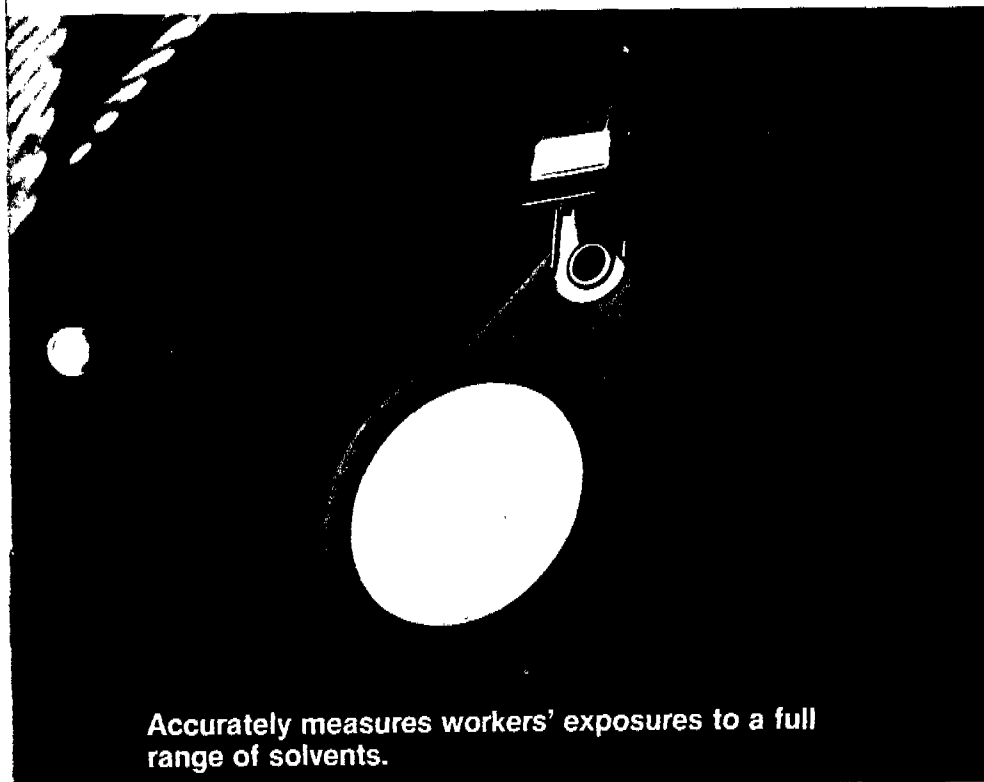


3M
Organic Vapor Monitor
#3500
Instructions for Use



3M 103198

3M

Notice to Purchaser:

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 Monitor #3500

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.

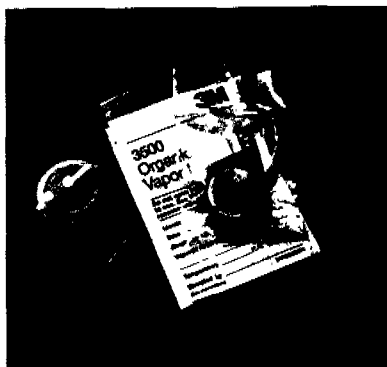
3M also provides a complete analytical service for the #3500. The 3M laboratory specializes in this analysis. 3M analysis mailers are enclosed in every box of monitors.

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- 3 A portion of the desorbing solvent, containing the organic contaminants, is withdrawn from the monitor and analyzed by gas chromatography.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.

3M 103200

III. Monitoring Instructions



1. The monitor, closure cap and pour spout are packaged in a resealable bag. Shipping carton can be used to mail exposed monitors to the lab for analysis or individual monitors can be sent to 3M in 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

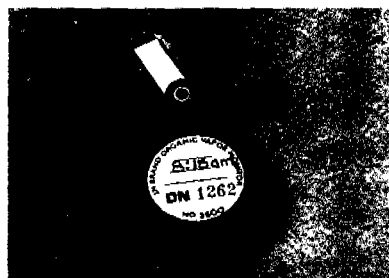


2. The monitor itself is contained in a clear plastic pouch. DO NOT REMOVE MONITOR FROM CLEAR POUCH UNTIL READY TO START SAMPLING.



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

3M 103201



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.

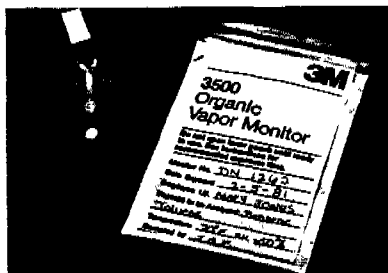


7. After sampling period is ended, remove plastic ring and white film. MOVE TO STEP 8 IMMEDIATELY.



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

3M 103202

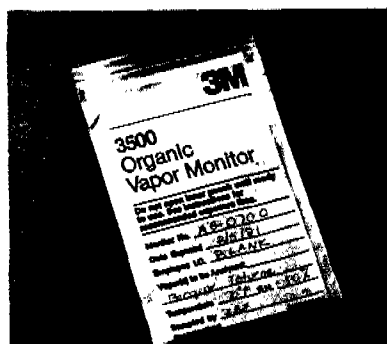


10. In spaces provided, record sampler number from back of sampler, date of sampling, employee I.D., Compound(s) to be analyzed, temperature & relative humidity if extreme.



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.

- At the monitoring site, remove a monitor from the clear pouch (Sec. III, Step 4).
- Immediately remove the white film and plastic ring and replace with closure cap (Sec. III, Steps 7 & 8).
- Return monitor to its resealable bag and label bag "Blank". Record monitor code numbers for which this monitor serves as the Blank.
- Submit the blank, along with exposed monitors, to the laboratory for analysis.

3M 103203

OV. List of Recommended Compounds for the #3500 Organic Vapor Monitor

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	Methyl Bromide
Acetonitrile	Diglycidyl Ether	Methyl Butyl Ketone (MBK)
Acrylonitrile	Diisobutyl Ketone (DIBK)	Methyl Cellosolve
Allyl Alcohol	Dimethyl Formamide (DMF)	Methyl Cellosolve Acetate
Allyl Chloride	Dioxane	Methyl Chloride
Amyl Acetate	Dipropylene Glycol Methyl Ether	Methyl Cyclohexane
iso - Amyl Acetate	Enflurane (2-chloro-1,1,2-Trifluoro ethyl difluoromethylether)	Methyl Cyclohexanone
sec - Amyl Alcohol	Epichlorohydrin	Methyl Cyclohexanol
iso - Amyl Alcohol	Ethyl Acetate	Methyl (n-amyl) Ketone
sec - Amyl Alcohol	Ethyl Acrylate	Methyl Ethyl Ketone (MEK)
Benzene	Ethyl Alcohol	Methyl Iodide
Benzyl Chloride	Ethyl sec. - Amyl Ketone	Methyl Isobutylcarbinol
Bromoform	Ethyl Benzene	Methyl Isobutyl Ketone (MIBK)
Butadiene	Ethyl Bromide	Methyl Methacrylate
Butyl Acetate	Ethyl Butyl Ketone	Methyl Propyl Ketone
iso - Butyl Acetate	Ethyl Chloride	a - Methyl Styrene
sec - Butyl Acetate	Ethyl Chlorohydrin	Naphtalene
tert - Butyl Acetate	Ethylene Dibromide	Nitro benzene
Butyl Alcohol	Ethylene Dichloride (1,2-Dichloroethane)	1 - Nitro Propane
iso - Butyl Alcohol	Ethyl Ether	2 - Nitro Propane
sec - Butyl Alcohol	Ethyl Formate	n - Octane
tert - Butyl Alcohol	Freon 112	Pentane
Butyl Cellosolve	Freon 113	Perchloroethylene
p-tert - Butyl Toluene	Freon 114	Phenyl Ether
Camphor	Freon 115	Phenyl Glycidyl Ether
Carbon Tetrachloride	Freon 116	Propyl Acetate
Cellosolve	Freon 12B2	Isopropyl Acetate
Cellosolve Acetate	Freon 13B1	Isopropyl Alcohol
Chlorobenzene	Furfural	Isopropyl Ether
Chlorobromomethane	Furfuryl Alcohol	n - Propyl Nitrate
Chloroform	Glycidol	Stoddard Solvent
1-Chloro-1-Nitropropane	Halothane	Styrene
Cumene	Heptane	1,1,2,2-Tetrachloroethane
Cyclohexane	Hexane	Tetra Hydrofuran
Cyclohexanol	Hexachloroethane	1,2,4-Trichlorobenzene
Cyclohexanone	Isophorone	Toluene
Cyclopentadiene	Isopropyl Alcohol	1,1,2-Trichloroethane
Diacetone Alcohol	Isopropyl Ether	Trichloroethylene
Dibutyl Phthalate	Isopropyl Glycidyl Ether	1,2,3-Trichloropropane
o - Dichlorobenzene	Methyl Acetate	Vinyl Chloride
p - Dichlorobenzene	Methyl (Dimethoxy Methane)	Vinyl Toluene
1,2 - Dichloroethyl Ether	Methyl Acrylate	Xylene
Dichloroethyl Ether		
1,1-Dichloro-1-Nitroethane		

VI. 3M Analysis Service

The same expertly staffed and fully equipped laboratory which developed the #3500 Organic Vapor Monitor can also provide complete gas chromatographic analysis.

The complete 3M 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 you can be confident of the results. 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.

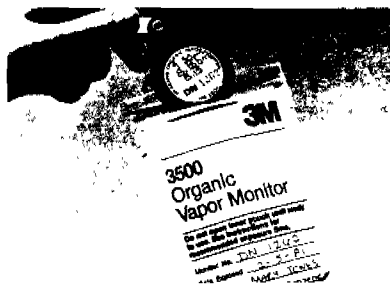
The Analysis Service will handle the majority of organics listed in the Compound Guide. Compounds analyzed by the analysis service are as follows:

Acetone	Cyclohexanol	Mesityl Oxide
Acetonitrile	Cyclohexanone	Mesitylene
Acrylonitrile	Cyclohexene	Methyl Acetate
Allyl Alcohol	Diacetone Alcohol	Methyl Acrylate
Allyl Chloride	Dibutyl Phthalate	Methyl Butyl Ketone (MBK)
Amyl Acetate	o - Dichlorobenzene	Methyl Cellosolve
sec - Amyl Acetate	p - Dichlorobenzene	Methyl Cellosolve Acetate
iso - Amyl Alcohol	Dichloromethane	Methyl Chloroform
sec - Amyl Alcohol	Diethylene Glycol	Methyl Ethyl Ketone
Benzene	Diisobutyl Ketone	Methyl Isobutyl Ketone
Benzyl Chloride	Dimethyl Formamide	Methyl Propyl Ketone
Bromoform	Dioxane	Naphthalene
Butadiene	Enflurane	Nitrobenzene
Butyl Acetate	Epichlorohydrin	n - Octane
iso - Butyl Acetate	Ethanol	Pentane
sec - Butyl Acetate	Ethyl Acetate	Perchloroethylene
tert - Butyl Acetate	Ethyl Acrylate	Phenyl Ether
Butyl Alcohol	Ethyl Benzene	Propyl Acetate
iso - Butyl Alcohol	Ethyl Bromide	Isopropyl Acetate
sec - Butyl Alcohol	Ethyl Ether	Propyl Alcohol
tert - Butyl Alcohol	Ethylene Chlorohydrin	Isopropyl Alcohol
Butyl Cellosolve	Ethylene Dibromide	Isopropyl Ether
p-tert - Butyl Toluene	Ethylene Dichloride	Propylene Dichloride
Camphor	Freon 112:	Stoddard Solvent
Carbon Tetrachloride	Freon 113:	Styrene
Cellosolve	Freon 114:	1,1,2,2-Tetrachloroethane
Cellosolve Acetate	Freon 115:	Tetrahydrofuran (THF)
Chlorobenzene	Freon 116:	Toluene
Chlorobromomethane	Freon 12B2:	1,1,2-Trichloroethane
Chloroform	Freon 13B1:	Trichloroethylene
1-Chloro-1-Nitropropane	Furfural	Vinyl Chloride
Cumene	Halothane	Vinyl Toluene
Cyclohexane	Heptane	Xylene
	Hexane	

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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 1/2 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 103206

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 C_o

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

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

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.

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 103208

Important Notice To Purchaser:

THE FOLLOWING WARRANTY IS MADE IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PURPOSE. 3M OH&SP products sold will meet 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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