

**RESPONSIVE TO REQUEST 1,
NOS. 12 AND 13**

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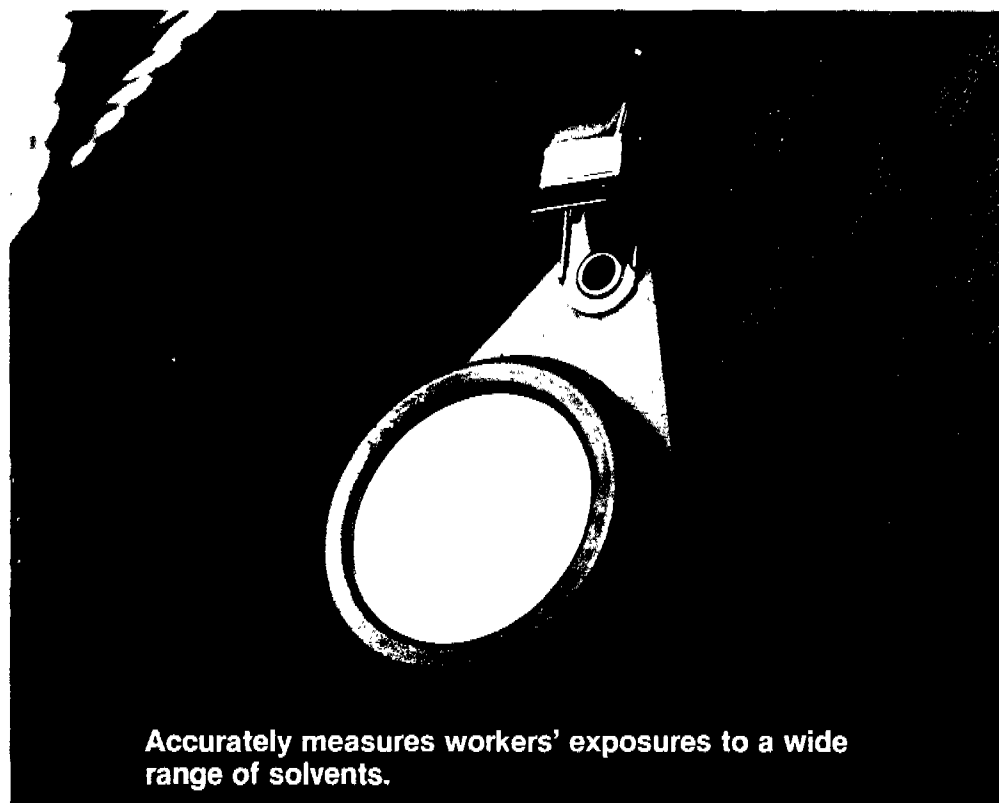
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3M

Organic Vapor Monitors

#3500/3510

Instructions for Use



3M 104003

3M

Notice to User:

The air samplers described herein, if properly used according to the instructions, meet or exceed the accuracy requirements outlined in those applicable regulations now in effect under the Occupational Safety and Health Act of 1970 (29 U.S.C. 641-678). If you have any questions concerning the use of these products, Contact OH&SP Technical Service on (1-800-328-1300).

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3M Brand Organic Vapor Monitors #3500/3510

I. General Product Description

The 3M Brand Organic Vapor Monitor #3500 is a sampling badge to be worn near the breathing zone of personnel exposed to potentially hazardous organic vapor environments. It is designed to measure average concentrations over a measured time interval of 8 hours or less. The monitor requires no sampling pump. It is analyzed using techniques similar to those outlined in NIOSH Physical & Chemical Analytical Method 127 for

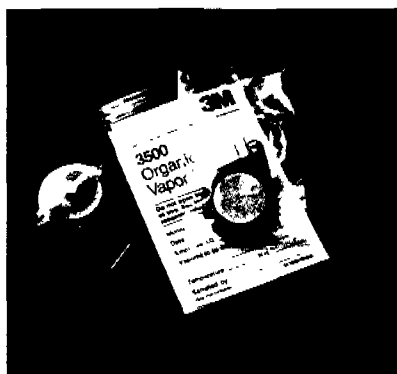
charcoal tubes. Analytical assay is correlated to environmental contaminant concentrations using data supplied by 3M Company.

* The 3500 monitor is designed to be analyzed by the user or by an independent laboratory. The 3510 is the same monitor but also includes a pre-paid analysis service from 3M.

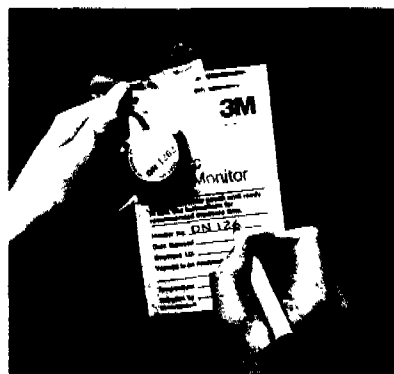
II. Principle of the Method

- 1** The contaminant enters the monitor by diffusion and is adsorbed by an active adsorbent medium (charcoal) inside the badge. The amount of contaminant adsorbed is determined by exposure time and contaminant concentration present in the sampled environment.
- 2** A measured volume of a suitable solvent is added to the monitor to desorb the collected organic vapors.
- 3** A portion of the desorbing solvent, containing the organic contaminants, is withdrawn from the monitor and analyzed by gas chromatography.
- 4** The weight of organic contaminant, determined by G.C. analysis, is converted to time weighted average exposure; using data supplied in the 3M Compound Guide and Calculation Guide. This product information may be obtained by completing the reply card found in each instruction guide.

III. Monitoring Instructions



1. The monitor and closure cap are packaged in a resealable bag. Shipping carton can be used to mail exposed monitors to the lab for analysis. Individual 3510 monitors can be sent to 3M in pre-paid mailers supplied.



3. Before removal of monitor from clear pouch, record the following on resealable bag and your data log:

- a) Monitor code from monitor back label
- b) Date of sampling
- c) Employee or area code
- d) Compounds to be analyzed
- e) Temperature and relative humidity



2. The monitor itself is contained in a clear plastic pouch. **DO NOT REMOVE MONITOR FROM CLEAR POUCH UNTIL READY TO START SAMPLING.**



4. Remove monitor from clear pouch by tearing at notch above pouch seal.



5. Record start time on back label of the monitor. MOVE TO STEP 6 IMMEDIATELY



8. Snap closure cap firmly onto monitor body. Be sure the two port plugs are firmly seated. SAMPLING IS NOW TERMINATED.



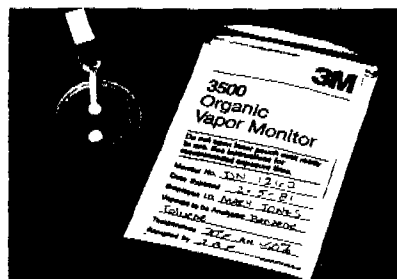
6. Attach monitor to employee as near to the breathing zone as possible DO NOT REMOVE WHITE FILM AND PLASTIC RING



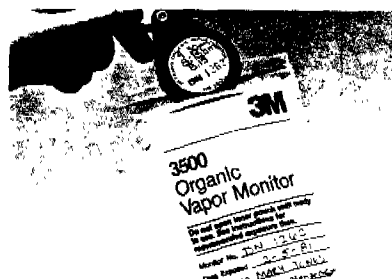
9. Record END TIME on back label of the monitor and on your data log



7. After sampling period is ended, remove plastic ring and white film. MOVE TO STEP 8 IMMEDIATELY.

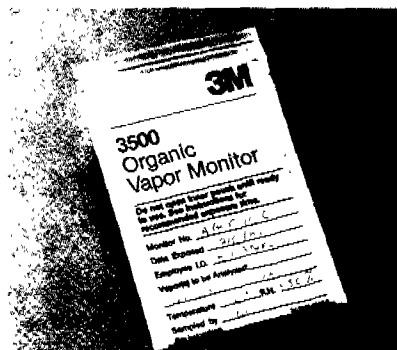


10. In spaces provided, record sampler number from back of sampler, date of sampling, employee I.D., Compound(s) to be analyzed, temperature & relative humidity if extreme.



11. Return monitor to resealable bag with matching monitor code number. Return bags to mailers, seal and send to laboratory for analysis. **KEEP MONITORS IN AREA FREE OF ORGANICS.**

IV. Preparation of Blanks



1. A blank is a control sample monitor that tells the laboratory analyst if any background contamination is present due to the handling of the monitors in the actual work environment.
2. Prepare a blank for each separate set of exposed monitors as follows. Refer to Section III, Monitoring Instructions.
 - a) At the monitoring site, remove a monitor from the clear pouch (Sec. III, Step 4).
 - b) Immediately remove the white film and plastic ring and replace with closure cap (Sec. III, Steps 7 & 8).
 - c) Return monitor to its resealable bag and label bag "Blank". Record monitor code numbers for which this monitor serves as the Blank.
 - d) Submit the blank, along with exposed monitors, to the laboratory for analysis.

V. List of Recommended Compounds for the #3500/3510 Organic Vapor Monitors

A list of compounds suitable for measurement by the monitor are found below. The complete compound guide notebook can be obtained by completing the card in each instruction booklet. For compounds not on this list, consult OH&SP Technical Service 612/733-6234.

*Acetone	Diethyl Phthalate	Mesitylene
Acetonitrile	Diglycidyl Ether	*Methyl Acetate
Acrylonitrile	Diisobutyl Ketone (DIBK)	Methyl Acrylate
Allyl Alcohol	Dimethyl Formamide (DMF)	*Methylal (Dimethoxy Methane)
Allyl Chloride	Dioxane	Methyl Butyl Ketone (MBK)
Amyl Acetate	Dipropylene Glycol Methyl Ether	Methyl Cellosolve
iso - Amyl Acetate	Enflurane (2-Chloro-1,2,2-Trifluoroethyl Difluoromethyl Ether)	Methyl Cellosolve Acetate
n - Amyl Alcohol	Epichlorohydrin	*Methyl Chloroform
sec - Amyl Alcohol	*Ethyl Acetate	(1,1,1-Trichloroethane)
Benzene	Ethyl Acrylate	Methyl Cyclohexane
Benzyl Chloride	*Ethyl Alcohol	Methyl Cyclohexanone
Bromoform	Ethyl (sec-Amyl) Ketone	Methyl Cyclohexanol
*Butadiene	Ethyl Benzene	Methyl (n-amy) Ketone
Butyl Acetate	*Ethyl Bromide	Methyl Ethyl Ketone (MEK)
iso - Butyl Acetate	Ethyl Butyl Ketone	Methyl Isobutylcarbinol
sec - Butyl Acetate	(3-Heptanone)	Methyl Isobutyl Ketone (MIBK)
tert - Butyl Acetate	*Ethyl Chloride	Methyl Methacrylate
Butyl Alcohol	Ethylene Chlorohydrin	Methyl Propyl Ketone
iso - Butyl Alcohol	*Ethylene Dibromide (1,2-Dibromoethane)	alpha - Methyl Styrene
sec - Butyl Alcohol	*Ethylene Dichloride (1,2-Dichloroethane)	Naphthalene
tert - Butyl Alcohol	*Ethyl Ether	n - Octane
Butyl Cellosolve	*Ethyl Formate	*Pentane
p - tert - Butyl Toluene	*Freon 112	Perchloroethylene
Camphor	*Freon 113	Phenyl Ether
Carbon Tetrachloride	*Freon 114	Phenyl Glycidyl Ether
Cellosolve	*Freon 115	Propyl Acetate
Cellosolve Acetate	*Freon 116	Propyl Alcohol
Chlorobenzene	*Freon 12B2	*Isopropyl Acetate
*Chlorobromomethane	*Freon 13B1	Isopropyl Alcohol
Chloroform	Furfural	Isopropyl Ether
Chloroprene	Furfuryl Alcohol	Isopropyl Glycidyl Ether
Cumene	Glycidol	Propylene Dichloride
Cyclohexane	Halothane (2-Bromo-2-Chloro-1,1,1-Trifluoroethane)	n - Propynitrate
Cyclohexanol	Heptane	Stoddard Solvent
Cyclohexanone	Hexane	Styrene
Cyclohexene	Hexachloroethane	1,1,2,2-Tetrachloroethane
Cyclopentadiene	Isophorone	Tetrahydrofuran (THF)
Diacetone Alcohol	*Isopropyl Acetate	1,2,4-Trichlorobenzene
Dibutyl Phthalate	Isopropyl Alcohol	Toluene
o - Dichlorobenzene	*Isopropyl Ether	1,1,2-Trichloroethane
p - Dichlorobenzene	Isopropyl Glycidyl Ether	Trichloroethylene
1,2 - Dichloroethyl Ether	Mesityl Oxide	1,2,3-Trichloropropane
Dichloroethyl Ether		*Vinyl Chloride
Dichloromethane		*Vinylidene Chloride
(Methylene Chloride)		Vinyl Toluene
		Xylene

* Because of their high vapor pressures (low boiling points), the starred (*) compounds are best sampled initially with the 3M #3520 Monitor (with Backup Section). Subsequent sampling may be done with the 3M 3500/3510 Monitor if determined, by #3520 results, that contaminant concentrations are within the 3500/3510 capacity limits.

VI. 3M Analysis Service (3510 only)

The complete 3510 package is offered for your convenience. It provides an economical and efficient means to get results quickly and accurately.

The corrugated shipping box in which the monitors are initially packaged is also a ready-to-use return mailing carton to 3M.

At 3M, samples will be carefully analyzed and a written confidential report on each monitor will be quickly returned to you. 3M offers prompt service with 7-day laboratory turn around time. The reports will also be kept on file for your future reference.

The 3510 pre-paid analysis includes analysis for up to 3 compounds selected from the list below.

*Acetone	Cyclohexene	Methyl Butyl Ketone (MBK)
Acetonitrile	Diacetone Alcohol	Methyl Cellosolve
Acrylonitrile	o - Dichlorobenzene	Methyl Cellosolve Acetate
Allyl Alcohol	p - Dichlorobenzene	*Methyl Chloroform
Allyl Chloride	Dichloromethane	(1,1,1-Trichloroethane)
Amyl Acetate	(Methylene Chloride)	Methyl Ethyl Ketone (MEK)
Iso - Amyl Acetate	Diisobutyl Ketone (DIBK)	Methyl Isobutyl Ketone (MIBK)
n - Amyl Alcohol	Dimethyl Formamide (DMF)	Methyl Methacrylate
sec - Amyl Alcohol	Dioxane	Methyl Propyl Ketone
Benzene	Enflurane (2-Chloro-1,1,2-	Naphthalene
Benzyl Chloride	Trifluoroethyl Difluoromethyl	n - Octane
Bromoform	Ether)	*Pentane
*Butadiene	Epichlorohydrin	Perchloroethylene
Butyl Acetate	*Ethanol (Ethyl Alcohol)	(Tetrachloroethylene)
Iso - Butyl Acetate	*Ethyl Acetate	*Phenyl Ether
sec - Butyl Acetate	Ethyl Acrylate	Propyl Acetate
tert - Butyl Acetate	*Ethyl Alcohol	*Propylene Oxide (use #3550
Butyl Alcohol	Ethyl Benzene	Monitor)
Iso - Butyl Alcohol	*Ethyl Bromide	Isopropyl Acetate
sec - Butyl Alcohol	Ethylene Chlorohydrin	Propyl Alcohol
tert - Butyl Alcohol	*Ethylene Dibromide	Isopropyl Alcohol
Butyl Cellosolve	(1,2-Dibromoethane)	Isopropyl Ether
p - tert - Butyl Toluene	*Ethylene Dichloride	Propylene Dichloride
Camphor	(1,2-Dichloroethane)	Stoddard Solvent
Carbon Tetrachloride	*Ethyl Ether	Styrene
Cellosolve	Furfural	1,1,2,2-Tetrachloroethane
Cellosolve Acetate	Halothane (2-Bromo-2-Chloro-	Tetrahydrofuran (THF)
Chlorobenzene	-1,1,1-Trifluoroethane)	Toluene
*Chlorobromomethane	Heptane	1,1,2-Trichloroethane
Chloroform	Hexane	Trichloroethylene
Cumene	Isophorone	1,1,2-Trichloro-1,2,2-Trifluoro-
Cyclohexane	Mesityl Oxide	ethane (Freon 113)
Cyclohexanol	Mesitylene	*Vinyl Chloride
Cyclohexanone	*Methyl Acetate	Vinyl Toluene
	Methyl Acrylate	Xylene

* Because of their high vapor pressures (low boiling points), the starred (*) compounds are best sampled initially with the 3M #3520 Monitor (with Backup Section). Subsequent sampling may be done with the 3M 3500/3510 Monitor if determined by #3520 results that contaminant concentrations are within the #3500/3510 capacity limits.

VII. General Analysis Procedure for #3500

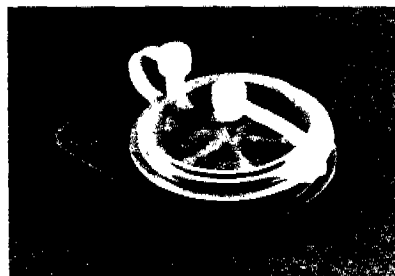
For detailed instructions for analysis including recovery coefficient determinations, please return enclosed card in section IX. A complete #3500 Compound Guide Notebook will be promptly sent for your information.



1. Samples should be inspected in the following areas:
 - a) Monitor code matches code recorded on bag.
 - b) Closure cap is firmly snapped to monitor body.
 - c) Closure cap plugs are firmly seated in the cap ports.



2. The center port is opened and 1.5 milliliters of carbon disulfide or other suitable desorption solvent, is injected. The rim port can be open to allow venting. Reseal both ports.



3. Let monitor stand for ½ hour with occasional gentle agitation applied.



4. Open both ports. Insert decanting spout into the rim port and carefully transfer the liquid to a sampler vial used with the automatic sampler of the gas chromatograph. The vial is immediately sealed. An alternate procedure is to use a syringe to withdraw a sample from the center port for manual injection into the gas chromatograph.



5. Gas chromatographic analysis is conducted as outlined in NIOSH P&CAM 127. The corrected weight for each contaminant, collected by the monitor, is obtained by subtracting out the contribution of the blank sample.

3M 104011

VIII. Calculation Procedures

1. Using gas chromatography analysis methods, determine the weight of each contaminant present on the monitor in milligrams.
2. Correct the weight by subtracting out the number of milligrams, if any, found in the blank sample for each individual contaminant.
3. Determine the recovery efficiency for each contaminant. The procedure found in the #3500 Compound Guide Notebook titled, "Recommended Procedure for Determination of Recovery Coefficients" should be utilized. To obtain this information, please send the reply card found on the back page of Instruction Booklet.
4. Using the Organic Vapor Monitor #3500 Compound Guide, determine the sampling rate for each contaminant.
5. Determine the sampling time in minutes for the contaminants from the back label of the exposed monitor.
6. Calculate the contaminant concentration using the following equations:

$$\frac{\text{mg}}{\text{m}^3} = \frac{(W) (10^6 \text{ cm}^3/\text{m}^3)}{(r) (K_s) (t)}$$

Where:
 W = Corrected weight in milligrams
 r = Recovery (Desorption) efficiency
 K_s = Monitor Sampling rate, cm³/min.
 t = Sampling time, minutes
7. To calculate concentration in ppm at reference conditions of 298°K and 760 mm.Hg. use the following equation:

$$\text{ppm} = \frac{\text{mg}}{\text{m}^3} \times \frac{24.45}{\text{MW}}$$

Where:

MW = Molecular weight, g./mole

The above equations calculate concentrations that can be strictly compared to OSHA standards only if the temperature during sampling was

298°K (25°C or 77°F). If sampling temperature is significantly different than 298°K, then a correction can be applied as follows:

Temperature corrected concentration C₀

$$C_0 = \frac{\text{mg}}{\text{m}^3} \times \left(\frac{298^\circ\text{K}}{T_s} \right)^{1/2}$$

$$C_0 = \text{ppm} \times \left(\frac{298^\circ\text{K}}{T_s} \right)^{1/2}$$

Where:

T_s = Temperature at Sample Site In °K.

This correction eliminates an error of approximately 1% for every 10°F (5.6°C) increment above or below 77°F (25°C).

See the 3M Brand Organic Vapor Monitor #3500 Calculation Guide for complete details and example calculations.

8. #3500 CALCULATION GUIDE

The #3500 Calculation Guide is designed for the customer involved in the analysis of the #3500 by the gas chromatograph. The #3500 Calculation Guide describes in detail the steps involved in calculating parts per million (ppm) or milligrams per cubic meter (mg/m³), when analysis and result tabulation are performed by the customer. The Guide also includes a discussion on the diffusion theory and a derivation of the equations in the calculation procedures.

The #3500 CALCULATION GUIDE is part of Section Three of the #3500 COMPOUND GUIDE NOTEBOOK -LABORATORY PROCEDURES.

3M disclaims responsibility for any comparison of test data to any existing or future health and safety standard regulating exposures to organic vapor as to whether such standards are or are not adequate to insure the safety of persons or property. 3M warrants only the accuracy of the sampling/analytical methods and the data obtained thereby.

IX. Organic Vapor Monitor #3500 Compound Guide Notebook

The 3M Brand Organic Vapor Monitor #3500 is analyzed using techniques similar to those outlined in NIOSH Physical and Chemical Analytical Method 127 for charcoal tubes.

To save time and help assure analysis accuracy, the 3M Laboratory provides the data required to accurately determine the Time Weighted Average concentration. The monitor is designed to measure TWA concentrations over a sampling period of 8 hours or less.

The constant sampling rate (cc/min.), the recovery coefficient, and other important analysis factors are provided in the Compound Guide Notebook.

Please complete information below, remove card and send to 3M in order to receive your copy of the 3500 Compound Guide Notebook.

Please register me for an Organic Vapor Monitor #3500 Compound Guide Notebook, as well as all future data sheets.

CHECK ONE:

- ☐ Send the data binder to me.
☐ Instead, send the binder directly to the laboratory named below.

Your Name _____
Title _____ Phone _____
Company Name _____
Address _____
City _____ State _____ Zip _____
Other compounds you wish to monitor _____

Name of Laboratory
to Receive Binder _____
Name of Person _____
Address _____
City _____ State _____ Zip _____

3M 104013

Important Notice To User :

THE FOLLOWING WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE: 3M OH&SP products sold will meet the physical standards and properties set forth in the applicable product specification data sheets issued by 3M. 3M's only obligation under this warranty shall be to replace such quantity of 3M OH&SP products proved to be defectively manufactured by failing to meet the aforementioned specification data sheets, and to be responsible for any third party personal injuries directly caused by said defects. Except as provided above, 3M shall not be liable or responsible for any loss, damage, or liability, direct, indirect, incidental, special or consequential, arising out of the sale, use or misuse of, or the inability to use products by the user.

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