Designation: D8142 – 23

Standard Test Method for Determining Chemical Emissions from Spray Polyurethane Foam (SPF) Insulation using Micro-Scale Environmental Test Chambers[1]

This standard is issued under the fixed designation D8142; 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 test method is used to identify and to measure the emissions of volatile organic compounds (VOCs) emitted from samples of cured spray polyurethane foam (SPF) insulation using micro-scale environmental test chambers combined with specific air sampling and analytical methods for VOCs.

1.2 Specimens prepared from product samples are maintained at specified conditions of temperature, humidity, airflow rate, and elapsed time in micro-scale chambers that are described in Practice D7706. Air samples are collected periodically at the chamber exhaust at the flow rate of the micro-scale chambers.

1.2.1 Samples for formaldehyde and other low-molecular weight carbonyl compounds are collected on treated silica gel cartridges and are analyzed by high performance liquid chromatography (HPLC) as described in Test Method D5197 and ISO 16000-3.

1.2.2 Samples for other VOCs are collected on multi-sorbent samplers and are analyzed by thermal-desorption gas chromatography / mass spectrometry (TD-GC/MS) as described in U.S. EPA Compendium Method TO-17 and ISO 16000-6.

1.3 This test method is intended specifically for SPF insulation products. Compatible product types include two component, high pressure and two-component, low pressure formulations of open-cell and closed-cell SPF insulation.

1.4 VOCs that can be sampled and analyzed by this test method generally include organic blowing agents such as 1,1,1,3,3-pentafluoropropane, formaldehyde and other carbonyl compounds, residual solvents, and some amine catalysts. Emissions of some organic flame retardants can be measured after 24 h with this method, such as tris (chloroisopropyl) phosphate (TCPP).

1.5 This test method does not cover the sampling and analysis of methylene diphenyl diisocyanate (MDI) or other isocyanates.

1.6 Area-specific and mass-specific emission rates are quantified at the elapsed times and chamber conditions as specified in 13.2 and 13.3 of this test method.

1.7 This test method is used to identify emitted compounds and to estimate their emission factors at specific times. The emission factors are based on specified conditions, therefore, use of the data to predict emissions in other environments may not be appropriate and is beyond the scope of this test method. The results may not be representative of other test conditions or comparable with other test methods.

1.8 This test method is primarily intended for freshly applied, SPF insulation samples that are sprayed and packaged as described in Practice D7859. The measurement of emissions during spray application and within the first hour following application is outside of the scope of this test method.

1.9 This test method can also be used to measure the emissions from SPF insulation samples that are collected from building sites where the insulation has already been applied. Potential uses of such measurements include investigations of odor complaints after product application. However, the specific details of odor investigations and other indoor air quality (IAQ) investigations are outside of the scope of this test method.

1.10 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.11 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.12 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

[1] This test method is under the jurisdiction of ASTM Committee D22 on Air Quality and is the direct responsibility of Subcommittee D22.05 on Indoor Air.

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2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

D1622/D1622M Test Method for Apparent Density of Rigid Cellular Plastics

D5116 Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products

D5197 Test Method for Determination of Formaldehyde and Other Carbonyl Compounds in Air (Active Sampler Methodology)

D5337 Practice for Setting and Verifying the Flow Rate of Personal Sampling Pumps

D6196 Practice for Choosing Sorbents, Sampling Parameters and Thermal Desorption Analytical Conditions for Monitoring Volatile Organic Chemicals in Air

D7706 Practice for Rapid Screening of VOC Emissions from Products Using Micro-Scale Chambers

D7859 Practice for Spraying, Sampling, Packaging, and Test Specimen Preparation of Spray Polyurethane Foam (SPF) Insulation for Testing of Emissions Using Environmental Chambers

2.2 *ISO Standards:*[3]

ISO 16000-3 Indoor Air—Part 3: Determination of Formaldehyde and Other Carbonyl Compounds in Indoor Air and Test Chamber Air—Active Sampling Method

ISO 16000-6 Indoor Air—Part 6: Determination of Volatile Organic Compounds in Indoor and Test Chamber Air by Active Sampling on Tenax TA Sorbent, Thermal Desorption, and Gas Chromatography Using MS or MS-FID

2.3 *Government Agency Methods:*

40 CFR Appendix B to Part 136 Definition and Procedure for the Determination of the Method Detection Limit-Revision 1.11[4]

California Department of Public Health Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, CDPH/EHLB/Standard Method V.1.2 (January 2017)

U.S. EPA Compendium Method TO-17 Determination of Volatile Organic Compounds in Ambient Air Using Active Sampling Onto Sorbent Tubes, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition (January 1999)[5]

U.S. EPA Method 325B Volatile Organic Compounds from Fugitive and Area Sources: Sampler Preparation and Analysis, Air Emission Measurement Center (EMC) (September 29, 2015)[5]

3. Terminology

3.1 *Definitions*—For definitions and terms commonly used for sampling and analysis of atmospheres, refer to Terminology D1356. For definitions and terms commonly used when testing materials and products for VOC emissions, refer to Guide D5116. For definition of micro-scale test chamber, refer to Practice D7706.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *area specific flow rate, n*—the ratio of the airflow rate into the chamber in m^3/h and the projected surface area of the test specimen exposed to air in m^2 with units of m/h.

3.2.2 *closed-cell SPF insulation, n*—SPF insulation that contains cells or voids that are not interconnected.

3.2.2.1 *Discussion*—Closed-cell SPF insulation typically has a density between 24 kg/m^3 to 32 kg/m^3 when fully cured.

3.2.3 *open-cell SPF insulation, n*—SPF insulation that contains cells or voids that are largely interconnected.

3.2.3.1 *Discussion*—Open-cell SPF insulation typically has a density between 6.4 kg/m^3 to 9.6 kg/m^3 when fully cured.

4. Principles

4.1 Micro-scale test chambers are used for measuring emissions of VOCs including formaldehyde and other carbonyl compounds from materials and products.

4.2 Wall adsorption effects of reactive compounds and SVOCs are minimized by reducing the exposed inner surface of the chamber by fitting the SPF samples directly into the micro-scale chamber with minimal headspace. Passivated treatment of the interior surfaces also contributes to reduced sorption effects.

4.3 Micro-scale chambers are used for measuring area-specific emissions from the surface of SPF insulation or mass-specific emissions from the mass of the sample.

5. Summary of Test Method

5.1 A micro-scale chamber is used to measure VOC emissions from SPF insulation samples. A representative test specimen is prepared from the sample and is placed directly into a micro-scale chamber. Air samples are collected from the chamber exhaust at specified elapsed times.

5.2 Clean dry air is supplied to a micro-scale chamber and passes over the exposed surface of the test specimen before reaching the exhaust port. The airflow rate and the temperature within the micro-scale chamber are controlled. As the air passes over the test specimen, emitted compounds are swept away from the sample's surface.

5.3 The standard temperature for the test method is 35 °C ± 1 °C. Emission rates of organic compounds from building materials and sorption and desorption of organic compounds from interior surfaces are sensitive to temperature. Operation of the micro-scale chamber at the specified temperature (above

[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] Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, http://www.iso.org.

[4] Available from U.S. Government Printing Office, Superintendent of Documents, 732 N. Capitol St., NW, Washington, DC 20401-0001, http://www.access.gpo.gov.

[5] Available from United States Environmental Protection Agency (EPA), William Jefferson Clinton Bldg., 1200 Pennsylvania Ave., NW, Washington, DC 20460, http://www.epa.gov.