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# Standard Practice for Selecting and Constructing Exposure Scenarios for Assessment of Exposures to Alkyd and Latex Interior Paints[1]

This standard is issued under the fixed designation D6669; 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.

ε[1] NOTE—Editorially updated the References section in May 2007.

## 1. Scope

1.1 This practice provides procedures for constructing scenarios for assessment of inhalation exposure to airborne emissions of chemicals released from alkyd or latex paints that are used indoors.

1.2 The indoor environments covered in this practice, in terms of considerations for developing exposure scenarios, are residences and office buildings.

1.3 Elements of the exposure scenarios include the product and chemical(s) to be assessed, the indoor environment where the product is applied, application of the product, chemical emissions during and after product application, and location/activity patterns of individuals who may be exposed to the airborne chemical emissions.

1.4 Steps to be performed after developing exposure scenarios, such as monitoring, modeling and exposure/risk assessment, also are described.

1.5 *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]

D1005 Test Method for Measurement of Dry-Film Thickness of Organic Coatings Using Micrometers

D1212 Test Methods for Measurement of Wet Film Thickness of Organic Coatings

D1356 Terminology Relating to Sampling and Analysis of Atmospheres

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

D6178 Practice for Estimation of Short-term Inhalation Exposure to Volatile Organic Chemicals Emitted from Bedding Sets

D6485 Guide for Risk Characterization of Acute and Irritant Effects of Short-Term Exposure to Volatile Organic Chemicals Emitted from Bedding Sets

E741 Test Method for Determining Air Change in a Single Zone by Means of a Tracer Gas Dilution

## 3. Terminology

3.1 *Definitions*—For definitions of terms used in this practice refer to Terminology D1356.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *emission profile*, *n*—a time-series of emission rates of one or more compounds.

3.2.2 *exposure scenario*, *n*—a description of how and where an estimated exposure occurs, including (*1*) the location and emission profile of the product or material that causes exposure, (*2*) the indoor environment where the individual is exposed to airborne emissions from the product or material, and (*3*) the location and activity patterns of the exposed individual.

3.2.3 *potential inhaled dose*, *n*—the product of air concentration to which an individual is exposed times breathing rate times duration of exposure.

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

## 4. Summary of Practice

4.1 This practice documents the items that need to be described when developing an exposure scenario for assessment of exposures to chemicals released indoors from alkyd or latex paints. Important considerations are discussed for each item, along with examples or alternatives where appropriate.

[1] This practice 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] 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.

4.2 An exposure scenario—a description of how and where an estimated exposure occurs—includes the following elements for paints used indoors (that is, interior paints):

4.2.1 The product and chemical(s) to be assessed.

4.2.2 The indoor environment where the product is applied, including properties such as volume and airflow rate.

4.2.3 The amount and rate of product use.

4.2.4 Chemical emissions during and after paint application.

4.2.5 Locations and breathing rates of an individual, or individuals, who may be exposed to the airborne chemical emissions.

4.3 Further considerations discussed in this practice include typical versus conservative assumptions, short-term versus long-term exposure perspectives, alkyd versus latex paints, and residential versus office settings.

4.4 More than one exposure scenario can be constructed. The practice also provides a list of elements to be included when comparing multiple scenarios.

## 5. Significance and Use

5.1 Increasing attention is being paid to human exposure to airborne chemicals from products or materials used indoors, for two reasons:

5.1.1 Individuals spend substantial fractions of their time indoors.

5.1.2 Such exposures can occur repeatedly throughout one's lifetime.

5.2 The primary objectives of this practice are as follows:

5.2.1 To list the elements that need to be considered in developing a scenario to describe how exposure occurs to chemicals emitted from alkyd or latex interior paints.

5.2.2 To discuss procedures and alternatives for choosing and describing these elements.

5.3 Elements of an exposure scenario, in turn, are used to practice a subsequent step of estimating exposures through monitoring studies or computer modeling exercises.

5.4 Once exposures have been estimated, the results can be used to assess the potential impacts of a specific paint formulation on the health of exposed individuals, or to compare the relative impacts of alternative formulations.

5.5 Estimation of exposures, or comparisons of estimated exposures across alternative paint formulations, can lead to development of environmentally preferable products by minimizing adverse health effects for exposed individuals.

## 6. Procedures for Developing Exposure Scenarios

6.1 *Describing the Product and Chemical(s)*:

6.1.1 Chemical emissions can vary according to the type of paint and painted substrate. Describe the following:

6.1.1.1 Alkyd or latex paint.

6.1.1.2 Flat, gloss, or semi-gloss paint.

6.1.1.3 Physical properties such as paint density (for example, in pounds per gallon or grams per $cm^3$).

6.1.1.4 Typical applications of the paint, in terms of (*1*) type of substrate to which it is applied (for example, gypsum wallboard vs. wood/trim vs. metal) and (*2*) type of room (for example, bedroom vs. bathroom or kitchen).

6.1.1.5 Typical warnings or advice on the paint container (for example, "Use in a well-ventilated area").

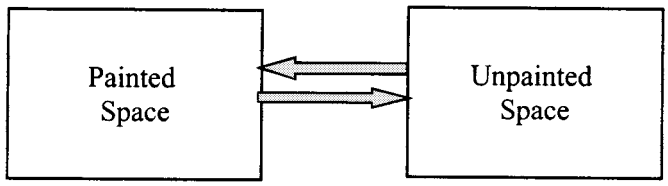


**FIG. 1 Conceptualization of a Painted Building**

6.1.2 The pattern and potential impact of chemical emissions over time can vary by chemical. Describe the following:

6.1.2.1 Physical/chemical properties of the chemical(s) under investigation, such as molecular weight and vapor pressure.

6.1.2.2 Role of the chemical(s) in the paint (for example, solvent).

6.1.2.3 Weight fraction of the chemical(s) in the paint.

6.1.2.4 Toxicity information, such as that commonly reported in Material Safety Data Sheets.

6.1.3 Chemical emissions can be affected by environmental factors such as temperature and humidity. These factors are discussed in 6.2. The pattern of chemical emissions also can depend on factors such as the paint application method, the amount of paint applied, and the rate of application. These factors are discussed in 6.3.

6.2 *Describing the Indoor Environment Where the Product Is Applied*:

6.2.1 Describe the size/volume and general configuration of the environment (for example, a two-story residence consisting of eight rooms with a volume of 15 000 $ft^3$ or 425 $m^3$). Specific considerations for residential versus office buildings are discussed under 6.6. Distributions for volumes of U.S. residences are presented in the *Exposure Factors Handbook* (**1**).[3]

6.2.2 Describe the indoor-outdoor air change rate (for example, in $h^{-1}$ or air changes per hour, ACH) and associated conditions such as opening of doors/windows and use of exhaust/circulation fans. Distributions for air change rates of U.S. residences are presented in the *Exposure Factors Handbook* (**1**). Persily (**2**) has measured air change rates in a limited set of office buildings.

6.2.3 *Discussion*—When conducting an actual exposure assessment, as opposed to constructing an exposure scenario to guide the assessment, it may be preferable to replace assumptions regarding air change rates with actual measurements, using methods such as those described in Test Method E741.

6.2.4 Describe the fraction of the building (or building volume) that is being painted. It usually is convenient to conceptualize the building as consisting of two indoor air spaces—a painted space and an unpainted space, with communicating air flows between the two spaces—as illustrated in Fig. 1.

6.2.5 Describe the airflow rates between the painted and unpainted spaces. The flows in the two directions are not necessarily equal, but it is often convenient to assume so. More than two indoor spaces can be specified, but the number of airflow rates will increase rapidly (for example, 2 rates for 2 spaces, 6 rates for 3 spaces, 12 rates for 4 spaces).

[3] The boldface numbers in parentheses refer to the list of references at the end of this practice.