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Standard Practice for Determining Emission Profiles of Volatile Organic Chemicals Emitted from Bedding Sets[1]

This standard is issued under the fixed designation D 6177; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the procedures for estimating emission profiles of volatile organic chemicals (VOCs) from bedding sets when a new bedding set is first brought into a house, based on emissions testing in environmental chambers.

1.2 Emission profiles from bedding sets are determined from air concentrations measured in environmental chambers.

1.3 VOC emissions from bedding sets, as in the case of other household furnishings, usually are highest when the products are new. Procedures described in this practice also are applicable to used bedding sets.

1.4 The practice is applicable to VOCs and not to semivolatile organic chemicals or nonvolatile organic chemicals.

1.5 This practice summarizes procedures for sample selection and handling. This practice also refers to pertinent sampling procedures and analytical methods for emission testing, but does not include technical details on selection of appropriate collection media and analytical methods or on sampling and analytical equipment and associated procedures.

1.6 Emission profiles based on this practice may be used for estimating human exposures to VOCs.

1.7 *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 regulating limitations prior to its use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 1356 Terminology Relating to Atmospheric Sampling and Analysis

D 3687 Practice for Analysis of Organic Compound Vapors Collected by the Activated Charcoal Tube Adsorption Method

D 5116 Guide for Small–Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products

D 5157 Guide for Statistical Evaluation of Indoor Air Quality Models

D 5197 Standard Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)

D 5466 Standard Test Method for Determination of Volatile Organic Chemicals in Atmospheres (Canister Sampling Methodology)

D 6196 Practice for Selection of Sorbents and Thermal Desorption Analysis Procedures for Volatile Organic Compounds in Air

E 355 Practice for Gas Chromatography Terms and Relationships

E 1333 Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber

3. Terminology

3.1 *Definitions*:

3.1.1 For definitions and terms used in this practice, refer to Terminology D 1356.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *air change rate*, *n*—the volume of outdoor air that enters the indoor environment in one h, divided by the volume of the indoor space.

3.2.2 *bedding set*, *n*—an ensemble that includes a mattress for sleeping and a supporting box spring.

3.2.3 *emission profile*, *n*—a time–series of emission rates of one or more chemicals.

3.2.4 *nonvolatile organic chemical*, *n*—an organic compound with saturation vapor pressure less than 10^{-8} kPa at 25°C.

3.2.5 *semi-volatile chemical*, *n*—an organic compound with saturation vapor pressure between 10^{-2} and 10^{-8} kPa at 25°C.

[1] This practice 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.

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3.2.6 *short–term exposure*, *n*—an exposure of one week or less in duration.

3.2.7 *volatile organic chemical*, *n*—an organic compound with saturation vapor pressure greater than 10^{-2} kPa at 25°C.

4. Summary of Practice

4.1 This practice describes procedures for determining VOC emission profiles of a bedding set using an environmental chamber.

4.2 These procedures include selection and handling of samples, and conducting chamber emission tests (Research Triangle Institute, 1995)[3]. Details related to storage and transportation of samples are included in selection and handling. Procedures for conducting chamber tests include selection of test conditions and methods for collection and analysis of air samples.

4.3 The practice also describes procedures for estimating emission profiles from the chamber concentration data.

5. Significance and Use

5.1 The objective of this practice is to provide procedures for estimating emission profiles of VOCs from bedding sets. These profiles can then be used to estimate human inhalation exposures to VOCs emitted from bedding sets. The estimated inhalation exposures ultimately can be used as an input to characterization of health risks from short–term VOC exposures.

5.2 The results of emissions testing for specific raw materials and components, or processes used in manufacturing different bedding sets, can be used to compare their relative impacts on airborne concentrations.

6. Facilities and Equipment

6.1 A facility to determine product or material emissions requires use of a room–size environmental test chamber, typically larger than 22.6 m^3. Emissions from components of bedding sets can be characterized in small chambers ranging in size from a few liters to 5 m^3. Chamber testing also requires associated equipment such as a clean–air generation system, monitoring and control systems, and sample collection and analysis equipment (see Guide D 5116 and Test Method E 1333).

7. Procedures for Sample Selection and Handling

7.1 The procedures for sample selection and handling include sample selection, packaging for shipping, and shipment and storage.

7.2 Select bedding sets to be tested directly from the production line. Volume of production can be considered as a criterion in selecting the type(s) of bedding set to be tested. Use a random number table to avoid biases in selection.

7.3 The selected bedding set(s) should be wrapped using the manufacturer's normal packaging materials and procedures. Further, to protect from damage during shipping, place the bedding sets in corrugated shipping containers.

7.4 Upon receipt at the testing laboratory, remove the bedding from corrugated shipping containers, but do not remove the manufacturer's normal packaging materials. Inspect for shipping damage and record the arrival condition. To isolate the bedding sets from the surrounding laboratory environment, place each bedding set wrapped in its normal packaging (manufacturer's shipping bag) in a larger outer bag, which has an inert surface.

7.5 Maintain a chain of custody record to note dates, times, and operations performed (such as storage and transportation) for each bedding set.

8. Procedures for Emissions Testing

8.1 Volatile organic emissions from indoor sources such as bedding sets vary widely in the number of chemicals and the strength of their emissions. To characterize emissions fully, the sample collection and analysis system must be capable of quantitative collection and analysis of volatile, polar, and nonpolar compounds. The design and operation of sample collection and analysis systems must be appropriate for the organic chemicals and their concentrations. Such systems include collection of samples using canister sampling methodology (Test Method D 5466) or, more often, collection on solid adsorbent tubes (for example, Practice D 6196), and instruments to analyze organic emissions (for example, gas chromatographs, see Practice E 355). Determination of formaldehyde and other aldehydes can be done by different methods (EPA Compendium, 1990).[4] One of these methods (Test Method D 5197), which collects air samples on 2,4-dinitrophenylhydrazine (DNPH)–treated silica gel cartridges followed by high performance liquid chromatography (HPLC), is preferred because of better sensitivity.

8.2 The remainder of this section describes certain air sampling procedures related to emissions testing of bedding sets and briefly summarizes analytical methods. Technical details on selection of appropriate collection media and analytical methods, and on sampling and analytical equipment and associated procedures, are provided in the references cited in 8.1.

8.3 *Screening Samples*:

8.3.1 The purpose of the screening samples is to identify volatile organic chemicals and their relative concentrations, to aid in selecting sampling durations, collection media, and laboratory analysis methods for conducting emissions testing.

8.3.2 Collect air samples from the manufacturer's shipping bags using sampling lines connected directly to sampling devices.

8.4 *Background Samples*:

8.4.1 The following types of background samples are necessary:

(*1*) background concentrations in the outer storage bag and the laboratory atmosphere, and

[3] Research Triangle Institute, "Final Report—Performance of Testing in Support of Research by the SPSC Indoor Air Quality Task Force," *RTI/5736/00-02RFR*, Research Triangle Park, NC, September 1995.

[4] Winberry, W.T., Forehand, L., Murphy, N.T., Ceroli, B., and Evans, A.," Compendium of Methods for the Determination of Air Pollutants in Indoor Air ('EPA Compendium')," *EPA/600/4-90/010*, U. S. Environmental Protection Agency, Research Triangle Park, NC, April 1990.

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