

to Purchaser:

Samplers described herein, if properly used according to the instructions, meet 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).

3M Brand Organic Vapor Monitor #3500

for PS+R

3/20/81

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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.

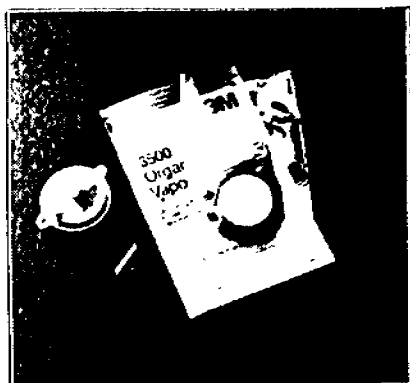
- 3 A portion of the desorbing solvent, containing the organic contaminants, is withdrawn from the monitor by gas chromatography.

- 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 usage guide.

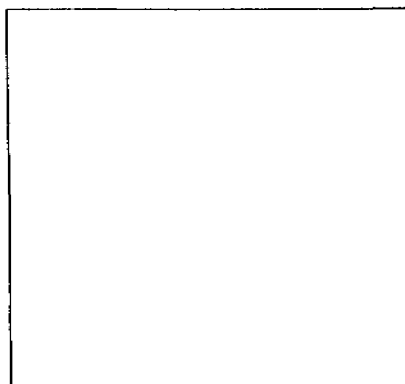
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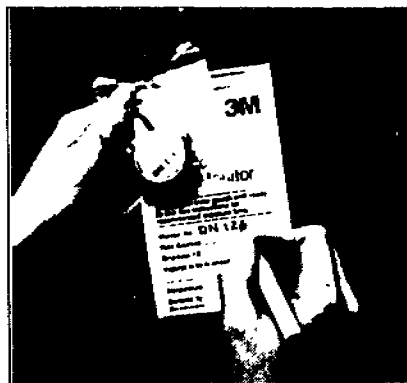
III. Monitoring Instructions



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.



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



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

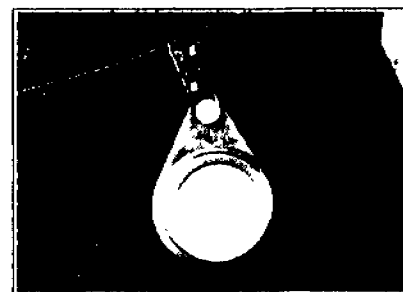
- a) Monitor code from monitor back label.
- b) Date of sampling
- c) Employee or area code
- d) Compounds to be analyzed
- e) Temperature and relative humidity



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.



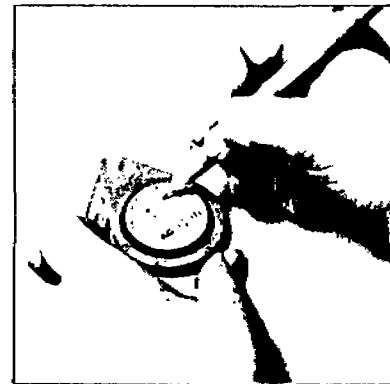
6. Attach monitor to employee as near to the breathing zone as possible. DO NOT REMOVE WHITE FILM AND PLASTIC RING.



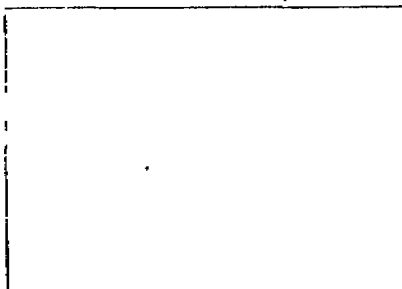
7. After sampling period is ended, remove plastic ring and white film. MOVE TO STEP 8 IMMEDIATELY.



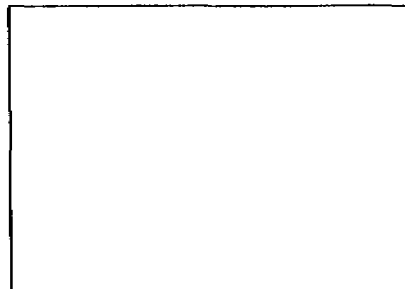
8. Snap closure cap firmly onto monitor body. Be sure the two port plugs are firmly seated. SAMPLING IS NOW TERMINATED.



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

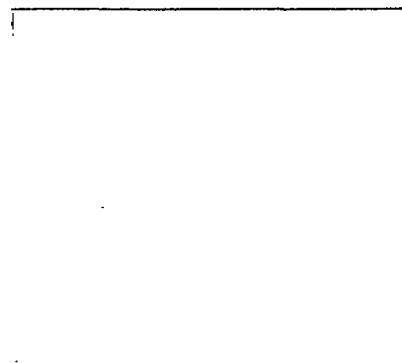


10. In spaces provided, record sampler number from back of sampler, date of sampling, employee I.D., Compound(s) to be analyzed, temperature & relative humidity if extreme.



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 3) **4**
- Immediately remove the white film and plastic ring and replace with closure cap (Sec. III, Steps 6 & 7) **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.

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

A list of compounds suitable for measurement by the monitor and recommended exposure times 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	Diglycidyl Ether	Methylal (Dimethoxy Meth-
Acetonitrile	Diisobutyl Ketone (DIBK)	Methyl Acrylate
Acrylonitrile	Dimethyl Formamide (DMF)	Methyl Bromide
Allyl Alcohol	Dioxane	Methyl Butyl Ketone (MBK)
Allyl Chloride	Dipropylene Glycol Methyl Ether	Methyl Cellosolve
Amyl Acetate	Enflurane (2-chloro-1,1,2-Trifluoroethyl difluoromethylether)	Methyl Cellosolve Acetate
iso - Amyl Acetate	Epichlorohydrin	Methylene Chloride
sec - Amyl Acetate	Ethyl Acetate	Methyl Cyclohexane
iso - Amyl Alcohol	Ethyl Acrylate	Methyl Cyclohexanone
sec - Amyl Alcohol	Ethyl Alcohol	Methyl Cyclohexanol
Benzene	Ethyl sec. - Amyl Ketone	Methyl (n-amy) Ketone
Benzyl Chloride	Ethyl Benzene	Methyl Ethyl Ketone (MEK)
Bromoform	Ethyl Bromide	Methyl Iodide
Butadiene	Ethyl Butyl Ketone	Methyl Isobutylcarbinol
Butyl Acetate	Ethyl Chloride	Methyl Isobutyl Ketone (M)
iso - Butyl Acetate	Ethyl Chlorohydrin	Methyl Methacrylate
sec - Butyl Acetate	Ethylene Dibromide	Methyl Propyl Ketone
tert - Butyl Acetate	Ethylene Dichloride	a - Methyl Styrene
Butyl Alcohol	(1,2-Dichloroethane)	Naphthalene
iso - Butyl Alcohol	Ethyl Ether	Nitro Benzene
sec - Butyl Alcohol	Ethyl Formate	1 - Nitro Propane
tert - Butyl Alcohol	Freon 11	2 - Nitro Propane
Butyl Cellosolve	Freon 12	n - Octane
p. tert - Butyl Toluene	Freon 13	Pentane
Camphor	Freon 14	Perchloroethylene
Carbon Tetrachloride	Freon 21	Phenyl Ether
Cellosolve	Freon 112	Phenyl Glycidyl Ether
Cellosolve Acetate	Freon 113	Propyl Acetate
Chlorobenzene	Freon 114	Isopropyl Acetate
Chlorobromomethane	Freon 115	Isopropyl Alcohol
Chloroform	Freon 116	Isopropyl Ether
Chloroprene	Freon 1282	Propylene Dichloride
1-Chloro-1-Nitropropane	Freon 13B1	n - Propyl Nitrate
Cumene	Furfural	Propylene Oxide
Cyclohexane	Furfuryl Alcohol	Stoddard Solvent
Cyclohexanol	Glycidol	Styrene
Cyclohexanone	Halothane	1,1,2,2-Tetra Chloroethane
Cyclopentadiene	Heptane	Tetra Hydrofuran
Diacetone Alcohol	Hexane	1,2,4-Trichlorobenzene
Dibutyl Phthalate	Hexachloroethane	Toluene
o - Dichlorobenzene	Isophorone	1,1,2-Trichloroethane
p - Dichlorobenzene	Isopropyl Alcohol	Trichloroethylene
1,2 - Dichloroethyl Ether	Isopropyl Ether	1,2,3-Trichloropropane
Dichloroethyl Ether	Isopropyl Glycidyl Ether	Vinyl Chloride
1,1-Dichloro-1-Nitroethane	Methyl Acetate	Vinyl Toluene
Diethyl Phthalate		Xylene

I. 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. Monitors are packaged ten to a box.

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. The reports will also be kept on file for your future reference.

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

Acetone	Diacetone Alcohol	Halothane
Acetonitrile	Dibutyl Phthalate	Isophorone
Acrylonitrile	o - Dichlorobenzene	Mesityl Oxide
Allyl Alcohol	p - Dichlorobenzene	Mesitylene
Allyl Chloride	Diethyl Phthalate	Methyl Acetate
Amyl Acetate	Diisobutyl Ketone	Methyl Acrylate
sec - Amyl Acetate	Dimethyl Formamide	Methyl Bromide
Iso - Amyl Alcohol	Dioxane	Methyl Butyl Ketone (MBK)
sec - Amyl Alcohol	Enflurane	Methyl Cellosolve
Benzene	Epichlorohydrin	Methyl Cellosolve Acetate
Benzyl Chloride	Ethyl Acetate	Methyl Chloroform
Bromoform	Ethyl Acrylate	Methyl Ethyl Ketone
Butadiene	Ethyl Benzene	Methyl Isobutyl Ketone
Butyl Acetate	Ethyl Bromide	Methyl Propyl Ketone
Iso - Butyl Acetate	Ethyl Ether	Naphthalene
sec - Butyl Acetate	Ethylene Chlorohydrin	Nitrobenzene
tert - Butyl Acetate	Ethylene Dibromide	n - Octane
Butyl Alcohol	Ethylene Dichloride	Pentane
Iso - Butyl Alcohol	Freon 11:	Perchloroethylene
sec - Butyl Alcohol	Freon 12:	Phenyl Ether
tert - Butyl Alcohol	Freon 13:	Propyl Acetate
Butyl Cellosolve	Freon 14:	Isopropyl Acetate
p-tert - Butyl Toluene	Freon 21:	Propyl Alcohol
Camphor	Freon 22:	Isopropyl Alcohol
Carbon Tetrachloride	Freon 23:	Isopropyl Ether
Cellosolve	Freon 112:	Propylene Dichloride
Cellosolve Acetate	Freon 113:	Stoddard Solvent
Chlorobenzene	Freon 114:	Styrene
Chlorobromomethane	Freon 115:	1,1,2,2-Tetrachloroethane
Chloroform	Freon 116:	Toluene
1-Chloro-1-Nitropropane	Freon 12B2:	1,1,2-Trichloroethane
Cumene	Freon 13B1:	Trichloroethylene
Cyclohexane	Furfural	Vinyl Chloride
Cyclohexanol	Glycidol	Vinyl Toluene
Cyclohexanone	Heptane	Xylene
Cyclohexene	Hexane	

VII. General Procedure for Use

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 J 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 the contribution of the blank sample.

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

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 Usage 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, gr./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_s

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

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

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 008699

Organic Vapor Monitor #3500 Compound Guide and 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 register me for an Organic Vapor Monitor #3500 (as all future data sheets.

CHECK ONE:

_____ Send the data binder to me.

_____ Instead, send the binder directly to the laborator

Your Name _____

Title _____ Phone _____

Company Name _____

Address _____

City _____ State _____

Other compounds you wish to monitor _____

Name of Laboratory

to Receive Binder _____

Name of Person _____

Address _____

City _____ State _____

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