assay technology

AT Labs a unit of assay technology

ANSI Sampler Evaluation (ANSI 104-1998)
Part I - Summary of Tests for Vinyl Chloride, Vinylidine Chloride, and 1,2-Dichloroethane

Sampler Description

Polypropylene sampling grid with multiple, parallel 1 mm sampling ports
200 mg charcoal wafer encased in polyester tray and sampler cap

Analytes and Levels Evaluated

Levels (ppm)	Cas No	Analyte
0.1-2.0	75-01-4	vinyl chloride
1 - 20	75-35-4	1,1-dichloroethylene (vinylidine chloride)
1 - 20	107-06-2	1,2-dichloroethane (ethylene dichloride)

Recommended Conditions & Sampling Times

Conditions	Min	Max	*Units*
Temp	10	30	^{o}C
Humidity	15	75	*% RH*
Sampling Time	0.25	10	*hr*

Testing Organization

Assay Technology, Inc., 1252 Quarry Lane, Pleasanton, California 94566

Testing Performed By

NL Keder, PhD, FT Posey, MS, K Taylor, BS

Dates of Testing

September 1994, Jan-Feb 1999

Test Apparatus & Method (Method AT-EXP-2)

Stock standard gas was created by static dilution from 100% analyte then mixed volumetrically with air and pumped at a controlled flow rate through an inert polypropylene chamber containing Diffusive Samplers under test. Flow was verified by rotameter and analyte concentrations were verified by charcoal tube samples continuously drawn from locations in the chamber bracketing the Samplers under test. Analysis was by gas chromatography.

EVALUATION SUMMARY

An evaluation was performed in which vinyl chloride, vinylidene chloride, and ethylene dichloride were sampled together on a single sampler. Overall accuracy (as Maximum Total Error at 95% confidence) was estimated as $\leq \pm$15% for vinylidine chloride and ethylene dichloride and $\leq \pm$ 25% for vinyl chloride based on estimated Sampler-to-Sampler variation of $\leq \pm$ 5%, Sampling Rate Error of $\leq \pm$ 10%, and minimal Bias (i.e. systematic error) except for measurable Reverse Diffusion when vinyl chloride was sampled under conditions of extreme environmental challenge.

Under extreme challenge (2 ppm vinyl chloride exposure in the presence of 15 ppm vinylidine chloride and 15 ppm ethylene dichloride with 100% humidity pre-conditioning) Bias Due to Reverse Diffusion sampling vinyl chloride on Sampler 546 was estimated as $\leq \pm$ 7% for a sampling time of 4 hours and $\leq \pm$ 15% for a sampling time of 8 hours. Sampler 541 (with the same charcoal mass and 4x the sampling rate of 546) is recommended for sampling times less than 2 hours to obtain improved analytical sensitivity.

Methods described here are referenced to numbered documents which specify details of the methods. Statistical results of the tests are reported in the following sections.

Sections 1 - 4 of ANSI/SEI 104-1998 are as follows:

1. Purpose, Practice, Rationale and Scope
2. Determination of Standard Compliance
3. References
4. Definitions

6.2 De-Sorption Efficiency (DE) (Method AT-DE-1)(forward)

Analyte recovery and de-sorption efficiency were determined by analysis (Method AT541) of charcoal wafers "spiked" volumetrically from standard solutions of analyte in carbon disulfide. Samplers were tested at several "spike" levels. De-sorption was performed using 2 ml of 97% CS_2 (w/ 3% benzyl alcohol).

Analyte Name	Amount Spiked	Amount Recovered	% DE	Date
	(ug/ml)	(ug/ml)		
VCM	2.34	2.00	85%	Nov-96
VCM	2.34	2.12	91%	Nov-96
VCM	2.34	2.06	88%	Nov-96
VCM	4.68	4.55	97%	Nov-96
VCM	4.68	4.25	91%	Nov-96
VCM	4.68	4.08	87%	Nov-96
VCM	19.8	17.0	86%	Feb-99
VCM	39.5	34.1	86%	Feb-99
VCM	59.3	53.5	90%	Feb-99
Grand Average			**89%**	
1,1-DCE	24.3	23.0	95%	May-94
1,1-DCE	24.3	23.8	98%	May-94
1,1-DCE	24.3	23.8	98%	May-94
1,1-DCE	48.5	50.2	104%	May-94
1,1-DCE	48.5	51.3	106%	May-94
1,1-DCE	48.5	48.5	100%	May-94
1,1-DCE	117.6	115.2	98%	Feb-99
1,1-DCE	430.9	409.4	95%	Feb-99
1,1-DCE	808.4	792.2	98%	Feb-99
Grand Average			**99%**	
EDC	2.74	2.67	98%	Oct-96
EDC	2.74	2.70	98%	Oct-96
EDC	2.74	2.65	97%	Oct-96
EDC	5.47	5.20	95%	Oct-96
EDC	5.47	5.25	96%	Oct-96
EDC	5.47	5.41	99%	Oct-96
EDC	10.94	10.70	98%	Oct-96
EDC	10.94	10.61	97%	Oct-96
EDC	10.94	10.78	99%	Oct-96
EDC	13.6	12.3	91%	Feb-99
EDC	29.5	26.6	90%	Feb-99
EDC	126	122	97%	Feb-99
EDC	621	604	97%	Feb-99
EDC	721	714	99%	Feb-99
EDC	1232	1153	94%	Feb-99
EDC	1229	1203	98%	Feb-99
EDC	30	26	87%	Feb-99
EDC	110	104	95%	Feb-99
EDC	268	256	96%	Feb-99
Grand Average			**96%**	

6.3 Effect of Concentration/Time on Sampler Accuracy

Samplers were subject to chamber exposures as described in Section 5 and analyzed by Method AT541. Exposures were applied to Samplers in the range 1-8 hours and 0.1-2.0 times the OSHA PEL.

RUN NO.	ANALYTE CONCN	EXPOSURE TIME	REF EXPOSURE (Charcoal Tube)	ANALYTE FOUND in MONITOR			UPTAKE RATE of MONITOR
	(ppm)	(hr)	(ppm-hr)	(ug)	(ug)	%	(ml/min)
	(Ref Method)		(ave)	(ave)	(+/-)(SD)	(+/-)(CV)	
1	5.07	7.27	36.86	47.69	1.44	3%	8.32
2	1.25	9.08	11.35	13.83	0.46	3%	7.83
3	6.65	2.00	13.30	17.96	0.83	5%	8.68
4	2.09	4.00	8.41	10.68	0.31	3%	8.16
5	1.07	8.00	8.56	11.35	0.35	3%	8.52
6	1.09	4.00	4.38	6.14	0.57	9%	9.01
7	1.90	3.00	8.53	10.63	0.68	6%	8.01
8	0.38	8.08	3.07	3.82	0.11	3%	8.00
			GRAND AVG Sampling Rate				8.32

6.4 Bias Due to Reverse Diffusion

Samplers were subject to Exposure Pulse (≥ OSHA PEL) with a duration less than 50% of the Recommended Sampling Time (RST) followed by a Zero Exposure Period (ZEP) for the duration of the RST. The recovery of analyte from Samplers analyzed immediately following Exposure Pulse was compared with analyte recovery from identically-exposed Samplers analyzed at the end of the RST (i.e. following the Zero Exposure Period). The difference between these two recoveries is taken as the extent of Reverse Diffusion (i.e. evaporative loss as % of Sample) from the Sampler under the experimental conditions chosen.

The Bias Due to Reverse Diffusion in actual practice will depend on the extent and duration of actual Exposure Pulses in the environment being monitored, and cannot be exactly determined in a lab test.

For this evaluation, Bias Due to Reverse Diffusion in actual practice was estimated as the extent of Reverse Diffusion (evaporative loss as % of Sample) when an Exposure Pulse at 1.0 times the PEL is applied for 50% of the duration of the RST followed by a Zero Exposure Period of 50% of the RST.

EXPOSURE: 2ppm VCM (4hr)

EVALUATION PARAMETERS	TEST RESULTS from MONITORS			% of Reference
2nd Exposure at Conc = 0.0	Found (ug)	Ave (ppm)	(%) (+/-)(CV)	(%)
AT 546 Monitor				
50% of Monitors	2.69	-	-	
Analyzed	2.56	-	-	
Immediately	2.63	-	-	
0 min	-	2.6	2%	100%
50% of Monitors	2.32	-	-	
Analyzed after Exp	2.14	-	-	
at 0.0 ppm for	2.25	-	-	
240 min	-	2.2	4%	**85%**
AT 541 Monitor				
50% of Monitors	11.4	-	-	
Analyzed	10.1	-	-	
Immediately	10.4	-	-	
0 min	-	10.6	6%	100%
50% of Monitors	9.6	-	-	
Analyzed after Exp	9.01	-	-	
at 0.0 ppm for	9.29	-	-	
240 min	-	9.3	3%	**87%**
3M 3500 Monitor				
50% of Monitors	39.8	-	-	
Analyzed	40.8	-	-	
Immediately	40.6	-	-	
0 min	-	40.4	1%	100%
50% of Monitors	31.4	-	-	
Analyzed after Exp	30.5	-	-	
at 0.0 ppm for	32.8	-	-	
240 min	-	31.6	4%	**78%**

EXPOSURE: 2ppm VCM (4 hr) 100% RH

EVALUATION PARAMETERS	TEST RESULTS from MONITORS			% OF REFERENCE
2nd Exposure at Conc = 0.0	Found (ug)	Ave (ppm)	(%) (+/-)(CV)	(%)
AT 546 Monitor				
50% of Monitors	2.49	-	-	
Analyzed	2.46	-	-	
Immediately	2.54	-	-	
0 min	-	2.5	2%	100%
50% of Monitors	2.02	-	-	also
Analyzed after Exp	2.08	-	-	**100% RH**
at 0.0 ppm for	2.08	-	-	
240 min	-	2.1	2%	**83%**
AT 541 Monitor				
50% of Monitors	10.98	-	-	
Analyzed	10.96	-	-	
Immediately	10.9	-	-	
0 min	-	10.9	0%	100%
50% of Monitors	8.2	-	-	also
Analyzed after Exp	7.98	-	-	**100% RH**
at 0.0 ppm for	8.12	-	-	
240 min	-	8.1	1%	**74%**
3M 3500 Monitor				
50% of Monitors	39.2	-	-	
Analyzed	39.2	-	-	
Immediately	39.7	-	-	
0 min	-	39.4	1%	100%
50% of Monitors	27.9	-	-	also
Analyzed after Exp	27.6	-	-	**100% RH**
at 0.0 ppm for	28	-	-	
240 min	-	27.8	1%	**71%**

6.4 Bias Due to Reverse Diffusion

Samplers were subject to Exposure Pulse (≥ OSHA PEL) with a duration less than 50% of the Recommended Sampling Time (RST) followed by a Zero Exposure Period (ZEP) for the duration of the RST. The recovery of analyte from Samplers analyzed immediately following Exposure Pulse was compared with analyte recovery from identically-exposed Samplers analyzed at the end of the RST (i.e. following the Zero Exposure Period). The difference between these two recoveries is taken as the extent of Reverse Diffusion (i.e. evaporative loss as % of Sample) from the Sampler under the experimental conditions chosen.

The Bias Due to Reverse Diffusion in actual practice will depend on the extent and duration of actual Exposure Pulses in the environment being monitored, and cannot be exactly determined in a lab test.

For this evaluation, Bias Due to Reverse Diffusion in actual practice was estimated as the extent of Reverse Diffusion (evaporative loss as % of Sample) when an Exposure Pulse at 1.0 times the PEL is applied for 50% of the duration of the RST followed by a Zero Exposure Period of 50% of the RST.

EXPOSURE: 1.5ppm VCM (2hr) + 15 ppm Vinylidene Chloride/15 ppm EDC

EVALUATION PARAMETERS	TEST RESULTS from MONITORS			% OF REFERENCE
2nd Exposure at Conc = 0.0	Found (ug)	Ave (ppm)	(%) (+/-)(CV)	(%)
AT 546 Monitor				
50% of Monitors Analyzed Immediately	1.55 1.54 1.59	- - -	- - -	
0 min	-	1.6	2%	100%
50% of Monitors Analyzed after Exp at 0.0 ppm for	1.49 1.45 1.45	- - -	- - -	
140	-	1.5	2%	**94%**
AT 541 Monitor				
50% of Monitors Analyzed Immediately	6.77 6.81 6.74	- - 7	- - 0	100%
0 min	-			
50% of Monitors Analyzed after Exp at 0.0 ppm for	6.35 6.25 5.84	- - 6	- - 0	
140	-			**91%**
3M 3500 Monitor				
50% of Monitors Analyzed Immediately		- - -	- - -	
0 min	-			No Test
50% of Monitors Analyzed after Exp at 0.0 ppm for		- - -	- - -	
140 min	-			No Test

EXPOSURE: 1.5ppm VCM (2hr) + 100% RH 15 ppm Vinylidene Chloride/15 ppm EDC

EVALUATION PARAMETERS	TEST RESULTS from MONITORS			% OF REFERENCE
2nd Exposure at Conc = 0.0	Found (ug)	Ave (ppm)	(%) (+/-)(CV)	(%)
AT 546 Monitor				
50% of Monitors Analyzed Immediately	1.23 1.19	- - -	- - -	
0 min	-	1.2	2%	100%
50% of Monitors Analyzed after Exp at 0.0 ppm for	1.13 1.13	- - -	- - -	
140 min	-	1.1	0%	**93%**
AT 541 Monitor				
50% of Monitors Analyzed Immediately	5.29 5.21	- - -	- - -	
0 min	-	5.3	1%	100%
50% of Monitors Analyzed after Exp at 0.0 ppm for	4.11 4.14	- - -	- - -	
140 min	-	4.1	1%	**79%**
3M 3500 Monitor				
50% of Monitors Analyzed Immediately	20.1 19.9	- - -	- - -	
0 min	-	20.0	1%	100%
50% of Monitors Analyzed after Exp at 0.0 ppm for	12.9 13.4	- - -	- - -	
140 min	-	13.2	3%	**66%**

6.6 Effects of Air Velocity & Orientation

Samplers were exposed to atmospheres of ethylene glycol dimethyl ether and naphthalene 2 hrs at concentrations in the range 0.5-15 ppm in a Chamber with zones of different cross-sectional areas such that linear velocities of 15 and 150 cm/sec, respectively, were generated. Samplers were placed in each zone with *50% of samplers placed normal to* and *50% of Samplers perpendicular to* the flow direction. When data were compared from the four locations (representing normal air velocity and orientation variation in workplaces), no significant differences were found among groups indicating the *absence of an effect of Air Velocity & Orientation on Sampling Rate in the range 15-150 cm/sec*. *This result is applicable to other organic vapors when the same Sampler is used*.

EXPOSURE: 3 ppm ETGME for 2 hr

EVALUATION PARAMETERS	TEST RESULTS from MONITORS			% OF REFERENCE
Air Velocity and Orientation	Values (ppm)	Ave (ppm)	(%) (+/-)(CV)	(%)
Air Velocity= 14 cm/sec parallel to Sampler Face				
Reference Value (Sorbent tube) =				**3.12**
14 cm/sec air velocity parallel to Monitor face	3.3	-	-	106%
	3.4	-	-	109%
	3.2	-	-	103%
	3	-	-	96%
	2.9	-	-	93%
	2.7	-	-	87%
	-	3.08	0.26	99%
Air Velocity= 14 cm/sec perpendicular to Sampler Face				
Reference Value (Sorbent tube) =				**3.12**
14 cm/sec air velocity pependicular to Monitor face	3.7	-	-	119%
	3.5	-	-	112%
	3	-	-	96%
	3.8	-	-	122%
	3.6	-	-	115%
	3.80	-	-	122%
	-	3.57	0.30	114%

EXPOSURE: 14 ppm ETGME for 2 hr

EVALUATION PARAMETERS	TEST RESULTS from MONITORS			% OF REFERENCE
Air Velocity and Orientation	Values (ppm)	Ave (ppm)	(%) (+/-)(CV)	(%)
Air Velocity= 153 cm/sec parallel to Sampler Face				
Reference Value (Sorbent tube) =				**14.20**
153 cm/sec air velocity parallel to Monitor face	14.1	-	-	99%
	14.4	-	-	101%
	15.5	-	-	109%
	14.6	-	-	103%
	16.1	-	-	113%
	14.90	-	-	105%
	-	14.93	0.74	105%
Air Velocity= 153 cm/sec parallel to Sampler Face				
Reference Value (Sorbent tube) =				**14.20**
153 cm/sec air velocity perpendicular to Monitor face	16.7	-	-	118%
	16.9	-	-	119%
	16.2	-	-	114%
	16	-	-	113%
	15.6	-	-	110%
	16.7	-	-	118%
	-	16.35	0.50	115%

EXPOSURE: 3 ppm naphthalene for 2hr

EVALUATION PARAMETERS	TEST RESULTS from MONITORS			% OF REFERENCE
Air Velocity and Orientation	Values (ppm)	Ave (ppm)	(%) (+/-)(CV)	(%)
Air Velocity= 14 cm/sec parallel to Sampler Face				
Reference Value (Sorbent tube) =				**2.90**
14 cm/sec air velocity parallel to Monitor face	2.7	-	-	93%
	2.6	-	-	90%
	2.4	-	-	83%
	2.6	-	-	90%
	-	2.58	0.13	89%
Air Velocity= 14 cm/sec perpendicular to Sampler Face				
Reference Value (Sorbent tube) =				**2.90**
14 cm/sec air velocity pependicular to Monitor face	2.9	-	-	100%
	2.7	-	-	93%
	2.4	-	-	83%
	3	-	-	103%
	2.8	-	-	97%
	3.00	-	-	103%
	-	2.80	0.23	97%

EXPOSURE: 0.5 ppm naphthalene for 2hr

EVALUATION PARAMETERS	TEST RESULTS from MONITORS			% OF REFERENCE
Air Velocity and Orientation	Values (ppm)	Ave (ppm)	(%) (+/-)(CV)	(%)
Air Velocity= 153 cm/sec parallel to Sampler Face				
Reference Value (Sorbent tube) =				**0.51**
153 cm/sec air velocity parallel to Monitor face	0.51	-	-	100%
	0.5	-	-	98%
	0.52	-	-	102%
	0.53	-	-	104%
	0.54	-	-	106%
	0.52	-	-	102%
	-	0.52	0.01	102%
Air Velocity= 153 cm/sec parallel to Sampler Face				
Reference Value (Sorbent tube) =				**0.51**
153 cm/sec air velocity perpendicular to Monitor face	0.54	-	-	106%
	0.55	-	-	108%
	0.56	-	-	110%
	0.56	-	-	110%
	0.55	-	-	108%
	0.63	-	-	124%
	-	0.57	0.03	111%

6.7 Effect of Temperature & Humidity

Samplers were exposed to atmospheres of ethylene glycol dimethyl ether and MIBK for 2 hrs at 10 and 3 ppm, respectively, in several Chamber runs in which nearly identical exposures were applied with variations in temperature and humidity as follows: 10°C/15%RH, 40°C/72%RH, 10°C/74% RH. Data from the three conditions (representing normal temperature & humidity variation) showed no significant differences among the groups indicating the *absence of an effect of Temperature & Humidity on Sampling Rate in the range 10-40°C* and 15-75% RH. *This result is applicable to other organic vapors when the same Sampler is used.*

EXPOSURE: 10 ppm EtGylDiMeEther for 2hr

EVALUATION PARAMETERS	TEST RESULTS from MONITORS			% of Reference
Temperature & Humidity	Values (ppm)	Ave (ppm)	(%) (+/-)(CV)	(%)
Temp =10°C, RH=15%				
Reference Value(Sorbent tube) =				**11.50**
T = 10°C	11.2	-	-	97%
	11.1	-	-	97%
	11.9	-	-	103%
RH = 15%	11.4	-	-	99%
	11.9	-	-	103%
	11.4	-	-	99%
	-	11.48	2.99	100%
Temp =40°C, RH=72%				
Reference Value(Sorbent tube) =				**11.10**
T = 40°C	11.5	-	-	104%
	11.6	-	-	105%
	11.7	-	-	105%
RH = 72%	11.3	-	-	102%
	10.9	-	-	98%
	11.7	-	-	105%
	-	11.45	2.71	103%
Temp =10°C, RH=74%				
Reference Value(Sorbent tube) =				**9.46**
T = 10°C	9.26	-	-	98%
	8.89	-	-	94%
	9.02	-	-	95%
RH = 74%	8.81	-	-	93%
	8.90	-	-	94%
	9.31	-	-	98%
	-	9.03	2.30	95%

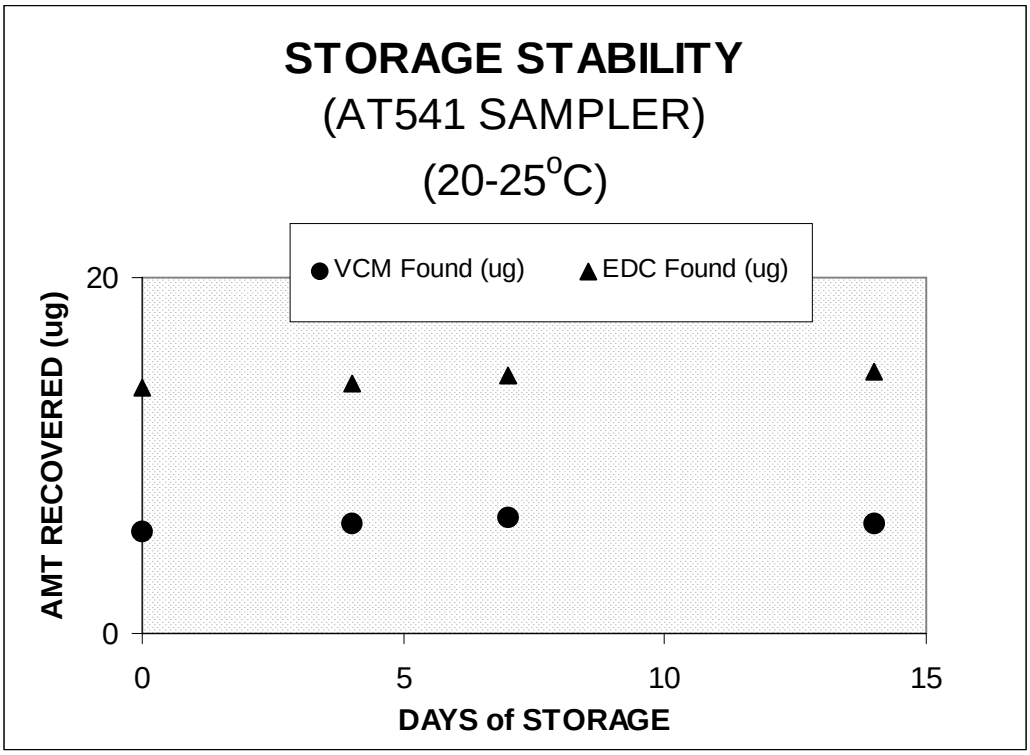
EXPOSURE: 3 ppm MIBK for 2 hr

EVALUATION PARAMETERS	TEST RESULTS from MONITORS			% OF REFERENCE
Temperature & Humidity	Values (ppm)	Ave (ppm)	(%) (+/-)(CV)	(%)
Temp =10°C, RH=10%				
Reference Value =				**3.31**
T = 10oC	3.53	-	-	107%
	3.28	-	-	99%
	3.46	-	-	105%
RH = 10%	3.23	-	-	98%
	3.43	-	-	104%
	3.57	-	-	108%
	-	3.42	3.96	103%
Temp =40°C, RH >70%				
Reference Value =				**3.31**
T = 40oC	3.33	-	-	101%
	3	-	-	91%
	3.33	-	-	101%
RH = >70%	2.94	-	-	89%
	3.18	-	-	96%
	3.08	-	-	93%
	-	3.14	5.21	95%
Temp =10°C, RH=74%				
Reference Value =				**3.01**
T = 10oC	3.04	-	-	101%
	3.27	-	-	109%
	2.99	-	-	99%
RH = 50%	3.05	-	-	101%
	2.98	-	-	99%
	3.46	-	-	115%
	-	3.13	6.16	104%

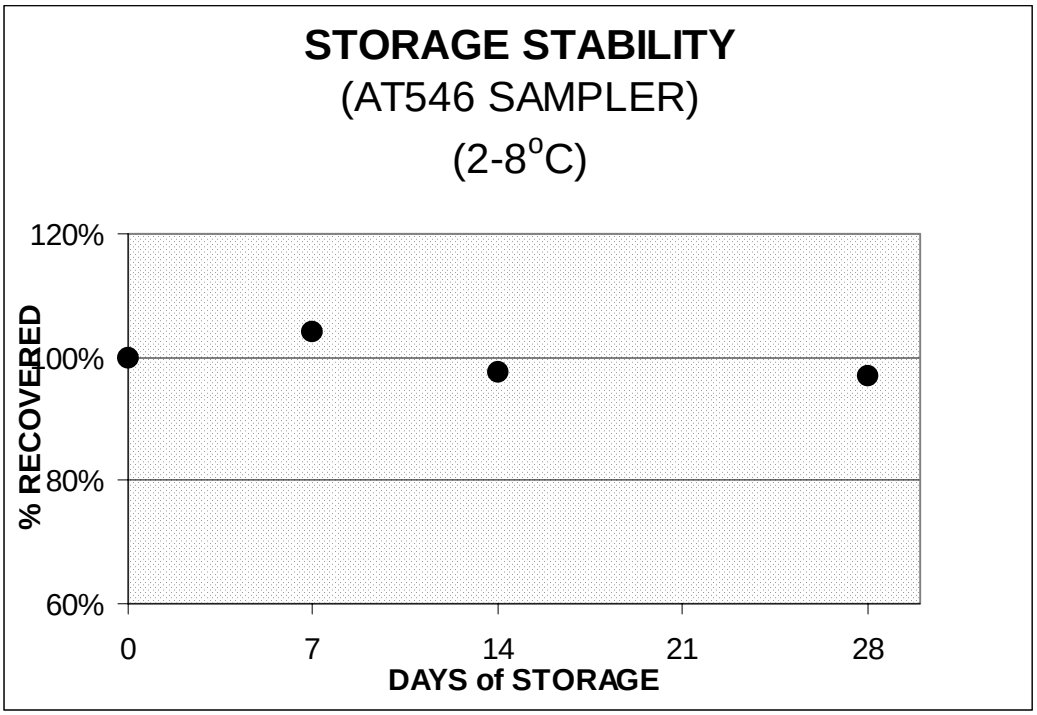
6.8 Effect of Storage after Sampling

Two identical sets of Samples were exposed (see Section 5) to Analyte concentrations near the OSHA PEL for at least 50% of the RST at 20-25°C. One set was analyzed immediately and the second set after storage at prescribed intervals. Two studies were performed. One included storage after sampling at room temperature for 4, 7, and 14 days, while a second study included of storage after sampling under refrigeration for 7,14, 21, and 28 days.

Room Temperature (20-25°C)				
Days of Storage =	**0.00**	**4.01**	**7.01**	**14.01**
VCM Found (ug)	**5.75**	**6.16**	**6.48**	**6.20**
Std Deviation = +/-	0.22	0.21	0.10	0.17
Co-Eff Variation = +/-	4%	3%	2%	3%
VCM % Recovery	**100%**	**107%**	**113%**	**108%**
EDC Found (ug)	**13.87**	**14.05**	**14.51**	**14.72**
Std Deviation = +/-	0.18	0.42	0.93	0.46
Co-Eff Variation = +/-	1%	3%	6%	3%
EDC % Recovery	**100%**	**101%**	**105%**	**106%**



Refrigeration (2-8°C)				
Days of Storage =	**0.00**	**7.00**	**14.00**	**28.00**
VCM Found (ug)	**7.64** **7.67**	**7.75** **8.20**	**7.47**	**7.43**
VCM % Recovery	**1.00**	**1.04**	**0.98**	**0.97**



6.9 Sampler Integrity

Ethylene Oxide Samplers (Monitor 502) in sealed packaging were exposed to >10 ppm ethylene oxide for >2 hours, then analyzed as directed in the Instructions for Use. Results from analysis were not significantly different from results for un-exposed Samplers (blank values) demonstrating the integrity of Sampler packaging. *This result with ethylene oxide (demonstrated to have extremely high permeability through plastics and pinholes) is applicable to all Samplers manufactured by Assay Technology and packaged in its standard aluminum foil pouch*.

6.10 Interferences (Method AT541)

Monitors 541 and 546 incorporate a collection wafer made from coconut charcoal demonstrated to collect upwards of 200 volatile organic compounds. The likelihood of the Sampler's collecting interfering substances is addressed by an analytical method (capillary gas chromatography) which can separate and analyze 100's of VOCs. Method AT541 features co-injection of analytical sample onto dual,high-resolution capillary columns (60 m x 0.32mm) providing identification of each analyte from its characteristic emergence time on two analytical columns as well as quantitation. A list of VOCs analyzed by this method are included in the Table.

CAS	CHEMICAL NAME	GROUP	CAS	CHEMICAL NAME	GROUP
			141-79-7	**Mesityl oxide**	OV-A
67-64-1	**Acetone**	OV-A	109-86-4	**Methoxyethanol (Me Cellosolve)**	OV-A
75-05-8	**Acetonitrile**	OV-A	110-49-6	**Methoxyethyl acetate(MeCSAc)**	OV-A
107-13-1	**Acrylonitrile**	OV-A	96-33-3	**Methyl acrylate**	OV-A
107-18-6	**Allyl Alcohol**	OV-A	67-56-1	**Methyl alcohol (methanol)**	OV-A
107-5-1	**Allyl Chloride**	OV-A	71-55-6	**Methyl chloroform (1,1,1-TCA)**	OV-A
628-63-7	**Amyl acetate**	OV-A	108-87-2	**Methyl cyclohexane**	OV-A
71-43-2	**Benzene**	OV-A	78-93-3	**Methyl ethyl ketone(2-butanone)**	OV-A
106-99-0	**Butadiene**	OV-A	107-31-3	**Methyl formate**	OV-A
71-36-3	**Butanol**	OV-A	110-12-3	**Methyl isoamyl ketone**	OV-A
75-65-0	**Butanol**	OV-A	108-11-2	**Methyl isobutyl carbinol**	OV-A
78-92-2	**Butanol (sec-butyl alcohol)**	OV-A	108-10-1	**Methyl isobutyl ketone (hexone)**	OV-A
111-76-2	**Butoxyethanol(ButylCellosolve)**	OV-A	80-62-6	**Methyl methacrylate**	OV-A
123-86-4	**Butyl acetate**	OV-A	107-87-9	**Methyl propyl ketone (2-pentanone)**	OV-A
540-88-5	**Butyl acetate**	OV-A	109-87-5	**Methylal (dimethoxymethane)**	OV-A
141-32-2	**Butyl acrylate**	OV-A	108-87-2	**Methylcyclohexane**	OV-A
1634-04-4	**Butyl methyl ether (MTBE)**	OV-A	75-09-2	**Methylene chloride**	OV-A
56-23-5	**Carbon tetrachloride**	OV-A	91-20-3	**Naphthalene**	OV-A
108-90-7	**Chlorobenzene**	OV-A	111-84-2	**Nonane**	OV-A
74-97-5	**Chlorobromomethane**	OV-A	111-65-9	**Octane**	OV-A
67-66-3	**Chloroform**	OV-A	109-66-0	**Pentane**	OV-A
126-99-8	**Chloroprene**	OV-A	127-18-4	**Perchloroethylene (PCE)**	OV-A
98-82-8	**Cumene**	OV-A	108-65-6	**Prop. Glyc. methyl ether acetate**	OV-A
110-82-7	**Cyclohexane**	OV-A	109-60-4	**Propyl acetate**	OV-A
108-93-0	**Cyclohexanol**	OV-A	71-23-8	**Propyl alcohol**	OV-A
108-94-1	**Cyclohexanone**	OV-A	106-94-5	**Propyl bromide**	OV-A
123-42-2	**Diacetone Alcohol**	OV-A	78-87-5	**Propylene dichloride**	OV-A
1717-00-6	**Dichloro-1-fluoroethane (HCFC141b)**	OV-A	107-98-2	**Propylene glycol methyl ether**	OV-A
75-71-8	**Dichlorodifluoromethane (CFC12)**	OV-A	110-86-1	**Pyridine**	OV-A
75-34-3	**Dichloroethane**	OV-A	100-42-5	**Styrene**	OV-A
107-06-2	**Dichloroethane (EDC)**	OV-A	76-12-0	**Tetrachloro-1,2-difluoroethane**	OV-A
540-59-0	**Dichloroethylene**	OV-A	76-11-9	**Tetrachloro-2,2-difluoroethane**	OV-A
75-43-4	**Dichlorofluoromethane (CFC21)**	OV-A	109-99-9	**Tetrahydrofuran(THF)**	OV-A
76-14-2	**Dichlorotetrafluoroethane (CFC114)**	OV-A	108-88-3	**Toluene**	OV-A
68-12-2	**Dimethyl formamide (DMF)**	OV-A	79-00-5	**Trichloroethane**	OV-A
123-91-1	**Dioxane**	OV-A	71-55-6	**Trichloroethane (methylchloroform)**	OV-A
106-89-8	**Epichlorohydrin**	OV-A	79-01-6	**Trichloroethylene (TCE)**	OV-A
110-80-5	**Ethoxyethanol(Cellosolve)**	OV-A	76-13-1	**Trichlorotrifluoroethane(CFC113)**	OV-A
111-15-9	**Ethoxyethyl acetate(EthylCell)**	OV-A	108-67-8	**Trimethylbenzene (mesitylene)**	OV-A
141-78-6	**Ethyl acetate**	OV-A	108-05-4	**Vinyl acetate**	OV-A
140-88-5	**Ethyl acrylate**	OV-A	593-60-2	**Vinyl bromide**	OV-A
64-17-5	**Ethyl alcohol (ethanol)**	OV-A	75-01-4	**Vinyl chloride**	OV-A
60-29-7	**Ethyl ether**	OV-A	75-35-4	**Vinylidene Chloride(1,1 DCE)**	OV-A
687-47-8	**Ethyl lactate**	OV-A	1330-20-7	**Xylenes**	OV-A
100-41-4	**Ethylbenzene**	OV-A			
107-07-3	**Ethylene chlorohydrin**	OV-A	100-44-7	**Benzyl chloride**	OV-B
106-93-4	**Ethylene dibromide**	OV-A	2426-08-6	**Butyl(n)glycidyl ether**	OV-B

110-71-4	**Ethylene glycol dimethyl ether**	OV-A	76-22-2	**Camphor**	OV-B
75-69-4	**Fluorotrichloromethane (CFC11)**	OV-A	2039-87-4	**Chloro(o)styrene**	OV-B
142-82-5	**Heptane**	OV-A	95-49-8	**Chloro(o)toluene**	OV-B
110-43-0	**Heptanone(methyl amyl ketone)**	OV-A	106-46-7	**Dichlorobenzene**	OV-B
110-54-3	**Hexane**	OV-A	95-50-1	**Dichlorobenzene**	OV-B
591-78-6	**Hexanone(MBK)**	OV-A	111-44-4	**Dichloroethyl ether**	OV-B
123-92-2	**Isoamyl acetate**	OV-A	77-73-6	**Dicyclopentadiene**	OV-B
123-51-3	**Isoamyl alcohol**	OV-A	108-83-8	**Diisobutylketone**	OV-B
110-19-0	**Isobutyl acetate**	OV-A	34590-94-8	**Dipropylene Glycol Methyl Ether**	OV-B
78-83-1	**Isobutyl alcohol**	OV-A	78-59-1	**Isophorone**	OV-B
108-21-4	**Isopropyl acetate**	OV-A	4016-14-2	**Isopropyl glycidyl ether(IGE)**	OV-B
67-63-0	**Isopropyl alcohol**	OV-A	98-83-9	**Methyl Styrene**	OV-B
108-20-3	**Isopropyl ether**	OV-A	101-84-8	**Phenyl ether**	OV-B
5989-27-5	**Limonene (as dipentene)**	OV-A	25013-15-4	**Vinyl toluene (methyl styrene)**	OV-B

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