

3M
Organic Vapor Monitor
Sampling Guide
For
Organic Vapor Monitor #3500/3510
Organic Vapor Monitor
With Back-Up Section #3520

February 1990

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.

A. OSHA Standards

The OSHA TWA-PELs (Time Weighted Average), given as workshift time weighted averages, are taken from the Federal Register as found in 29 CFR 1910.1000 as of 19 January 1989 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 TWAs. 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.

The top section of the 3520 (containing the primary adsorbent) has the same geometric dimension as the 3M Organic Vapor Monitor 3500. Therefore, the sampling rate is the same, and also has 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 or environments with high relative humidity, it is difficult to accurately define the diffusional sampling capacity. Therefore, under these conditions, the weight (W_s) collected by the secondary adsorbent of the backup section can be compared with the weight (W_p) collected by the primary adsorbent to determine sample validity. The ratio W_s/W_p 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.

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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 up to four when using the 3520 Organic Vapor Monitor.

2. Effect of Humidity

Recommended sampling periods have been tabulated for concentration ranges from 0.1 to 0.5 times the PEL and from 0.5 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 and Biological Exposure Indices Adopted by ACGIH for 1989-1990." The monitor is recommended for STEL sampling if, during the 15 minute sampling period, the monitor collects a sufficient quantity of the contaminant for analysis.

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&ESD Technical Service at 1-800-243-4630.

Compounds

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

(1) Ethylene Oxide can be monitored using 3M 3550/3551 Ethylene Oxide Monitor

(2) Formaldehyde can be monitored using 3M 3720/3721 Formaldehyde Monitor.

(3) Methylene Chloride, see technical data bulletin #71.

F. 3M Analytical Service

Selected compounds listed in the OVM Sampling Guide will be analyzed by 3M using the 3M 3510 Monitor sold with a prepaid analysis. For more information, contact your 3M Sales Representative or your local 3M OH&ESD Safety Products Distributor.

Sampling Guide

Compound	Recommended Sampling Period (Hrs.)				OSHA Standard TWA-PEL () ACGIH TLV (ppm)	C = Ceiling STEL	Sampling Rate	
	RH < 70%		RH > 70%				(cc/min.)	Microgram/ppm-Hr.
	0.1-0.5 PEL	0.5-3 PEL	0.1-0.5 PEL	0.5-3 PEL				
Acetone*	1	0.5	1	0.5	750	1000	40.1	5.71
Acetonitrile*	8	2	6	1	40	60	48.2	4.85
Acrylonitrile	8	2	6	1	2	10	43.8	5.70
Allyl Alcohol	8	8	8	6	2	4	40.4	5.75
Allyl Chloride	8	8	8	6	1	2	35.1	6.63
n-Amyl Acetate*	8	8	8	4	100		26.0	7.36
n-Amyl Alcohol (1-Pentanol)	8	8	8	8	—		30.9	6.68
s-Amyl Acetate	8	8	8	4	125		27.2	8.68
s-Amyl Alcohol (2-Pentanol)	8	8	8	8	—		31.15	6.73
Benzene*	8	8	8	6	1	5	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	(10)		42.8	5.67
n-Butyl Acetate	8	7	6	3	150	200	31.6	9.00
s-Butyl Acetate	8	5	6	3	200		28.6	8.14
t-Butyl Acetate	8	4	6	3	200		29.4	8.37
Butyl Acrylate	8	8	8	6	10		28.7	9.01
n-Butyl Alcohol*	8	8	8	4	—	C50	34.3	5.55
s-Butyl Alcohol	8	6	6	3	100		34.8	6.32
t-Butyl Alcohol	8	7	6	3	100	150	35.2	6.39
Butyl Cellosolve (2-Butoxyethanol)	8	8	8	6	25		27.3	7.92
Butyl Cellosolve Acetate	8	8	8	8	—		24.4	9.59
Butyl Glycidyl Ether (BGE)	8	8	8	8	25		27.0	8.61
p-tert-Butyltoluene*	8	8	8	6	10	20	20.7	7.51
Camphor	8	8	8	6	2		21.4	7.11
Carbon Disulfide	8	4	6	2	4	12	42.8	7.88
Carbon Tetrabromide	8	8	8	8	0.1	0.3	26.6	21.6
Carbon Tetrachloride*	8	8	8	8	2		30.2	11.41
Cellosolve* (2-Ethoxyethanol)	8	5	8	3	200 (5)		32.4	7.14
Cellosolve Acetate* (2-Ethoxyethyl Acetate)	8	8	8	4	100 (5)		26.6	8.60
Chlorobenzene*	8	8	8	5	75		29.3	8.12
o-Chlorostyrene	8	8	8	6	50	75	26.0	8.87
o-Chlorotoluene	8	8	8	6	50		27.3	8.51
Chlorobromomethane*	8	1.5	6	1.5	200		34.4	10.89
Chloroform*	8	8	8	6	2		33.5	9.78
1-Chloro-1-nitropropane	8	8	8	8	2		30.4	9.25
Chloroprene (2-Chloro-1, 3-butadiene)	8	8	8	6	10		32.2	7.03
Cumene*	8	8	8	6	50		24.5	8.82
Cyclohexane*	8	3	6	2	300		32.4	6.67
Cyclohexanol*	8	8	8	8	50		29.5	7.24
Cyclohexanone*	8	8	8	8	25		28.9	6.94
Cyclohexene*	8	3	6	2	300		32.3	6.49
Cyclopentadiene	3	1	3	1	75	—	39.5	6.41
Cyclopentane	0.5	NR	0.5	NR	600	—	36.2	6.22
Diacetone Alcohol*	8	8	8	6	50		28.2	7.15
o-Dichlorobenzene*	8	8	8	6		C50	27.8	10.03
p-Dichlorobenzene*	8	8	8	6	75	110	27.8	10.03
1, 1-Dichloroethane	8	1.5	4	1.5	100		33.2	8.07
1, 2-Dichloroethylene*	1	0.2	1	0.2	200		35.2	8.38
1, 1-Dichloro-1-nitroethane	8	8	8	8	2		28.5	10.07
Dichloroethyl Ether	8	8	8	6	5	10	26.1	9.16
Dicyclopentadiene	8	8	8	8	5	—	23.6	7.67
Diethyl Ketone	8	8	8	8	200	—	32.8	6.92
Diisobutyl Ketone* (DIBK)	8	8	8	8	25		24.6	8.56

* Compound has been subjected to extensive laboratory testing for sampling rate validation.

** 3520 only.

† See Technical Data Bulletin No. 63.

Sampling Guide

Compound	Recommended Sampling Period (Hrs.)				OSHA Standard TWA-PEL () ACGIH TLV (ppm)	C = Ceiling STEL	Sampling Rate		
	RH < 70%		RH > 70%				(cc/min.)	Microgram/ ppm-Hr.	
	0.1-0.5 PEL	0.5-3 PEL	0.1-0.5 PEL	0.5-3 PEL					
Dimethyl Formamide (DMF)	8	8	8	6	10	150	32.4	5.8	
p-Dioxane	8	8	8	8	25		34.5	7.45	
Dipropyl Ketone (4-hepanone)	8	8	8	8	50		27.8	7.79	
Dipropylene Glycol Methyl Ether	8	8	8	4	100		25.3	9.19	
Divinyl Benzene	8	8	8	8	10		22.2	7.09	
Enflurane (2-Chloro-1, 1, 2-trifluoroethyl difluoromethyl ether)	8	8	8	6	— (2)	25	28.3	12.81	
Epichlorohydrin (1-Chloro-2, 3-epoxy-propane)	8	8	8	8	2		29.6	6.76	
Ethyl Acetate*	7	1	4	1	400		34.5	7.45	
Ethyl Acrylate	8	8	8	6	5		32.2	7.90	
Ethyl Alcohol	4	0.5	4	0.5	1000		51.2	5.78	
Ethyl Amyl Ketone (5-menthyl -3-heptanone)	8	8	8	8	25	—	26.0	8.18	
Ethyl Benzene	8	8	8	4	100	125	27.3	7.10	
Ethyl Bromide*	1	0.2	1	0.2	200	250	36.4	9.74	
Ethyl Butyl Ketone (3-Heptanone)	8	8	8	6	50	500	28.0	7.83	
Ethyl Ether	0.3	NR	0.3	NR	400		36.8	6.68	
Ethyl Formate	3	0.5	3	0.5	100	C1	38.8	7.04	
Ethyl Mercaptan (Ethanethiol)	8	8	8	8	0.5		41.1	6.27	
Ethylene Chlorohydrin (2-Chloroethanol)	8	8	8	6	20		33.9	6.66	
Ethylene Dibromide* (1, 2-Dibromoethane)	8	8	8	6			29.6	13.66	
Ethylene Dichloride* (1, 2-Dichloroethane)	8	8	8	8			1	33.2	8.07
Furfural	8	8	8	8	2	15	34.3	8.08	
Furfuryl Alcohol	8	8	8	8	10		32.6	6.98	
Forane (1-Chloro -2, 2, 2, Trifluoro Ethyl Difluoro Methyl Ether)	8	8	8	6	25		28.4	12.8	
Glycidol (2, 3-Epoxy-1-propanol)	8	8	8	8			37.1	6.74	
Halothane (2-Bromo-2-chloro,1, 1, 1-trifluoroethane)	8	8	6	4			— (2)	30.2	14.63
n-Heptane*	8	2	4	2	400	500	28.9	7.08	
Hexachlorobutadiene	8	8	8	8	0.02	—	23.1	14.8	
Hexachloroethane	8	8	8	8	1	—	26.7	15.53	
Hexachloropentadiene	8	8	8	8	0.01		21	14.1	
Hexane Isomers*	8	1.5	4	1.5	500		1000	32.0	6.74
n-Hexane	8	4	8	4	50	125	32.0	6.74	
s-Hexyl Acetate	8	8	8	4	50		28.1	9.93	
Isoamyl Acetate	8	8	8	4	100		27.2	8.68	
Isoamyl Alcohol*	8	8	8	4	100		32.3	6.98	
Isobutyl Acetate*	8	8	8	4	150		31.0	8.82	
Isobutyl Alcohol*	8	8	8	6	50	—	35.9	5.81	
Isooctyl Alcohol	8	8	8	8	50		25.3	8.07	
Isophorone*	8	8	8	8	4		21.7	7.34	
Isopropoxyethanol (Ethylene Glycol Isopropyl Ether)	8	8	8	8	25		—	29.4	7.51
Isopropyl Acetate	8	2	6	2	250		310	31.7	7.93
Isopropyl Alcohol	8	2	6	2	400	500	39.4	5.17	
Isopropyl Ether	5	0.8	4	0.8	500	75	31.2	7.81	
Isopropyl Glycidyl Ether	8	8	8	6	50		29.1	8.28	
Mesityl Oxide*	8	8	8	6	15		25	31.2	7.49
Mesitylene* (Trimethyl Benzene)	8	8	8	6	25		26.3	7.73	
Methyl Acetate*	3	0.5	3	0.5	200		250	37.9	6.72
Methyl Acrylate	8	7	6	3	10	1000	35.8	7.56	
Methylal (Dimethoxymethane)	0.3	NR	0.3	NR	1000		37.9	7.07	
Methyl n-Amyl Ketone (2-Heptanone)	8	8	8	4	100		27.9	7.81	
Methyl Bromide**	4	0.5	3	0.5	50		46.5	10.84	
					5				

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**3520 only.

Sampling Guide

Compound	Recommended Sampling Period (Hrs.)				OSHA Standard TWA-PEL () ACGIH TLV (ppm)	STEL	Sampling Rate	
	RH < 70%		RH > 70%				(cc/min.)	Microgram/ ppm-Hr.
	0.1-0.5 PEL	0.5-3 PEL	0.1-0.5 PEL	0.5-3 PEL				
Methyl n-Butyl Ketone* (2-Hexanone)	8	8	8	8	5		29.7	7.29
Methyl Cellosolve* (2-Methoxyethanol)	8	8	8	6	25 (5)		36.3	6.76
Methyl Cellosolve Acetate* (Ethylene Glycol Methyl Ether Acetate)	8	8	8	6	25 (5)		29.0	8.38
Methyl Cyclohexane*	8	2.5	6	2	400		28.9	6.94
Methyl Cyclohexanol	8	8	8	6	50		28.8	8.06
Methyl Ethyl Ketone* (2-Butanone)	8	3	6	2	200	300	36.3	6.41
Methyl Formate	0.7	NR	0.7	NR	100	150	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	2		36.7	12.79
Methyl Isoamyl Ketone	8	8	8	4	50		28.0	7.83
Methyl Isobutyl Carbinol (Methyl Amyl Alcohol)	8	8	8	6	25	40	29.2	6.51
Methyl Isobutyl Ketone* (Hexanone)	8	8	8	8	50	75	30.0	7.35
Methyl Isopropyl Ketone	8	8	8	8	200	—	32.8	6.94
Methyl Methacrylate	8	8	8	4	100		31.8	7.80
Alpha Methyl Styrene*	8	8	8	6	50	100	25.0	7.24
Methylene Chloride* (Dichloromethane)**	†	†	†	†	500 (100)		37.9	7.91
Morpholine	8	8	8	8	20	30	33.1	7.08
Naphtha (VM&P)*	8	2	6	2	300	400	33.2	8.15
Naphthalene	8	8	8	6	10	15	24.6	6.88
Nonane*	8	5	6	3	200		24.6	7.71
n-Octane*	8	3	6	2	300	375	26.6	7.43
Pentane*	2.5	0.4	2.5	0.4	600	750	35.3	5.56
2-Pentanone* (Methyl Propyl Ketone)	8	5	6	3	200	250	33.0	6.95
Perchloroethylene (Tetrachloroethylene)	8	8	8	6	25		28.3	11.53
Phenyl Ether	8	8	8	6	1		24.1	10.05
Phenyl Glycidyl Ether	8	8	8	6	1		20.8	7.71
n-Propyl Acetate*	8	4	8	3	200	250	30.1	7.53
n-Propyl Alcohol*	8	8	6	4	200	250	39.7	5.21
Propylene Dichloride* (1, 2-Dichloropropane)	8	8	6	4	75	110	30.6	8.49
Propylene Glycol Monomethyl Ether	8	8	8	4	100	150	32.4	6.09
Propylene Oxide	6	3	4	2	20	—	42.5	6.06
n-Propyl Nitrate	8	8	8	4	25	40	33.3	7.27
Resorcinol	8	8	8	8	10	20	27.0	7.28
Stoddard Solvent	8	8	8	6	100		24.3	8.59
Styrene*	8	8	8	6	50	100	26.8	6.83
1, 1, 2, 2-Tetrachloroethane	8	8	8	8	1		28.4	11.71
1, 1, 1, 2-Tetrachloro-2, 2-difluoroethane	5	0.75	4	0.75	500		29.7	14.87
1, 1, 2, 2-Tetrachloro-1, 2-difluoroethane	5	0.75	4	0.75	500		28.2	14.12
Tetrahydrofuran	8	2	4	2	200	250	37.2	6.57
Toluene*	8	8	8	6	100	150	31.4	7.08
1, 1, 1-Trichloroethane	6	1	4	1	350	450	30.9	10.09
1, 1, 2-Trichloroethane*	8	8	6	6	10		29.7	9.69
Trichloroethylene*	8	8	8	8	50	200	31.1	10.00
1, 1, 2-Trichloro-1, 2, 2-trifluoroethane (Freon 113)	0.5	NR	0.5	NR	1000	1250	31.4	14.41
1, 2, 3-Trichloropropane	8	8	8	6	10		27.4	9.88
Vinyl Acetate	8	8	6	4	10	20	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	1		38.6	9.19
Vinyl Toluene	8	8	6	4	100		26.8	7.75
Xylene*	8	8	6	4	100	150	27.3	7.09

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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.

The top section of the 3520 (containing the primary adsorbent) has the same geometric dimension as the 3M Organic Vapor Monitor 3500. Therefore, the sampling rate is the same, and also has 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 or 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 adsorbent of the backup section can be compared with the weight (Wp) collected by the primary adsorbent 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.

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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 3520 Organic Vapor Monitor.

2. Effect of Humidity

Recommended sampling periods have been tabulated for concentration ranges from 0.1 to 0.5 times the PEL and from 0.5 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&ESD Technical Service at 1-800-243-4630.

Compounds

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

(1) Ethylene Oxide can be monitored using 3M 3550/3551 Ethylene Oxide Monitor

(2) Formaldehyde can be monitored using 3M 3720/3721 Formaldehyde Monitor.

F. 3M Analytical Service

Selected compounds listed in the OVM Sampling Guide will be analyzed by 3M using the 3M 3510 Monitor sold with a prepaid analysis. For more information, contact your 3M Sales Representative or your local 3M OH&ESD Safety Products Distributor.

Sampling Guide

Compound	Recommended Sampling Period (Hrs.)				OSHA Standard TWA-PEL () ACGIH TLV (ppm)	STEL	Sampling Rate	
	RH < 70%		RH > 70%				(cc/min.)	Microgram ppm/hr.
	0.1-0.5 PEL	0.5-3 PEL	0.1-0.5 PEL	0.5-3 PEL				
Acetone*	1	0.5	1	0.5	750	1000	40.1	5.71
Acetonitrile*	8	2	6	1	40	60	48.2	4.85
Acrylonitrile	8	2	6	1	2	10	43.8	5.70
Allyl Alcohol	8	8	8	6	2	4	40.4	5.75
Allyl Chloride	8	8	8	6	1	2	35.1	6.63
n-Amyl Acetate*	8	8	8	4	100	5	26.0	7.36
s-Amyl Acetate	8	8	8	4	125		27.2	8.68
Benzene*	8	8	8	6	1		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	(10)	200	42.8	5.67
n-Butyl Acetate	8	7	6	3	150		31.6	9.00
s-Butyl Acetate	8	5	6	3	200		28.6	8.14
t-Butyl Acetate	8	4	6	3	200		29.4	8.37
Butyl Acrylate	8	8	8	6	10		28.7	9.01
n-Butyl Alcohol*	8	8	8	4	100 (50)	50	34.3	5.55
s-Butyl Alcohol	8	6	6	3	100	150	34.8	6.32
t-Butyl Alcohol	8	7	6	3	100		35.2	6.39
Butyl Cellosolve* (2-Butoxyethanol)	8	8	8	6	25		27.3	7.92
Butyl Cellosolve Acetate	8	8	8	8	—		24.4	9.59
Butyl Glycidyl Ether (BGE)	8	8	8	8	25	12	27.0	8.61
p-tert-Butyltoluene*	8	8	8	6	10		20.7	7.51
Camphor	8	8	8	6	2		21.4	7.11
Carbon Disulfide	8	4	6	2	4		42.8	7.88
Carbon Tetrachloride*	8	8	8	8	2		30.2	11.41
Cellosolve* (2-Ethoxyethanol)	8	5	8	3	200 (5)	75	32.4	7.14
Cellosolve Acetate* (2-Ethoxyethyl Acetate)	8	8	8	4	100 (5)		26.6	8.60
Chlorobenzene*	8	8	8	5	75		29.3	8.12
o-Chlorostyrene	8	8	8	6	50		26.0	8.87
o-Chlorotoluene	8	8	8	6	50		27.3	8.51
Chlorobromomethane*	8	1.5	6	1.5	200		34.4	10.89
Chloroform*	8	8	8	6	2		33.5	9.78
1-Chloro-1-nitropropane	8	8	8	8	2		30.4	9.25
Chloroprene (2-Chloro-1, 3-butadiene)	8	8	8	6	10		32.2	7.03
Cumene*	8	8	8	6	50		24.5	8.82
Cyclohexane*	8	3	6	2	300		32.4	6.67
Cyclohexanol*	8	8	8	8	50		29.5	7.24
Cyclohexanone*	8	8	8	8	25		28.9	6.94
Cyclohexene*	8	3	6	2	300		32.3	6.49
Diacetone Alcohol*	8	8	8	6	50		28.2	7.15
o-Dichlorobenzene*	8	8	8	6	75	50	27.8	10.03
p-Dichlorobenzene*	8	8	8	6		100	27.8	10.03
1, 1-Dichloroethane	8	1.5	4	1.5		100	33.2	8.07
1, 2-Dichloroethylene*	1	0.2	1	0.2		200	35.2	8.38
1, 1-Dichloro-1-nitroethane	8	8	8	8		2	28.5	10.07
Dichloroethyl Ether	8	8	8	6	5	10	26.1	9.16
Diisobutyl Ketone* (DIBK)	8	8	8	8	25		24.6	8.56

* Compound has been subjected to extensive laboratory testing for sampling rate validation.

** 3520 only.

† See Technical Data Bulletin No. 63.

Sampling Guide

Compound	Recommended Sampling Period (Hrs.)				OSHA Standard TWA-PEL () ACGIH TLV (ppm)	STEL	Sampling Rate	
	RH < 70%		RH > 70%				(cc/min.)	Microgram ppm/hr.
	0.1-0.5 PEL	0.5-3 PEL	0.1-0.5 PEL	0.5-3 PEL				
Dimethyl Formamide (DMF)	8	8	8	6	10		32.4	5.8
p-Dioxane	8	8	8	8	25		34.5	7.45
Dipropylene Glycol Methyl Ether	8	8	8	4	100		25.3	9.19
Enflurane	8	8	8	6	—		28.3	12.81
(2-Chloro-1, 1, 2-trifluoroethyl difluoromethyl ether)					(2)			
Epichlorohydrin (1-Chloro-2, 3-epoxy-propane)	8	8	8	8	2		29.6	6.76
Ethyl Acetate*	7	1	4	1	400		34.5	7.45
Ethyl Acrylate	8	8	8	6	5	25	32.2	7.90
Ethyl Alcohol	4	0.5	4	0.5	1000		51.2	5.78
Ethyl Benzene	8	8	8	4	100	125	27.3	7.10
Ethyl Bromide*	1	0.2	1	0.2	200	250	36.4	9.74
Ethyl Butyl Ketone (3-Heptanone)	8	8	8	6	50		28.0	7.83
Ethyl Ether	0.3	NR	0.3	NR	400	500	36.8	6.68
Ethyl Formate	3	0.5	3	0.5	100		38.8	7.04
Ethylene Chlorohydrin (2-Chloroethanol)	8	8	8	6		1	33.9	6.66
Ethylene Dibromide* (1, 2-Dibromomethane)	8	8	8	6	20		29.6	13.66
Ethylene Dichloride* (1, 2-Dichloroethane)	8	8	8	8	1	2	33.2	8.07
Furfural	8	8	8	8	2		34.3	8.08
Furfuryl Alcohol	8	8	8	8	10	15	32.6	6.98
Glycidol (2, 3-Epoxy-1-propanol)	8	8	8	8	25		37.1	6.74
Halothane (2-Bromo-2-chloro,1, 1, 1-trifluoroethane)	8	8	6	4	—		30.2	14.63
					(2)			
n-Heptane*	8	2	4	2	400	500	28.9	7.08
Hexachloroethane	8	8	8	8	1		26.7	15.53
Hexane*	8	1.5	4	1.5	500	1000	32.0	6.74
n-Hexane	8	4	8	4	50		32.0	6.74
s-Hexyl Acetate	8	8	8	4	50		28.1	9.93
Isoamyl Acetate	8	8	8	4	100		27.2	8.68
Isoamyl Alcohol*	8	8	8	4	100	125	32.3	6.98
Isobutyl Acetate*	8	8	8	4	150		31.0	8.82
Isobutyl Alcohol*	8	8	8	6	50		35.9	5.81
Isophorone*	8	8	8	8	4		21.7	7.34
Isopropyl Acetate	8	2	6	2	250	310	31.7	7.93
Isopropyl Alcohol	8	2	6	2	400	500	39.4	5.17
Isopropyl Ether	5	0.8	4	0.8	500		31.2	7.81
Isopropyl Glycidyl Ether	8	8	8	6	50	75	29.1	8.28
Mesityl Oxide*	8	8	8	6	15	25	31.2	7.49
Mesitylene* (Trimethyl Benzene)	8	8	8	6	25		26.3	7.73
Methyl Acetate*	3	0.5	3	0.5	200	250	37.9	6.72
Methyl Acrylate	8	7	6	3	10		35.8	7.56
Methylal (Dimethoxymethane)	0.3	NR	0.3	NR	1000		37.9	7.07
Methyl n-Amyl Ketone (2-Heptanone)	8	8	8	4	100		27.9	7.81
					(50)			
Methyl Bromide**	4	0.5	3	0.5	5		46.5	10.84

*Compound has been subjected to extensive laboratory testing for sampling rate validation.

**3520 only.

3M 005243

Sampling Guide

Compound	Recommended Sampling Period (Hrs.)				OSHA Standard TWA-PEL () ACGIH TLV (ppm)	STEL	Sampling Rate		
	RH < 70%		RH > 70%				(cc/min.)	Microgram ppm/hr.	
	0.1-0.5 PEL	0.5-3 PEL	0.1-0.5 PEL	0.5-3 PEL					
Methyl n-Butyl Ketone* (2-Hexanone)	8	8	8	8	5	75	29.7	7.29	
Methyl Isobutyl Ketone* (Hexanone)	8	8	8	6	50		30.0	7.35	
Methyl Cellosolve* (2-Methoxyethanol)	8	8	8	6	25 (5)		36.3	6.76	
Methyl Cellosolve Acetate* (Ethylene Glycol Methyl Ether Acetate)	8	8	8	6	25 (5)		29.0	8.38	
Methyl Chloroform*	6	1	4	1	350	450	30.9	10.09	
Methyl Cyclohexane*	8	2.5	6	2	400	300	28.9	6.94	
Methyl Cyclohexanol	8	8	8	6	50		28.8	8.06	
Methyl Ethyl Ketone* (2-Butanone)	8	3	6	2	200		36.3	6.41	
Methyl Formate	0.7	NR	0.7	NR	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	2	40	36.7	12.79	
Methyl Isobutyl Carbinol (Methyl Amyl Alcohol)	8	8	8	6	25		29.2	6.51	
Methyl Isoamyl Ketone	8	8	8	4	50		28.0	7.83	
Methyl Methacrylate	8	8	8	4	100	100	31.8	7.80	
Alpha Methyl Styrene*	8	8	8	6	50		25.0	7.24	
Methylene Chloride* (Dichloromethane)**	†	†	†	†	500 (100)			37.9	7.91
Naphtha (VM&P)*	8	2	6	2	300	400	33.2	8.15	
Naphthalene	8	8	8	6	10		15	24.6	6.88
Nonane*	8	5	6	3	200		24.6	7.71	
n-Octane*	8	3	6	2	300	375	26.6	7.43	
Pentane*	2.5	0.4	2.5	0.4	600	750	35.3	5.56	
2-Pentanone* (Methyl Propyl Ketone)	8	5	6	3	200	250	33.0	6.95	
Perchloroethylene (Tetrachloroethylene)	8	8	8	6	25		28.3	11.53	
Phenyl Ether	8	8	8	6	1		24.1	10.05	
Phenyl Glycidyl Ether	8	8	8	6	1		20.8	7.71	
n-Propyl Acetate*	8	4	8	3	200	250	30.1	7.53	
n-Propyl Alcohol*	8	8	6	4	200	250	39.7	5.21	
Propylene Dichloride* (1, 2-Dichloropropane)	8	8	6	4	75	110	30.6	8.49	
Propylene Glycol Monomethyl Ether	8	8	8	4	100	150	32.4	6.09	
n-Propyl Nitrate	8	8	8	4	25	40	33.3	7.27	
Stoddard Solvent	8	8	8	6	100	100	24.3	8.59	
Styrene*	8	8	8	6	50		26.8	6.83	
1, 1, 2, 2-Tetrachloroethane	8	8	8	8	1		28.4	11.71	
1, 1, 1, 2-Tetrachloro-2, 2-difluoroethane	5	0.75	4	0.75	500		29.7	14.87	
1, 1, 2, 2-Tetrachloro-1, 2-difluoroethane	5	0.75	4	0.75	500		28.2	14.12	
Tetrahydrofuran	8	2	4	2	200	250	37.2	6.57	
Toluene*	8	8	8	6	100	150	31.4	7.08	
1, 1, 1-Trichloroethane	6	1	4	1	350	450	28.9	9.46	
1, 1, 2-Trichloroethane*	8	8	6	6	10		29.7	9.69	
Trichloroethylene*	8	8	8	8	50	200	31.1	10.00	
1, 1, 2-Trichloro-1, 2, 2-trifluoroethane	0.5	NR	0.5	NR	1000	1250	31.4	14.41	
1, 2, 3-Trichloropropane	8	8	8	6	10	20	27.4	9.88	
Vinyl Acetate	8	8	6	4	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	1		38.6	9.19	
Vinyl Toluene	8	8	6	4	100	150	26.8	7.75	
Xylene*	8	8	6	4	100		27.3	7.09	

*Compound has been subjected to extensive laboratory testing for sampling rate validation.

**3520 Only

†See Technical Data Bulletin #71.

3M 005244

3M
Organic Vapor Monitor
Sampling Guide
For
Organic Vapor Monitor #3500/3510
Organic Vapor Monitor
With Back-Up Section #3520

ANOTHER STEP TOWARDS BETTER OCCUPATIONAL HEALTH AND SAFETY

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**3M Occupational Health and
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Building 220-3E, 3M Center
St. Paul, Minnesota 55144-1000

3M 005245



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.

A. OSHA Standards

The OSHA TWA-PELs (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 TWAs. 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.

The top section of the 3520 (containing the primary adsorbent) has the same geometric dimension as the 3M Organic Vapor Monitor 3500. Therefore, the sampling rate is the same, and also has 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 or environments with high relative humidity, it is difficult to accurately define the diffusional sampling capacity. Therefore, under these conditions, the weight (W_s) collected by the secondary adsorbent of the backup section can be compared with the weight (W_p) collected by the primary adsorbent to determine sample validity. The ratio W_s/W_p 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 3520 Organic Vapor Monitor.

2. Effect of Humidity

Recommended sampling periods have been tabulated for concentration ranges from 0.1 to 0.5 times the PEL and from 0.5 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	Methyl Alcohol (Methanol)
Ethylene Oxide (1)	Methyl Chloride
Formaldehyde (2)	Methyl, Dimethyl, Trimethyl Amines
Hydrogen Sulfide	Methylene Chloride
Isocyanates	Organic Solids
	Sulfur Dioxide

(1) Ethylene Oxide can be monitored using 3M 3550/3551 Ethylene Oxide Monitor

(2) Formaldehyde can be monitored using 3M 3720/3721 Formaldehyde Monitor.

F. 3M Analytical Service

Selected compounds listed in the OVM Sampling Guide will be analyzed by 3M using the 3M 3510 Monitor sold with a prepaid analysis. For more information, contact your 3M Sales Representative or your local 3M OH&SP Safety Products Distributor.

Sampling Guide

Compound	Recommended Sampling Period (Hrs.)				OSHA Standard TWA-PEL () ACGIH TLV C-Ceiling (ppm)	Sampling Rate	
	RH < 70%		RH > 70%			(cc/min.)	Microgram
	0.1-0.5 PEL	0.5-3 PEL	0.1-0.5 PEL	0.5-3 PEL			ppm/hr.
Acetone*	1	0.5	1	0.5	1000 (750)	40.1	5.71
Acetonitrile*	8	2	6	1	40	48.2	4.85
Acrylonitrile	8	2	6	1	2 (2)	43.8	5.70
Allyl Alcohol	8	8	8	6	2	40.4	5.75
Allyl Chloride	8	8	8	6	1	35.1	6.63
n-Amyl Acetate*	8	8	8	4	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
i-Amyl Alcohol*	8	8	8	4	100	32.3	6.98
s-Amyl Alcohol	8	8	8	4	(100)	32.3	6.98
Benzene*	8	8	8	6	1	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	(10)	42.8	5.67
n-Butyl Acetate	8	7	6	3	150	31.6	9.00
s-Butyl Acetate	8	5	6	3	200	28.6	8.14
t-Butyl Acetate	8	4	6	3	200	29.4	8.37
Butyl Acrylate	8	8	8	6	(10)	28.7	9.01
Butyl Alcohol*	8	8	8	4	100 (50)	34.3	5.55
s-Butyl Alcohol	8	6	6	3	150	34.8	6.32
t-Butyl Alcohol	8	7	6	3	100	35.2	6.39
Butyl Cellosolve* (2-Butoxyethanol)	8	8	8	6	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	10	20.7	7.51
Camphor	8	8	8	6	2	21.4	7.11
Carbon Disulfide	8	2	6	1	20	42.8	7.88
Carbon Tetrachloride*	8	8	8	6	10	30.2	11.41
Cellosolve* (2-Ethoxyethanol)	8	5	8	3	200 (5)	32.4	7.14
Cellosolve Acetate* (2-Ethoxyethyl Acetate)	8	8	8	4	100 (5)	26.6	8.60
Chlorobenzene*	8	8	8	5	75 (75)	29.3	8.12
o-Chlorostyrene	8	8	8	6	— (50)	26.0	8.87
o-Chlorotoluene	8	8	8	6	— (50)	27.3	8.51
Chlorobromomethane*	8	1.5	6	1.5	200	34.4	10.89
Chloroform*	8	4	6	3	50 (10)	33.5	9.78
1-Chloro-1-nitropropane	8	8	8	6	20 (2)	30.4	9.25
Chloroprene (2-Chloro-1, 3-butadiene)	8	8	6	4	25 (10)	32.2	7.03
Cumene*	8	8	8	6	50	24.5	8.82
Cyclohexane*	8	3	6	2	300	32.4	6.67
Cyclohexanol*	8	8	8	6	500	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	50	28.2	7.15
o-Dichlorobenzene*	8	8	8	6	50	27.8	10.03
p-Dichlorobenzene*	8	8	8	6	75	27.8	10.03
1, 1-Dichloroethane	8	1.5	4	1.5	100 (200)	33.2	8.07
1, 2-Dichloroethylene*	1	0.2	1	0.2	200	35.2	8.38
1, 1-Dichloro-1-nitroethane	8	8	8	6	10	28.5	10.07
Dichloroethyl Ether	8	8	8	6	15 (5)	26.1	9.16
Diisobutyl Ketone* (DIBK)	8	8	8	6	50 (25)	24.6	8.56

** 3520 only.

Sampling Guide

Compound	Recommended Sampling Period (Hrs.)				OSHA Standard TWA-PEL () ACGIH TLV C-Ceiling (ppm)	Sampling Rate	
	RH < 70%		RH > 70%			(cc/min.)	Microgram ppm/hr.
	0.1-0.5 PEL	0.5-3 PEL	0.1-0.5 PEL	0.5-3 PEL			
Dimethyl Formamide (DMF)	8	8	8	6	10	32.4	5.8
p-Dioxane	8	8	8	4	100 (25)	34.5	7.45
Dipropylene Glycol Methyl Ether	8	8	8	4	100	25.3	9.19
Enflurane (2-Chloro-1, 1, 2 trifluoroethyl difluoromethyl ether)	8	8	8	6	— (2)	28.3	12.81
Epichlorohydrin (1-Chloro-2, 3-epoxy-propane)	8	8	8	6	5 (2)	29.6	6.76
Ethyl Acetate*	7	1	4	1	400	34.5	7.45
Ethyl Acrylate	8	8	6	4	25 (5)	32.2	7.90
Ethyl Alcohol	4	0.5	4	0.5	1000	51.2	5.78
Ethyl Benzene	8	8	8	4	100	27.3	7.10
Ethyl Bromide*	1	0.2	1	0.2	200	36.4	9.74
Ethyl Butyl Ketone (3-Heptanone)	8	8	8	6	50	28.0	7.83
Ethyl Ether	0.3	NR	0.3	NR	400	36.8	6.68
Ethyl Formate	3	0.5	3	0.5	100	38.8	7.04
Ethylene Chlorohydrin (2-Chloroethanol)	8	8	8	6	5	33.9	6.66
Ethylene Dibromide* (1, 2-Dibromomethane)	8	8	8	6	20	29.6	13.66
Ethylene Dichloride* (1, 2-Dichloroethane)	8	8	6	4	50 (10)	33.2	8.07
Furfural	8	8	8	8	5 (2)	34.3	8.08
Furfuryl Alcohol	8	8	8	6	50 (5)	32.6	6.98
Glycidol (2, 3-Epoxy-1-propanol)	8	8	8	6	50 (25)	37.1	6.74
Halothane (2-Bromo-2-chloro,1, 1, 1 trifluoroethane)	8	8	6	4	— (2)	30.2	14.63
Heptane*	8	2	4	2	500 (400)	28.9	7.08
Hexachloroethane	8	8	8	8	1 (10)	26.7	15.53
Hexane*	8	1.5	4	1.5	500 (50)	32.0	6.74
s-Hexyl Acetate	8	8	8	4	50	28.1	9.93
Isoamyl Acetate	8	8	8	4	100	27.2	8.68
Isoamyl Alcohol*	8	8	8	4	100	32.3	6.98
Isobutyl Acetate*	8	8	8	4	150	31.0	8.82
Isobutyl Alcohol*	8	8	8	4	100 (50)	35.9	5.81
Isophorone*	8	8	8	6	25 (5)	21.7	7.34
Isopropyl Acetate	8	2	6	2	250	31.7	7.93
Isopropyl Alcohol	8	2	6	2	400	39.4	5.17
Isopropyl Ether	5	0.8	4	0.8	500 (250)	31.2	7.81
Isopropyl Glycidyl Ether	8	8	8	6	50	29.1	8.28
Mesityl Oxide*	8	8	8	6	25 (35)	31.2	7.49
Mesitylene* (Trimethyl Benzene)	8	8	8	6	25	26.3	7.73
Methyl Acetate*	3	0.5	3	0.5	200	37.9	6.72
Methyl Acrylate	8	7	6	3	10	35.8	7.56
Methylal (Dimethoxymethane)	0.3	NR	0.3	NR	1000	37.9	7.07
Methyl Amyl Ketone (2-Heptanone)	8	8	8	4	100 (50)	27.9	7.81
Methyl Bromide	4	0.5	3	0.5	20 (5)	46.5	10.84

3M 005249

Sampling Guid

Compound	Recommended Sampling Period (Hrs.)				OSHA Standard TWA-PEL () ACGIH TLV C-Ceiling (ppm)	Sampling Rate	
	RH < 70%		RH > 70%			(cc/min.)	Microgram ppm/hr.
	0.1-0.5 PEL	0.5-3 PEL	0.1-0.5 PEL	0.5-3 PEL			
Methyl Butyl Ketone* (2-Hexanone)	8	8	8	4	100 (5)	29.7	7.29
Methyl Isobutyl Ketone* (Hexanone)	8	8	8	4	100 (50)	30.0	7.35
Methyl Cellosolve* (2-Methoxyethanol)	8	8	8	6	25 (5)	36.3	6.76
Methyl Cellosolve Acetate* (Ethylene Glycol Methyl Ether Acetate)	8	8	8	6	25 (5)	29.0	8.38
Methyl Chloroform*	6	1	4	1	350	30.9	10.09
Methyl Cyclohexane*	8	2.5	6	2	500 (400)	28.9	6.94
Methyl Cyclohexanol	8	8	8	4	100 (50)	28.8	8.06
Methyl Ethyl Ketone* (2-Butanone)	8	3	6	2	200	36.3	6.41
Methyl Formate	0.7	NR	0.7	NR	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	5 (2)	36.7	12.79
Myethyl Isobutyl Carbinol (Methyl Amyl Alcohol)	8	8	8	6	25	29.2	6.51
Methyl Isoamyl Ketone	8	8	8	4	50	28.0	7.83
Methyl Methacrylate	8	8	8	4	100	31.8	7.80
Alpha Methyl Styrene*	8	8	8	4	100 (50)	25.0	7.24
Methylene Chloride* (Dichloromethane)**	†	†	†	†	500 (100)	37.9	7.91
Naphtha (VM&P)*	8	2	6	2	300	33.2	8.15
Naphthalene	8	8	8	6	10	24.6	6.88
Nonane*	8	5	6	3	— (200)	24.6	7.71
Octane*	8	3	6	2	500 (300)	26.6	7.43
Pentane*	2.5	0.4	2.5	0.4	1000 (600)	35.3	5.56
2-Pentanone* (Methyl Propyl Ketone)	8	5	6	3	200	33.0	6.95
Perchloroethylene (Tetrachloroethylene)	8	7	6	3	100 (50)	28.3	11.53
Phenyl Ether	8	8	8	6	1	24.1	10.05
Phenyl Glycidyl Ether	8	8	8	6	10 (1)	20.8	7.71
n-Propyl Acetate*	8	4	8	3	200	30.1	7.53
n-Propyl Alcohol*	8	8	6	4	200	39.7	5.21
Propylene Dichloride* (1, 2-Dichloropropane)	8	8	6	4	75	30.6	8.49
Propylene Glycol Monomethyl Ether	8	8	8	4	— (100)	32.4	6.09
n-Propyl Nitrate	8	8	8	4	25	33.3	7.27
Stoddard Solvent	8	4	6	3	500 (100)	24.3	8.59
Styrene*	8	8	8	4	100 (50)	26.8	6.83
1, 1, 2, 2-Tetrachloroethane	8	8	8	6	5 (1)	28.4	11.71
1, 1, 1, 2-Tetrachloro-2, 2-difluoroethane	5	0.75	4	0.75	500	29.7	14.87
1, 1, 2, 2-Tetrachloro-1, 2-difluoroethane	5	0.75	4	0.75	500	28.2	14.12

**3520 Only

†See Technical Data Bulletin #71.

Sampling Guide

Compound	Recommended Sampling Period (Hrs.)				OSHA Standard TWA-PEL () ACGIH TLV C-Ceiling (ppm)	Sampling Rate	
	RH < 70%		RH > 70%			(cc/min.)	Microgram ppm/hr.
	0.1-0.5 PEL	0.5-3 PEL	0.1-0.5 PEL	0.5-3 PEL			
Tetrahydrofuran	8	2	4	2	200	37.2	6.57
Toluene*	8	6	6	3	200 (100)	31.4	7.08
1, 1, 2-Trichloroethane*	8	8	6	6	10	29.7	9.69
Trichloroethylene*	8	8	8	6	100 (50)	31.1	10.00
1,1,2-Trichloro - 1, 2, 2-trifluoroethane	0.5	NR	0.5	NR	1000	31.4	14.41
1, 2, 3-Trichloropropane	8	8	8	6	50	27.4	9.88
Vinyl Acetate	8	8	6	4	— (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	(10)	38.6	9.19
Vinyl Toluene	8	8	6	4	100 (50)	26.8	7.75
Xylene*	8	8	6	4	100	27.3	7.09

**3520 Only

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

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Occupational Health and Safety Products Division/3M

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

3M 005252

3M

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 or 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	—		— (10)	28.7	9.01
Butyl Alcohol*	8	8	8	4	—		100 (50)	34.3	5.55
s-Butyl Alcohol	8	6	6	3	—		150	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 (100)	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	— (50)	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	200	34.4	10.89
Chloroform*	8	4	6	3	50	Yes	50 (10)	33.5	9.78
1-Chloro-1-nitropropane	8	8	8	6	—		20	30.4	9.25
Chloroprene (2-Chloro-1,3-butadiene)	8	8	6	4	—		25 (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 (200)	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	10	28.5	10.07
Dichloroethyl Ether	8	8	8	6	10	Yes	15 (5)	26.1	9.16
Diisobutyl Ketone* (DIBK)	8	8	8	6	—		50	24.6	8.56

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%					(cc/min.)	Microgram ppm/hr.
	.1-5 PEL	.5-3 PEL	.1-5 PEL	.5-3 PEL	STEL (ppm)	OVM Usage			
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

3M
Organic Vapor Monitor
Sampling Guide

May, 1981

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, MN 55144

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Organic Vapor Monitor Sampling Guide

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 #3500 Organic Vapor Monitor 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 Sampling 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.

• *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.

C. Length of Sampling Period

When sampling for organic contaminants, full workshift sampling periods are recommended as the most comprehensive measure 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 is recommended.

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.

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
Carbon Monoxide
Ethylene Oxide
Formaldehyde
Hydrogen Sulfide
Isocyanates

Methane, Ethane, Propane
Methyl Alcohol (Methanol)
Methyl Chloride
Methyl, Dimethyl, Trimethyl Amines
Organic Solids
Sulfur Dioxide

All Compounds listed in **bold** type in the 3500 Sampling Guide will be analyzed by the 3M Specialty Analysis Service. For more information contact your 3M Sales Representative or your local OH&SP Safety Products Distributor.

3M 005260

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
t-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
							(10)		
Butyl Alcohol*	8	8	8	4	—		100	34.3	5.55
							(50)		
s-Butyl Alcohol	8	6	6	3	—		150	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
							(100)		
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
							(50)		
o-Chlorotoluene	8	8	8	6	75	Yes	—	27.3	8.51
							(50)		
Chlorobromomethane*	8	1.5	6	1.5	250	Yes	200	34.4	10.89
Chloroform	8	4	6	3	50	Yes	50	33.5	9.78
							(10)		
1-Chloro-1-nitropropane	8	8	8	6	—		20	30.4	9.25
Chloroprene (2-Chloro-1,3-butadiene)	8	8	6	4	—		25	32.2	7.03
							(10)		
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
							(200)		
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	10	28.5	10.07
Dichloroethyl Ether	8	8	8	6	10	Yes	15	26.1	9.16
							(5)		
Diisobutyl Ketone*	8	8	8	6	—		50	24.6	8.56

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	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	6.68
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*	8	8	8	6	35	Yes	25	29.0	8.38
(Ethylene Glycol Methyl Ether Acetate)									
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
Methyl 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-Tetrchloroethane	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-Tetrchloro-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