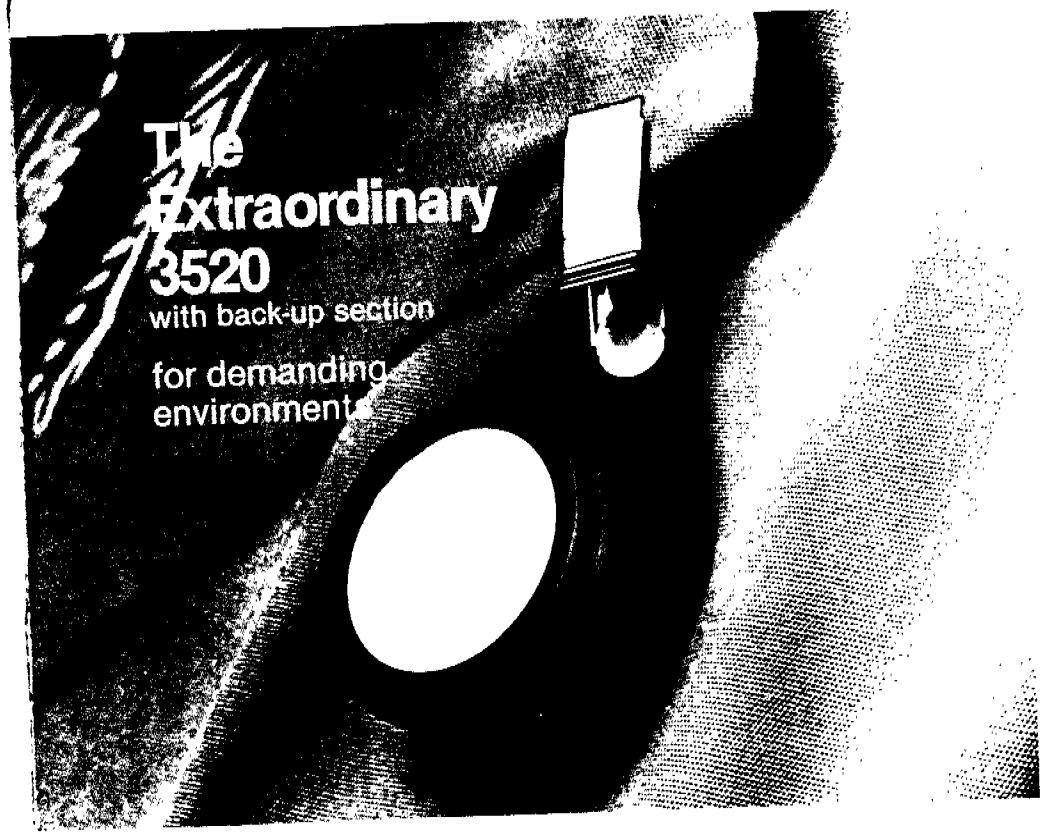
3M Organic Vapor Monitor #3520 Instructions for Use



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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).

Table of Contents

3M Brand Organic Vapor Monitor with Backup Section #3520

I. General Product Description

The 3M #3520 Organic Vapor Monitor *with backup section* is a badge to be worn near the breathing zone of personnel exposed to potential hazardous organic vapor environments. It is designed to measure time-weighted-average concentrations (which can be compared to the permissible exposure levels) over a measured time interval. The monitor is equipped with a backup section which collects contaminant when the capacity of the primary adsorbent has been exceeded. The monitor requires no sampling pump. It is analyzed using techniques similar to those outlined in NIOSH Method Physical and Chemical Analytical Method 127 for charcoal tubes. Analytical assay is correlated to environmental contaminant concentrations using data supplied by 3M Company.

II. Principle of the Method

A. The contaminant enters the monitor by diffusion. The monitor consists of *two* layers of adsorbent medium separated by a small space within the monitor. The contaminant first diffuses to the primary adsorbent medium. The amount of contaminant adsorbed by the primary layer is determined by exposure time and contaminant concentration in the sampled environment. *For a specific contaminant, the secondary adsorbent begins to collect contaminant by diffusion when the capacity of the primary adsorbent is exceeded.*

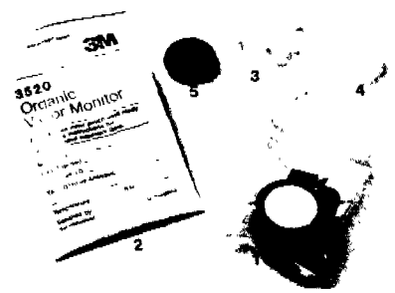
B. At the end of the sampling period, the primary and secondary adsorbent sections of the monitor are separated and sealed with closure caps. For analysis, a measured volume of eluent is added to each section of the monitor to desorb the contaminants from the adsorbents.

C. For each section, an aliquot of the eluent solution is analyzed via gas chromatography. The weight of contaminant on each adsorptive medium is quantified by peak area comparison to known standards.

D. By comparing the weight collected on each of the adsorbents (secondary and primary), the validity of the sample collected by the monitor can be determined. *The sample is valid if no contaminant is found on the secondary adsorbent or if the ratio of the weight collected on the secondary to the weight collected on the primary is less than or equal to .50.* (See Section III. B.6 for details.)

E. If the sample is determined to be valid, then the weight of contaminant on the primary and secondary adsorbent is used to calculate the time-weighted-average concentration of the contaminant in the environment during the sampling period.

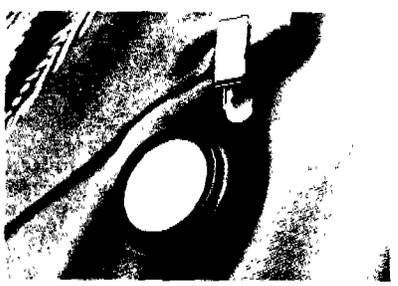
III. Monitoring Instructions



1. The monitor (1) is removed from the zip lock bag. (2) The two closure caps (3 & 4) and the brown cup (5) remain in the package. The monitor should not be removed from the inner bag until just prior to use.

2. When ready to start sampling, the monitor is removed from the clear inner package.

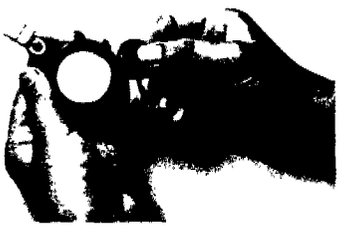
3. The sampling start time is recorded on the back of the monitor.



4. The monitor is attached to worker near the breathing zone. The white film and ring must *not* be removed until the sampling period is terminated.

NOTE:
The 3520 Organic Vapor Monitor with the backup section increases the effective sampling capacity *by a factor of four over the 3500 Organic Vapor Monitor. Therefore, the recommended sampling periods tabulated in the Sampling Guide for the 3500 Organic Vapor Monitor can be increased four times when sampling with the 3520 Organic Vapor Monitor*

5. After sampling, the end time is recorded on the back of the monitor.



6. The white face and retaining ring are removed at the *end* of the sampling period. Move to step 7 immediately.

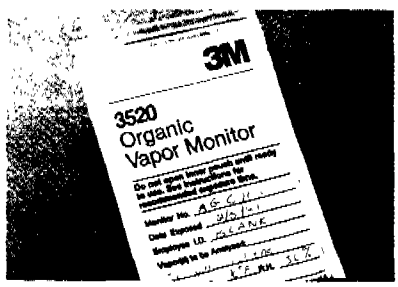
7. The closure cap is snapped onto the primary (top) section and the ports firmly closed.

8. The primary (top) and secondary (bottom) section of the monitor are separated immediately.

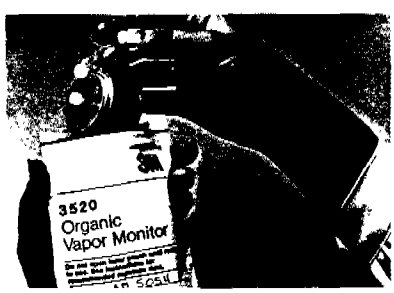
9. The brown cup is snapped into place on the bottom of the primary (top) section. Please be sure the cup is snapped securely.

10. The closure cap is snapped into place on the secondary (bottom) section and the ports firmly closed with the attached plugs.

11. The primary (top) and secondary (bottom) section are joined back-to-back by snapping the cup of the primary (top) section to the bottom of the secondary (bottom) section.



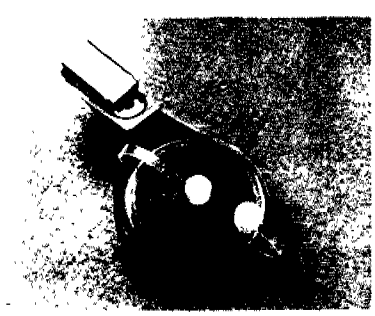
12. In spaces provided, record sampler number from back of sampler, date of sampling, employee I.D., Compound(s) to be analyzed, temperature & relative humidity if extreme.



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

14. The monitor should be analyzed as soon after use as possible using analytical techniques described in the "3M Brand Organic Vapor Monitor Compound Guide."

IV. Preparation of Blanks



A control or blank sample should be provided for the analyst. This is necessary for accuracy of results. The blank sample is prepared at the monitoring site using the following procedure:

a. The monitor and closure caps are removed from the package.
b. The white face and retaining ring are closed.
c. The closure cap is snapped on and the ports closed.
d. The primary and secondary sections are separated.
e. The brown cup is installed on the bottom of the primary section. The second closure cap is snapped on the secondary sections and the ports closed.
f. The package is labeled "blank" and the badge number for which it serves as a blank is recorded.
g. The blank sample is packaged and submitted for analysis along with the exposed monitors.

V. List of Recommended Compounds For the #3520 Organic Vapor Monitor

A list of compounds suitable for measurement by the monitor are found below. Those compounds marked with an * should be monitored with the 3520 initially. Subsequent sampling may be done with the 3M #3500/3510 Monitors if determined, by #3520 results, that contaminant concentrations are within the capacity limits of the 3500/3510.

FOR COMPOUNDS NOT ON THIS LIST, CONSULT OH&SP TECHNICAL SERVICE 612/733-6234.

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

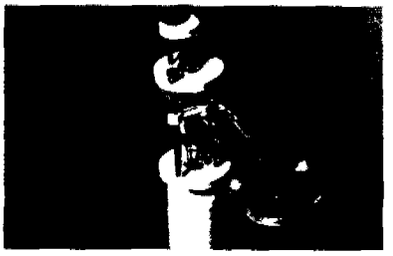
VI. General Analysis Procedure for #3520

For detailed instructions for analysis including recovery coefficient determinations, please return enclosed card in section IX. A complete #3520 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. Any deviations must be noted on the analytical report.

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

5. Gas chromatographic analysis is conducted as outlined in NIOSH P&CAM 127. The corrected weight of each contaminant on the adsorptive element is obtained by subtracting out the contribution of the blank sample and dividing by the desorption efficiency determined for the contaminant.



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.

4. Open both ports. Insert decanting spount 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.

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* The 1.5 ml eluent volume is appropriate for 2.0 ml automatic sampler vials. Different eluent volume may be used if desired, but corresponding desorption efficiency values must be verified.

VII. Calculation Procedures

1. Using gas chromatography analysis methods determine the weight of each contaminant present on the primary and secondary adsorbents 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. The validity of the samples collected can be determined by comparing the weight (W_s) collected on the secondary adsorbent with the weight (W_p) collected on the primary adsorbent. Because the mass of activated carbon in the primary adsorbent is equivalent to the mass in the secondary adsorbent, the capacity of a contaminant on each should be equivalent. But, in order to assure a valid sampler under all sampling conditions, the ratio of the contaminant weight (W_s) on the secondary adsorbent to the contaminant weight (W_p) on the primary adsorbent must meet the following criteria:

$$\frac{W_s}{W_p} \leqslant .50$$

When sampling the environment with multiple contaminants with the 3520 Organic Vapor Monitor, the above criteria can be used to determine the sample validity of each contaminant. Therefore, for those contaminants which fulfill the above criteria, the weight (W_p) on the primary adsorbent and the weight (W_s) on the secondary adsorbent can be used to accurately determine the time-weighted-average concentration.

4. The corrected weight of each contaminant on the primary and secondary adsorbent can be used to calculate the time-weighted-average concentration according to the following equation:

$$C(mg/m^3) = \frac{W_p}{K_{pt}} + \frac{W_s}{K_{st}}$$

where,

W_p = corrected weight collected by the primary adsorbent

W_s = corrected weight collected by the secondary adsorbent

K_p = sampling rate of the contaminant onto the primary adsorbent

K_s = sampling rate of the contaminant onto the secondary adsorbent

t = length of sampling period

The above equation can be simplified to the following:

$$C\ (mg/m^3) = \frac{W_p + KW_s}{K_{pt}}$$

where,

K = 2.2 — a constant determined by the ratio of K_p/K_s. For all contaminants, this ratio has been determined to be a constant of 2.2.

With this simplication, the time-weighted-average concentration of the contaminant in the environment can be calculated from the corrected weight collected by the primary and secondary adsorbent, the length of the sampling period and the sampling rate. The geometric dimensions (area and length) of the primary diffusional chamber for the 3520 Organic Vapor Monitor with the backup section are the same as the dimensions of the diffusional chamber for the 3500 Organic Vapor Monitor. Therefore, the sampling rates (K_p) of the contaminants onto the primary adsorbent of the 3520 Organic Vapor Monitor are the same as those tabulated in the Sampling and Analysis Guide for the 3500 OrganicVapor Monitor in the 3M Brand Organic Vapor Monitor Compound Guide.

5. From the Analysis Guide, the Calculation Constants A and B can be used to further simplify the Calculation of the time-weighted-average concentration. The concentration in milligrams per cubic meter of the contaminant in the environment sampled can be calculated from the following expression: ***

$$C\ (mg/m^3) = \frac{W_p + 2.2\,W_s}{r \times t} \times A$$

The time-weighted-average concentration in parts per million (ppm) of the contaminant can be calculated from the following expression:

$$C\ (ppm) = \frac{W_p + 2.2\,W_s}{r \times t} \times B$$

6. The sampling rate (K_p) and the calculation constants A & B for each organic compound are obtained from 3M Brand Organic Vapor Monitor Compound Guide.

7. The above equations calculate concentrations that can be strictly compared to OSHA standards only if the temperature during samping 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_0.

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

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

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 Analysis Guide for complete details and example calculations.

8. Additional Literature

a. #3500 Analysis Guide

The #3500 Analysis Guide is designed for the customer involved in the analysis of the #3500 by the gas chromatograph. The #3500 Analysis Guide describes in detail the steps involved in calculating parts per million (ppm) or milligrams per cubic meter (mg/m^3) 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 Analysis Guide is part of Section Three of the #3500 COMPOUND GUIDE NOTEBOOK LABORATORY PROCEDURES.

b. #3520 Sampling Guide

The #3520 Sampling Guide contains additional information regarding sampling rates and time for the #3520 Organic Vapor Monitor.

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.

** Decantation of the eluent solution into vials requires some technique to avoid spillage. It is recommended that this step be practiced a few times before valuable samples are attempted.

*** The contaminant weights (W_p and W_s) in the following expressions are uncorrected for desorption efficiencies. The correction is made in the expressions by dividing by the desorption efficiency (r).

VIII. Organic Vapor Monitor #3500 Compound Guide Notebook

The 3M Brand Organic Vapor Monitors 3500 and 3520 are 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 monitors are 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_____

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