

The ANSI/BIFMA Furniture Emissions Standards

#799 - VOC Workshop – Healthy Buildings 2009

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Business and Institutional
Furniture Manufacturers
Association

The Steelcase logo consists of the word "Steelcase" in a white, sans-serif font, centered within a solid blue square background.

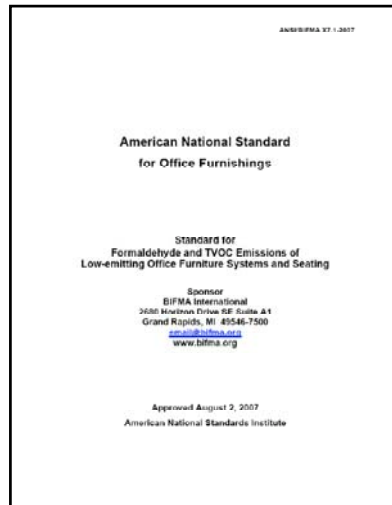
U.S. History of Furniture Emissions Standards

- 1989** Varied Customer/Government Requirements
- 1994** U.S. Federal Gov. (GSA) Encourages BIFMA IAQ Research
- 1999** BIFMA & EPA Partner on ETV Protocol
- 2000** Greenguard and California Section 01350 Initiated
- 2002** USGBC LEED-CI Includes Greenguard (proprietary)
- 2004** BIFMA Focuses Effort, Partners with Key Scientists
- 2005** BIFMA Releases Furniture Emissions Standards (FES)
- 2006** Adopted by USGBC LEED-CI, California, NSF, and SCS
- 2007** ANSI Approves BIFMA FES, GEI Partial Adoption
- 2009** Collaborative for High Performance Schools Adapts FES

Two American National Standards



ANSI/BIFMA M7.1-2007
*Standard Test Method for
Determining VOC Emissions from
Office Furniture Systems,
Components and Seating*



ANSI/BIFMA X7.1-2007
*Standard for Formaldehyde and
TVOC Emissions of Low-emitting
Office Furniture Systems and Seating*

ANSI/BIFMA M7.1 Test Method

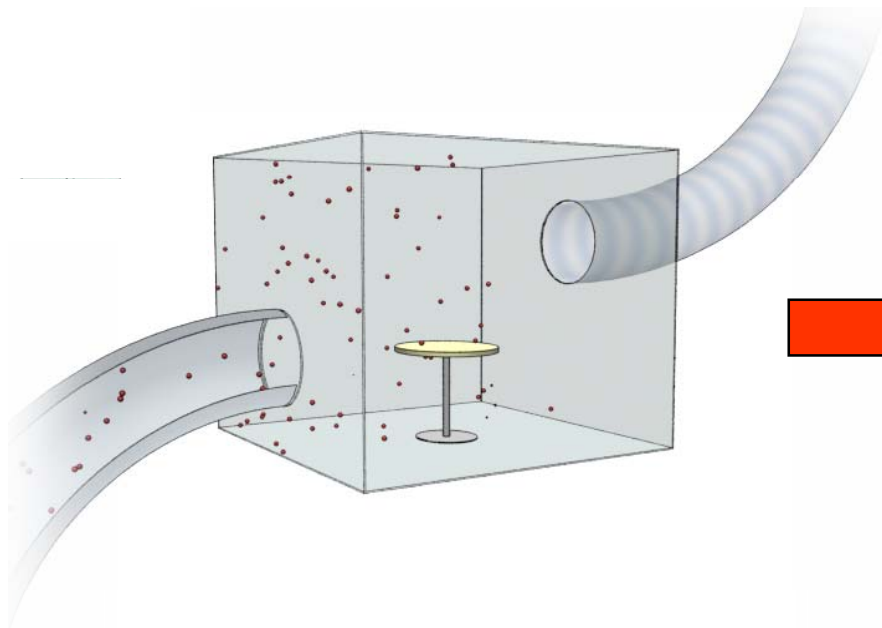
- Over ten years ANSI transparent, consensus development with broad stakeholder input:
 - Laboratories
 - Manufacturers
 - US EPA Indoor Environment Branch
 - State of California Dept. of Public Health
 - National Research Council Canada
 - Architects, Designers, many others.
- Leadership from Dr. Jianshun (Jensen) Zhang, Syracuse University



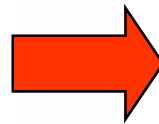
ANSI/BIFMA M7.1 Test Method

- Purpose - product certification or determination of VOC emissions of workstations, seating, and related materials.
- Requires duplicate measurements in chamber:
 - 72 h, 168 h, and optionally at 336 h.
- Has optional power-law model with defined limitations to allow estimations at day 14 from measurements at days 3 and 7 (Zhang et.al. 2006).
- Used to determine compliance with VOC requirements at both 7 and 14 days.

How to Link Chamber Tests to Actual Buildings?



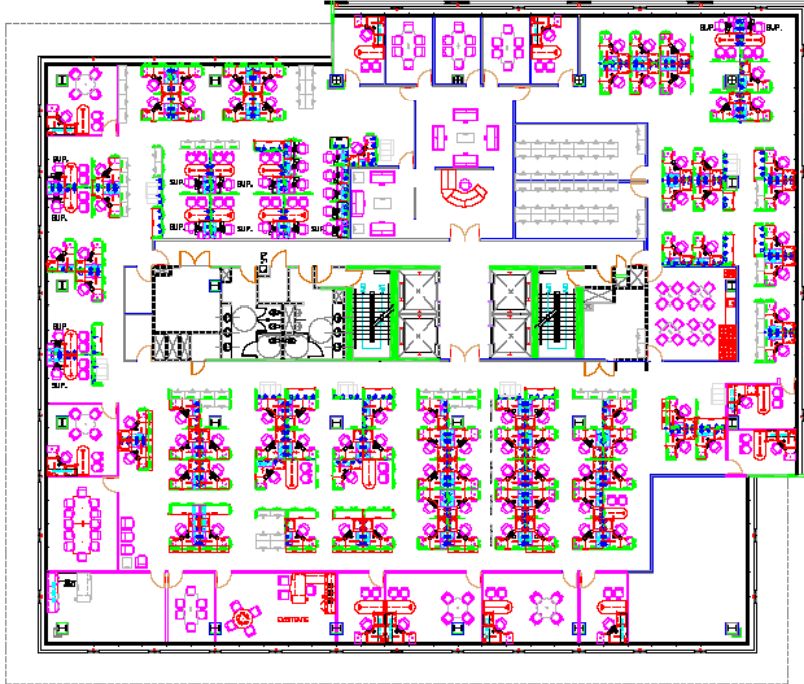
Test Chamber



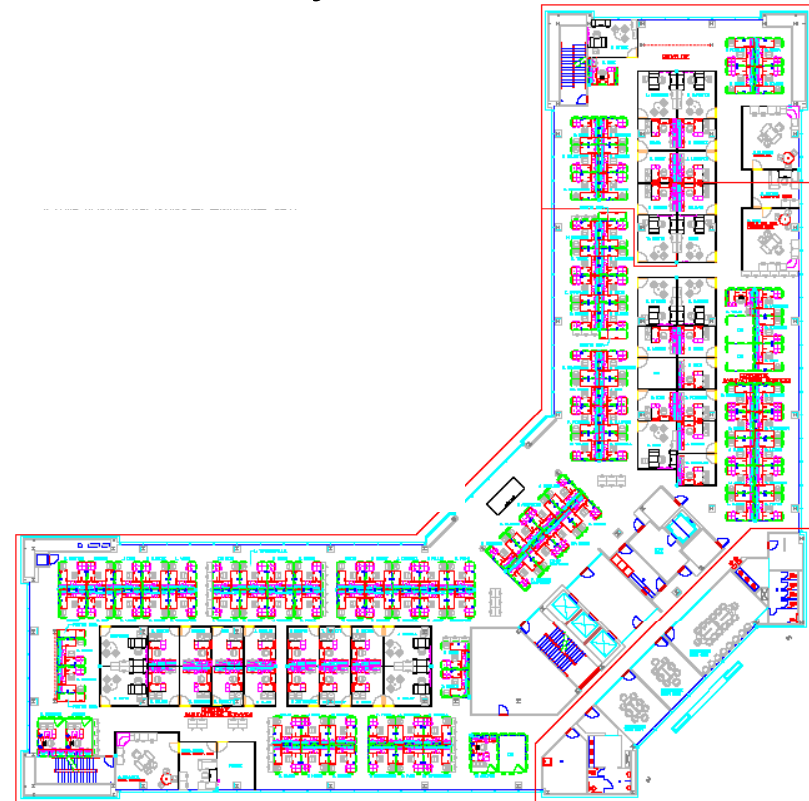
Actual Office Conditions

Investigation of Office Workstation Size

Random sample of 31 floor plans across North America
– over 5,000 workstations analyzed.



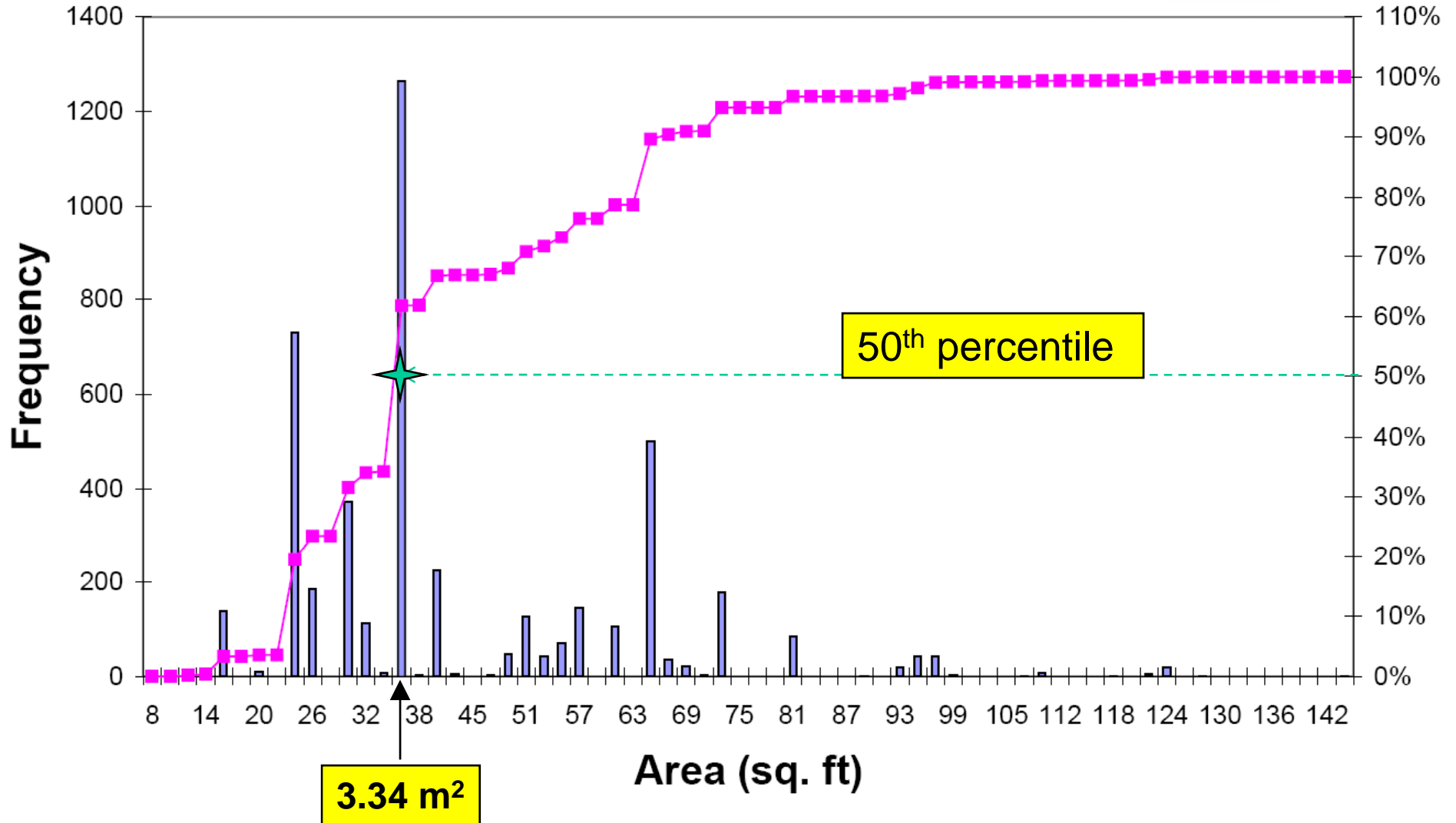
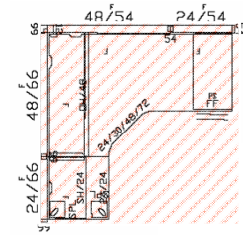
Example Plan #1



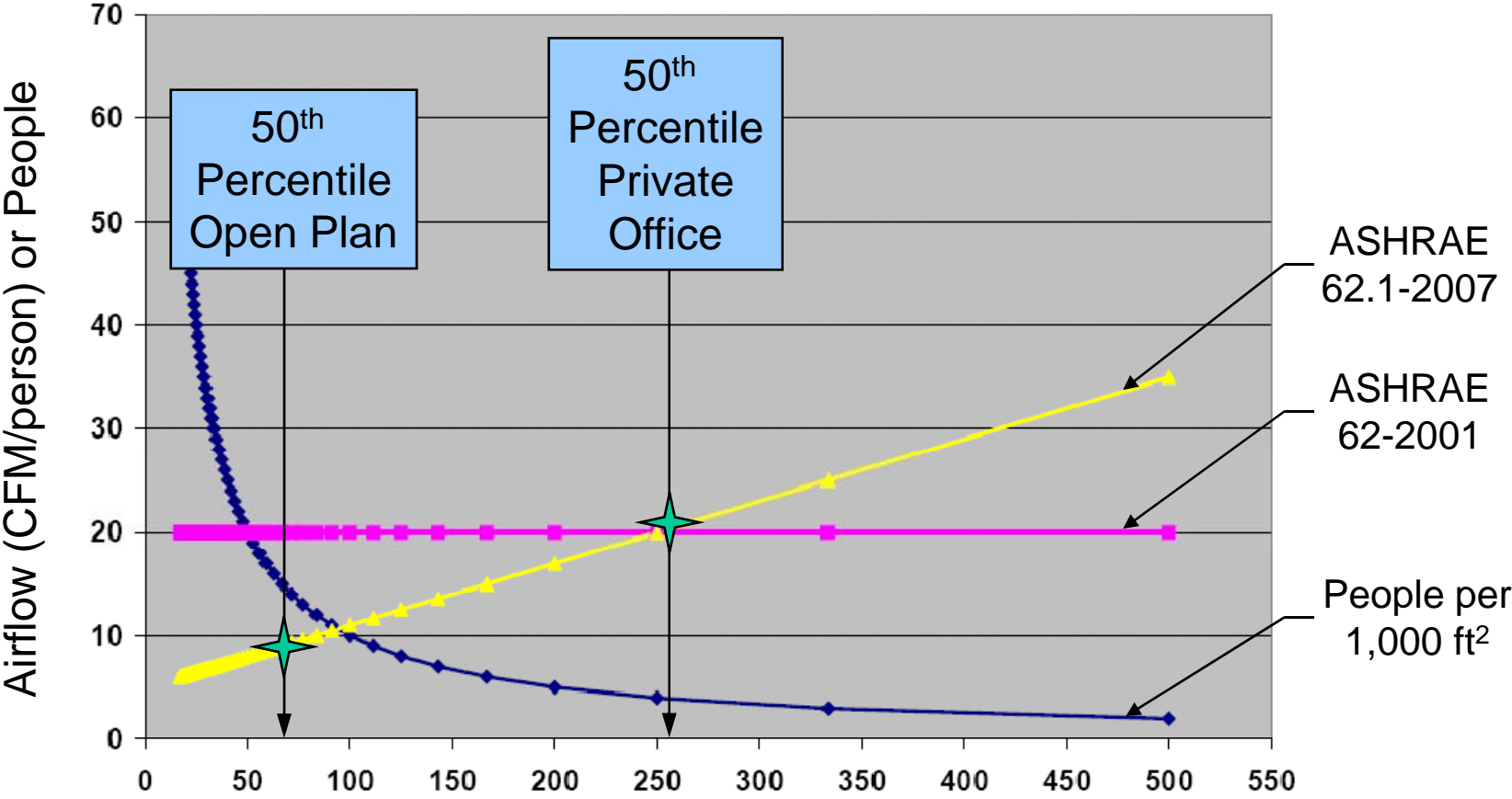
Example Plan #2

Open Plan Workstation Floor Area

Without Apportioned Common Office Space (n = 4,594)

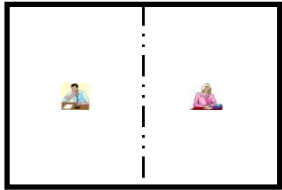


Outside (Clean) Air Required in Offices



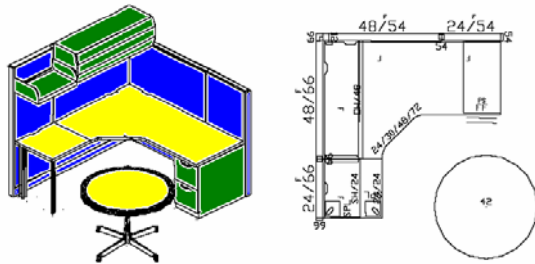
Office Floor Area (ft²) per Person

High Density,
Small
Workstations

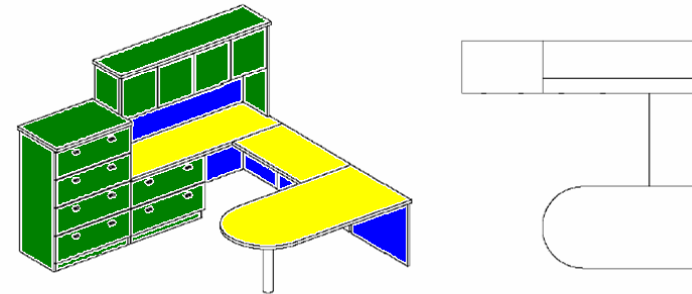


Low Density,
Big
Workstations

ANSI/BIFMA M7.1 Exposure Scenarios Use 90th Percentile Furniture Conditions



Open Plan Workstation



Private Office

Parameter	Open Plan Workstation	Private Office Workstation	Seating
Floor Area per Workstation with Common Area (m ²)	5.95	23.78	
Modeled Building/Room Volume (m ³)	16.3	65.2	24.8
Modeled Air Flow, Q, (m ³ /h)	15.02	34.59	
Panel Vertical Area (m ²)	11.08	7.63	
Work Surface Horizontal Area (m ²)	6.10	6.73	
Storage External Surface Area (m ²)	4.57	10.55	
Total Potential Emitting Surface Area (m ²)	21.75	24.91	Largest

Definition of Standard Office Environments for Evaluating the Impact of Office Furniture Emissions on Indoor VOC Concentrations

Randal D. Carter
Associate Member ASHRAE

Jianshun S. Zhang, PhD
Member ASHRAE

ABSTRACT

A representative "worst-case" office environment, which defines the size and volume of the office space, the amount and type of office furniture surface area, and the outdoor, clean airflow rate is necessary to estimate the impact of office furniture emissions on indoor VOC concentrations based on the emission rates measured from chamber tests. In this study, 31 randomly selected floor plans from North American office buildings were analyzed in detail. The floor plans were from projects in late 2004 and early 2005 and were provided by an industry cross section of seven major office furniture manufacturers. The analysis included documenting the potential emitting surface area for each workstation and a determination of how much common office space (aisles, etc.) was present and shared between workstations and other adjoining spaces. The 90th percentile conditions for total furniture surface area within the 50th percentile workstation footprint sizes were identified from the more than 5000 workstations analyzed to provide a representative "worst-case" office environment model (i.e., occupant exposure scenario).

Based on the analysis, the representative "worst-case" standard open plan office environment for a single workstation system is defined as 5.94 m² (64 ft²) floor area by 2.74 m (9 ft) high (576 ft³ or 16.3 m³), accounting for a standard 1.83 m × 1.83 m (6 ft × 6 ft) open plan workstation system, traffic area, and support space for shared copiers, files, storage, etc. The space is assumed to be occupied by a single occupant and has an outdoor or clean air ventilation rate of 4.17 L/s (8.84 cfm), in accordance with ASHRAE Standard 62.1-2004. The representative "worst-case" standard private office environment for a single workstation system is defined as 23.78 m² (256 ft²) floor area by 2.74 m (9 ft) high (2304 ft³ or 65.2 m³), accounting

for a standard 13.38 m² (144 ft²) private office workstation system, traffic area, and support space for shared copiers, files, storage, etc. The space is assumed to be occupied by a single occupant and has an outdoor or clean air ventilation rate of 9.63 L/s (20.4 cfm) in accordance with ASHRAE Standard 62.1-2004. A comparison to historical office environment models is included.

INTRODUCTION

An evolving variety of sometimes conflicting test methods, model office environments, and requirements for modeling volatile organic compound (VOC) emissions from office furniture have been specified by various US organizations from 1989 to the present (Washington 1989; US EPA 1996; US EPA 1999; California 2000; Greenguard 2001; California 2004; USGBC 2004; BIFMA 2005a, 2005b; SCS 2005; California 2006). In these varied programs, environmental chamber testing of office furniture workstations or components is used to determine the emission rates, which are in turn used to estimate the impact of the workstation system on the VOC concentration levels in actual buildings by using a prescribed office environment model (i.e., occupant exposure scenario). Some of these programs define office environment models that are intended to be representative of specific buildings (Washington 1989; US EPA 1996; California 2000), while others do not contain any office environment model (US EPA 1999). The proliferation of office furniture emission programs with varied and potentially outdated office environment models raises questions as to how well the models represent actual building environments and makes it extremely difficult to compare VOC emissions performance across the broad variety of office furniture types available today.

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ANSI/BIFMA M7.1
research defining
standard office
scenarios was
published in 2007 by
the ASHRAE
Transactions Journal.

See www.bifma.org

ANSI/BIFMA X7.1 Standard

Maximum Concentrations Allowed per Workstation

- TVOC 500 ug/m³
- Formaldehyde 50 ppb
- Total Aldehydes 100 ppb
- 4-Phenylcyclohexene 6.5 ug/m³

Seating is allowed ½ of these limits.

Limits required at 7 days after unpacking.

Laboratories must be ISO 17025 accredited with ANSI/BIFMA M7.1 within their scope and all tests conducted accordingly.

Product changes require review and retesting. If no changes, must still retest at least every 3 years.

Preview of ANSI/BIFMA FES 2010

-- Seeking Reviewers --

- Improvements to reduce measurement variation identified from round-robin and other studies (Zhang, et.al. HB2009 #693).
- Includes scaling from small chamber test results on representative materials to determine compliance of assembled furniture products (Hodgson, et.al. HB2009 #444).
- Defines compliance requirements for individual furniture items (table, desk, easel, conference tables, etc.)
- Defines maximum emission factors for compliance.
- New, BIFMA e3-2008 Furniture Sustainability Standard adds requirement for “Section 01350” individual VOCs. Details available at www.levelcertified.org.

We have much in common.

There are opportunities to harmonize internationally on measurement points at 3, 7, and 14 days to allow one test to determine compliance with multiple criteria.

The ANSI/BIFMA M7.1 test method provides a proven, versatile tool for VOC chamber measurements that is adaptable to a variety of criteria.

For Harmonization We All Need:

- **Strong, Standardized Measurement Protocols**
(Open, Scientific, Repeatable, Reproducible,
Developed with Transparent, Consensus-Based
Processes with *Broad Participation* – industry,
government, users, labs, non-gov. organizations, etc.)
- **Market Understanding and Acceptance**
(Useful, Meaningful, Credible Conformance Standards)
- **Level Playing Field with Open Competition**
(Qualified Labs, Manufacturers, and Certifiers)
- **Cost Effective Tools**
(Knowledge for Testing Dollar Spent)

Please contact Randy Carter,
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more information or to discuss.