

# GREENGUARD INDOOR AIR QUALITY (IAQ) STANDARD FOR BUILDING MATERIALS, FINISHES AND FURNISHINGS

## 1 Background

### 1.1 Purpose

The GREENGUARD Environmental Institute (GEI) has created this standard to establish a nationally recognized voluntary standard for qualifying building materials, finishes and furnishings as certified low emitting products for the indoor environment.

### 1.2 Scope

#### 1.2.1 General

The standard is applicable to the determination of organic emissions from building materials, finishes and furnishings (See Appendix A). This is a product performance based standard, and the complete toxicity effects of the emissions are beyond the scope of the standard.

The use of environmental test chambers and indoor exposure models to characterize the dynamic emissions from products and their components are well established.

The achievement of test results, that have meaning within the context of the standard, require rigorous sample selection procedures, defined sample collection and handling procedures, and the employment of precise and accurate analytical measurement systems and procedures. Additionally, the manufacturer of the product(s) evaluated in reference to the requirements set forth by the standard must have in place a production quality control system that is capable of assuring products shall be manufactured with consistently close results in similar emissions characteristics over time. Such relevant requirements are set forth in standards and procedures that are referenced by this standard.

This standard does not purport to address the safety concerns, if any, associated with its use. It is the responsibility of the user of the standard to establish appropriate safety and health practices, as well as to determine what regulatory limitations, if any, may exist.

#### 1.2.2 Suitability for Certification

This Standard was created with reference to ISO/IEC 17007:2009 and is suitable for certification purposes.

### 1.3 Process

Certification procedures are presented in **GG.PM.001**, "Program Manual for GREENGUARD Product Certification Programs."

## 2 Terminology

**2.1 Product:** The end result of the manufacturing process, to be offered to the marketplace or as an OEM. A unique item distinguishable by a discrete model number. Specifically, any item supplied by the Manufacturer that the Manufacturer desires to have GREENGUARD certified. An OEM refers to a component product made by one manufacturer and sold to another company who uses it to make a final product for the marketplace.

## 3 Requirements

### 3.1 Emissions Testing

Product emissions are measured following the testing requirements of **GGTM.P066**, “Standard Method for Measuring and Evaluating Chemical Emissions from Building Materials, Finishes, and Furnishings using Dynamic Environmental Chambers” by an accredited indoor air quality testing laboratory recognized by the GEI. The testing and measurement methodologies are consistent and comply with those of the California Department of Health Services' CA/DHS/EHLB/R-174 “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers 2004” (CA Section 01350) and ANSI/BIFMA M7.1-2007 “Standard Test Method for Determining VOC Emissions from Office Furniture Systems, Components and Seating.”

### 3.2 Exposure Modeling

Exposure concentrations are determined using the models presented in **GGTM.P066**. The surface areas for the major product types are presented in Table 6.4 in **GGTM.P066**, while surface areas for other products have been established and are available upon request. The surface areas for systems furniture, both open plan and private office, are those specified in ANSI/BIFMA M7.1-2007. As needed, specialized models (room size, ventilation rate and product area) are created for specific product use and documented within the certification report(s).

#### 3.2.1 Office Environment

The GREENGUARD office environment is the default scenario, unless otherwise specified as indicated in 3.2.2 and 3.2.3. The GREENGUARD office has dimensions of 3.05 m x 4.27 m x 2.44 m (10' x 14' x 8'), which results in a room volume of 32 m<sup>3</sup> (1130 ft<sup>3</sup>). The room has one 0.914 m x 2.13 m (3' x 7') door and four 1.09 m x 0.94 m (43" x 37") windows. The office is designed for single occupancy. The ventilation rate used is 0.72 ACH and is based on assumed floor occupancy of 7 people per 92.9 m<sup>2</sup> (1000 ft<sup>2</sup>) and ASHRAE Standard 62.1-2007 “Ventilation for Acceptable Indoor Air Quality” using the specified parameters of 5 cfm per person and 0.06 cfm/ft<sup>2</sup> for office spaces in office buildings. This room model is used for all office furniture with the exception of open plan workstation systems and seating. For open plan systems, a room volume of 16.3 m<sup>3</sup> (576 ft<sup>3</sup>) with the floor defined ventilation rate of 0.92 ACH is used, as defined in ANSI/BIFMA M7.1-2007. The room volume is derived from the BIFMA defined typical open plan office environment for a single workstation system of 2.44 m x 2.44 m (8' x 8') floor area with 2.74 m (9') ceilings, accounting for a standard 1.83 m x 1.83 m (6' x 6') open plan workstation system. Seating uses an average of the BIFMA M7.1-2007 private and open plan offices with an air flow rate of 24.8 m<sup>3</sup>/hr in a room volume of 40.7 m<sup>3</sup> (0.61 ACH).

#### 3.2.2 Educational Environment

The educational environment is used for products specifically designed for educational environment use and not found in use in offices. This includes products such as student desks and chairs, lunchroom tables, and risers. GREENGUARD uses the CA/DHS/EHLB/R-174 classroom defined as: “... a 24-ft wide by 40-ft long classroom with an 8.5-ft high ceiling. Use a ventilation rate of 0.9 h<sup>-1</sup>. This is a weekly average assuming 40 hours per week of ventilation system operation at 3.0 h<sup>-1</sup> and 128 hours per week at 0.2 h<sup>-1</sup> due to infiltration. The 3.0 h<sup>-1</sup> value is approximately equivalent to the ASHRAE 62-2001 ventilation guideline of 15 cubic feet per minute (cfm) per occupant for 27 occupants in this space. Assume that only 90% of the room volume of 231 m<sup>3</sup> is ventilated at this rate due to occupancy of the space by cabinetry, furnishings and other room contents.”

### 3.2.3 Residential Environment

The residential environment is used for products specifically designed for use in a residential setting, specifically a bedroom. This includes mattresses and other bedding, cribs and other bedroom/nursery furniture. The GREENGUARD residential model is composed of two sets of parameters, one for a 2nd floor isolated bedroom/nursery 3.05 m x 4.27m (10' x 14') and one for a 1st floor open living/dining area. The living/dining area includes a 20.9 m<sup>2</sup> (225 ft<sup>2</sup>) dining room, a 28.8 m<sup>2</sup> (310 ft<sup>2</sup>) kitchen with breakfast nook, a 20.9 m<sup>2</sup> (225 ft<sup>2</sup>) living room, and 6.97 m<sup>2</sup> (75 ft<sup>2</sup>) for the foyer/stairwell areas. It is assumed that the ceiling heights on the 2nd floor are 2.44 m (8') high and those on the first floor are 2.74 m (9') high, consistent with current construction trends. The ventilation rate of 0.45 ACH is the recommended typical residential ventilation rate from the USEPA Exposure Factors Handbook (Table 17-31) (August 1997).

### 3.2.4 Summary Table

A summary of the dimensions of the modeling environments is provided in the Table below.

Parameter	GREENGUARD Office	GREENGUARD /BIFMA Open Plan "Office"*	GREENGUARD Classroom	GREENGUARD Bedroom	GREENGUARD Living/Dining Area
Room Length	3.05 m (10 ft)	2.44 m (8 ft)	12.2 m (40 ft)	3.05 m (10 ft)	77.6 m <sup>2</sup> (835 ft <sup>2</sup> )
Room Width	4.27 m (14 ft)	2.44 m (8 ft)	7.31 m (24 ft)	4.27 m (14 ft)	
Room Height	2.44 m (8 ft)	2.74 m (9 ft)	2.59 m (8.5 ft)	2.44 m (8 ft)	2.74 m (9 ft)
Room Volume	32 m <sup>3</sup> (1130 ft <sup>3</sup> )	16.3 m <sup>3</sup> (576 ft <sup>3</sup> )	231 m <sup>3</sup> (8160 ft <sup>3</sup> )	32 m <sup>3</sup> (1130 ft <sup>3</sup> )	213 m <sup>3</sup> (7520 ft <sup>3</sup> )
Ventilated Fraction	1.0	1.0	0.9	1.0	1.0
Air Change Rate	0.72 hr <sup>-1</sup>	0.92 hr <sup>-1</sup>	0.9 hr <sup>-1</sup>	0.45 hr <sup>-1</sup>	0.45hr <sup>-1</sup>

**\*For use with open plan office systems only**

### 3.3 Emissions Criteria

Product emissions are required to meet the following exposure concentration criteria within 168 hours of testing. The list of product types in each column below will increase as new product types enter certification. The list of product types for which this certification is applicable is maintained in Appendix A.

Applicable to All Products		
Parameter	Full Levels (Applicable for Building Construction Materials and Finishes, Wood Finishes, Countertops, Casework, Visual Display Products, and Furniture Workstations, Casework Systems, and Movable Walls)	Half Levels (Applicable for OEM Materials, Mattresses and Bedding, Seating, Individual Casegoods, Tables, Workstation Components, Shelving, and Children's Furniture)
Total VOCs (TVOC) <sup>1</sup>	≤ 0.5 mg/m <sup>3</sup>	≤ 0.25 mg/m <sup>3</sup>
Formaldehyde	≤ 0.05 ppm	≤ 0.025 ppm
Total Aldehydes <sup>2</sup>	≤ 0.1 ppm	≤ 0.05 ppm
Individual VOCs <sup>3</sup>	≤ 0.1 TLV	≤ 0.1 TLV
Listing of measured carcinogens and reproductive toxins as identified by California Proposition 65, the U.S. National Toxicology Program (NTP), and the International Agency on Research on Cancer (IARC) must be provided.		
Applicable to Specific Products Only		
4-Phenylcyclohexene <sup>4</sup>	≤ 0.0065 mg/m <sup>3</sup>	≤ 0.0033 mg/m <sup>3</sup>
Respirable Particles <sup>5</sup>	≤ 0.05 mg/m <sup>3</sup>	≤ 0.025 mg/m <sup>3</sup>

<sup>1</sup>Defined to be the total response of measured VOCs falling within the C<sub>6</sub> – C<sub>16</sub> range, with responses calibrated to a toluene surrogate.

<sup>2</sup>Defined to be the total response of a specific target list of aldehydes (2-butenal; acetaldehyde; benzaldehyde; 2, 5-dimethylbenzaldehyde; 2-methylbenzaldehyde; 3-and/or 4-methylbenzaldehyde; butanal; 3-methylbutanal; formaldehyde; hexanal; pentanal; propanal), with each individually calibrated to a compound specific standard.

<sup>3</sup>Any VOC not listed must produce an air concentration level no greater than 1/10 the Threshold Limit Value (TLV) industrial workplace standard (Reference: American Conference of Government Industrial Hygienists, 6500 Glenway, Building D-7, and Cincinnati, OH 45211-4438).

<sup>4</sup>Applicable to furniture, including components and construction materials, and flooring.

<sup>5</sup>Particles applicable to fibrous, particle-releasing products with exposed surface area in air streams (a forced air test with specific test method) and for wood finishing (sanding) systems.

## Appendix A

### **Product Types held to Full Levels:**

Insulation, Wall Finishes, Flooring, Paints and Coatings, Wood Finishes, Building Construction Materials, Countertops, Casework, Adhesives/Sealants, Ceiling Systems, Doors, Air Filters, Textiles, Visual Display Products, Window Treatments, Workstations, Caseload Systems, and Movable Walls

### **Product Types held to Half Levels:**

OEM Materials (Upholstery, Furniture Construction Adhesives, Furniture Panel Textiles, Surfacing Materials, Furniture Insulation, Flexible Duct Media), Mattresses and Bedding, Seating, Individual Caseloads, Tables, Workstation Components, Shelving, Children's Furniture