

3M

Organic Vapor Monitor
Sampling Guide

For

Organic Vapor Monitor #3500/3510

Organic Vapor Monitor

With Back-Up Section #3520/3530

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Litho in U.S.A.

**3M Occupational Health and
Environmental Safety Division**

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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 given as workshift time weighted averages, are taken from the code of Federal Regulations as found in 29 CFR 1910.1000 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 PEL. 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

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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 3520/3530 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	Organic Solids
Isocyanates	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 or 3530 Monitor sold with a prepaid analysis. For more information, contact your 3M Sales Representative or your local 3M OH&ESD Safety Products Distributor.

Sampling Guid

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		27.5	7.98
Butyl Cellosolve Acetate*	8	8	8	8	—		24.3	9.55
Butyl Glycidyl Ether (BGE)	8	8	8	8	25		27.0	8.61
z-Butyl Methyl Ether*	—	—	—	—	—		32.8	7.09
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	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
Cyclopentadiene	3	1	3	1	75	—	39.5	6.41
Cyclopentane	0.5	NR	0.5	NR	600	—	36.2	6.22
n-Decane*	—	—	—	—	—		23.0	8.03
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
n-Dodecane*	—	—	—	—	—		21.5	8.98
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	125 250	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		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	500	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			33.9	6.66
Ethylene Dibromide* (1, 2-Dibromoethane)	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	15	34.3	8.08
Furfuryl Alcohol	8	8	8	8	10		32.6	6.98
Forane (1-Chloro -2, 2, 2, Trifluoroethyl Difluoro-methyl/Ether)	8	8	8	6			28.4	12.8
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	— (2)	500 — —	30.2	14.63
n-Heptane*	8	2	4	8	400		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
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
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	250	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 n-Amyl Ketone (2-Heptanone)	8	8	8	4	100 (50)		27.9	7.81
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.

Sampling Guid

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	10.12
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

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

**3520 Only

†See Technical Data Bulletin #71.