COMPARISON OF HAND-HELD PHOTOIONIZATION DETECTORS TO CHARCOAL TUBE & GC-ECD, DRÄGER COLORIMETRIC TUBE, AND A SINGLE-GAS PORTABLE INSTRUMENT FOR DETECTION OF METHYL BROMIDE RESIDUE

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DISCLAIMER

The mention of commercial products, their source, or use in connection with material reported herein is not to be construed as an actual or implied endorsement of such product.

ABSTRACT

A preliminary study was designed to compare ppbRAE Photo-Ionization Detector (ppbPID) and MiniRae Photo-Ionization Detector (ppmPID) to petroleum charcoal tube trapping and gas chromatograph with electron capture detector analysis (charcoal tube & GC-ECD) method for monitoring methyl bromide residue in air. The monitoring was conducted for four hours after fumigation and aeration at a nut processing plant in Winters, CA on March 2, 2001. Dräger colorimetric tube method and an IQ 350 instrument were also included in this study.

Compared to the charcoal tube method with a 50% recovery adjustment, the quantitative results of the ppmPID and Dräger tube methods over estimated while the ppbPID and IQ-350 underestimated the methyl bromide concentrations in this study. Correlation analysis indicated ppbPID, ppmPID, Dräger tube, and IQ350 were all significantly correlated ($P_{0.05}$) to the charcoal tube method. Furthermore, there were statistically significant ($P_{0.05}$) linear regressions of the ppbPID, ppmPID, Dräger tube, and IQ 350 with the charcoal tube method.

The systematic variance between DPR's normal charcoal tube & GC-ECD method and the instantaneous instrument, ppbPID and ppmPID, measurement might be due to an instrument calibration error.

The portable ppbPID provides real-time and continuous monitoring with programmable and data logging capabilities. These characteristics would make it an attractive tool for instantaneous methyl bromide air concentration monitoring. However, the interference of non-targeted, photo-ionizable chemicals must be considered. Standard calibration should be improved, and further studies must be conducted for the ppbPID to be used in the DPR regulation programs.

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INTRODUCTION

The ability to determine instantaneous methyl bromide air concentration is important to prevent exposure to levels of the fumigant over the limits of health concern. In the past, applicators have relied on colorimeter tubes equipped with a hand-pump to determine the concentration of methyl bromide present. Recently a new product, ppbRae Volatile Organic Compound (VOC) Monitor with dual channel sensors, has been marketed to provide an alternative for hand-held, real-time, continuous monitoring.

This preliminary study compared the ppbPID, ppmPID, Dräger colorimetric tube, and IQ-350 readings to the results of petroleum charcoal tube trapping and GC-ECD analysis, the DPR standard method, for monitoring methyl bromide residue in air.

MONITORING METHODS AND MATERIALS

The monitoring was conducted for four hours after fumigation at a nut production plant in Winters, CA on March 2, 2001. The fumigation chamber was subdivided into two chambers with a wall in the middle. The left chamber was fumigated and aerated three days prior to the study. The right chamber was 11,400 ft^3 and fumigated at 5:00 pm on March 1, 2001. Twenty-nine pounds Meth-O Gas® was used to fumigate 160,000 lbs of almond nuts for 12 hours in the right chamber. After 4 hours of aeration the methyl bromide concentration was checked with a Dräger colorimetric tube. When methyl bromide concentration was less than 5 ppm, the monitoring commenced in the right chamber using the following methods:

Charcoal Tube & GC-ECD

Duplicate half-hour samples were taken inside the fumigation chamber for three hours. A half-hour and a one-hour break were taken after the second and fourth sampling periods, respectively. The two petroleum charcoal tubes (SXC#226-38-02) were set approximately five feet from ground on a wheel cart positioned in the center of the chamber in a three-foot-wide pathway. The samples were taken at a flow rate of 300 ml/min using SKC personal air sampling pumps (SKC#224-PCXR8). The flow rate of each pump was checked and recorded at the beginning and the end of each sampling interval. The sampled tubes were placed in dry ice and sent to the laboratory on the same day. The samples were extracted with ethyl acetate on March 5, 2001 and GC-ECD analysis was finished on March 6, 2001.

Four laboratory quality assurance samples were spiked, extracted, and analyzed on March 2, 5, and 6, 2001, respectively. Two charcoal tubes were spiked at 1µg and other two at 25 µg levels.

Dräger colorimetric tube

Samples were collected every 15 minutes inside the chamber. The colorimetric

tube was positioned together with the charcoal tubes on the same sampling rack. Sampling duration time averaged seven minutes and ranged from five to eleven minutes. During the monitoring, the same break periods were taken as the charcoal tube sampling.

ppbRae PID (ppbPID)

The instrument was positioned together with the charcoal tube pump and the sample tubing was placed on the same rack as the charcoal tubes. Instantaneous monitoring was conducted continuously and concentrations were averaged at one-minute increments. The internal pump was set at a flow rate of 400 ml/minute and the high alarm at 5,000 ppb. The standard was calibrated using isobutylene by the Rae Systems, Inc. The monitoring results were logged and stored in the ppbRae unit until downloaded to computer for data manipulation. During the monitoring, the same break periods were taken as the charcoal tube sampling.

MiniRae PID (ppmPID)

A MiniRae PID (ppmPID) was also used for comparison in this study. The ppmPID functions the same as the ppbPID except that it is not equipped with the dual channel sensors, so only detects down to ppm (10^{-6}), instead of ppb (10^{-9}) level. The instrument setting and monitoring procedure were the same as the ppbPID.

IQ 350

The nut company provided a single gas, portable instrument, IQ 350, for method comparison. The IQ 350 was placed on the same sampling cart and its reading was manually recorded at the time when the Dräger tube samples were taken.

Detailed information for the first three methods is described in the Protocol for Study #X100 (Attachment I). However, there are two major deviations: the sampling schedule shown in the protocol was changed and the originally planned monitoring inside the warehouse, where the fumigated products were stored, could not be accomplished because the concentration was too low to be detected by Dräger tube method and it would take at least 24 hours sampling by charcoal tube method. As an alternative, the left chamber was monitored after the second (one hour) break for the method comparison at low concentrations. Samples numbered from 9 to 12 (from 11 to 16 for IQ350) were collected in the left chamber.

CALCULATIONS

For the charcoal tube & GC-ECD method, sample volume was calculated by:

(Start flow rate + End flow rate)/2 x Sampling time

On samples 1 and 2, where the end flow rate was not recorded, the start flow rate was used for the entire sampling period.

The concentration (ng/l) was calculated by:

Mass (μg methyl bromide analyzed per sample) / Sample volume (ml) x 1,000,000

The concentration (ng/l) was converted to ppm by:

$ppm = (ng/l * V_{std} * T) / (MW * T_{std} * 1000)$

$= (ng/l * 22.4 * 298)/(94.9 * 273 * 1000)$

where V_{std} = idea gas volume (22.4 liter/mole) at standard conditions:
pressure = 1 atmosphere and temperature, T_{std} = 273 K;
MW = molecular weight (94.9 g/mole);
T = temperature (298 K); and
1000 = ng/μg.

RESULTS AND DISCUSSIONS

Charcoal tube & GC-ECD method

Table 1 presents the results of charcoal tube & GC-ECD method. The averages of duplicate samples in each sampling interval ranged from 0.25 to 1.66 ppm and standard deviations ranged from 0.01 to 0.09 ppm for the studied period. The laboratory spike recoveries ranged from 73.0 to 77.6% with an average of 75.0% and a standard deviation of 2.1% (Table 2).

Dräger colorimetric tube method

Table 3 shows the tested readings on Dräger colorimetric tube. Every two Dräger tube samples were averaged to approximate the corresponding sampling period of the charcoal tube method. The averages ranged from 0.7 to 4.5 ppm and standard deviations ranged from 0.1 to 1.4 ppm.

ppbPID and ppmPID

The instantaneously monitored maximum, minimum, and average readings at one-minute increments were displayed and stored in the ppbPID and ppmPID. The stored data are reported in Attachment II and III. Table 4 gives the one-minute increment readings averaged in periods consistent with charcoal tube sampling. The averaged ppbPID readings ranged from 0.2 to 1.3 ppm and standard deviations ranged from 0.2 to 0.7 ppm. The averaged ppmPID readings ranged from 1.1 to 33.0 ppm and standard deviations ranged from 0.2 to 1.5 ppm.

Both ppbPID and ppmPID were initially calibrated using isobutylene by the Rae Systems, Inc. However, an accident occurred during monitoring. The exhaust of the ppmPID was blocked for a few seconds, as a test, at 9:50a.m. The readings on ppmPID immediately increased to ten times higher than those on other instruments. In the process of solving this problem, calibration mode was unintentionally changed to using ambient air. However, the lamp response factor was not changed. Both initial and final instrument

configurations are in Attachment IV. The monitoring was interrupted for half hour after the second run of the charcoal tube sampling.

IQ-350

IQ-350 equipped with a PID displayed the detected concentrations instantaneously. The readings were manually recorded when the Dräger tube samples were taken and averaged corresponding to charcoal tube sampling period in Table 5. The average readings ranged from 0.8 to 1.4 ppm with standard deviations ranged from 0.07 to 0.22 ppm.

Comparison of five methods

Table 6 summarizes the average and standard deviation for the five different methods or instruments. Biermann and Barry (1999) studied methyl bromide trapping efficiency using stainless steel canister to compare charcoal tube sampling. Via a set of tests to quantify the effects of temperature, humidity, and concentration, the overall average recovery of methyl bromide with charcoal tube sampling and GC-ECD analysis by the CDFA Center for Analytical Chemistry was estimated at 50%. Therefore both original and 50% recovery adjusted results are presented for the charcoal tube method. Figure 1 depicts the method comparison results with the 50% recovery adjusted for charcoal tube method and with the data points at 9:47 a.m. excluded due to the abnormal operation as stated previously. The following discussions are based on these two corrections as well.

As shown in Figure 1, the quantitative results of the five methods or instruments were fairly diverse. Compared to the DPR's normal charcoal tube method with 50% recovery adjustment, the ppmPID and Dräger tube methods over estimated while the ppbPID and IQ-350 underestimated the air concentrations of methyl bromide residue in this study.

However, the similar shape of the five curves (Figure 1) indicated that each method tracked the change of methyl bromide concentrations during the monitoring period. Figure 2 depicts the comparison of the four methods, Dräger tube, IQ-350, ppbPID, and ppmPID, to the charcoal tube method. Analysis of correlation and regression of this comparison revealed that the four methods were all significantly correlated ($P_{0.05}$) to the charcoal tube method (Table 6). Furthermore, the relationship of the four methods to the charcoal tube method could be quantitatively described by a linear regression. The regression coefficients of slope and intercept are given in Table 6. The F test results showed that for 1 and 3 degrees of freedom, the regression of the Dräger tube, ppbPID, and ppmPID methods to the charcoal tube method was significant at the 1% level and the IQ-350 method was significant at the 5% level.

The systematic variance between DPR's normal charcoal tube trapping and GC-ECD analysis and the instantaneous instrument, ppbPID and ppmPID, measurement might be due to an instrument calibration error because the instantaneous instrument readings are based on precalibrated conversion factors of response signal vs standard concentration.

Both ppbPID and ppmPID were tested for interference effects of forklift exhaust in the

warehouse. There was no significant detection for the ambient air inside the warehouse even on the forklift traffic pathway. However, the reading was greatly increased when the instruments were close to the forklift exhaust (within approximately one foot distance).

Table 1. Methyl Bromide by Charcoal Tube & GC-ECD method

Sample	Time			Flow Rate		Sample		Methyl Bromide				
#	Start	End	Running minutes	Start ml/min	End	Volume ml	Mass µg	Concentration ng/l	ppb		Avg ppm	Dev
1	9:15	9:46	31.0	287.5		8912.5	40.8	4578	1179	1.18		
2	9:15	9:46	31.0	280.0		8680.0	38.3	4412	1137	1.14	1.16	0.03
3	9:47	10:17	30.0	292.0	294.0	8790.0	42.2	4801	1237	1.24		
4	9:47	10:18	31.0	283.0	283.0	8773.0	40.8	4651	1198	1.20	1.22	0.03
5	10:50	11:20	30.0	284.0	286.0	8550.0	49.8	5825	1501	1.50		
6	10:50	11:20	30.0	284.0	286.0	8550.0	53.9	6304	1624	1.62	1.56	0.09
7	11:22	11:52	30.0	280.0	280.0	8400.0	54.2	6452	1662	1.66		
8	11:22	11:52	30.0	292.0	292.0	8760.0	56.1	6404	1650	1.65	1.66	0.01
9	12:36	13:06	30.0	279.0	278.0	8355.0	15.3	1831	472	0.47		
10	12:36	13:06	30.0	291.0	292.0	8745.0	15.3	1750	451	0.45	0.46	0.01
11	13:07	13:37	30.0	283.0	283.0	8490.0	8.1	948	244	0.24		
12	13:07	13:37	30.0	292.0	294.0	8790.0	9.0	1027	265	0.26	0.25	0.01

Table 2. Laboratory Spike Recovery of Charcoal Tube & GC-ECD method

Lab QA #	Spike µg	Analyzed µg	Recovery %
1	25	18.90	75.6
2	1	0.78	77.6
3	25	18.40	73.6
4	1	0.73	73.0
Average			**75.0**
Standard Deviation			2.1

Table 3. Methyl Bromide Reading on Dräger Tube

Sample #	Time			Methyl bromide		
	Start	End	Running minutes	Reading	Avg ppm	Dev
1	9:20	9:27	0:07	3.0		
2	9:35	9:46	0:11	2.5	2.8	0.4
3	9:59	10:07	0:08	3.0		
4	10:12	10:20	0:08	2.2	2.6	0.6
5	10:54	11:00	0:06	5.0		
6	11:09	11:14	0:05	4.0	4.5	0.7
7	11:24	11:30	0:06	3.0		
8	11:41	11:47	0:06	5.0	4.0	1.4
9	12:38	12:45	0:07	1.0		
10	12:53	13:00	0:07	0.8	0.9	0.1
11	13:11	13:17	0:06	0.6		
12	13:25	13:31	0:06	0.7	0.7	0.1

Table 4. Average Methyl Bromide by ppbPID and ppmPID Monitoring

Period	ppbPID				ppmPID	
	ppb		ppm		ppm	
	Reading	Dev	Reading	Dev	Reading	Dev
09:11-09:41	1197	310	1.20	0.31	4.7	0.7
09:42-10:13	946	390	0.95	0.39	33.0	1.1
10:50-11:20	1298	484	1.30	0.48	5.6	1.5
11:22-11:50	1325	688	1.33	0.69	5.3	0.4
12:31-13:06	482	221	0.48	0.22	2.4	0.4
13:07-13:36	212	156	0.21	0.16	1.1	0.3

Table 5. Methyl Bromide Reading on IQ-350

Sample #	Reading (ppm)			
	Time	MeBr	Avg	Dev
1	9:27	1.4		
2	9:45	1.3	1.35	0.07
3	9:56	1.3		
4	10:07	1.5	1.40	0.14
5	11:01	1.2		
6	11:16	1.5	1.35	0.21
7	11:23	1.4		
8	11:30	1.5		
9	11:47	1.9		
10	11:51	1.5	1.58	0.22
11	12:37	0.7		
12	13:00	0.9	0.80	0.14
13	13:16	0.9		
14	13:25	1.1		
15	13:30	0.9		
16	13:38	0.9	0.95	0.10

Table 6. Methyl bromide Comparison of Five Methods

Time	Average MeBr (ppm)					
	Charcoal Tube & GC-ECD		Dräger	IQ-350	ppbPID	ppmPID
	Original	Adjusted				
9:15	1.16	2.32	2.8	1.4	1.20	4.72
9:47	1.22	2.44	2.6	1.4	0.95	32.99
10:50	1.56	3.12	4.5	1.4	1.30	5.60
11:22	1.66	3.32	4.0	1.6	1.33	5.26
12:36	0.46	0.92	0.9	0.8	0.48	2.44
13:07	0.25	0.50	0.7	1.0	0.21	1.08
Time	**Standard Deviation**					
	Charcoal Tube & GC-ECD		Dräger	IQ-350	ppbPID	ppmPID
	Original	Adjusted				
9:15	0.03	0.06	0.4	0.1	0.31	0.67
9:47	0.03	0.05	0.6	0.1	0.39	1.14
10:50	0.09	0.17	0.7	0.2	0.48	1.50
11:22	0.01	0.02	1.4	0.2	0.69	0.43
12:36	0.01	0.03	0.1	0.1	0.22	0.44
13:07	0.01	0.03	0.1	0.1	0.16	0.34

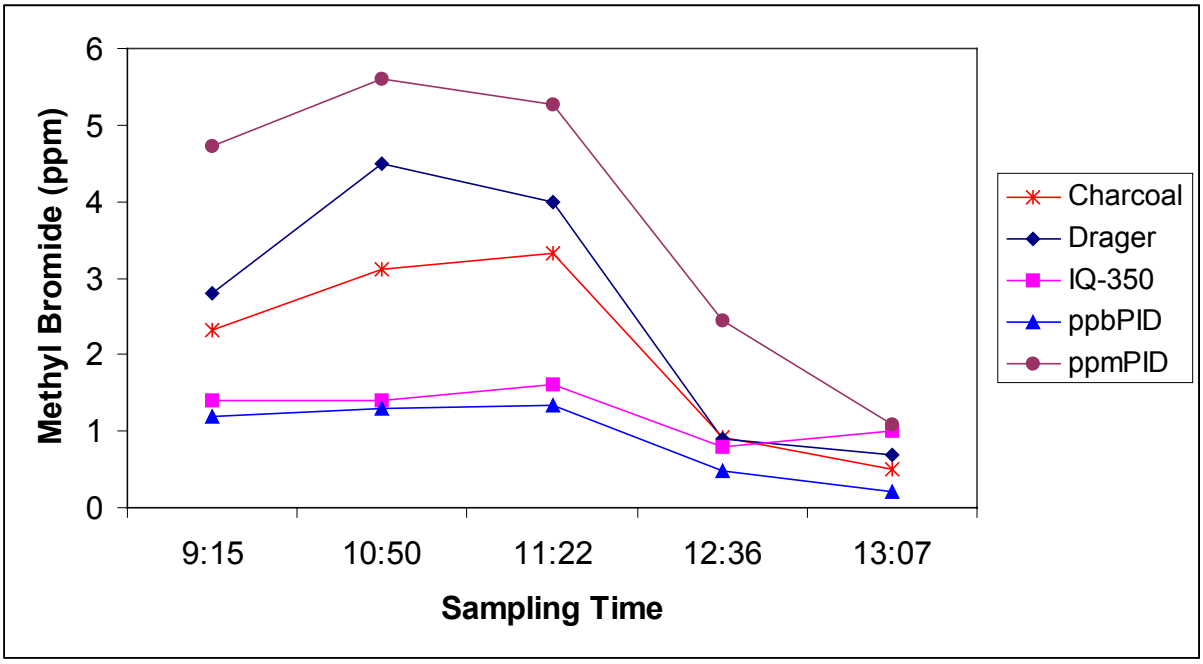
Table 7. Correlation and Regression Analysis

	Dräger	IQ-350	ppbPID	ppmPID
Correlation Coefficient r	0.98**	0.93*	0.98**	0.97**
Slope b	1.34	0.23	0.40	1.50
Intercept a	-0.15	0.73	0.09	0.76
Coefficient of determination r^2	0.97	0.87	0.95	0.95
F	87.71**	19.41*	63.32**	57.33**
df	3	3	3	3
Std. Error of b	0.14	0.05	0.05	0.20
Std. Error of a	0.33	0.12	0.12	0.46
Std. Error of Y	0.37	0.14	0.13	0.51
Regression sum of squares	11.71	0.36	1.03	14.70
Residual Sum of squares	0.40	0.06	0.05	0.77

*$F_{0.05}$=10.13 *$r_{0.05}$=0.88

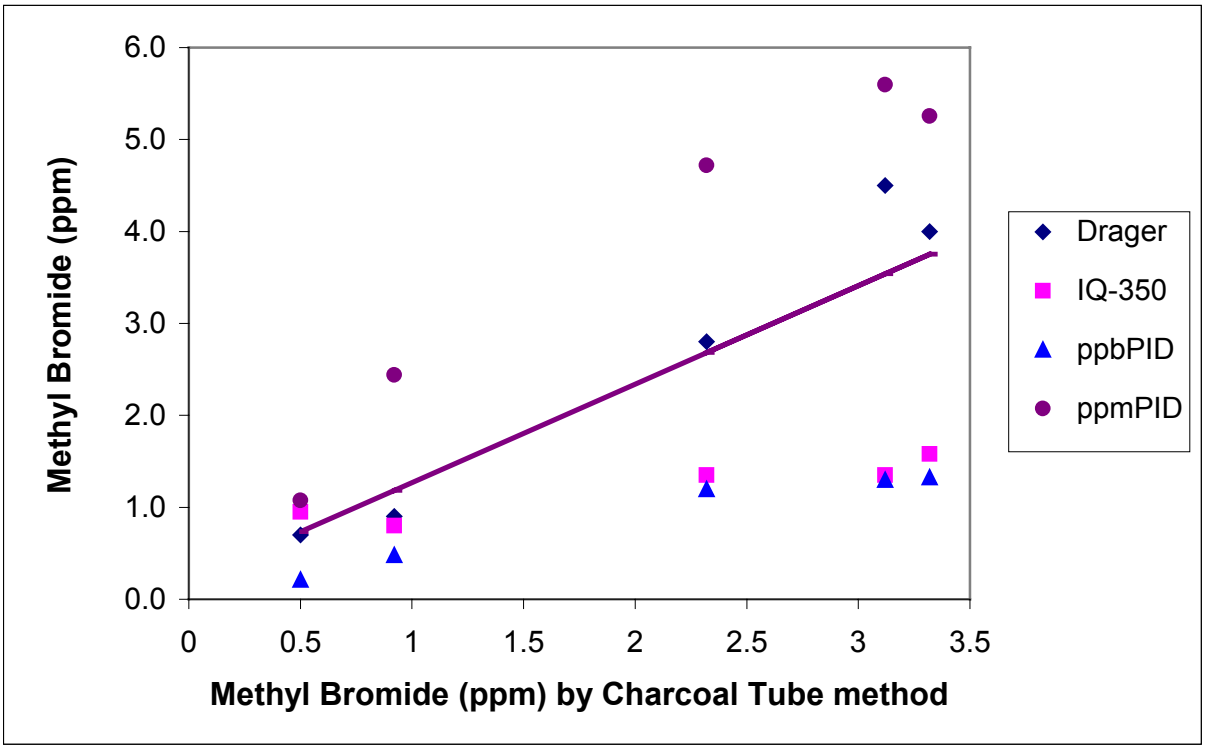
**$F_{0.01}$=34.12 **$r_{0.01}$=0.96

Figure 1. Comparison of Five Methyl Bromide Monitoring Methods



Note: Time refers to the beginning of charcoal tube sampling. All data are the average of half hour readings.

Figure 2. Drager, IQ-350, ppbPID, and ppmPID Compared to Charcoal Tube & GC-ECD



CONCLUSIONS

This preliminary study compared five different methods or instruments for monitoring methyl bromide residue at a fumigation chamber. The portable IQ-350, ppbRae PID and MiniRae PID are convenient and provide instantaneous, real-time, continuous monitoring. The ppbRae PID and MiniRae PID with programmable characteristics and data log storage capabilities would enhance their uses for other purpose, e.g. collect data for modeling. However, the interference of non-targeted and photo-ionizable chemicals should be considered. Standard calibration should be improved and further studies must be conducted.

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Attachment I Study Protocol

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Study # X100

STUDY PROTOCAL FOR COMPARISON OF A HAND-HELD PHOTOIONIZATION DETECTOR TO CHARCOAL TUBE & GC-ECD AND DRÄGER COLORIMETRIC TUBE METHODS FOR DETECTION OF METHYL BROMIDE RESIDUE

JANUARY 10, 2001

I. INTRODUCTION

The ability to detect instantaneous methyl bromide measurements is important to prevent exposure to levels of the fumigant over the limits of health concern. In the past, applicators have relied on hand pumps equipped with a colorimeter tube to determine the concentration of methyl bromide present. Recently a new product has become available to provide an alternative for real-time monitoring.

The ppbRAE Volatile Organic Compound (VOC) Monitor with dual channel sensors is claimed, by its manufacturer, to being the most sensitive Photo-Ionization Detector (PID) on the market. It could provide hand-held, real-time continuous monitoring for the detection of methyl bromide air concentrations following fumigations in the food production industry. The ppbRAE could provide a useful tool for quick measurement of methyl bromide concentrations before re-entry of personnel into fumigated areas. However, the measurement method and the reliability of the monitoring result need to be evaluated.

II. OBJECTIVE

The ppb RAE PID readings will be compared to both the Dräger colorimetric tube readings and the DPR standard air pump/petroleum charcoal tube trapping and GC-ECD analysis method for monitoring methyl bromide residue in a fumigation chamber at a nut processing plant.

III. PERSONNEL

This trial study will be conducted by personnel from the Environmental Hazards Assessment Program under the overall supervision of Randy Segawa, Senior Environmental Research Scientist.

Key personnel include:

Project Leader -	Shifang Fan
Associated Staff Scientist -	Dave Kim
Field Coordinator -	Johanna Walters
Laboratory Liaison -	Carissa Ganapathy
Analyzing Laboratory -	California Department of Food and Agriculture, Center for Analytical Chemistry
Agency and Public Contact -	Randy Segawa

All questions concerning this project should be directed to at (916) 324-4100.

IV. STUDY DESIGN

The monitoring will be conducted at four hours post-fumigation (after four hours aeration) for four hours at a nut processing plant in Winters, CA.

Charcoal Tube Trapping and GC-ECD Analysis
Samples will be taken in duplicates at 300ml/min. every half hour for the first two hours inside the fumigation chamber for the comparison at high concentrations, and every half hour during the last two hours inside the warehouse where the fumigated products are stored for the comparison at low concentrations. The sampled tubes will be placed on dry ice and sent to lab immediately for extraction and GC-ECD analysis within five days.

Dräger colorimetric tube
Tests will be conducted in duplicate every 15 minutes in the chamber, and every half hour in the warehouse.

ppbRae PID
Test will be carried out, in duplicate with MiniRae, continuously at one-minute increment for two hours at each location.

The monitoring by all three methods will be conducted at the same locations along an i/o row (free space) between piled bins in the opened chamber and warehouse as indicated in the attached diagram.

The instantaneous monitoring results with the PID and Dräger tube will be reviewed to determine on site if the test interval should be changed and whether the test should be continued or terminated.

V. MONITORING METHODS

Each charcoal tube (SXC#226-38-02) is stacked two in a series, consisting of 400 milligram activated petroleum charcoal in a primary tube and 200 milligram in a secondary tube. Air sample trapping will be conducted using personal air sampling pump (SKC#224-PCXR8). The charcoal tube sampler will be positioned approximately four feet above ground level. Flow rates will be set at 300 milliliters per minute. Once samples are collected, each tube will be tightly capped and samples will be placed on dry ice and remain frozen until analysis.

The dräger colorimetric tube tests will be conducted using a Dräger Accuro® hand pump (SKC#800-64000) and methyl bromide sensitive colorimetric tubes at 0.5 ppm (SKC#800-01671). Samples are collected by squeezing and releasing the hand pump five times to achieve the 0.5 ppm detection level. At this time an instantaneous reading is taken by observing the color change in the colorimetric tube.

The ppbRae PID with 10.6 eV UV lamp is precalibrated and set for methyl bromide monitoring:

Lamp:	10.6 eV
Calibration:	done by manufacturer using isobutylene
Background:	monitoring or cancel
Alarm:	Low-1 ppb, high-5000 ppb
Operation Mode:	survey
Data logging:	upload instrument setup from PC through RS-232 link to serial port and download data to PC after monitoring.
Sampling pump:	minimum 400cc/minute, auto shut down when obstruction is detected.
Low Flow Alarm:	auto shut off pump
Filter:	insert water trap filter to inlet tube
Program:	continuously monitoring at one minute increments for two hours at each location.

VI. DATA ANALYSIS

The test results will be statistically evaluated for the significant difference of concentration determined among the three methods with time if possible. Otherwise, perform some sort of non-parametric analysis to determine if there are systematic differences between the three. Then possibly some sort of analysis which normalizes for the perceived function, assuming all three show the same function, and analyzes the residuals at the bottom line.

VII. BUDGET

Environmental Monitoring budget for monitoring methyl bromide residue associated with a fumigation application. The following is an estimate of the costs for this monitoring event.

Monitoring Personnel		
2 Associate ERS ($24.35/hr)* x 8 hrs =	390	
1 ERS (19.68/hr) x 8 hrs =	157	
Staff Benefits (37.5%) =	205	
Total Monitoring Personnel Services =		$ 752
Operating Expenses		
Vehicle Mileage ($0.31/mile) =	30	
Monitoring Supplies =	500	
Chemical Analysis:		
$150/sample x 18 samples (max.) =	2700	
Continuing Quality Control =	200	
Total Operating Expenses =		$ 3430
TOTAL ESTIMATED COST:		$ 4182

*This figure includes time required for sample preparation, travel, monitoring, data analysis, and report preparation.

Attachment II Monitoring Data on ppbPID

Table 1 ppbPID Data from 9:11 to 9:44 in the Right Chamber

Instrument: ppbRAE (PGM7240) Serial Number: 100177
User ID: ppb Site ID: chamber2
Data Points: 63 Gas Name: Me bromide Sample Period: 60 sec
Last Calibration Time: 10/26/2000 12:16

Measurement Type:			Min(ppb)		Avg(ppb)		Max(ppb)	
High Alarm Levels:			50000		50000		50000	
Low Alarm Levels:			0		0		0	
Number	Date	Time	Min(ppb)	Alarm	Avg(ppb)	Alarm	Max(ppb)	Alarm
1	3/2/01	9:11	642	L	1207	L	2706	L
2	3/2/01	9:12	785	L	1046	L	3117	L
3	3/2/01	9:13	739	L	1080	L	3942	L
4	3/2/01	9:14	749	L	1371	L	1645	L
5	3/2/01	9:15	742	L	1257	L	2058	L
6	3/2/01	9:16	584	L	1148	L	1897	L
7	3/2/01	9:17	800	L	1100	L	1871	L
8	3/2/01	9:18	822	L	1496	L	3065	L
9	3/2/01	9:19	499	L	803	L	1132	L
10	3/2/01	9:20	549	L	849	L	1028	L
11	3/2/01	9:21	921	L	1379	L	2368	L
12	3/2/01	9:22	623	L	1234	L	2442	L
13	3/2/01	9:23	977	L	1530	L	3736	L
14	3/2/01	9:24	572	L	1082	L	2912	L
15	3/2/01	9:25	545	L	886	L	1224	L
16	3/2/01	9:26	671	L	1036	L	1531	L
17	3/2/01	9:27	793	L	1615	L	2765	L
18	3/2/01	9:28	1098	L	1392	L	1739	L
19	3/2/01	9:29	510	L	739	L	1241	L
20	3/2/01	9:30	642	L	1451	L	3707	L
21	3/2/01	9:31	885	L	1384	L	2487	L
22	3/2/01	9:32	642	L	1371	L	3389	L
23	3/2/01	9:33	618	L	1239	L	1662	L
24	3/2/01	9:34	482	L	706	L	1033	L
25	3/2/01	9:35	504	L	1185	L	3119	L
26	3/2/01	9:36	571	L	808	L	1278	L
27	3/2/01	9:37	814	L	1712	L	4977	L
28	3/2/01	9:38	578	L	771	L	1125	L
29	3/2/01	9:39	673	L	774	L	938	L
30	3/2/01	9:40	877	L	1612	L	4018	L
31	3/2/01	9:41	1025	L	1832	L	2329	L
32	3/2/01	9:42	846	L	1222	L	1657	L
33	3/2/01	9:43	1020	L	1307	L	1819	L
34	3/2/01	9:44	578	L	1102	L	1620	L
35	3/2/01	9:45	838	L	1407	L	2757	L
36	3/2/01	9:46	1077	L	1564	L	2337	L

37	3/2/01 9:47	997	L	1236	L	2300	L
38	3/2/01 9:48	926	L	1270	L	2123	L
39	3/2/01 9:49	933	L	1784	L	3308	L
40	3/2/01 9:50	1592	L	2164	L	2873	L
41	3/2/01 9:51	591	L	956	L	1504	L
42	3/2/01 9:52	550	L	862	L	1161	L
43	3/2/01 9:53	416	L	632	L	878	L
44	3/2/01 9:54	652	L	837	L	1081	L
45	3/2/01 9:55	445	L	722	L	1082	L
46	3/2/01 9:56	673	L	961	L	1266	L
47	3/2/01 9:57	559	L	956	L	1635	L
48	3/2/01 9:58	569	L	1080	L	1904	L
49	3/2/01 9:59	465	L	793	L	1120	L
50	3/2/01 10:00	394	L	850	L	1560	L
51	3/2/01 10:01	610	L	908	L	1761	L
52	3/2/01 10:02	572	L	801	L	1028	L
53	3/2/01 10:03	379	L	479	L	841	L
54	3/2/01 10:04	423	L	508	L	669	L
55	3/2/01 10:05	464	L	547	L	659	L
56	3/2/01 10:06	351	L	486	L	690	L
57	3/2/01 10:07	389	L	532	L	688	L
58	3/2/01 10:08	416	L	717	L	1258	L
59	3/2/01 10:09	414	L	581	L	928	L
60	3/2/01 10:10	549	L	777	L	996	L
61	3/2/01 10:11	525	L	769	L	967	L
62	3/2/01 10:12	435	L	724	L	1628	L
63	3/2/01 10:13	486	L	752	L	1055	L

Table 2 ppbPID Data from 10:36 to 11:50 in the Right Chamber

Instrument: ppbRAE (PGM7240) Serial Number: 100177
User ID: ppb Site ID: chamber3
Data Points: 75 Gas Name: Me bromide Sample Period: 60 sec
Last Calibration Time: 10/26/2000 12:16

Measurement Type:	Min(ppb)	Avg(ppb)	Max(ppb)
High Alarm Levels:	50000	50000	50000
Low Alarm Levels:	0	0	0

Number	Date Time	Min(ppb)	Alarm	Avg(ppb)	Alarm	Max(ppb)	Alarm
1	3/2/01 10:36	1140	L	1530	L	2590	L
2	3/2/01 10:37	766	L	1421	L	3267	L
3	3/2/01 10:38	622	L	864	L	1703	L
4	3/2/01 10:39	703	L	1182	L	2172	L
5	3/2/01 10:40	433	L	851	L	1173	L
6	3/2/01 10:41	27	L	1013	L	2969	L
7	3/2/01 10:42	805	L	1531	L	4023	L
8	3/2/01 10:43	1269	L	1848	L	2514	L
9	3/2/01 10:44	1082	L	1962	L	3927	L

10	3/2/01 10:45	652	L	890	L	1241	L
11	3/2/01 10:46	637	L	1186	L	2189	L
12	3/2/01 10:47	518	L	1300	L	3287	L
13	3/2/01 10:48	1351	L	2045	L	3379	L
14	3/2/01 10:49	1633	L	2310	L	2930	L
15	3/2/01 10:50	1846	L	2206	L	2657	L
16	3/2/01 10:51	1230	L	2274	L	3207	L
17	3/2/01 10:52	625	L	1928	L	2714	L
18	3/2/01 10:53	307	L	781	L	1468	L
19	3/2/01 10:54	593	L	1154	L	1676	L
20	3/2/01 10:55	766	L	1569	L	2448	L
21	3/2/01 10:56	746	L	1636	L	2614	L
22	3/2/01 10:57	778	L	974	L	1169	L
23	3/2/01 10:58	725	L	1145	L	1475	L
24	3/2/01 10:59	1234	L	1447	L	1819	L
25	3/2/01 11:00	598	L	1013	L	1468	L
26	3/2/01 11:01	802	L	1120	L	1616	L
27	3/2/01 11:02	413	L	721	L	1145	L
28	3/2/01 11:03	295	L	769	L	1116	L
29	3/2/01 11:04	1071	L	1448	L	1905	L
30	3/2/01 11:05	1501	L	2096	L	2934	L
31	3/2/01 11:06	1783	L	2352	L	3150	L
32	3/2/01 11:07	598	L	1188	L	1603	L
33	3/2/01 11:08	440	L	1219	L	2699	L
34	3/2/01 11:09	588	L	1073	L	1810	L
35	3/2/01 11:10	510	L	860	L	1263	L
36	3/2/01 11:11	693	L	1118	L	1655	L
37	3/2/01 11:12	1200	L	1728	L	2475	L
38	3/2/01 11:13	589	L	1283	L	2505	L
39	3/2/01 11:14	319	L	1430	L	2578	L
40	3/2/01 11:15	596	L	1015	L	1842	L
41	3/2/01 11:16	319	L	596	L	1003	L
42	3/2/01 11:17	425	L	823	L	1290	L
43	3/2/01 11:18	499	L	747	L	1203	L
44	3/2/01 11:19	693	L	1515	L	2203	L
45	3/2/01 11:20	581	L	1011	L	1385	L
46	3/2/01 11:21	603	L	921	L	1269	L
47	3/2/01 11:22	474	L	873	L	1436	L
48	3/2/01 11:23	642	L	1190	L	2255	L
49	3/2/01 11:24	640	L	1120	L	1377	L
50	3/2/01 11:25	666	L	1154	L	1734	L
51	3/2/01 11:26	578	L	1203	L	1793	L
52	3/2/01 11:27	683	L	1069	L	1931	L
53	3/2/01 11:28	657	L	817	L	1038	L
54	3/2/01 11:29	401	L	979	L	1606	L
55	3/2/01 11:30	353	L	888	L	1371	L
56	3/2/01 11:31	809	L	1161	L	1888	L
57	3/2/01 11:32	938	L	1318	L	1788	L
58	3/2/01 11:33	1020	L	2404	L	2806	L
59	3/2/01 11:34	1380	L	2134	L	2774	L
60	3/2/01 11:35	918	L	1796	L	2269	L

61	3/2/01 11:36	1922	L	2440	L	3043	L
62	3/2/01 11:37	1465	L	2945	L	3728	L
63	3/2/01 11:38	921	L	1861	L	2475	L
64	3/2/01 11:39	1397	L	2050	L	3391	L
65	3/2/01 11:40	1210	L	1692	L	2516	L
66	3/2/01 11:41	1018	L	1500	L	2123	L
67	3/2/01 11:42	1137	L	1996	L	4046	L
68	3/2/01 11:43	746	L	1505	L	2527	L
69	3/2/01 11:44	460	L	899	L	1159	L
70	3/2/01 11:45	533	L	815	L	1135	L
71	3/2/01 11:46	440	L	1068	L	1557	L
72	3/2/01 11:47	333	L	1201	L	1674	L
73	3/2/01 11:48	0		199	L	855	L
74	3/2/01 11:49	13	L	120	L	263	L
75	3/2/01 11:50	0		35	L	256	L

Table 3 ppbPID Data from 12:31 to 13:36 in the Left Chamber

Instrument: ppbRAE (PGM7240) Serial Number: 100177
User ID: ppb Site ID: chamber4
Data Points: 66 Gas Name: Me bromide Sample Period: 60 sec
Last Calibration Time: 10/26/2000 12:16

Measurement Type:	Min(ppb)		Avg(ppb)		Max(ppb)	
High Alarm Levels:	50000		50000		50000	
Low Alarm Levels:	0		0		0	
Number Date Time	Min(ppb)	Alarm	Avg(ppb)	Alarm	Max(ppb)	Alarm
1 3/2/01 12:31	302	L	437	L	549	L
2 3/2/01 12:32	459	L	529	L	649	L
3 3/2/01 12:33	380	L	529	L	666	L
4 3/2/01 12:34	406	L	517	L	632	L
5 3/2/01 12:35	285	L	357	L	579	L
6 3/2/01 12:36	297	L	487	L	639	L
7 3/2/01 12:37	452	L	638	L	810	L
8 3/2/01 12:38	355	L	850	L	1652	L
9 3/2/01 12:39	277	L	365	L	491	L
10 3/2/01 12:40	285	L	399	L	508	L
11 3/2/01 12:41	299	L	411	L	569	L
12 3/2/01 12:42	336	L	381	L	426	L
13 3/2/01 12:43	295	L	669	L	1220	L
14 3/2/01 12:44	258	L	425	L	661	L
15 3/2/01 12:45	119	L	181	L	289	L
16 3/2/01 12:46	125	L	147	L	173	L
17 3/2/01 12:47	90	L	112	L	146	L
18 3/2/01 12:48	95	L	113	L	147	L
19 3/2/01 12:49	112	L	140	L	187	L
20 3/2/01 12:50	124	L	229	L	423	L

21	3/2/01 12:51	391	L	543	L	685	L
22	3/2/01 12:52	430	L	538	L	700	L
23	3/2/01 12:53	343	L	489	L	606	L
24	3/2/01 12:54	396	L	521	L	754	L
25	3/2/01 12:55	435	L	593	L	763	L
26	3/2/01 12:56	476	L	622	L	797	L
27	3/2/01 12:57	360	L	555	L	703	L
28	3/2/01 12:58	552	L	707	L	911	L
29	3/2/01 12:59	436	L	973	L	1674	L
30	3/2/01 13:00	790	L	906	L	1120	L
31	3/2/01 13:01	280	L	820	L	1140	L
32	3/2/01 13:02	27	L	146	L	440	L
33	3/2/01 13:03	40	L	377	L	810	L
34	3/2/01 13:04	297	L	436	L	544	L
35	3/2/01 13:05	334	L	526	L	904	L
36	3/2/01 13:06	331	L	679	L	1754	L
37	3/2/01 13:07	292	L	458	L	690	L
38	3/2/01 13:08	130	L	323	L	528	L
39	3/2/01 13:09	42	L	142	L	263	L
40	3/2/01 13:10	27	L	103	L	197	L
41	3/2/01 13:11	85	L	231	L	571	L
42	3/2/01 13:12	37	L	103	L	202	L
43	3/2/01 13:13	47	L	111	L	224	L
44	3/2/01 13:14	45	L	215	L	566	L
45	3/2/01 13:15	88	L	222	L	464	L
46	3/2/01 13:16	35	L	115	L	205	L
47	3/2/01 13:17	40	L	87	L	176	L
48	3/2/01 13:18	102	L	399	L	933	L
49	3/2/01 13:19	171	L	413	L	1021	L
50	3/2/01 13:20	443	L	681	L	1200	L
51	3/2/01 13:21	261	L	565	L	1067	L
52	3/2/01 13:22	251	L	381	L	589	L
53	3/2/01 13:23	90	L	186	L	425	L
54	3/2/01 13:24	68	L	140	L	198	L
55	3/2/01 13:25	74	L	162	L	304	L
56	3/2/01 13:26	117	L	172	L	227	L
57	3/2/01 13:27	96	L	157	L	207	L
58	3/2/01 13:28	115	L	188	L	249	L
59	3/2/01 13:29	79	L	175	L	231	L
60	3/2/01 13:30	68	L	133	L	204	L
61	3/2/01 13:31	57	L	106	L	181	L
62	3/2/01 13:32	27	L	124	L	185	L
63	3/2/01 13:33	45	L	118	L	195	L
64	3/2/01 13:34	0		55	L	185	L
65	3/2/01 13:35	0		37	L	76	L
66	3/2/01 13:36	0		72	L	190	L

Attachment III Monitoring Data on ppmPID

Table 4 ppmPID Data from 9:13 to 9:51 in the Right Chamber

Instrument: MiniRAE 2000 (PGM7600) Serial Number: 001521
User ID: ppm Site ID: chamber4
Data Points: 39 Gas Name: Me bromide Sample Period: 60 sec
Last Calibration Time: 01/27/2001 10:26

Measurement Type:			Min(ppm)		Avg(ppm)		Max(ppm)	
High Alarm Levels:			1005		1005		1005	
Low Alarm Levels:			0		0		0	
Number	Date	Time	Min(ppm)	Alarm	Avg(ppm)	Alarm	Max(ppm)	Alarm
1	3/2/01	9:13	2.7	L	3.2	L	3.7	L
2	3/2/01	9:14	3.4	L	3.8	L	4.0	L
3	3/2/01	9:15	3.4	L	3.7	L	4.4	L
4	3/2/01	9:16	3.5	L	3.9	L	4.4	L
5	3/2/01	9:17	3.5	L	4.2	L	4.7	L
6	3/2/01	9:18	3.5	L	4.0	L	4.7	L
7	3/2/01	9:19	3.5	L	4.2	L	4.7	L
8	3/2/01	9:20	3.9	L	4.2	L	4.7	L
9	3/2/01	9:21	3.9	L	4.2	L	4.7	L
10	3/2/01	9:22	4.0	L	4.5	L	4.9	L
11	3/2/01	9:23	4.0	L	4.3	L	4.7	L
12	3/2/01	9:24	3.9	L	4.2	L	4.9	L
13	3/2/01	9:25	4.0	L	4.4	L	5.1	L
14	3/2/01	9:26	4.4	L	4.6	L	5.1	L
15	3/2/01	9:27	4.5	L	4.8	L	5.2	L
16	3/2/01	9:28	4.5	L	4.8	L	5.2	L
17	3/2/01	9:29	4.5	L	4.8	L	5.2	L
18	3/2/01	9:30	4.7	L	5.0	L	5.4	L
19	3/2/01	9:31	4.7	L	4.9	L	5.4	L
20	3/2/01	9:32	4.7	L	4.9	L	5.2	L
21	3/2/01	9:33	4.7	L	5.0	L	5.4	L
22	3/2/01	9:34	4.9	L	5.2	L	6.8	L
23	3/2/01	9:35	5.2	L	5.5	L	6.2	L
24	3/2/01	9:36	5.2	L	5.6	L	5.9	L
25	3/2/01	9:37	5.2	L	5.4	L	5.7	L
26	3/2/01	9:38	5.1	L	5.5	L	6.1	L
27	3/2/01	9:39	5.2	L	5.7	L	6.8	L
28	3/2/01	9:40	5.2	L	5.4	L	5.7	L
29	3/2/01	9:41	5.1	L	5.2	L	5.6	L
30	3/2/01	9:42	5.1	L	5.4	L	6.4	L
31	3/2/01	9:43	5.4	L	5.8	L	6.4	L
32	3/2/01	9:44	5.6	L	6.4	L	7.1	L
33	3/2/01	9:45	5.9	L	6.1	L	6.6	L
34	3/2/01	9:46	5.7	L	6.1	L	6.8	L

35	3/2/01 9:47	5.2	L	5.6	L	6.2	L
36	3/2/01 9:48	5.4	L	5.6	L	5.9	L
37	3/2/01 9:49	5.4	L	5.7	L	6.1	L
38	3/2/01 9:50	5.6	L	34.3	L	79.9	L
39	3/2/01 9:51	67.3	L	70.0	L	71.9	L

Table 5 ppmPID Data from 9:55 to 10:14 in the Right Chamber

Instrument: MiniRAE 2000 (PGM7600) Serial Number: 001521
User ID: ppm Site ID: chamber5
Data Points: 20 Gas Name: Me bromide Sample Period: 60 sec
Last Calibration Time: 01/27/2001 10:26

Measurement Type:	Min(ppm)	Avg(ppm)	Max(ppm)
High Alarm Levels:	1005	1005	1005
Low Alarm Levels:	0	0	0

Number	Date Time	Min(ppm)	Alarm	Avg(ppm)	Alarm	Max(ppm)	Alarm
1	3/2/01 9:55	51.1	L	54.3	L	57.8	L
2	3/2/01 9:56	48.9	L	50.3	L	51.6	L
3	3/2/01 9:57	46.9	L	48.7	L	49.9	L
4	3/2/01 9:58	45.9	L	46.5	L	47.4	L
5	3/2/01 9:59	42.8	L	45.0	L	46.2	L
6	3/2/01 10:00	41.9	L	42.8	L	44.2	L
7	3/2/01 10:01	40.2	L	41.4	L	42.6	L
8	3/2/01 10:02	38.5	L	39.5	L	40.6	L
9	3/2/01 10:03	36.2	L	37.6	L	39.2	L
10	3/2/01 10:04	36.2	L	37.0	L	37.7	L
11	3/2/01 10:05	36.0	L	36.5	L	37.5	L
12	3/2/01 10:06	35.5	L	36.2	L	37.2	L
13	3/2/01 10:07	35.7	L	36.1	L	37.0	L
14	3/2/01 10:08	35.3	L	36.3	L	37.5	L
15	3/2/01 10:09	34.3	L	34.8	L	35.7	L
16	3/2/01 10:10	32.1	L	33.3	L	35.0	L
17	3/2/01 10:11	31.2	L	31.9	L	32.9	L
18	3/2/01 10:12	31.7	L	32.1	L	32.9	L
19	3/2/01 10:13	31.2	L	31.9	L	32.6	L
20	3/2/01 10:14	31.1	L	31.8	L	32.4	L

Table 6 ppmPID Data from 10:40 to 11:51 in the Right Chamber

Instrument: MiniRAE 2000 (PGM7600) Serial Number: 001521
User ID: ppm Site ID: chamber9
Data Points: 72 Gas Name: Me bromide Sample Period: 60 sec
Last Calibration Time: 03/02/2001 10:24

Measurement Type:			Min(ppm)		Avg(ppm)		Max(ppm)	
High Alarm Levels:			1005		1005		1005	
Low Alarm Levels:			0		0		0	
Number	Date	Time	Min(ppm)	Alarm	Avg(ppm)	Alarm	Max(ppm)	Alarm
1	3/2/01	10:40	4.7	L	4.7	L	4.8	L
2	3/2/01	10:41	4.7	L	4.7	L	5.0	L
3	3/2/01	10:42	4.5	L	4.6	L	4.8	L
4	3/2/01	10:43	4.6	L	4.9	L	5.2	L
5	3/2/01	10:44	4.7	L	9.2	L	43.0	L
6	3/2/01	10:45	6.8	L	10.7	L	54.6	L
7	3/2/01	10:46	6.8	L	9.6	L	23.9	L
8	3/2/01	10:47	7.0	L	7.4	L	8.8	L
9	3/2/01	10:48	6.8	L	7.2	L	10.1	L
10	3/2/01	10:49	6.0	L	6.6	L	7.1	L
11	3/2/01	10:50	5.8	L	5.9	L	6.4	L
12	3/2/01	10:51	5.6	L	5.9	L	6.5	L
13	3/2/01	10:52	5.5	L	5.7	L	6.0	L
14	3/2/01	10:53	5.7	L	5.9	L	6.1	L
15	3/2/01	10:54	5.8	L	5.9	L	6.1	L
16	3/2/01	10:55	5.5	L	5.6	L	5.8	L
17	3/2/01	10:56	5.4	L	5.6	L	5.8	L
18	3/2/01	10:57	5.1	L	5.3	L	5.5	L
19	3/2/01	10:58	4.9	L	5.1	L	5.3	L
20	3/2/01	10:59	4.7	L	4.8	L	5.0	L
21	3/2/01	11:00	4.6	L	4.7	L	4.9	L
22	3/2/01	11:01	4.5	L	4.6	L	4.8	L
23	3/2/01	11:02	4.6	L	4.7	L	4.9	L
24	3/2/01	11:03	4.5	L	4.5	L	4.9	L
25	3/2/01	11:04	4.6	L	4.6	L	4.9	L
26	3/2/01	11:05	4.6	L	4.7	L	4.8	L
27	3/2/01	11:06	4.6	L	4.7	L	4.9	L
28	3/2/01	11:07	4.6	L	4.7	L	4.9	L
29	3/2/01	11:08	4.7	L	4.8	L	4.9	L
30	3/2/01	11:09	5.0	L	5.6	L	5.9	L
31	3/2/01	11:10	4.6	L	5.2	L	5.8	L
32	3/2/01	11:11	4.5	L	4.8	L	5.1	L
33	3/2/01	11:12	4.1	L	4.4	L	4.7	L
34	3/2/01	11:13	4.2	L	4.3	L	4.7	L
35	3/2/01	11:14	4.7	L	4.9	L	5.3	L
36	3/2/01	11:15	4.8	L	5.0	L	5.6	L
37	3/2/01	11:16	5.4	L	5.6	L	6.0	L
38	3/2/01	11:17	5.5	L	5.9	L	7.3	L

39	3/2/01 11:18	6.1	L	6.5	L	8.2	L
40	3/2/01 11:19	5.5	L	6.0	L	6.7	L
41	3/2/01 11:20	5.2	L	5.5	L	6.2	L
42	3/2/01 11:21	4.9	L	5.2	L	5.5	L
43	3/2/01 11:22	5.0	L	5.1	L	5.4	L
44	3/2/01 11:23	5.2	L	5.4	L	5.8	L
45	3/2/01 11:24	5.4	L	5.6	L	5.8	L
46	3/2/01 11:25	5.6	L	5.7	L	6.0	L
47	3/2/01 11:26	5.5	L	5.7	L	5.9	L
48	3/2/01 11:27	5.5	L	5.5	L	5.8	L
49	3/2/01 11:28	5.2	L	5.4	L	5.6	L
50	3/2/01 11:29	5.3	L	5.3	L	5.5	L
51	3/2/01 11:30	5.0	L	5.2	L	5.3	L
52	3/2/01 11:31	4.9	L	5.1	L	5.3	L
53	3/2/01 11:32	4.9	L	5.0	L	5.1	L
54	3/2/01 11:33	4.8	L	4.9	L	5.1	L
55	3/2/01 11:34	4.7	L	4.8	L	5.0	L
56	3/2/01 11:35	4.7	L	4.7	L	4.8	L
57	3/2/01 11:36	4.7	L	4.8	L	5.0	L
58	3/2/01 11:37	4.9	L	4.9	L	5.1	L
59	3/2/01 11:38	4.6	L	4.7	L	5.0	L
60	3/2/01 11:39	4.6	L	4.7	L	4.8	L
61	3/2/01 11:40	4.6	L	4.7	L	4.9	L
62	3/2/01 11:41	4.8	L	5.0	L	5.3	L
63	3/2/01 11:42	4.8	L	4.8	L	5.0	L
64	3/2/01 11:43	5.1	L	5.2	L	5.4	L
65	3/2/01 11:44	4.9	L	5.1	L	5.3	L
66	3/2/01 11:45	5.1	L	5.2	L	5.4	L
67	3/2/01 11:46	5.1	L	5.2	L	5.4	L
68	3/2/01 11:47	5.2	L	5.3	L	5.6	L
69	3/2/01 11:48	5.4	L	5.7	L	6.1	L
70	3/2/01 11:49	5.2	L	5.7	L	6.5	L
71	3/2/01 11:50	3.5	L	4.7	L	5.5	L
72	3/2/01 11:51	4.8	L	5.4	L	6.6	L

Table 7 ppmPID Data from 12:33 to 13:38 in the Left Chamber

Instrument: MiniRAE 2000 (PGM7600) Serial Number: 001521
User ID: ppm Site ID: chambe10
Data Points: 66 Gas Name: Me bromide Sample Period: 60 sec
Last Calibration Time: 03/02/2001 10:24

Measurement Type:	Min(ppm)	Avg(ppm)	Max(ppm)
High Alarm Levels:	1005	1005	1005
Low Alarm Levels:	0	0	0

Number	Date Time	Min(ppm)	Alarm	Avg(ppm)	Alarm	Max(ppm)	Alarm
1	3/2/01 12:33	3.5	L	3.6	L	3.7	L
2	3/2/01 12:34	2.7	L	3.2	L	3.6	L

3	3/2/01 12:35	2.7	L	2.7	L	2.9	L
4	3/2/01 12:36	2.6	L	2.7	L	2.8	L
5	3/2/01 12:37	2.7	L	2.7	L	2.9	L
6	3/2/01 12:38	2.5	L	2.6	L	2.8	L
7	3/2/01 12:39	2.5	L	2.6	L	2.8	L
8	3/2/01 12:40	2.3	L	2.7	L	3.0	L
9	3/2/01 12:41	2.9	L	3.0	L	3.3	L
10	3/2/01 12:42	3.0	L	3.2	L	3.3	L
11	3/2/01 12:43	3.1	L	3.1	L	3.3	L
12	3/2/01 12:44	2.9	L	3.0	L	3.3	L
13	3/2/01 12:45	2.4	L	2.5	L	2.9	L
14	3/2/01 12:46	2.2	L	2.4	L	2.7	L
15	3/2/01 12:47	2.1	L	2.1	L	2.3	L
16	3/2/01 12:48	2.1	L	2.1	L	2.3	L
17	3/2/01 12:49	2.2	L	2.5	L	2.7	L
18	3/2/01 12:50	2.6	L	2.6	L	2.7	L
19	3/2/01 12:51	2.2	L	2.4	L	2.6	L
20	3/2/01 12:52	2.1	L	2.2	L	2.3	L
21	3/2/01 12:53	2.1	L	2.2	L	2.3	L
22	3/2/01 12:54	2.0	L	2.0	L	2.2	L
23	3/2/01 12:55	1.9	L	2.0	L	2.1	L
24	3/2/01 12:56	1.9	L	1.9	L	2.1	L
25	3/2/01 12:57	2.1	L	2.2	L	2.3	L
26	3/2/01 12:58	2.2	L	2.2	L	2.4	L
27	3/2/01 12:59	2.2	L	2.2	L	2.3	L
28	3/2/01 13:00	2.2	L	2.2	L	2.3	L
29	3/2/01 13:01	2.2	L	2.2	L	2.4	L
30	3/2/01 13:02	2.2	L	2.2	L	2.4	L
31	3/2/01 13:03	2.0	L	2.2	L	2.4	L
32	3/2/01 13:04	1.8	L	2.0	L	2.4	L
33	3/2/01 13:05	1.7	L	1.8	L	2.5	L
34	3/2/01 13:06	1.8	L	1.8	L	2.0	L
35	3/2/01 13:07	1.7	L	1.8	L	1.9	L
36	3/2/01 13:08	1.6	L	1.7	L	2.0	L
37	3/2/01 13:09	1.6	L	1.6	L	1.7	L
38	3/2/01 13:10	1.5	L	1.6	L	1.7	L
39	3/2/01 13:11	1.3	L	1.4	L	1.6	L
40	3/2/01 13:12	1.2	L	1.2	L	1.4	L
41	3/2/01 13:13	1.3	L	1.3	L	1.4	L
42	3/2/01 13:14	1.1	L	1.2	L	1.3	L
43	3/2/01 13:15	1.1	L	1.1	L	1.2	L
44	3/2/01 13:16	1.2	L	1.2	L	1.3	L
45	3/2/01 13:17	1.1	L	1.1	L	1.3	L
46	3/2/01 13:18	1.1	L	1.1	L	1.2	L
47	3/2/01 13:19	1.0	L	1.0	L	1.1	L
48	3/2/01 13:20	1.1	L	1.1	L	1.3	L
49	3/2/01 13:21	1.1	L	1.1	L	1.4	L
50	3/2/01 13:22	1.1	L	1.2	L	1.3	L
51	3/2/01 13:23	1.1	L	1.1	L	1.3	L
52	3/2/01 13:24	1.1	L	1.1	L	1.3	L
53	3/2/01 13:25	1.1	L	1.1	L	1.2	L

54	3/2/01 13:26	1.1	L	1.1	L	1.1	L
55	3/2/01 13:27	1.1	L	1.1	L	1.1	L
56	3/2/01 13:28	1.0	L	1.1	L	1.2	L
57	3/2/01 13:29	1.0	L	1.0	L	1.1	L
58	3/2/01 13:30	1.0	L	1.0	L	1.1	L
59	3/2/01 13:31	1.0	L	1.0	L	1.1	L
60	3/2/01 13:32	0.7	L	0.9	L	1.1	L
61	3/2/01 13:33	0.6	L	0.6	L	0.8	L
62	3/2/01 13:34	0.6	L	0.6	L	0.8	L
63	3/2/01 13:35	0.6	L	0.6	L	1.0	L
64	3/2/01 13:36	0.4	L	0.5	L	0.6	L
65	3/2/01 13:37	0.4	L	0.5	L	0.7	L
66	3/2/01 13:38	0.4	L	0.4	L	0.6	L

Table 8 ppmPID Data from 13:50 to 13:53 in the Warehouse

Instrument: MiniRAE 2000 (PGM7600) Serial Number: 001521
User ID: ppm Site ID: chambe11
Data Points: 4 Gas Name: Me bromide Sample Period: 60 sec
Last Calibration Time: 03/02/2001 10:24

Measurement Type:		Min(ppm)		Avg(ppm)		Max(ppm)	
High Alarm Levels:		1005		1005		1005	
Low Alarm Levels:		0		0		0	
Number	Date Time	Min(ppm)	Alarm	Avg(ppm)	Alarm	Max(ppm)	Alarm
1	3/2/01 13:50	0.4	L	0.4	L	0.5	L
2	3/2/01 13:51	0.4	L	0.4	L	0.5	L
3	3/2/01 13:52	0.1	L	0.3	L	0.5	L
4	3/2/01 13:53	0.3	L	2.2	L	4.7	L

Attachment IV ppbPID and ppmPID configurations

ppbPID Configurations - Calibration Date: 2000-10-26

Instrument: ppbRAE (PGM7240) Serial Number: 100177

Firmware Version: 1.05
Datalog: Enabled

General:

Site ID: chamber User ID: ppb
Security Level: Level 2 -- no password needed
User Mode: Program
Operator Mode: Survey
Warm-up Time: 0 sec.
Comfort Beep: Disabled
Back Light Time Out Period: 60 sec.
Clock from PC: Yes
Dilution Factor: 1
Calibration Time: 2000-10-26 12:16 (yyyy-mm-dd hh:mm)
Alarm Mode: Auto Reset
Power On Zero: Disabled
Datalog Selection: Min Avg Max
Datalog Interval: 60 sec.
Datalog Mode: Manual start/stop

Manual Datalog Run Time: 24:0 (hh:mm)
Periodic Datalog Start Time: 8:0 (hh:mm)
Periodic Datalog Stop Time: 22:0 (hh:mm)
Scheduled Datalog Start Time: 1998-5-1 6:0 (yyyy-mm-dd hh:mm)
Scheduled Datalog Stop Time: 1998-5-1 10:0 (yyyy-mm-dd hh:mm)

Gas Parameters:

Measurement Unit: ppb
Current Gas: Me bromide
Cal Memory: 1
STEL Alarm Level: 5000 ppb
TWA Alarm Level: 2000 ppb
Low Alarm Level: 100 ppb
High Alarm Level: 5000 ppb
Calibration Span: 10000 ppb
10.6eV Lamp Response Factor: 1.7
11.7eV Lamp Response Factor: 1.3
9.8eV Lamp Response Factor: 0.0

Others:

Power On Message: RAE Systems

ppmPID Configurations - Calibration Date: 2001-1-27

Instrument: MiniRAE 2000 (PGM7600) Serial Number: 001521

Firmware Version: 1.08
Datalog: Enabled

General:

Site ID: chamber User ID: ppm
Security Level: Level 2 -- no password needed
User Mode: Program
Operator Mode: Survey
Warm-up Time: 0 sec.
Comfort Beep: Disabled
Back Light Time Out Period: 60 sec.
Clock from PC: Yes
Dilution Factor: 1
Calibration Time: 2001-1-27 10:26 (yyyy-mm-dd hh:mm)
Alarm Mode: Auto Reset
Power On Zero: Disabled
Datalog Selection: Min Avg Max
Datalog Interval: 60 sec.
Datalog Mode: Manual start/stop

Manual Datalog Run Time: 24:0 (hh:mm)
Periodic Datalog Start Time: 8:0 (hh:mm)
Periodic Datalog Stop Time: 22:0 (hh:mm)
Scheduled Datalog Start Time: 1998-5-1 6:0 (yyyy-mm-dd hh:mm)
Scheduled Datalog Stop Time: 1998-5-1 10:0 (yyyy-mm-dd hh:mm)

Gas Parameters:

Measurement Unit: ppm
Current Gas: Me bromide
Cal Memory: 1
STEL Alarm Level: 3.0 ppm
TWA Alarm Level: 1.0 ppm
Low Alarm Level: 2.0 ppm
High Alarm Level: 5.0 ppm
Calibration Span: 5.0 ppm
10.6eV Lamp Response Factor: 1.7
11.7eV Lamp Response Factor: 1.3
9.8eV Lamp Response Factor: 0.0

Others:

Power On Message: RAE Systems

ppmPID Configurations - Calibration Date: 2001-3-2

Instrument: MiniRAE 2000 (PGM7600) Serial Number: 001521

Firmware Version: 1.08
Datalog: Enabled

General:

Site ID: chambe11 User ID: ppm
Security Level: Level 2 -- no password needed
User Mode: Program
Operator Mode: Survey
Warm-up Time: 0 sec.
Comfort Beep: Disabled
Back Light Time Out Period: 60 sec.
Clock from PC: No
Dilution Factor: 1
Calibration Time: 2001-3-2 10:24 (yyyy-mm-dd hh:mm)
Alarm Mode: Auto Reset
Power On Zero: Disabled
Datalog Selection: Min Avg Max
Datalog Interval: 60 sec.
Datalog Mode: Manual start/stop

Manual Datalog Run Time: 24:0 (hh:mm)
Periodic Datalog Start Time: 8:0 (hh:mm)
Periodic Datalog Stop Time: 22:0 (hh:mm)
Scheduled Datalog Start Time: 1998-5-1 6:0 (yyyy-mm-dd hh:mm)
Scheduled Datalog Stop Time: 1998-5-1 10:0 (yyyy-mm-dd hh:mm)

Gas Parameters:

Measurement Unit: ppm
Current Gas: Me bromide
Cal Memory: 1
STEL Alarm Level: 1005.0 ppm
TWA Alarm Level: 1004.0 ppm
Low Alarm Level: 0.0 ppm
High Alarm Level: 1005.0 ppm
Calibration Span: 100.0 ppm
10.6eV Lamp Response Factor: 1.7
11.7eV Lamp Response Factor: 1.3
9.8eV Lamp Response Factor: 0.0

Others:

Power On Message: RAE Systems