

3M

Organic Vapor Monitor

Sampling Guide

For

Organic Vapor Monitor #3500/3510

Organic Vapor Monitor

With Back-Up Section #3520

December, 1982

ANOTHER STEP TOWARDS BETTER OCCUPATIONAL HEALTH AND SAFETY
R35SG-A(1221)R2

Occupational Health and Safety Products Division/3M
220-7W 3M Center
St. Paul, Minnesota 55144

3M 002252

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158

Use of the Sampling Guide Tables:

The following table summarizes OSHA standards, 3M monitor sampling information and recommended sampling procedures for a variety of organic compounds for which the 3M Organic Vapor Monitors can be used to accurately determine the environmental exposures. The table is not exhaustive and will be updated periodically. To obtain periodic updates, return the registration card contained in every box of monitors to 3M Company.

A. OSHA Standards

The OSHA TWA-PEL's (Time Weighted Average) given as workshift time weighted averages are taken from the Federal Register as found in 29 CFR 1910.1000 as of 1 January 1977 and are summarized in the "NIOSH/OSHA Pocket Guide to Chemical Hazards." Also included in parentheses are the current ACGIH (American Conference of Governmental Industrial Hygienist) values in cases where they differ from OSHA TWA's. These values are subject to change and appropriate publications should be consulted for the most current information.

B. Monitor Samples Information

* Sampling Rate

All sampling rates have an accuracy of $\pm 5\%$. The (*) compounds in the Sampling Guide tables have been subjected to an extensive amount of laboratory work to verify the sampling rate. The sampling rates given for the remaining compounds in this table were determined from empirical relationships as outlined in a publication on Sampling Rate Validation. The sampling rates are tabulated as cubic centimeters/minute and micrograms/ppm-hour. The publication on Sampling Rate Validation Protocol can be obtained upon request from 3M Company.

The top section of the #3520 (containing the primary absorbent) has the same geometric dimension as the 3M Organic Vapor Monitor #3500. Therefore, the sampling rates are the same, and also have an accuracy of $\pm 5\%$.

* Capacity

The capacity of the monitor for each individual compound is a function of molecular structure, vapor pressure, environmental conditions, etc. The capacity values are tabulated in Section II - Analysis Guide, and are used to determine the length of a recommended sampling period.

Because of the backup section, the effective sampling capacity of the Organic Vapor Monitor #3520 is four times greater than the values listed for the Organic Vapor Monitor #3500/3510.

When sampling environments containing contaminant mixtures on environments with high relative humidity, it is difficult to accurately define the diffusional sampling capacity. Therefore, under these conditions, the weight (Ws) collected by the secondary absorbent of the backup section can be compared with the weight (Wp) collected by the primary absorbent to determine sample validity. The ratio Ws/Wp must be equal to or less than 0.50.

C. Length of Sampling Period

1. General

3500/3510

When sampling for organic contaminants, full workshift sampling periods are recommended as the most comprehensive measures of worker exposure. When sampling some organic contaminants, sampling periods shorter than a full workshift are required in order to sample within the recommended capacity of the monitor. Under these circumstances, sequential sampling with several monitors can be performed.

3520

For those compounds where the recommended length of the sampling period for the Organic Vapor Monitor 3500/3510 is less than a full workshift, the length of the sampling period can be increased by a factor of four when using the Organic Vapor Monitor #3520. Because of the increased effective capacity of the Organic Vapor Monitor #3520, sampling periods longer than a full workshift are possible. **The preferred recommendation is for full workshift sampling periods.**

2. Effect on Humidity

Recommended sampling periods have been tabulated for concentration ranges from .1 to .5 times the PEL and from .5 to 3 times the PEL for relative humidities less than or greater than 70%. These recommended sampling periods should not be exceeded when using OVM #3500/3510.

3. Minimum Sampling Time

To confirm quantitatively the presence and concentration of a contaminant in the atmosphere, most analysts must have a minimum of 10 micrograms for G.C. analysis. A sampling period of at least 15 minutes is recommended even when 10 micrograms of the contaminant could be collected in a shorter period. For a contaminant at a low concentration level, the sampling rate of micrograms/ppm-hr. should be used to verify a sampling period during which at least 10 micrograms of the contaminant would be collected.

D. Short Term Exposure Limit (STEL)

The ACGIH has recommended a short-term exposure limit (STEL) as a maximum concentration to which workers can be exposed for a period up to 15 minutes continuously. No more than four (4) such excursions per day are permitted, with at least 60 minutes between exposure periods, provided that the recommended ACGIH daily TLV-TWA also is not exceeded. The STEL values summarized in the following tables can be found in the "Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1980." The monitor is recommended for STEL sampling if, during the 15 minute sampling period, the monitor will collect a minimum of 10 micrograms of the contaminant when sampling at the STEL concentrations.

E. Unsuitable Compounds

The OVM is not recommended for the compounds listed below because of adverse or inadequate interactions with the sorbent material. This list is representative of classes of compounds not suitable for use with the OVM.

Compounds not on this list or the Compound Guide should be handled by consultation with OH&SP Technical Service.

Compounds

Ammonia	Methane, Ethane, Propane
Carbon Monoxide (1)	Methyl Alcohol (Methanol)
Ethylene Oxide (2)	Methyl Chloride
Formaldehyde (3)	Methyl, Dimethyl, Trimethyl Amines
Hydrogen Sulfide	Organic Solids
Isocyanates	Sulfur Dioxide

- (1) Carbon Monoxide can be monitored using 3M Monitor #3400
- (2) Ethylene Oxide can be monitored using 3M Ethylene Oxide Monitor #3550/3551
- (3) Formaldehyde can be monitored using 3M Formaldehyde Monitor #3750/3751

F. Compounds Printed in Bold Type

All compounds listed in **bold** type in the OVM Sampling Guide will be analyzed by 3M for the OVM #3510. †For more information contact your 3M Sales Representative or your local OH&SP Safety Products Distributor.

†Pre-paid analysis for up to three compounds.

Sampling Guide

COMPOUND	RECOMMENDED SAMPLING PERIOD (Hrs.)				SHORT TERM EXPOSURE LIMIT (15 min.)		OSHA Standard TWA-PEL () ACGIH TLV C-Ceiling (ppm)	SAMPLING RATE	
	RH < 70%		RH > 70%						
	.1-.5 PEL	.5-3 PEL	.1-.5 PEL	.5-3 PEL	STEL (ppm)	OVM Usage	(cc/min.)	Microgram ppm/hr.	
Acetone*	1	0.5	1	0.5	1250	Yes	1000	40.1	5.71
Acetonitrile*	8	2	6	1	60	Yes	40	48.2	4.85
Acrylonitrile	8	2	6	1	—		2	43.8	5.70
Allyl Alcohol	8	8	8	6	2	No	2	40.4	5.75
Allyl Chloride	8	8	8	6	2	No	1	35.1	6.63
n-Amyl Acetate*	8	8	8	4	150	Yes	100	26.0	7.36
s-Amyl Acetate	8	8	8	4	—		125	27.2	8.68
n-Amyl Alcohol*	8	8	8	4	—		(100)	31.4	6.78
l-Amyl Alcohol*	8	8	8	4	125	Yes	100	32.3	6.98
s-Amyl Alcohol	8	8	8	4	—		(100)	32.3	6.98
Benzene*	8	8	8	6	25	Yes	10	35.5	6.78
Benzyl Chloride	8	8	8	6	—		1	27.2	8.48
Bromoform	8	8	8	6	—		0.5	29.3	18.19
Butadiene	0.4	NR	0.4	NR	1250	Yes	1000	42.8	5.67
n-Butyl Acetate	8	7	6	3	200	Yes	150	31.6	9.00
s-Butyl Acetate	8	5	6	3	250	Yes	200	28.6	8.14
t-Butyl Acetate	8	4	6	3	250	Yes	200	29.4	8.37
Butyl Acrylate	8	8	8	6	—		—	28.7	9.01
Butyl Alcohol*	8	8	8	4	—		(10)	34.3	5.55
s-Butyl Alcohol	8	6	6	3	—		(50)	34.8	6.32
t-Butyl Alcohol	8	7	6	3	150	Yes	100	35.2	6.39
Butyl Cellosolve* (2-Butoxyethanol)	8	8	8	6	150	Yes	50	28.2	8.15
Butyl Glycidyl Ether (BGE)	8	8	8	6	—		50	27.0	8.61
p-tert-Butyltoluene*	8	8	8	6	20	Yes	10	20.7	7.51
Camphor	8	8	8	6	3	No	2	21.4	7.11
Carbon Disulfide	8	2	6	1	—		20	42.8	7.88
Carbon Tetrachloride*	8	8	8	6	20	Yes	10	30.2	11.41
Cellosolve* (2-Ethoxyethanol)	8	5	8	3	150	Yes	200	32.4	7.14
Cellosolve Acetate* (2-Ethoxyethyl Acetate)	8	8	8	4	150	Yes	(100)	26.6	8.60
Chlorobenzene*	8	8	8	5	—		75	29.3	8.12
o-Chlorostyrene	8	8	8	6	75	Yes	—	26.0	8.87
o-Chlorotoluene	8	8	8	6	75	Yes	(50)	27.3	8.51
Chlorobromomethane*	8	1.5	6	1.5	250	Yes	(50)	34.4	10.89
Chloroform*	8	4	6	3	50	Yes	200	33.5	9.78
1-Chloro-1-nitropropane	8	8	8	6	—		50	30.4	9.25
Chloroprene (2-Chloro-1,3-butadiene)	8	8	6	4	—		(10)	32.2	7.03
Cumene*	8	8	8	6	75	Yes	50	24.5	8.82
Cyclohexane*	8	3	6	2	375	Yes	300	32.4	6.67
Cyclohexanol*	8	8	8	6	—		50	29.5	7.24
Cyclohexanone*	8	8	8	6	—		50	28.9	6.94
Cyclohexene*	8	3	6	2	—		300	32.3	6.49
Diacetone Alcohol*	8	8	8	6	75	Yes	50	28.2	7.15
o-Dichlorobenzene*	8	8	8	6	—		50	27.8	10.03
p-Dichlorobenzene*	8	8	8	6	110	Yes	75	27.8	10.03
1,1-Dichloroethane	8	1.5	4	1.5	250	Yes	100	33.2	8.07
1,2-Dichloroethylene*	1	0.2	1	0.2	250	Yes	(200)	35.2	8.38
1,1-Dichloro-1-nitroethane	8	8	8	6	10	Yes	200	28.5	10.07
Dichloroethyl Ether	8	8	8	6	10	Yes	10	26.1	9.16
Diisobutyl Ketone* (DIBK)	8	8	8	6	—		(5)	24.6	8.56
							50		

Sampling Guide

COMPOUND	RECOMMENDED SAMPLING PERIOD (Hrs.)				SHORT TERM EXPOSURE LIMIT (15 min.)		OSHA Standard TWA-PEL () ACGIH TLV C-Ceiling (ppm)	SAMPLING RATE	
	RH < 70%		RH > 70%						
	.1-5 PEL	.5-3 PEL	.1-5 PEL	.5-3 PEL	STEL (ppm)	OVM Usage		(cc/min.)	Microgram ppm/hr.
Dimethyl Formamide (DMF)	8	8	8	6	20	Yes	10	32.4	5.8
p-Dioxane	8	8	8	4	—		100 (50)	34.5	7.45
Dipropylene Glycol Methyl Ether	8	8	8	4	150	Yes	100	25.3	9.19
Enflurane	8	8	8	6	—		— (2)	28.3	12.81
(2-Chloro-1,1,2 trifluoroethyl difluoromethyl ether)									
Epichlorohydrin	8	8	8	6	5	No	5 (2)	29.6	6.76
(1-Chloro-2,3-epoxy-propane)									
Ethyl Acetate*	7	1	4	1	—		400	34.5	7.45
Ethyl Acrylate	8	8	6	4	—		25	32.2	7.90
Ethyl Alcohol	4	0.5	4	0.5	—		1000	51.2	5.78
Ethyl Benzene	8	8	8	4	125	Yes	100	27.3	7.10
Ethyl Bromide*	1	0.2	1	0.2	250	Yes	200	36.4	9.74
Ethyl Butyl Ketone (3-Heptanone)	8	8	8	6	75	Yes	50	28.0	7.83
Ethyl Ether	0.3	NR	0.3	NR	500	Yes	400	36.8	6.68
Ethyl Formate	3	0.5	3	0.5	150	Yes	100	38.8	7.04
Ethylene Chlorohydrin (2-Chloroethanol)	8	8	8	6	—		5	33.9	6.66
Ethylene Dibromide*	8	8	8	6	—		20	29.6	13.66
(1,2-Dibromomethane)									
Ethylene Dichloride*	8	8	6	4	15	Yes	50 (10)	33.2	8.07
(1,2-Dichloroethane)									
Furfural	8	8	8	8	15	Yes	5	34.3	8.08
Furfuryl Alcohol	8	8	8	6	10	Yes	50 (5)	32.6	6.98
Glycidol (2,3-Epoxy-1-propanol)	8	8	8	6	75	Yes	50	37.1	6.74
Halothane	8	8	6	4	—		— (2)	30.2	14.63
(2-Bromo-2-chloro-1,1,1 trifluoroethane)									
Heptane*	8	2	4	2	500	Yes	500 (400)	28.9	7.08
Hexachloroethane	8	8	8	8	3	Yes	1	26.7	15.53
Hexane*	8	1.5	4	1.5	125	Yes	500 (100)	32.0	6.74
s-Hexyl Acetate	8	8	8	4	—		50	28.1	9.93
Isoamyl Acetate	8	8	8	4	125	Yes	100	27.2	8.68
Isoamyl Alcohol*	8	8	8	4	125	Yes	100	32.3	6.98
Isobutyl Acetate*	8	8	8	4	187	Yes	150	31.0	8.82
Isobutyl Alcohol*	8	8	8	4	75	Yes	100 (50)	35.9	5.81
Isophorone*	8	8	8	6	—		25 (5)	21.7	7.34
Isopropyl Acetate	8	2	6	2	310	Yes	250	31.7	7.93
Isopropyl Alcohol	8	2	6	2	500	Yes	400 (250)	39.4	5.17
Isopropyl Ether	5	0.8	4	0.8	310	Yes	500 (250)	31.2	7.81
Isopropyl Glycidyl Ether	8	8	8	6	75	Yes	50	29.1	8.28
Mesityl Oxide*	8	8	8	6	—		25	31.2	7.49
Mesitylene* (Trimethyl Benzene)	8	8	8	6	35	Yes	25	26.3	7.73
Methyl Acetate*	3	0.5	3	0.5	250	Yes	200	37.9	6.72
Methyl Acrylate	8	7	6	3	—		10	35.8	7.56
Methylal (Dimethoxymethane)	0.3	NR	0.3	NR	1250	Yes	1000	37.9	7.07
Methyl Amyl Ketone (2-Heptanone)	8	8	8	4	150	Yes	100	27.9	7.81
Methyl Bromide	4	0.5	3	0.5	—		20 (15)	46.5	10.84

Sampling Guide

COMPOUND	RECOMMENDED SAMPLING PERIOD (Hrs.)				SHORT TERM EXPOSURE LIMIT (15 min.)		OSHA Standard TWA-PEL () ACGIH TLV C-Ceiling (ppm)	SAMPLING RATE	
	RH < 70%		RH > 70%						
	.1-.5 PEL	.5-3 PEL	.1-.5 PEL	.5-3 PEL	STEL (ppm)	OVM Usage		(cc/min.)	Microgram ppm/hr.
Methyl Butyl Ketone* (2-Hexanone)	8	8	8	4	50	Yes	100	29.7	7.29
Methyl Isobutyl Ketone* (Hexanone)	8	8	8	4	125	Yes	100	30.0	7.35
Methyl Cellosolve* (2-Methoxyethanol)	8	8	8	6	35	Yes	25	36.3	6.76
Methyl Cellosolve Acetate* (Ethylene Glycol Methyl Ether Acetate)	8	8	8	6	35	Yes	25	29.0	8.38
Methyl Chloroform*	6	1	4	1	450	Yes	350	30.9	10.09
Methyl Cyclohexane*	8	2.5	6	2	500	Yes	500	28.9	6.94
Methyl Cyclohexanol	8	8	8	4	75	Yes	100 (50)	28.8	8.06
Methyl Ethyl Ketone* (2-Butanone)	8	3	6	2	300	Yes	200	36.3	6.41
Methyl Formate	0.7	NR	0.7	NR	150	Yes	100	45.0	6.33
5-Methyl-3-heptanone (Ethyl Amyl Ketone)	8	8	8	6	—		25	26.4	7.39
Methyl Iodide	6	1	4	1	10	Yes	5	36.7	12.79
Myethyl Isobutyl Carbinol (Methyl Amyl Alcohol)	8	8	8	6	40	Yes	25	29.2	6.51
Methyl Isoamyl Ketone	8	8	8	4	150	Yes	100	28.0	7.83
Methyl Methacrylate	8	8	8	4	125	Yes	100	31.8	7.80
Alpha Methyl Styrene*	8	8	8	4	—		100	25.0	7.24
Methylene Chloride* (Dichloromethane)	1	0.2	1	0.2	250	Yes	500 (200)	37.9	7.91
Naphtha (VM&P)*	8	2	6	2	400	Yes	300	33.2	8.15
Naphthalene	8	8	8	6	15	Yes	10	24.6	6.88
Nonane*	8	5	6	3	250	Yes	— (200)	24.6	7.71
Octane*	8	3	6	2	375	Yes	500	26.6	7.43
Pentane*	2.5	0.4	2.5	0.4	750	Yes	1000 (600)	35.3	5.56
2-Pentanone* (Methyl Propyl Ketone)	8	5	6	3	250	Yes	200	33.0	6.95
Perchloroethylene (Tetrachloroethylene)	8	7	6	3	150	Yes	100	28.3	11.53
Phenyl Ether	8	8	8	6	2	No	1	24.1	10.05
Phenyl Glycidyl Ether	8	8	8	6	15	Yes	10	20.8	7.71
n-Propyl Acetate*	8	4	8	3	250	Yes	200	30.1	7.53
n-Propyl Alcohol*	8	8	6	4	250	Yes	200	39.7	5.21
Propylene Dichloride* (1,2-Dichloropropane)	8	8	6	4	110	Yes	75	30.6	8.49
Propylene Glycol Monomethyl Ether	8	8	8	4	150	Yes	— (100)	32.4	6.09
n-Propyl Nitrate	8	8	8	4	40	Yes	25	33.3	7.27
Stoddard Solvent	8	4	6	3	125	Yes	500 (100)	24.3	8.59
Styrene*	8	8	8	4	125	Yes	100	26.8	6.83
1,1,2,2-Tetrachloroethane	8	8	8	6	10	Yes	5	28.4	11.71
1,1,1,2-Tetrachloro-2,2-difluoroethane	5	0.75	4	0.75	625	Yes	500	29.7	14.87
1,1,2,2-Tetrachloro-1,2-difluoroethane	5	0.75	4	0.75	625	Yes	500	28.2	14.12
Tetrahydrofuran	8	2	4	2	250	Yes	200	37.2	6.57
Toluene*	8	6	6	3	150	Yes	200	31.4	7.08
1,1,2-Trichloroethane*	8	8	6	6	20	Yes	10	29.7	9.69
Trichloroethylene*	8	8	8	6	150	Yes	100 (50)	31.1	10.00
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5	NR	0.5	NR	1250	Yes	1000	31.4	14.41
1,2,3-Trichloropropane	8	8	8	6	75	Yes	50	27.4	9.88
Vinyl Acetate	8	8	6	4	20	Yes	— (10)	35.8	7.56
Vinyl Bromide	2	2	2	2	—		(5)	41.0	10.77
Vinyl Chloride*	2	2	2	1.5	—		1 (5)	40.9	6.22
Vinylidene Chloride	2	2	2	2	20	Yes	(10)	38.6	9.19
Vinyl Toluene	8	8	6	4	150	Yes	100	26.8	7.75
Xylene*	8	8	6	4	150	Yes	100	27.3	7.09

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Organic Vapor Monitor # 3500

Analysis Guide

ANOTHER STEP TOWARDS BETTER OCCUPATIONAL HEALTH AND SAFETY

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**Occupational Health and
Safety Products Division/3M**

220-7W, 3M Center
St. Paul, Minnesota 55144

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Organic Vapor Monitor Analysis Guide

USE OF THE ANALYSIS GUIDE TABLES:

The Analysis Guide is designed for the customer involved in the analysis of the 3M #3500 Organic Vapor Monitor by the gas chromatograph. The following tables summarize the 3M monitor sampling rate, capacity, recovery coefficient and calculation constants. The analysis guide provides the necessary information to calculate the time-weighted-average concentration in parts per million (ppm) or milligrams per cubic meter (mg/m^3).

A. Monitor Sample Information

• Sampling Rate

The (*) compounds in the Sampling Guide tables have been subjected to an extensive amount of laboratory work to verify the sampling rate. The sampling rates given for the remaining compounds in this table were determined from empirical relationships as outlined in a publication on Sampling Rate Validation. All sampling rates have an accuracy of $\pm 5\%$. The sampling rates are tabulated as either cubic centimeters/minute or micrograms/ppm-hour.

• Capacity

The capacity of the monitor for each individual compound is a function of molecular structure, vapor pressure, environmental conditions, etc. The capacity is stated in terms of weight (milligrams). For a single contaminant, if the analyst finds the weight collected by the monitor is greater than the defined capacity, then the validity of the sample should be questioned.

When sampling multiple contaminants, the combined weights of the contaminants collected should not exceed the defined value for the single contaminant with the lowest capacity.

• Recovery Coefficients (Desorption Efficiency)

The collected sample is removed from the activated carbon wafer for analysis by desorption with carbon disulfide (CS_2) or other suitable solvents. In order for the laboratory analyst to determine accurately the amount of contaminant collected by the adsorbent, it is necessary to know the efficiency of the desorption process. The recovery coefficient or desorption efficiency is determined by adding a known weight of contaminant onto the adsorbent and measuring the weight of contaminant in the desorbing solvent. The recovery coefficient is calculated by dividing the recovered weight by the known weight. It is recommended that each analytical laboratory determine recovery coefficients according to the procedure outlined by the 3M laboratory contained in the Analysis Guide as "Recommended Procedure for Determination of Recovery Coefficients." Recovery coefficients determined by the 3M laboratory are tabulated in the following tables.

B. Procedure to Calculate Contaminant Concentrations

The time-weighted-average concentration of the environment sampled can be calculated by knowing the length of the sampling period, the contaminant weight determined by gas chromatography, the recovery coefficient and the calculation constant either A or B. The calculation constant A is used to calculate the concentration when expressed in units of milligrams per cubic meter (mg/m^3) and constant B when expressed in units of parts per million (ppm). The calculation constant A and B have been determined for every contaminant in the Analysis Guide by the following expressions:

$$A = \frac{1000}{\text{Sampling Rate}}$$

$$B = \frac{1000}{(\text{Sampling Rate})} \times \frac{(24.45)}{(\text{Molecular Weight})}$$

The contaminant concentration can be calculated with the following information:

- **Sampling Information**

Contaminant
Length of Sampling Period (min.) t

- **Contaminant Information from Tables in Analysis Guide**

Calculation Constant A or B

- **Analytical Results**

Contaminant weight recovered W (Micrograms)
Recovery Coefficient (r)

The time-weighted-average concentration in milligrams per cubic meter of the contaminant in the environment sampled can be calculated from the following expression:

$$C(\text{mg}/\text{m}^3) = \frac{W (\text{micrograms})}{r \times t (\text{minutes})} \times A$$

The time-weighted-average concentration in parts per million (ppm) of the contaminant can be calculated from the following expression:

$$C(\text{ppm}) = \frac{W (\text{micrograms})}{r \times t (\text{minutes})} \times B$$

The above expressions calculate the time-weighted-average concentrations at a sampling temperature of 25°C (298°K) and pressure of 760 mm. When sampling at other environmental conditions, the above expressions need to be corrected only for variations in temperature. The above expressions can be multiplied by the following temperatures correction factors (CF_T) for samples collected at temperatures other than 25°C (77°F).

Sampling (°C)	Temperature (°F)	Temperature Correction Factor (CF _T)
44	111	.97
37	99	.98
31	88	.99
25	77	1.00
19	66	1.01
13	55	1.02
7	45	1.03
2	36	1.04
- 3	27	1.05
- 8	18	1.06

From the above table, every 10-11° above or below 77°F requires a one percent correction to the calculated time-weighted-average concentration.

If the temperature correction is desired, the time weighted average concentration can be calculated by the following expression:

$$C(\text{mg}/\text{m}^3) = \frac{W (\text{micrograms})}{r \times t (\text{minutes})} \times A \times \text{CF}_T$$

$$C(\text{ppm}) = \frac{W (\text{micrograms})}{r \times t (\text{minutes})} \times B \times \text{CF}_T$$

Examp^l Calculation

Contaminant	Benzene
Length of Sampling Period (t)	420 minutes
Temperature (T)	75°F
Calculation Constant A	28.2
or B	8.83
Contaminant Weight Recovered (W)	27.2 micrograms
Recovery Coefficient(r)	1.02

Using Calculation Constant A:

$$C(\text{mg}/\text{m}^3) = \frac{27.2}{(1.02)(420)} \times 28.2$$

$$C = 1.79 \text{ mg}/\text{m}^3$$

Using Calculation Constant B:

$$C(\text{ppm}) = \frac{27.2}{(1.02)(4.20)} \times 8.83$$

$$C = .56 \text{ ppm}$$

ANALYSIS GUIDE

	Sampling Rate (cc/min)	Capacity (mg)	Recovery Coefficient	Calculation Constant	
				A (mg/m ³)	B (ppm)
Acetone*	40.1 ± .9	3	.87	24.9	10.51
Acetonitrile	48.2	14	—	20.8	12.37
Acrylonitrile	43.8	11	—	22.8	10.53
Allyl Alcohol	40.4	20	—	24.75	10.43
Allyl Chloride	35.1	1	—	28.5	9.05
n-Amyl Acetate*	26.0 ± .5	>25	1.08	38.6	7.26
s-Amyl Acetate	27.2	>25	—	36.8	6.91
n-Amyl Alcohol*	31.2 ± .4	>25	1.00 +	32.1	8.91
i-Amyl Alcohol*	32.3 ± .4	>25	.99 +	31.0	8.63
s-Amyl Alcohol	32.3	>25	.99 +	31.0	8.60
Benzene*	35.5 ± .6	13	1.02	28.2	8.83
Benzyl Chloride	27.2	>25	1.05	36.8	7.08
Bromoform	29.3	>25	1.05	34.1	3.30
Butadiene	42.8	.4	—	23.4	10.53
n-Butyl Acetate	31.6	25	1.04	31.7	6.67
s-Butyl Acetate	28.6	>25	1.07	35.0	7.37
t-Butyl Acetate	29.4	19	1.05	34.0	7.17
Butyl Acrylate	28.7	>25	—	34.8	6.66
Butyl Alcohol*	34.3 ± .7	>25	.98 +	29.2	9.63
s-Butyl Alcohol	34.8	19	.97 +	28.7	9.44
t-Butyl Alcohol	35.2	13	—	28.4	9.39
Butyl Cellosolve* (2-Butoxyethanol)	28.2 ± .6	>25	.86	35.5	7.35
Butyl Glycidyl Ether (BGE)	27.0	>25	—	37.0	6.97
p-tert-Butyltoluene*	20.7 ± .4	>25	1.10	48.3	7.98
Camphor	21.4	>25	—	46.7	7.52
Carbon Disulfide	42.8	1	—	23.4	7.52
Carbon Tetrachloride*	30.2 ± .4	14	1.05	33.1	5.26
Cellosolve* (2-Ethoxyethanol)	32.4 ± .9	>25	.78	30.9	8.39
Cellosolve Acetate* (2-Ethoxyethyl Acetate)	26.6 ± .4	>25	1.03	37.6	6.96
Chlorobenzene*	29.3 ± .6	>25	1.00	34.1	7.38
o-Chlorostyrene	26.0	>25	—	38.5	6.77
o-Chlorotoluene	27.3	>25	—	36.6	7.05
Chlorobromomethane*	34.4 ± .9	10	1.00	29.1	5.51
Chloroform	33.5	7	.98	29.9	6.13
1-Chloro-1-nitropropane	30.4	>25	—	32.9	6.49
Chloroprene (2-Chloro-1,3-butadiene)	32.2	5	—	31.1	8.53
Cumene*	24.5 ± .9	>25	.96	40.8	8.32
Cyclohexane*	32.4 ± .7	22	1.07	30.9	8.98
Cyclohexanol*	29.5 ± .3	>25	1.00 +	32.7	8.48
Cyclohexanone*	28.9 ± .3	>25	.97	34.6	8.63
Cyclohexene*	32.3 ± .4	22	1.02	31.0	9.23
Diacetone Alcohol*	28.2 ± .4	>25	1.04 +	35.5	7.47
o-Dichlorobenzene*	27.8 ± .6	>25	.95	36.0	5.98
p-Dichlorobenzene*	27.8 ± .6	>25	.95	36.0	5.98
1,1 Dichloroethane	33.2	4	—	30.1	7.44
1,2 Dichloroethylene*	35.2 ± .5	1	.99	28.4	7.16
1,1 Dichloro-1-nitroethane	28.5	>25	—	35.1	5.96
Dichloroethyl Ether	26.1	>25	—	38.3	6.55

+ Methylene Chloride as the solvent

3M 002262

ANALYSIS GUIDE

	Sampling Rate (cc/min)	Capacity (mg)	Recovery Coefficient	Calculation Constant	
				A (mg/m ³)	B (ppm)
Diisobutyl Ketone*	24.6 ± .8	>25	1.07	40.7	7.00
Dimethyl Formamide	32.4	>25	—	30.9	10.34
p-Dioxane	34.5	>25	—	29.0	8.05
Dipropylene Glycol Methyl Ether	25.3	>25	—	39.5	6.53
Enflurane (2-Chloro-1,1,2 trifluoro-ethyl difluoromethyl ether)	28.3	4	—	35.3	4.68
Epichlorohydrin (1-Chloro-2,3-epoxy-propane)	29.6	>25	.95	33.8	8.88
Ethyl Acetate*	34.5 ± .6	10	1.01	29.0	8.05
Ethyl Acrylate	32.2	19	—	31.1	7.59
Ethyl Alcohol	51.2	12	—	19.5	10.38
Ethyl Benzene	27.3	>25	—	36.6	8.45
Ethyl Bromide*	36.4 ± .3	1	1.03	27.5	6.16
Ethyl Butyl Ketone (3-Heptanone)	28.0	>25	—	35.7	7.66
Ethyl Ether	36.8	.4	—	27.2	8.98
Ethyl Formate	38.8	1	—	25.8	8.52
Ethylene Chlorohydrin (2-Chloroethanol)	33.9	>25	—	29.5	8.90
Ethylene Dibromide* (1,2-Dibromomethane)	29.6 ± .4	>25	1.04	33.8	4.39
Ethylene Dichloride* (1,2-Dichloroethane)	33.2 ± .7	18	1.02	30.1	7.44
Furfural	34.3	>25	—	32.8	8.35
Furfuryl Alcohol	32.6	>25	—	30.7	7.65
Glycidol (2,3-Epoxy-1-propanol)	37.1	>25	—	27.0	8.91
Halothane (2-Bromo-2-chloro-1,1,1 trifluoroethane)	30.2	4	—	33.1	5.96
Heptane*	28.9 ± .7	>25	1.08	34.6	8.46
Hexachloroethane	26.7	>25	—	37.5	3.86
Hexane*	32.0 ± .7	18	1.05	31.3	8.88
s-Hexyl Acetate	28.1	>25	—	35.6	6.04
Isoamyl Acetate	27.2	>25	—	36.8	8.64
Isoamyl Alcohol*	32.3 ± .4	>25	1.03 +	31.0	8.60
Isobutyl Acetate*	31.0 ± .3	>25	—	32.3	6.80
Isobutyl Alcohol*	35.9 ± .7	>25	1.02 +	27.9	9.20
Isophorone*	21.7 ± .7	>25	1.03 +	46.1	8.16
Isopropyl Acetate	31.7	15	1.05 +	31.5	7.56
Isopropyl Alcohol	39.4	17	—	25.4	10.34
Isopropyl Ether	31.2	10	—	33.0	7.91
Isopropyl Glycidyl Ether	29.1	>25	—	34.4	7.24
Mesityl Oxide*	31.2 ± 1.2	>25	.99	32.1	8.00
Mesitylene* (Trimethyl Benzene)	26.3 ± .7	>25	1.06	38.0	7.75
Methyl Acetate*	37.0 ± .6	2	1.00	27.0	8.93
Methyl Acrylate	35.8	11	—	27.9	7.94
Methylal (Dimethoxymethane)	37.9	1	—	26.4	8.49
Methyl Amyl Ketone (2-Heptanone)	27.9	>25	—	35.8	7.69
Methyl Bromide	46.5	.5	—	21.5	5.53
Methyl Butyl Ketone* (2-Hexanone)	29.7 ± .7	>25	1.00	33.7	8.23
Methyl Isobutyl Ketone* (Hexanone)	30.0 ± .4	>25	1.06	33.3	8.15
Methyl Cellosolve* (2-Methoxyethanol)	36.3 ± .4	>25	.75	27.5	8.86

+ Methylene Chloride as the solvent

ANALYSIS GUIDE

	Sampling Rate (cc/min)	Capacity (mg)	Recovery Coefficient	Calculation Constant	
				A (mg/m ³)	B (ppm)
Methyl Cellosolve Acetate* (Ethylene Glycol Methyl Ether Acetate)	29.0 ± .5	>25	1.00	34.5	7.14
Methyl Chloroform*	30.9 ± .3	12	1.03	32.4	5.95
Methyl Cyclohexane*	28.9 ± .4	>25	1.05	34.6	8.63
Methyl Cyclohexanol	28.8	>25	—	34.7	7.45
Methyl Ethyl Ketone* (2-Butanone)	36.3 ± .9	12	1.00	27.5	9.35
Methyl Formate	45.0	.2	—	22.2	9.06
5-Methyl-3-heptanone (Ethyl Amyl Ketone)	26.4	>25	—	37.9	7.24
Methyl Iodide	36.7	.2	—	27.3	4.69
Methyl Isobutyl Carbinol (Methyl Amyl Alcohol)	29.2	>25	—	34.2	8.21
Methyl Isoamyl Ketone	28.0	>25	—	35.7	7.66
Methyl Methacrylate	31.8	24	—	31.5	7.69
Alpha Methyl Styrene*	25.0 ± .5	>25	1.01	40.0	8.29
Methylene Chloride* (Dichloromethane)	37.9 ± .3	2	.90	26.9	7.59
Naphtha (VM&P)*	33.2 ± .7	20	1.04	30.1	7.36
Naphthalene	24.6	>25	—	40.7	7.76
Nonane*	24.6 ± .6	>25	1.09	40.7	9.04
Octane*	26.6 ± .6	>25	1.08	37.6	8.06
Pentane*	35.3 ± .9	7	1.02	28.3	9.62
2-Pentanone* (Methyl Propyl Ketone)	33.0 ± .5	23	1.03	30.3	8.62
Perchloroethylene*	28.3 ± .5	>25	1.05	35.3	5.20
Phenyl Ether	24.1	>25	—	41.5	5.97
Phenyl Glycidyl Ether	20.8	>25	—	48.1	7.84
n-Propyl Acetate*	30.1 ± .5	21	—	33.3	7.96
n-Propyl Alcohol*	39.7 ± .7	25	.93 +	25.2	10.26
Propylene Dichloride* (1,2 Dichloropropane)	30.6 ± .4	25	1.04	32.7	7.07
Propylene Glycol Monomethyl Ether	32.4	>25	—	32.3	7.58
n-Propyl Nitrate	33.3	>25	—	30.0	8.25
Stoddard Solvent	24.3	>25	—	41.2	6.99
Styrene*	26.8 ± .8	>25	1.08	37.3	8.77
1,1,2,2-Tetrachloroethane	28.4	>25	.89	35.2	5.12
1,1,1,2-Tetrachloro-2,2-difluoroethane	29.7	5	—	33.9	4.06
1,1,2,2-Tetrachloro-1,2-difluoroethane	28.2	5	—	35.5	4.25
Tetrahydrofuran	37.2	8	—	26.8	9.13
Toluene*	31.4 ± .6	25	1.05	31.8	8.46
1,1,2-Trichloroethane*	29.7 ± .6	>25	1.02	33.7	6.19
Trichloroethylene*	31.1 ± .2	20	1.00	32.2	6.00
1,1,2-Trichloro-1,2,2-trifluoroethane	31.4	.5	—	31.9	4.16
1,2,3-Trichloropropane	27.4	>25	—	36.5	6.07
Vinyl Acetate	35.8	7	1.02	27.9	7.94
Vinyl Bromide	41.0	.3	—	24.4	5.57
Vinyl Chloride*	40.8 ± .5	.04	1.02	24.4	9.56
Vinylidene Chloride	38.4	.5	—	25.9	6.53
Vinyl Toluene	26.8	>25	—	37.3	7.73
Xylene*	27.3 ± .5	>25	1.07	36.6	8.45

+ Methylene Chloride as the solvent

3M 002264

NOTES

3M 002265