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Standard Guide for Placement and Use of Diffusion Controlled Passive Monitors for Gaseous Pollutants in Indoor Air¹

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1. Scope

1.1 This guide covers the placement and use of diffusion controlled monitors in the indoor atmosphere.

1.2 Diffusion controlled passive monitors within this guide include both area and personal monitors for use in residences, public buildings, offices, and other non-industrial workplaces and dwelling environments. A passive monitor is any air monitor that does not utilize electrical or mechanical power in order to supply air to the sorbent media or chemical reactant within the monitor and sample according to Fick's first law of diffusion.

1.3 The purpose of this guide is to ensure uniformity of sampling within a variety of indoor environments and to facilitate comparison of results.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

[D1356 Terminology Relating to Sampling and Analysis of Atmospheres](#)

[D1357 Practice for Planning the Sampling of the Ambient Atmosphere](#)

[D4597 Practice for Sampling Workplace Atmospheres to Collect Gases or Vapors with Solid Sorbent Diffusive Samplers](#)

[D3614 Guide for Laboratories Engaged in Sampling and Analysis of Atmospheres and Emissions](#)

¹ This method is under the jurisdiction of ASTM Committee D22 on Sampling and Analysis of Atmospheres and is the direct responsibility of Subcommittee D22.05 on Indoor Air.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3. Terminology

3.1 *Definitions*—For definitions of terms used in this guide refer to Terminology [D1356](#).

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *passive monitor*—a diffusion controlled air monitor that does not utilize electrical or mechanical power in order to supply air to the sorbent media or chemical reactant within the monitor. These monitors may be worn by an individual (personal passive monitor) or used as sampling devices within specific locations (area passive monitor).

4. Summary of Guide

4.1 Contaminants in air are sampled by collection with a sorbent or chemically reactive medium in order to undergo subsequent analysis for determination of concentration. Contaminants in air are transported to the sorption medium or reacting chemical through vapor or gas diffusion. During the sampling process, the compounds, in a molecular state, diffuse from the environment adjacent to the sampler through a first region of defined geometric structure and into a second adsorbing region containing the sorbent.

4.2 Guidance is provided for the placement, handling, and use of passive air monitors within an indoor environment.

5. Significance and Use

5.1 The objective of this guide is to provide guidance for the placement and use of passive monitors that when uniformly applied enables the user to eliminate many interferences in the sampling of indoor air. Since the analysis of the indoor environment by passive air monitors is influenced by many factors other than the method of sampling, efforts are made to minimize interfering factors and maintain the air at conditions typical of the measurement location within the vicinity of the passive air monitor. However, when performing diagnostic or special measurements, non-typical indoor air environment conditions may be desirable or required. Thus, the objectives of a sampling study may determine the conditions needed for sampling.

5.2 Passive sampling provides for time integrated measurements. Passive monitors are usually placed in an indoor environment over a time period to obtain a cumulative sample;

hence, interfering factors should be anticipated and eliminated where possible. Passive monitors often lack the sensitivity to measure short-term peak concentrations.

5.3 With suitable instruction regarding placement of passive monitors, placement and retrieval of the monitors can be performed by unskilled personnel (for example, occupants).

6. General Principles

6.1 The choice of a passive monitor, characteristics of the sampling site, number of sampling points, number of monitors, and number of sampling periods depends on the objectives of the monitoring program.

6.2 Passive monitors rely on air currents within an indoor environment for circulation of a representative sample atmosphere to the vicinity of the monitor. Therefore, it is essential that air circulation in the vicinity of the sampler be sufficient to keep the boundary layer thin enough so that the analyte can diffuse across it, preventing a localized concentration depletion by the monitor. The adequacy of the sampling is directly influenced by the location and subsequent exposure of the monitor to a representative indoor atmosphere.

6.3 The objective of the study may affect the type of monitor selected and the location of placement. In general terms, Practice **D1357** will acquaint the user with established overall study considerations.

7. Sampling with Passive Monitors

7.1 Inspect the monitor and package carefully. The monitor or its protective packaging may have been damaged during shipment. The user should not directly contact the monitor with bare skin and, in no case, permit anything to contact the sampling face.

7.2 *Calibration of the Passive Monitor*—Information relating to calibration may be found in Practice **D4597**. These documents also provide information relating to the determination of the required minimum sampling time.

7.3 The sampling period begins when lid, cover, or protective container of the monitor is removed to permit sampling by the monitor. The starting time of the sampling period should be transcribed to a log-book or appropriate form and on the monitor label. The writing instrument, for example, markers, should not provide the potential of contamination to the monitor. A means of resealing or replacing the monitor lid or cover should be ensured.

7.4 The monitor should have a permanently attached identification code or serial number that should be transcribed to a log-book or an appropriate form. The logbook should include information describing the location of the monitor and pertinent information regarding the building and deployment area, such as construction, type of heating system, insulation, occupancy number and patterns, and major appliance location. A room deployment should additionally list location within the room: activities, general location of furnishings, possible sinks/sources, vents, and other relevant features. Include a diagram of the sampling location and building, depicting the information listed in this subsection. If the occupant deploys the monitor, sufficient instructions should be included regard-

ing proper location and sampling procedures. A form should be included for easy collection of occupant information necessary for log-book entries.

7.5 If the monitor is deployed for other than a screening measurement, the monitor should be placed by an experienced professional familiar with the monitor used. For specific diagnostic measurements, a deviation from the guidelines in this document is permissible.

7.6 *Recovery of the Passive Monitor:*

7.6.1 The sampling period is terminated when the monitor is sealed and removed from the sampling environment.

7.6.2 Record the time and date for measurement termination in a logbook or on any appropriate form and on the monitor label. Any damage to the monitor or variation in the monitor placement since deployment should be noted in the log-book or on any appropriate form.

7.6.3 Adequate information should be entered into the logbook to permit interpretation of results and comparison to similar measurements. Any variation in the sampling location, building structure, or building systems should be noted.

7.6.4 The monitor should be analyzed within time specifications of the specific monitor used.

8. Procedure

8.1 *Factors Affecting Use of Passive Monitors:*

8.1.1 *Detection Limit*—The detection limit for the passive monitor may preclude obtaining useful results if the concentration in the test area is insufficient to exceed the detection limit during the minimum sampling duration.

8.1.1.1 *Minimum Sampling Duration*—The duration of sampling can affect the results obtained. If the concentration in the air is low, a short sampling time may not produce an acceptable mass of sampled material on the monitor. Monitors may require a minimum sampling duration to achieve representative results.

8.1.2 *Accuracy*—The accuracy of the monitor selected should be appropriate for the testing purpose. The duration of sampling and the exposure concentration may affect the technically claimed accuracy (see **10.2**).

8.1.3 *Precision*—Precision of all monitors should be determined for each use through the application of field blank samples, duplicates, and laboratory controls. Five percent of the monitors should be held for blanks and 10 % used as duplicates (see **10.2**).

8.1.4 *Selectivity*—The monitor chosen should be as selective as possible for the contaminant species and concentration range of interest to avoid problems of interference.

8.1.5 *Interferences*—Some passive monitors will measure multiple contaminants as a single integrated result, that is, poor selectivity. The concentration of the interfering species may or may not significantly affect the results of the intended species of interest. Any interfering species should be investigated for concentration and deleterious effect upon the results of the species of interest.

8.1.6 *Sampling Rate Air Velocity*—Most passive monitors operate on the principle of diffusion; hence, either excessive airflow that modifies calibrated diffusion or lack of airflow causing a starvation effect will impact adversely on the resulting measurement through altering the sampling rate.