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## Open Office Panel Systems Indoor Air Quality Specification

### 5.7 Indoor Air Quality (IAQ) Requirements (Mandatory)

#### 5.7.1 Introduction to Indoor Air Quality (IAQ) Requirements (Mandatory)

Purpose: The Indoor Air Quality (IAQ, hereafter) specification is intended to ensure good indoor air quality in office spaces that contain “open office panel systems” (OOPS, hereafter). This specification is intended to safeguard building occupants from adverse exposures to “volatile organic compounds” (VOCs, hereafter). The requirements for testing and measuring VOCs emitted from office furniture systems are described herein. These protocols use, to the greatest extent possible, standardized industry accepted procedures for analytical testing including test chamber conditions, specimen acquisition and handling, and conditioning, models and parameters.

Schedule of Submittals: All bidders must submit for evaluation all of the required submittals described in Section 5.7.4 (i.e. Subsections 5.7.4.1 through 5.7.4.3) in this IAQ specification with the Draft Proposal. Failure to submit all of the required information and to meet the IAQ Specification’s – Section 5.7.2.1: Acceptance Criteria #1 and Section 5.7.2.2: Acceptance Criteria #2 – as described herein, prior to submittal of the Final Proposal, shall result in your bid proposal being considered non-responsive to the IAQ specification and will be grounds for bid rejection.

All submitted testing data shall not be older more than one (1) year from the “Final” bid proposal submittal due date.

Principles: The IAQ specification requires laboratory testing of a representative OOPS workstation (i.e. a full OOPS workstation or each of the primary components of the OOPS workstation) in an environmentally-controlled chamber and evaluation of the “individual VOCs” (iVOCs, hereafter) emitted from the OOPS workstation. The iVOC emission concentrations expected in a typical office from the OOPS workstation are evaluated using a simple occupant exposure model (i.e. single compartment, no sinks) together with typical office parameters and the chamber measured emissions. This specification employs BIFMA’s office configuration parameters based on peer-reviewed research (See Appendix D for reference to the publication in ASHRAE (American Society of Heating, Refrigerating and Air-conditioning Engineers). This specification requires that the expected office emission concentrations from the OOPS workstation are below the health based chronic reference exposure limits set by the California Environmental Protection Agency’s “Office of Environmental Health Hazard Assessment” (OEHHA).

For Clarification regarding ANSI/BIFMA: Any reference to and/or sections of the “American National Standards Institute / Business and Institution Furniture Manufacturer’s Association” (ANSI/BIFMA) Standards in this IAQ specification have been updated to reflect the ANSI/BIFMA M7.1-2007 & X7.1-2007 (adopted September 26, 2007), respectively. Bidders may obtain copies of these ANSI/BIFMA standards using the following link: <http://www.bifma.org/standards/index.html>

For Clarification regarding Laboratories: At the present time, the State of California (State, hereafter) does not accredit or certify laboratories for measuring emissions from the OOPS. The State is currently aware of the following laboratories doing environmental chamber emissions tests:

- a) Air Quality Sciences (AQS), <http://www.aqs.com> Contact: Marilyn Black, (770) 933-0641 or [mblack@aqsc.com](mailto:mblack@aqsc.com) .
- b) Berkeley Analytical Associates (BAA). Contact: Raja Tannous, (510) 236-2325 or [baalab@berkeleyanalytical.com](mailto:baalab@berkeleyanalytical.com) .
- c) Bodycote Material Testing, <http://mtusa.bodycote.com/> . Contact: (888) 263-9268 or [info@bodycote.com](mailto:info@bodycote.com) .
- d) Forintek, <http://www.forintek.ca/> . Contact: Alpha Barry, at (418) 695-2647 or [Alpha.Barry@qc.forintek.ca](mailto:Alpha.Barry@qc.forintek.ca) .

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- e) Materials Analytical Services (MAS), <http://www.mastest.com> Contact: (800) 421-8451.
- f) Professional Services Industries, Inc. (PSI), <http://www.psiusa.com> Contact: Erwin Schtfort, (541) 484-9212.

These laboratories are listed for information only and are not endorsed or certified by the State. Other laboratories may also be capable of offering acceptable environmental chamber testing services. Any testing laboratory will be acceptable provided the methods described herein are followed and documented.

### 5.7.2 IAQ Acceptance Criteria Requirements (Mandatory)

The offered OOPS shall meet the requirements of the ANSI/BIFMA X7.1-2007 Standard as described in Section 5.7.2.1 – Acceptance Criteria # 1 and shall meet the State of California iVOC emission concentration limits as described in Section 5.7.2.2 – Acceptance Criteria # 2.

#### 5.7.2.1 IAQ Acceptance Criteria #1: ANSI/BIFMA X7.1-2007 (Mandatory)

The offered OOPS shall be chamber tested according to the requirements of the ANSI/BIFMA X7.1-2007 Standard and shall meet the requirements of the ANSI/BIFMA X7.1-2007 Standard including the requirements of Section 5.7.2.1.1 the Maximum Acceptable (IAQ) Limits shown in Table 5.7.2.1.1 (See Section 5.7.9 – Appendix C for additional clarification).

##### 5.7.2.1.1 Maximum Acceptable (IAQ) Limits Requirements (Mandatory)

The offered OOPS office emissions shall meet the Maximum Acceptable IAQ Limits shown in Table 5.7.2.1.1 at or before the 168 hour time point, after manufacture.

**Table 5.7.2.1.1 – Maximum Acceptable IAQ Limits**

Chemical Contaminant	Emission Limits System Furniture
TVOC	0.5 mg/m <sup>3</sup>
Formaldehyde	50 parts per billion
Total aldehydes	100 parts per billion
4-Phenylcyclohexene (4-PCH)	0.0065 mg/m <sup>3</sup>

#### 5.7.2.2 IAQ Acceptance Criteria #2: State of California iVOC limits (Mandatory)

The offered OOPS shall be chamber tested according to the requirements of the ANSI/BIFMA M7.1-2007 Standard and the calculated iVOCs office emissions concentrations shall be less than the “Maximum Allowable iVOCs Office Concentrations for Emissions Tests” in Section 5.7.2.2.1 as shown in Table 5.7.2.2.1 below at a 336 hour time point, after manufacture. In addition the proposed OOPS must meet the emission testing requirements described in Section 5.7.3.

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### 5.7.2.2.1 Maximum Allowable iVOCs Concentrations Requirements (336 hour)

**Table 5.7.2.2.1 State of California Maximum Allowable iVOCs Concentrations Limits**

Compound Name	CAS Number	MW	C R E L	Maximum Allowable Conc. (µg/m <sup>3</sup> )
Ethylbenzene	100-41-4	106.2	Y	1000
Styrene	100-42-5	104.2	Y	450
p-Xylene	106-42-3	106.2	Y	350
1,4-Dichlorobenzene	106-46-7	147	Y	400
Epichlorohydrin	106-89-8	92.52	Y	1.5
Ethylene Glycol	107-21-1	62.1	Y	200
1-Methoxy-2-propanol (Propylene glycol monomethyl ether)	107-98-2	90.12	Y	3500
Vinyl Acetate	108-05-4	86.1	Y	100
m-Xylene	108-38-3	106.2	Y	350
Toluene	108-88-3	92.1	Y	150
Chlorobenzene	108-90-7	112.56	Y	500
Phenol	108-95-2	94.1	Y	100
2-Methoxyethanol	109-86-4	76.1	Y	30
Ethylene glycol monomethyl ether acetate	110-49-6	118.13	Y	45
n-Hexane	110-54-3	86.2	Y	3500
2-Ethoxyethanol	110-80-5	90.1	Y	35
2-Ethoxyethyl acetate	111-15-9	132.2	Y	150
1,4-Dioxane	123-91-1	88.1	Y	1500
Tetrachloroethylene	127-18-4	165.8	Y	17.5
Formaldehyde	50-00-0	30.1	Y	16.5
Isopropanol	67-63-0	60.1	Y	3500
Chloroform	67-66-3	119.4	Y	150
N,N-Dimethyl Formamide	68-12-2	73.09	Y	40
Benzene	71-43-2	78.1	Y	30
1,1,1-Trichloroethane	71-55-6	133.4	Y	500
Acetaldehyde	75-07-0	44.1	Y	9
Methylene Chloride	75-09-2	84.9	Y	200
Carbon Disulfide	75-15-0	76.14	Y	400
Trichloroethylene	79-01-6	131.4	Y	300
1-Methyl-2-Pyrrolidinone	872-50-4	99.13	N	160
Naphthalene	91-20-3	128.2	Y	4.5
o-Xylene	95-47-6	106.2	Y	350

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### 5.7.3 Emission Testing Requirements (Mandatory)

Chamber emission testing in accordance with ANSI/BIFMA M7.1-2007 Standard – “Method For Testing VOC Emissions From Office Furniture Systems, Components And Seating” is required to show compliance to Section 5.7.2.1 – IAQ Acceptance Criteria # 1 and Section 5.7.2.2 – IAQ Acceptance Criteria # 2. In addition, the emission testing provisions found in Sections 5.7.3.1 through 5.7.3.7 below are required for laboratory testing conducted to meet Section 5.7.2.2 – IAQ Acceptance Criteria # 2.

#### 5.7.3.1 Target VOC List Requirements (Mandatory)

All compounds identified in the chamber emission tests shall be quantified and reported.

#### 5.7.3.2 Calibration Requirements (Mandatory)

Multi-point calibrations with pure compounds are required for quantification of all identified iVOCs on the listed in Table 5.7.2.2.1.

#### 5.7.3.3 – Required Fabric Screening Requirements (Mandatory)

Each substantially different fabric (i.e. manufactured with different material or processes; different composition, ingredients, coatings, etc.) shall be small chamber test screened in accordance with the fabric screening procedure in the ANSI/BIFMA M7.1-2007 Standard to ensure that the net workstation emissions are below the maximum allowable limits indicated in Table 5.7.2.2.1.

#### 5.7.3.4 – Alternative Low-emitting Component Screening (Non-Mandatory)

To demonstrate compliance with the acceptance criteria of this IAQ specification it will be acceptable to offer an “Alternative Low-emitting Component Screening” test or materials from those tested in initial lab reports provided that laboratory emission screening tests are conducted on primary components *only* and provided they show that the calculated net workstation office emission concentrations are below the maximum allowable limits indicated in Table 5.7.2.2.1.

Screening tests are restricted to primary components only. Small scale chamber work-surface or panel screening tests must be conducted with representative full-component assemblies including laminates and coatings adhered to it and shall include at least one (1) true manufactured edge to represent the relative proportion of edge to planar component surface area in the offered workstation system. Dry cutting methods shall be used to avoid grease, oil, solvents or other chemical contaminants. Non-true edges may be taped using a low-emitting paraffin wax. Pieces shall be suspended on an open gate exposing front and back surfaces in the chamber.

#### 5.7.3.5 – Most Abundant Peaks Requirements (Mandatory)

The ten (10) most abundant peaks of identified compounds (greater than the lower limit of quantification) not listed in Table 5.7.2.2.1, shall be quantified and reported using toluene surrogate calibration.

#### 5.7.3.6 Power-law Model Option (Non- Mandatory)

A power-law extrapolation may be applied in emission factor calculations in accordance with the ANSI/BIFMA M7.1-2007. Both 72 hour and 168 hour emission factors shall be used to estimate 336 hour values. When the emission factor at 336 hours is determined using the power-law defined in Sections 10.4 and 10.5 of the ANSI/BIFMA M7.1-2007, emission factors with  $-0.20 < b < 0.20$  shall be reported as constant.

#### 5.7.3.7 – Direct Measurement Option (Mandatory)

When the power-law is not used, “direct measurements” are required. Any direct measurement collected between 72 hour and 336 hour is acceptable.

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### 5.7.4 Office Concentrations Calculations (Mandatory)

Office emission concentrations shall be calculated per ANSI/BIFMA M7.1-2007 protocol using emission factors derived from chamber tests, and the ANSI/BIFMA M7.1-2007 office model parameters:  $Q_{\text{office}} = 15 \text{ m}^3/\text{h}$ , office floor area =  $5.94 \text{ m}^2$ , office volume =  $16.3 \text{ m}^3$ , and workstation component surface areas of the open plan workstation listed in Table A2.1 of the ANSI/BIFMA M7.1-2007:  $11.08 \text{ m}^2$ , for panels,  $6.103 \text{ m}^2$  for work surfaces, and  $4.569 \text{ m}^2$  for storage units respectively.

### 5.7.5 IAQ Submittal Requirements (Mandatory)

Bidders are required to provide all of the information Sections 5.7.5.1 through 5.7.5.3 and shall work with their labs and/or certifiers to obtain the required emission testing information and calculations for submittal with the bid proposal.

#### 5.7.5.1 Workstation Component Information Requirements (Mandatory)

Workstation Component Information for the OOPS shall be submitted via the CA IAQ Workbook (CD) (See Table 5.7.7 (Sample), in this specification). The Workstation Component Information shall include a complete listing of the components in the proposed OOPS workstation(s) and shall list the materials and processes in the manufactured panel component including framing, panel insulation, panel structural and cores, panel binders, resins, adhesives, and coatings.

The Workstation Component Information shall also include a list of all of the offered fabrics or panel coverings and their associated materials and processes. Workstation Component Information shall list the materials and processes used in the manufactured work-surface components including the work-surface; cores, laminates, backer layers, edge banding, adhesives, and coatings.

If composite or engineered woods are used in the panel work-surface, or storage unit component assemblies the type and resin type must be listed in the CA IAQ Workbook (CD). Any stain resistant coatings applied to any components shall be listed in CA IAQ Workbook (CD).

Workstation Component Information shall include a list of all of the material and processes in the manufacture of storage units including the materials and processes for filing drawers, shelving, and filing cabinet including a list of the adhesives, coatings, and lubricants used in the manufactured storage units.

#### 5.7.5.2 – California (CA) IAQ Workbook Requirements (Mandatory)

The CA IAQ Workbook (via electronic media, CD) shall be submitted with the draft bid proposal. The CA IAQ Workbook (CD) shall include the chamber test air flow rate, chamber floor area dimensions and volume, specimen dimensions/configurations, the measured test concentrations, the calculated equation and office and configuration parameters used to calculate emission factors, and calculated 336 hour iVOC office emission concentrations. The CA IAQ Workbook (CD) shall show that the tested workstation office emissions are less than the maximum acceptable limits listed in Table 5.7.2.2.1.

#### 5.7.5.3 Laboratory Report Requirements (Mandatory)

Laboratory reports of chamber emission testing conducted to show compliance with the IAQ acceptance criteria shall be submitted with the draft bid proposal. Laboratory reports for screening tests of offered fabrics or alternate components (any substantially different from those in the Primary test reports) shall be submitted with the draft bid proposal. Laboratory reports shall include all of the information required in “Section 12.2 of the ANSI/BIFMA M7.1-2007 Standard” for the Open Plan condition including iVOC measurements. The laboratory report shall include results of each chamber test or screen conducted including the following information:

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1. Name and address of the laboratory
2. Name and address of the client (where applicable);
3. Detailed description and unambiguous identification of the item(s) tested that match the offered groupings;
4. Dates of manufacture, collection, and shipment of the item(s);
5. Dates of receipt of the test item;
6. Date(s) of the performance of test;
7. Statement that the BIFMA M7.1-2007 Standard test method was used;
8. Statement that screening tests for fabric of backers were conducted;
9. Signature and title, of the person(s) accepting responsibility for the content of the report;
10. Test conditions including all of the following; chamber dimensions, volume, clean air supply flow rate, temperature, humidity, amount and dimensions of the test
11. Measured test concentrations, including chamber test concentrations of VOCs between C6 and C16 measured by the GC/MS analysis. A table including; names of VOCs identified from the air samples, the collection time points, the measured concentrations in individual samples at the sample collections times, the mean concentrations and relative deviations of duplicates, the calibration compound used for each VOC concentration. A statement shall be provided describing the type of sorbent tubes used for air sampling, the sampling volumes, and the GC/MS operating conditions and calibration information. A statement shall be provided that multi point calibrations were conducted for all measured iVOCs. Chamber test concentrations shall be provided of Aldehydes measured by HPLC analysis. A table shall be provided including; the names of the aldehydes identified in the chemical analysis, including Formaldehyde and Acetaldehyde, the collection points, the measured concentrations of each of these compounds, the mean concentrations and relative deviations of the duplicates. A statement shall be provided at the bottom of the table describing the cartridges used for air sampling, the sampling volume, and the HPLC operating conditions and calibration information.
12. Calculation Equation and Office / Configurations Parameters used to calculate emission factors. Calculated Emission Factors of the iVOCs measured by GC/MS and the aldehydes measured by HPLC, and the TVOC Sum, TVOC Toluene calculated from the mean values at the collection time points. A statement indicating if the power law was used or if direct measurements were used and if power law was used then the value of coefficients a and b.
13. The 336 hour iVOC Office Emission Concentrations shall be calculated at all test time points and 336 hours calculated from the model equation using the emission factors for the defined Typical Office Environment of a Single Office Workstation calculated by BIFMA M7.1-2007 Equations (12), (13), (14), or (15), depending on the type of test and analysis conducted. A statement shall be provided at the bottom of each table stating that the calculated office concentrations are for Open Plan condition: 1 occupant, 5.94 m<sup>2</sup> (64 ft<sup>2</sup>) floor area, 4.17 L/s (8.84 cfm) clean air ventilation rate.

Laboratory reports used for compliance to the Section 5.7.2.1 – IAQ Acceptance Criteria # 1 may also be used to show compliance with Section 5.7.2.2 – IAQ Acceptance Criteria # 2. The Laboratory reports shall include all of the information listed in Section 5.7.10 (Appendix D) of this IAQ specification. Furthermore, any submitted testing data shall not be older than one (1) year from the “Final” bid proposal due date.

However, submitted testing data using a previous version of the BIFMA M7.1 Standard will be acceptable provided that the tests conducted are not older than one (1) year from the “Final” bid proposal due date and that the previous BIFMA version is no earlier than either the BIFMA M7.1-2006 or BIFMA M7.1-2005, respectively. Any earlier version of the BIFMA standard(s) will not be acceptable and if submitted will be considered non-responsive to this IAQ specification.

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### 5.7.6 Target VOCs Maximum Allowable Office Concentration Emission Tests (Mandatory)

The maximum allowable office VOC concentrations requirements for individual chemical compounds listed in Table 5.7.2.2.1 of this IAQ specification, are based on relevant health-related guidelines from the California Environmental Protection Agency's Office of Environmental Health Hazard Assessment (OEHHA), Air Toxicology and Epidemiology Section's non-cancer chronic Reference Exposure Limits (cRELs) for toxic individual VOCs (iVOCs) (See Section 5.7.11.1 – References of this IAQ specification for citations). The cRELs for the iVOCs are established by OEHHA as mandated in the "Air Toxics Hot Spots Information and Assessment Act", AB 2588, Connelly, as amended by SB 1731, Calderon. The cRELs are designed to protect individuals who work in the vicinity of emissions of these substances. They are based on the most sensitive relevant adverse health effect reported in the medical and toxicological literature. A Chronic Reference Exposure Level (CREL) is an airborne level that would pose no significant health risk to the most sensitive individuals in the population indefinitely exposed to that level. CRELs are based solely on health considerations, and are developed from the best available data in the scientific literature.

For screening of building materials based on their laboratory-derived emission factors, the maximum allowable office concentration limits are generally set at 1/2 of the control level (e.g., 1/2 CREL). This conservative approach is taken because there are often additional sources of iVOCs in the office space besides office furniture.

In the case of formaldehyde and acetaldehyde, 1/2 of their CRELs (1.5 µg/m<sup>3</sup>, and 4.5 µg/m<sup>3</sup>, respectively), are close to levels encountered in outdoor air, as well as close to their limits of detection in air.

OEHHA developed an 8-hour cREL for formaldehyde based on its 1-hour acute cREL (94 µg/m<sup>3</sup>); this value was set at 33 µg/m<sup>3</sup>. Hence, the acceptance criterion for formaldehyde has been set at 16.5 µg/m<sup>3</sup>.

OEHHA has yet to establish an 8-hour REL for acetaldehyde; this is likely to be several times higher than the current REL. In the interim, the maximum acceptable limit for this specification is a value, 9 µg/m<sup>3</sup> for acetaldehyde.

**Table 5.7.7 Workstation Component Information (Sample)**

Component ID	Sub-part type and ID	Material	Process	Manufacturer & Model #
Panel	#1 Fabric <sup>1</sup>	Nylon	Spun	Company A City Y, State Model #675454
Panel	#2 Fabric <sup>2</sup>	PET	Spun	Company B City Y, State Model # 45689
Panel	#3 Panel Covering <sup>3</sup>	Perforated aluminum	Cold rooled and laser cut perforations	Company C City Y, State Model #675454

<sup>1</sup> All significantly different offered fabrics or panel coverings should be listed in this Table.

<sup>2</sup> All significantly different offered fabrics or panel coverings should be listed in this Table.

<sup>3</sup> All significantly different offered fabrics or panel coverings should be listed in this Table.

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Component ID	Sub-part type and ID	Material	Process	Manufacturer & Model #
Panel	Panel Core	Fiber board glass fiber Urea/formaldehyde resin	Rotary mixed and hot pressed	Company X City Y, State Model Quiet 100 # 45678
Panel	Panel Core Coating Both Sides	acrylic sealant	UV cured	Company X City Y, State Model # 4545454
Panel	Panel Adhesive 1	HDPE	Hot gun	Company X City Y, State Model # 4545454
Panel	Panel Adhesive 2	PET (100% PC recycled content)	Hot gun	Company X City Y, State Model # 4545454
Panel	Panel Frame	steel	rolled	Company X City Y, State Model # 4545454
Panel	Panel #123 Fabric	Polyester	Spun	Company X City Y, State Model # 4545454
Panel	Panel #456 Fabric	Wool	boiled	Company X City Y, State Model # 4545454
Panel	Panel #789 Fabric/cover	Perforated aluminum	Die cut	Company X City Y, State Model # 4545454
Work-surface	Work-surface Core	Particle board 35% PC Recycled wood soy resin	Rotary mixed Hot pressed	Company X City Y, State Model # 4545454
Work-surfaces	Work-surface Top Laminate	melamine	Hot poured and pressed	Company X City Y, State Model # 4545454
Work-surfaces	Work-surface Underside Backer #1	Craft paper	extruded	Developed in-house
Work surfaces	Worksurface Underside Backer #1	Tevlar	extruded	Company X City Y, State Model # 4545454
Work surfaces	Worksurface Adhesive #1	Acrylic	UV cured	Company X City Y, State Model # 4545454
Work surfaces	Worksurface Adhesive #2	Acrylic	UV cured	Company X City Y, State Model # 4545454
Storage Unit	Storage Drawers shelves, cabinets and files	Painted Steel	Powder coated	Company X City Y, State Model # 4545454

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Other possible VOC sources: thread locking compounds, anti-fungal compounds, cleaners or spot removers used during manufacturing, other adhesives used to assemble on site; paints, coatings or finishes including mold or mildew retardants, flame retardants, fabric or surface sealants, water repellents, etc.

### 5.7.7 Clarification on Certifications (Mandatory)

Certifications are not required for compliance to this IAQ Specification. However, certification(s) submitted with the bid proposal will be accepted provided that the certification documentation explicitly states the offered open office panel system chamber testing result(s) meet the IAQ acceptance criteria and/of allowable limits specified in this IAQ specification and the proposed system(s) was emission tested in accordance with the ANSI/BIFMA M7.1-2007 Standard including that (but not limited to) the following; all of the required submittals are submitted with the bid proposal, all of the submitted information, as required, in Section 5.7.8 (Workstation Component Information – Table B2), all of the required Laboratory Reports, and submitted within the CA IAQ Workbook, via CD, as required. Further specific clarifications as follows:

Clarification on Chamber Emission Testing Requirements: The open office panel system shall be tested in accordance with the ANSI/BIFMA M7.1-2007 Standard Method For Testing VOC Emission From Office Furniture Systems, Components And Seating for both Section 5.7.1.1 & 5.7.1.2 – IAQ Acceptance Criteria's #1 & #2 and the maximum allowable limits in Section 5.7.6 (Table A1). Chamber tests using previous versions of the BIFMA M7.1 will also be acceptable for emission testing conducted prior to September 2007, since the current ANSI/BIFMA M7.1-2007 Standard was formally approved in September 2007. Chamber test protocol in accordance to alternate "Non-BIFMA M7.1" standards will not be acceptable for this RFP.

Clarification on Chamber Emission Testing – Full Scale Chamber: A full workstation representative of the offered open office panel system emission tested in accordance with ANSI/BIFMA M7.1-2007 Standard testing protocol, tested in a large/full scale chamber shall meet the configuration requirements for surface area specified in Appendix A – Section A2.1 of the ANSI/BIFMA M7.1-2007 Standard this reference may be accessed using the following link: <http://www.bifma.org/standards/index.html>

Clarification on Chamber Emission Testing – Mid-Scale Chamber: In lieu of full scale chamber testing, Mid-scale chamber testing will be acceptable provided that each of the primary workstation components (i.e. a panel, a work-surface, and a storage unit) representative components offered in the open office panel system workstation are emission tested in accordance with the ANSI/BIFMA M7.1-2007 testing protocol.

Clarification on Chamber Emission Testing – Small Chamber: In lieu of full or Mid-scale chamber testing, small scale emission testing will be acceptable provided cut pieces of the primary pieces of the workstation components (i.e. a panel, a work-surface, and a storage unit) representative of the components in the offered open office panel system workstation are emission tested in a small chamber in accordance with the ANSI/BIFMA M7.1-2007 Standard testing protocol. Small scale chamber testing may be conducted in conjunction with mid-scale chamber testing of components. Component pieces tested in small scale chambers must be representative of the component's full workstation assembly including the fabric, layers, core materials, coatings, adhesives found in the component in the product, and at least one true edge that represents the relative proportion of edge to planar component surface area in the offered full workstation system and shall include 20 square inches of surface of the component exposed in the chamber. Dry cutting methods shall be used to avoid grease, oil, solvents or other chemicals from contaminating cut test specimens. Non-true edges may be taped using low emitting aluminized tape or butted against a metal frame or sealed with a low emitting paraffin wax. The primary component pieces for mid and small scale chamber

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tests shall be suspended on an open gate exposing front and back surfaces in the chamber.

Clarification on Office Emission Concentration Calculation Requirements: The emission concentrations shall be calculated using the specific office model equations and parameters defined in the ANSI/BIFMA M7.1-2007 Standard. Only the ANSI/BIFMA M7.1-2007 Standard office model parameters:  $Q_{\text{office}} = 15 \text{ m}^3/\text{h}$ , office floor area =  $5.94 \text{ m}^2$ , office volume =  $16.3 \text{ m}^3$ . When components are mid or small chamber tested, the net emission shall be calculated using the total component surface areas of each primary components the ANSI/BIFMA M7.1-2007 Open Plan workstation configuration listed in Table A2.1 of ANSI/BIFMA M7.1-2007:  $11.08 \text{ m}^2$ , for panels,  $6.103 \text{ m}^2$  for work surfaces, and  $4.569 \text{ m}^2$  for storage units, respectively.

### 5.7.8 References, Abbreviations, Definitions, and Symbols

- Acute Reference Exposure Level, May 2000: [http://www.oehha.ca.gov/air/acute\\_rel/allAcRELS.html](http://www.oehha.ca.gov/air/acute_rel/allAcRELS.html)
- ANSI/BIFMA Furniture Emissions Standard M7.1-2007 (*Standard Test Method for Determining VOC Emissions from Office Furniture Systems, Components and Seating*), approved September 5<sup>th</sup> 2007: <http://www.bifma.org/standards/index.html>
- ANSI/BIFMA Furniture Emissions Standard X7.1-2007 (*Standard for formaldehyde and TVOC emissions of low-emitting office furniture systems and seating*), August 2<sup>nd</sup> 2007: <http://www.bifma.org/standards/index.html>
- California Department of Health Services (DHS) (*Standard Practice for the Testing of Volatile Organic Emissions from Various Sources using Small-Scale Environmental Chambers*), July 2004: <http://www.dhs.ca.gov/iaq/VOCS/Practice.htm>
- Carter, R. D. and Zhang, J.S. 2007. Definition of standard office environments for evaluating the impact of office furniture emissions on indoor VOC concentrations. *ASHRAE Transactions* 113(2):466-77.
- Chronic Reference Exposure Levels, February 2005: [http://www.oehha.ca.gov/air/chronic\\_rels/AllChrels.html](http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html)
- European Collaborative Action *target compound list*, European Commission, 1997
- Proposition 65: Safe Harbor Levels, August 2005: <http://www.oehha.ca.gov/prop65/pdf/aug2005statusreport.pdf>
- Toxic Air Contaminant Identification List, December 1999: <http://www.arb.ca.gov/toxics/quickref.htm#TAC>
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### 5.7.9 Abbreviations, Symbols, and Definitions

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
BIFMA	Business and Institutional Furniture Manufacturer's Association
CARB	California Air Resources Board
CAS	Chemical Abstracts Service (number)
CD	CA IAQ Workbook (via electronic media "Compact Disk")
CREL	Chronic Reference Exposure Level
cReLs	Chronic Reference Exposure Limits
CTR	Certified Test Reports
DNPH	2,4-Dinitrophenylhydrazine
EPA	U.S. Environmental Protection Agency
GC/MS	Gas Chromatography/Mass Spectrometry
HPLC	High Performance Liquid Chromatography

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## Open Office Panel Systems Indoor Air Quality Specification

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iVOCs	Individual Volatile Organic Compounds
IAQ	Indoor Air Quality
LEED-NC	U.S. Green Building Council's Leadership in Environmental & Energy Design (LEED) New Construction (NC) Volume 2.0
MADL	Maximum Allowable Daily Levels
MSDS	Material Safety Data Sheet
MW	Molecular weight
NIST	National Institute of Standards and Technology
NSRL	No Significant Risk Level
OEHHA	Office of Environmental Health Hazard Assessment, Cal/EPA
Prop 65	Safe Drinking Water and Toxic Enforcement Act of 1986 (No Significant Risk Levels for Carcinogens and Maximum Allowable Dose Levels for Chemicals Causing Reproductive Toxicity)
$Q_{space}$	Air ventilation rate in the space ( $m^3 h^{-1}$ )
QA/QC	Quality assurance/quality control
REL	Reference Exposure Level(s)
RSD	Relative Standard Deviation
State/CA	State of California
TAC	Toxic Air Contaminant
TVOC	Total Volatile Organic Compound(s)
VOC	Volatile organic compound(s)
$\mu g$	microgram