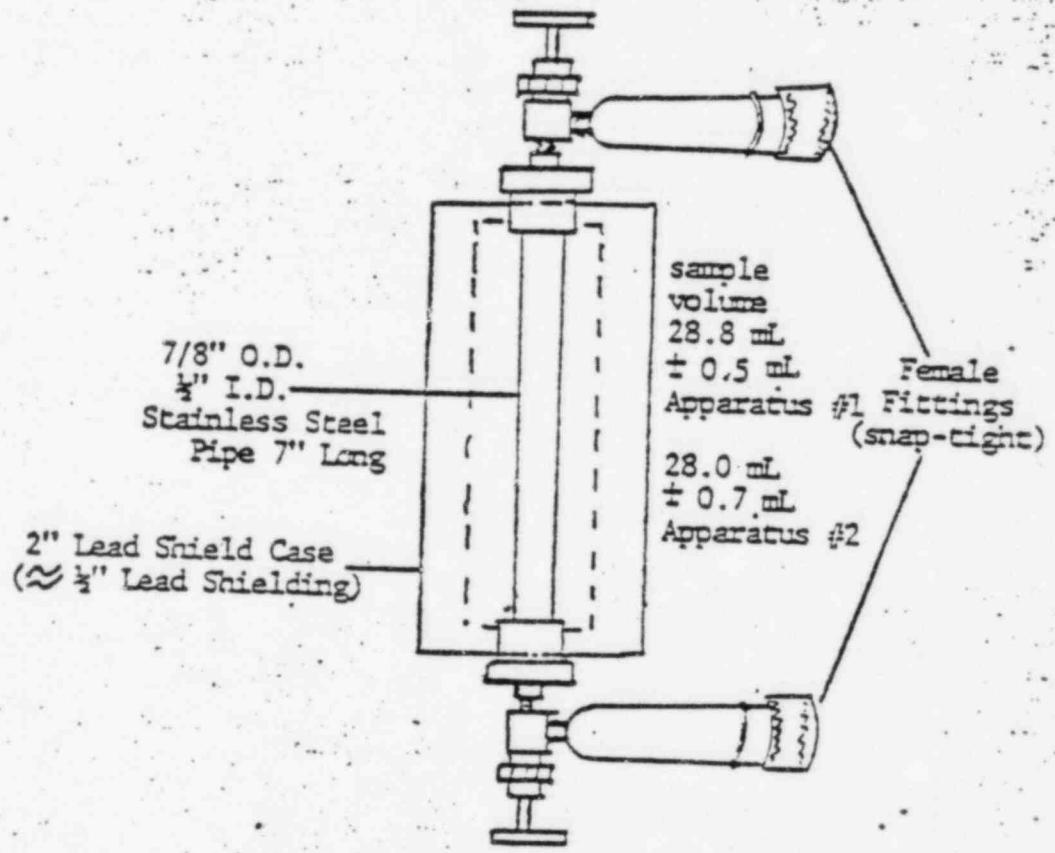
REMARKS: _____

_____

_____

_____

ATTACHMENT II



POST-ACCIDENT RCS COOLANT
SHIELDED COOLANT SAMPLE COLLECTION APPARATUS

ATTACHMENT III

This Attachment will be issued at a later date.

ERPIP 4.4.7.4 REVIEW/APPROVAL

REVISION	CHANGE	REVIEWER SIG/ DATE	SUPERVISOR EPU SIG/DATE	POSRC MTG	PLANT SUPERINTENDENT /DATE
9	–	[illegible] for D.F. Watson 2-3-83	[illegible] 01	83-01	J B Russell 1/3/83

CALVERT CLIFFS NUCLEAR POWER PLANT
EMERGENCY RESPONSE PLAN
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES

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TITLE: POST-ACCIDENT HYDROGEN ANALYSIS

1.0 RESPONSIBLE INDIVIDUAL

The Chemistry Director (CD) is responsible for determining the need for performing post-accident hydrogen analysis.

Members of the Liquid Release Monitoring Team are responsible to the CD 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 CD.

The Emergency Reentry Monitoring Team member is responsible to the Radiation Protection Director (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 When directed by CD.

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

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

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: _____ / _____
LRMT Initial Date

3.2.1.3 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. ( )

_____ / _____
ERMT Name Time

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

1. Key for the PAHAS #75 ( )

_____ / _____
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, lapel 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 approved 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.

- CAUTION -

FAILURE TO USE THE PERMANENT SHIELDING PLACED IN THE PAHAS, TO THE FULLEST EXTENT POSSIBLE, MAY RESULT IN UNDUE RADIATION EXPOSURE.

4.0 PROCEDURE

4.1 Appartus

4.1.1 The control panels, 1C139 and 1C140, 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, 1C101 and 1C102, 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 1C101 and 1C102 located on the 45' elevation of the Auxiliary building.

4.2.2 Verify that the power is "ON" and the Control Modual is in the "STANDBY" mode on both 1C101 and 1C102.

- 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 and CD 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_2 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 1C101 and 1C102, respectively.

4.2.3.3 On the H_2 Control Moduals

(a) Verify H_2 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_2 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, reseat 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 valves.

- NOTE -

The zero and span should have read 0 and 10%, respectively ± 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_2 Control Module adjust the function selector to "STANDBY".

4.2.5 On the H_2 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_2 Sample Return	6507 G/6540 G

PANEL 1C102

Containment #1 N. Primary Sheild	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 Sheild

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 # 3).

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
Containmnet #2 DOME 189' EL.	6507 F/6540 F

PANEL 1C102

Containmnet #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
Containmnet #2 H_2 Sample Return	6507 G/6540 G

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

PANEL 1C101

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 1C102

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

4.2.9 On the H_2 Control Modules adjust the control from "STANDBY" to "ANALYZE".

4.2.10 On the H_2 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_2 analyzer results.

- CAUTION -

Operation of the containment gas pump greater than 200 hours may necessitate pump maintenance.

4.2.11 When the CD no longer requires hydrogen analysis place the unit in "STANDBY" mode. Record all steps on Attachment 1.

(a) Switch the functional selector switch on the H_2 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.

5.1.3 Initial H_2 measurements.

5.2 Collect lapel air samples & send to counting laboratory for analysis.

5.3 Report to RPD and CD for full debriefing and provide copy of completed data shown on Attachment 1.

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:			
	1C101	1C102	
Zero Value as found	____%	____%	____/____
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 2

UNIT #1

VALVE LINE UP CHECK LIST

Key Operated Valves

		SAMPLE POINT	INBOARD	OUTBOARD
	__	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

Sequecer Line-Ups (Auto-ON)

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

Initials _____ Time/Date _____/_____

ATTACHMENT 3

UNIT #2

VALVE LINE UP CHECK LIST

Key Operated Valves

		SAMPLE POINT	INBOARD	OUTBOARD
	—	CNTMT # SOUTH PRIMARY SHIELD	6507B	6540B
1C101	—	CNTMT # PRESSURIZER	6507C	6540C
	—	CNTMT # 135' ELEVATION	6507D	6540D
	—	H_2 SX RETURN	6507G	6540G
	—	CNTMT # NORTH PRIMARY SHIELD	6507A	6540A
1C102	—	CNTMT # WEST 135' ELEVATION	6507E	6540E
	—	CNTMT # DOME 189' ELEVATION	6507F	6540F

Sequecer Line-Ups (Auto-ON)

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

Initials _____ Time/Date _____/

ATTACHMENT 4

SEQUENCER SAMPLE POINTS

POINT #	SAMPLE POINT	HYDROGEN READING	INITIAL/TIME
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' El	_____%	_____/_____
6	U-1 CNTMT PRZR	_____%	_____/_____
7	U-1 CNTMT South Primary Shield	_____%	_____/_____
8	U-2 CNTMT Dome 189' El	_____%	_____/_____
9	U-2 CNTMT West	_____%	_____/_____
10	U-2 CNTMT North Primary Shield	_____%	_____/_____

PERFORMED BY: _____/_____
Signature Date

ERPIP 4.4.7.5 REVIEW/APPROVAL

REVISION	CHANGE	REVIEWER SIG/ DATE	SUPERVISOR EPU SIG/DATE	POSRC MTG	PLANT SUPERINTENDENT /DATE
Rev 0	—	B.A. Watson 9-24-82	[signature] 9/24/82	82-124	J.B. Dimmel 9-24-82
1	—	Telephone for B.A. Watson 12-28-82	[signature] 12/30/82	82-171	W.S. Kibon 12/31/82

CALVERT CLIFFS NUCLEAR POWER PLANT
EMERGENCY RESPONSE PLAN
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES

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9	1		
10	1		
11	1		
12	1		
13	1		

TITLE: POST-ACCIDENT SAMPLING SYSTEM AND ANALYSIS

1.0 RESPONSIBLE INDIVIDUAL

The Chemistry Director (CD) is responsible 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 every hour as necessary, 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 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 Time

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 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. Keys for the PASS RCS & H_2 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
3.1.2.4	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' Aux. 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 Sample System access area on the 45' elevation of the Aux. 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 are in the "ON" position.

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 coolant sample.	2. Verify that the valve switch positions and manual valves are in "NORMAL" line-up positons and energized per Attachment 2.
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. Perform Sample Analysis and obtain samples as per Section 4.0.
3.	Ensure that Lapel Air Samplers are turned on.	

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 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. 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 radioiostopic 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 2) 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 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 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 conditon 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 midpositon.

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).

SEE NOTE ON NEXT PAGE

- 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). Contract 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 tha 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 sig. (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_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 sclae 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 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_{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.

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_{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.

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) ± 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 ($Na_3PO_4 \cdot 12\ H_2O$). (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 radioistopic 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 5 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 changesd (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 reuqired 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-5023 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, 4.8, 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 positon 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_2.

(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 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 upper right hand port is for the Containment 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.

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 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.	(d) 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 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 2 "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:

ΔV = final ml - 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 intial 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 (^oF)
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)

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

Where:

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

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

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_B = PI-5031 Pressure (psig)

T = TI-5001 Temperature (°F)

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 $NA_3 PO_4 \cdot 12 H_2O$ 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	Valve	Position	Valve	Position
*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		

* Manual valves located in Sample Station.

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) _____ °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

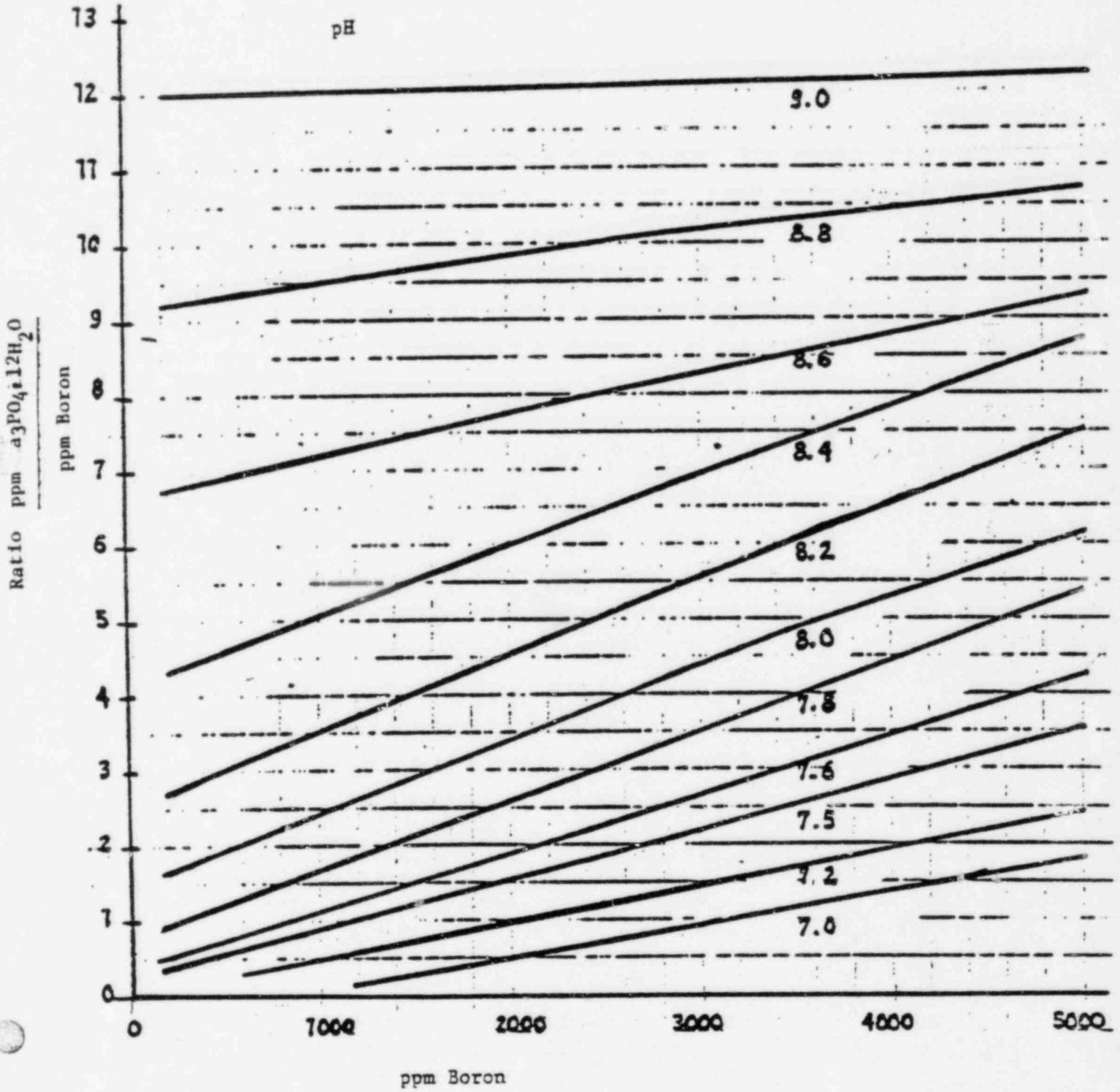
DATE/TIME: __/__/__ _____

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) _____

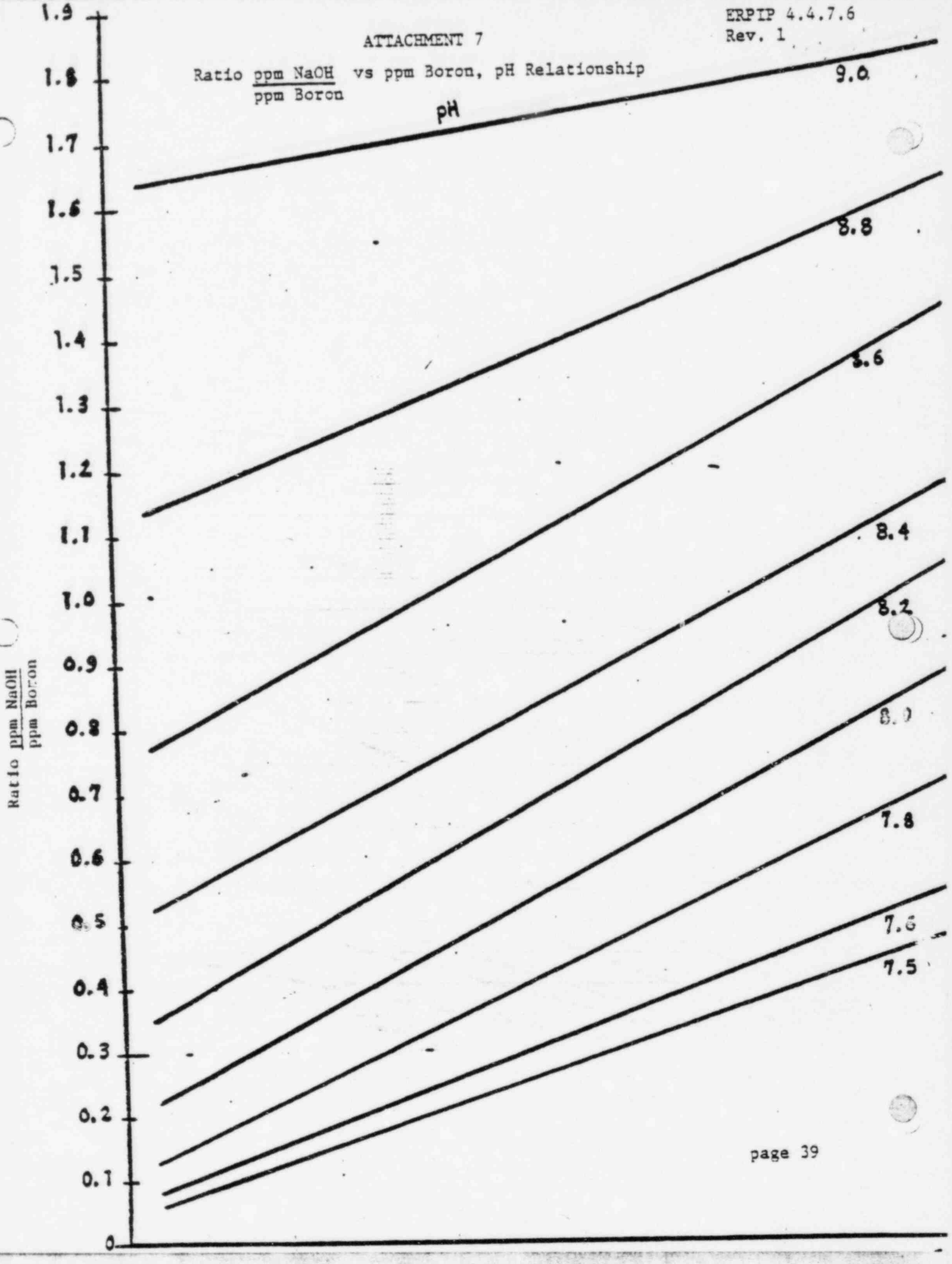
ATTACHMENT 6

Ratio $\frac{\text{ppm } Na_3PO_4 \cdot 12\ H_2O}{\text{ppm Boron}}$ vs ppm Boron, pH Relationship



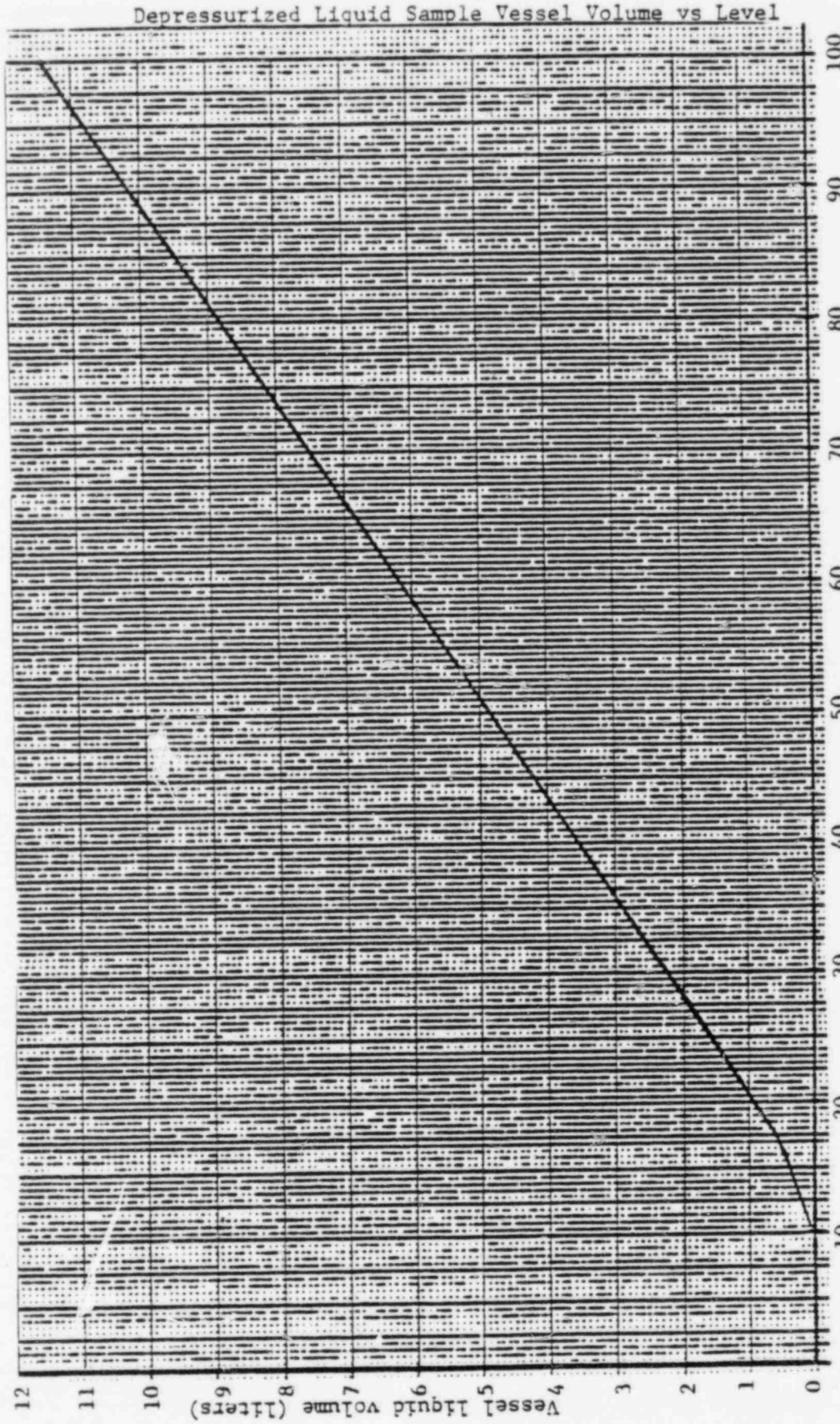
ATTACHMENT 7

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



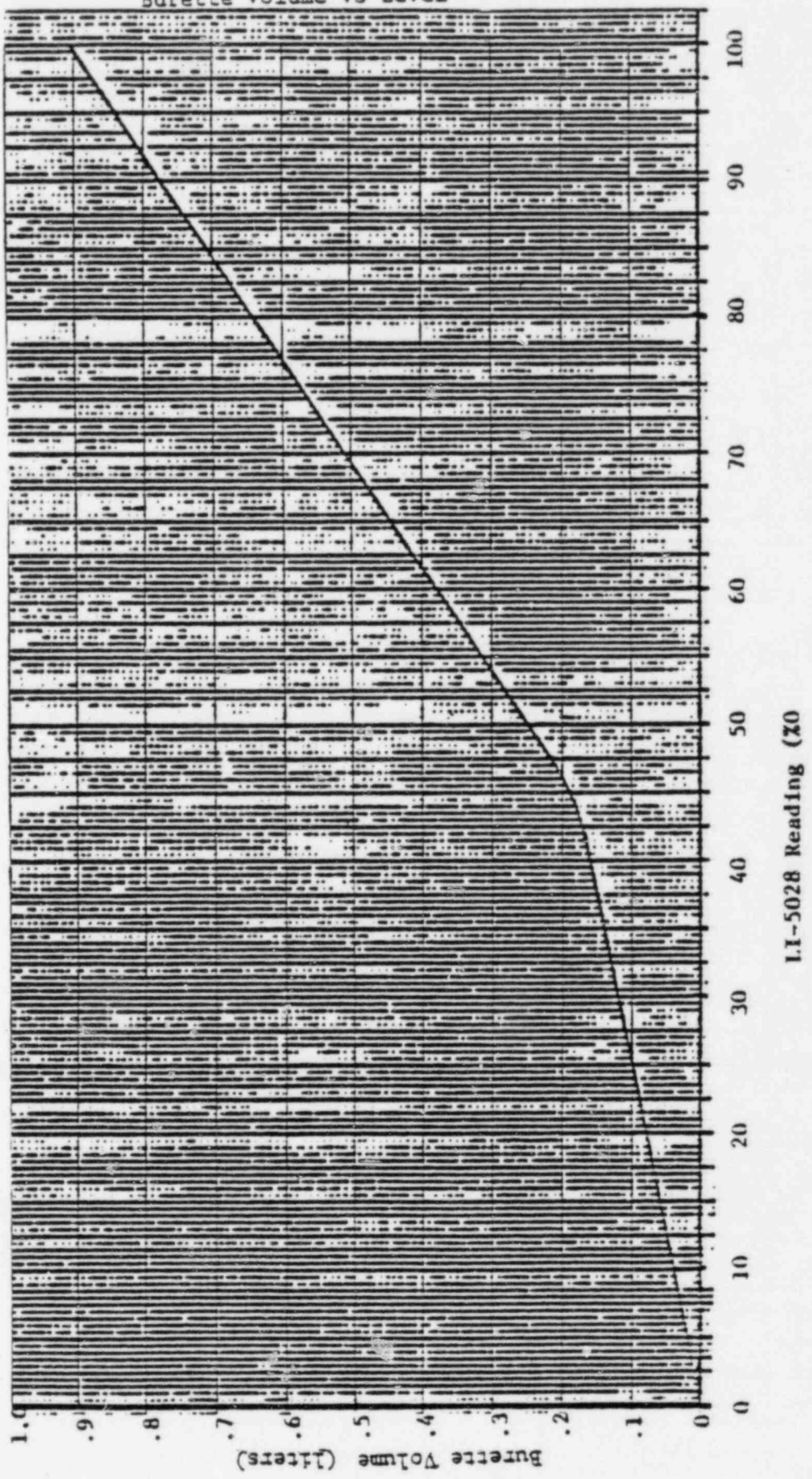
ATTACHMENT 8

Depressurized Liquid Sample Vessel Volume vs Level



ATTACHMENT 9

Burette Volume vs Level



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] 9/24/82	[signature] 9/24/82	82-124	J R Russell 9-24-82
1	—	R Futrell for B.A. Watson 12-27-82	[signature] 12/29/82	82-169	J R Russell 12/29/82

CALVERT CLIFFS NUCLEAR POWER PLANT
EMERGENCY RESPONSE PLAN
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES

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

TITLE: AID TO AFFECTED PERSONNEL

-CONTENTS-

Section	Procedure
4.6.1	EMERGENCY PERSONNEL RADIATION EXPOSURES
4.6.2	FIRST AID AND MEDICAL CARE (EFADT)
4.6.3	HEALTH PHYSICS ASSISTANCE AT CALVERT MEMORIAL HOSPITAL
4.6.4	GUIDANCE FOR FIRST AID AND MEDICAL PERSONNEL AND HEALTH PHYSICIST IN INITIAL MANAGEMENT OF IRRADIATED OR RADIOACTIVELY CONTAMINATED PERSONNEL.
4.6.5	FARM DEMONSTRATION BUILDING DECONTAMINATION FACILITY

TITLE: FARM DEMONSTRATION BUILDING DECONTAMINATION FACILITY

RESPONSIBLE INDIVIDUAL: Any individual qualified to perform Personnel Decontamination.

CONDITIONS: Personnel decontamination is required

AND

Controlled Area Medical Treatment Room use is prevented.

ACTIONS

_____ / _____
Signature Date

- CAUTION -

Farm Demonstration Tank No. 1 permits sewage to enter the septic drainfield (conventional filtration of the sewage waste into the environment). Failure to isolate Tank No. 1 as specified may result in radioactive materials entering the environment.

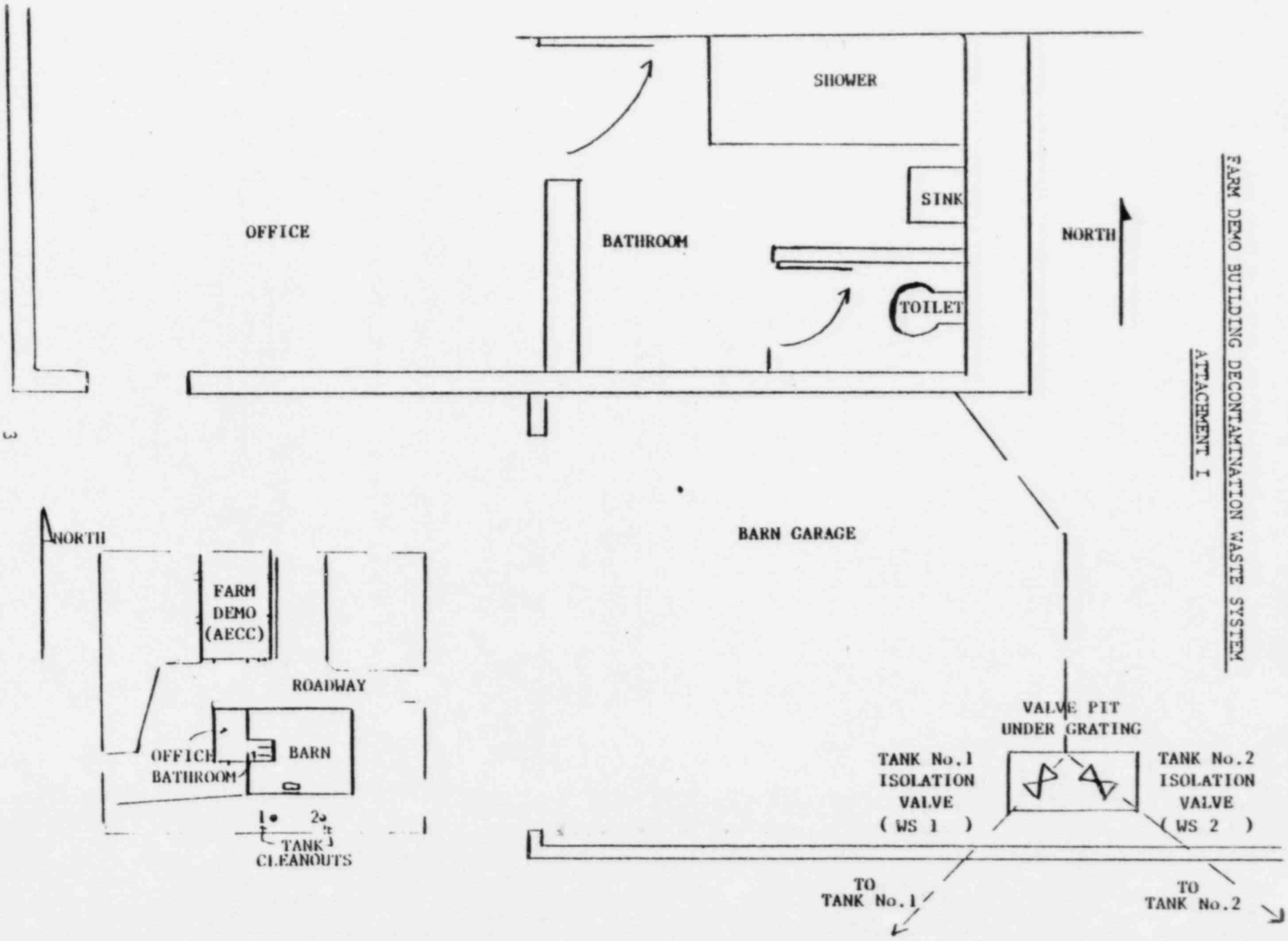
1. **AT** the Farm Demonstration garage, **REMOVE** the valve pit grating cover. (see Attachment 1.)	Action Complete _____
2. **CLOSE** Waste System Tank No. 1 isolation valve WS-1.	Action Complete _____
3. **OPEN** Waste System Tank No. 2 isolation valve WS-2.	Action Complete _____
4. **REPLACE** the valve pit grating cover.	Action Complete _____

5. **TAG** Tank No. 2 Cleanout (Attachment #1) with a caution-radioactive materials tag (or equivalent). Tag must require Chemistry to be contacted prior to opening.	Action Complete _____

6. **SET UP** bathroom as a Radiological Control Area. Must include a step off pad at the door, personnel monitor (RM-14 or equivalent), bags for contaminated waste and decontamination supplies.	Action Complete _____

7. **NOTIFY** Chemistry Director and Radiation Protection Director that: •facility is prepared to receive contaminated personnel •Tank No. 2 requires sampling and monitoring prior to pumping out.	Action Complete _____

8. **FORWARD** this checklist and all records related to this emergency response to the Supervisor-Emergency Planning.



FARM DEMO BUILDING DECONTAMINATION WASTE SYSTEM

ATTACHMENT 1

ATTACHMENT 1

ERPIP 4.6.5 REVIEW/APPROVAL

REVISION	CHANGE	REVIEWER SIG/ DATE	SUPERVISOR EPU SIG/DATE	POSRC MTG	PLANT SUPERINTENDENT /DATE
0	—	C.L. Rayburn 12-9-82	[illegible] for 12-15-82	82 164	J.S. Russell 12/17/82

CALVERT CLIFFS NUCLEAR POWER PLANT
EMERGENCY RESPONSE PLAN
IMPLEMENTATION PROCEDURES

LIST OF EFFECTIVE PAGES __

ERPIP PAGE	REV.
1	0
2	0
3	0