Watching Your CARBs: A guide to monitoring formaldehyde emissions in your supply chain and your finished products

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Agenda

- Introduction to UL and Indoor Air Quality
- CARB ATCM for Formaldehyde from Composite Wood Products
- Chemical Emissions Certifications for Finished Products
- Questions



Our mission drives everything we do....

Working for a safer world since 1894



UL founder William Henry Merrill following 1893 Chicago World's Fair

Since the Chicago World's Fair we have been on the leading edge of safety science

The Definition of Safety is Evolving...So is UL

Complex issues of today have replaced concerns of the past. And the safety landscape of tomorrow is yet to be defined.

- Fire and Electrical Safety
- Wireless Testing
- Performance Testing
- Indoor Air Quality
- Chemical Regulations
- Transaction Security
- Renewable Energy





Indoor Air Quality Stats and Facts





MORE POLLUTED THAN OUTDOOR AIR³



Health Impacts of Poor Indoor Air





Every day in the U.S.

40,000 people miss work due to asthma
30,000 people suffer attacks
5,000 people visit the ER due to a severe attack

Facts About Indoor Chemicals

- Wide variety of Volatile Organic Compounds
- Typically 50 100 (or more) VOCs found in indoor air samples
- Concentrations vary by building type, interior materials, indoor activities, and proximity to outdoor sources (roads, industrial facilities, etc.)
- Generally measured in the part per billion range



Top 25 VOCs Identified in Building Air

- 1. Toluene (Methylbenzene)
- 2. Formaldehyde
- 3. Hexanal
- 4. Undecane
- 5. Dodecane
- 6. Benzaldehyde
- 7. Xylene (para and/or meta)
- 8. Acetic acid
- 9. Cyclopentasiloxane, decamethyl
- 10. Decane
- 11. Nonyl aldehyde
- 12. 1-Hexanol, 2-ethyl
- 13. Benzene, ethyl

- 14. Acetaldehyde
- 15. Xylene, ortho
- 16. Tetradecane
- 17. Pentadecane
- 18. Nonane
- 19. Propylene glycol
- 20. Decanal
- 21. Heptane
- 22. Pinene, à
- 23. Benzene
- 24. Limonene
- 25. Tridecane



Indoor Sources are Numerous

- Furniture and Cabinetry
- Wallcovering, Flooring, Building Materials
- Paints, Adhesives, Sealants
- Cleaners
- Occupants/Occupant Activities
- Electronic Equipment







What do consumers know about IAQ?



% Certain - High IQ
% Certain-Total Sample



IAQ Certification – Importance by Product Type

Extremely/Very Important That Product be IAQ Certified



Source: Harris Interactive, December 2008

<u>Tier 1</u>

Paint, Carpet, Flooring, and Bedding stand out as the types of products for which consumers will insist on IAQ certification (60%+)

<u>Tier 2</u>

Textiles, Furniture and Appliances are the next most important group to consumers in terms of IAQ certification (45%+)

<u> Tier 3</u>

Consumer Electronics (Computers, TVs and Printers) are the least important product group in terms of IAQ certification (30%+)

CARB Air Toxics Control Measure for Formaldehyde Emissions from Composite Wood Products

California Air Resources Board

California Environmental Protection Agency

Air Resources Board

Formaldehyde is used in wood binding adhesives and resins.

Formaldehyde was designated as a toxic air contaminant (TAC) in California in 1992 with no safe level of exposure. State law requires ARB to take action to reduce human exposure to all TACs.

The International Agency for Research on Cancer (IARC) reclassified formaldehyde from "probably carcinogenic to humans" to "carcinogenic to humans" in 2004, based on the increased risk of nasopharyngeal cancer.

The Air Resources Board (ARB) evaluated formaldehyde exposure in California and found that one of the major sources of exposure is from inhalation of formaldehyde emitted from composite wood products.

The first emission standards became effective on January 1, 2009.



Composite Wood Products



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Medium Density Fiberboard (MDF)

Particleboard (PB)

Hardwood Plywood (HWPW)

Solid Wood (not subject to regulation)

Decreasing Formaldehyde Emissions

Decreasing Resin Content

CARB Formaldehyde Emission Limits

Product	Phase 2 Levels (ppm***)
Hardwood Plywood – Veneer Core	0.05
Hardwood Plywood – Composite Core*	0.05
Particleboard	0.09
MDF	0.11
Thin MDF**	0.13

* Hardwood plywood panel using particleboard or MDF in the core.

** Maximum thickness of 8 mm.

*** Chamber concentration according to ASTM E 1333 test method.



Requirements of the Supply Chain

Classification	Definition	Requirements
Manufacturer	Produces MDF, PB, or HWPW	 Third Party Certification Emission Standards Quality Assurance Facility Inspections Product Labeling Statements of Compliance Recordkeeping
Distributor	Purchases composite wood or finished products for resale (not manufacturer or retailer)	 "Reasonable prudent precautions" Statements of Compliance Recordkeeping
Importer	Liable for payment of any duties (or authorized agent)	 "Reasonable prudent precautions" Statements of Compliance Recordkeeping
Fabricator	Uses composite wood to make finished products (including laminated products)	 "Reasonable prudent precautions" Product Labeling Statements of Compliance Recordkeeping
Retailer	Sells composite wood or finished products directly to consumers	 "Reasonable prudent precautions" Recordkeeping

3rd Party Certification Requirements for "Manufacturers"

- Quarterly Testing by 3rd Party Certifier by Primary or Secondary Test Method
- Quarterly facility inspections and audits of manufacturer records
- ✓ Establish Quality Control Manual
- ✓ Establish Quality Control Testing for Formaldehyde (1 test per shift)
- ✓ Train Quality Control Personnel



Primary Test Method

ASTM E 1333 - Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using a Large Chamber



- 1. Test newly manufactured boards
- 2. Condition boards for 7-days
- 3. Measure formaldehyde concentration after 16-20 hours in chamber
- 4. Compare measured chamber concentration to acceptance criteria

Secondary Test Method

ASTM D 6007 - Standard Test Method for Determining Formaldehyde Concentrations in Air from Wood Products Using a Small-Scale Chamber

Equivalence must be determined by each lab 1 time per year.



Test Method allows significant flexibility in conditioning and chamber time.

The timing should be aligned with ASTM E 1333 to ensure good correlation.

Recordkeeping Requirement for "Fabricators"





Labeling Requirement for "Fabricators"

Clearly label all finished goods containing HWPW, PB, or MDF destined for sale in California

CARB strongly recommends labeling of both the finished good and the box

finished good and the box

Labels must include:

1. Fabricator's name

Green Day Furniture Company 01/2009 California 93120 compliant for formaldehyde OR California 93120 compliant for formaldehyde. Produced with all ULEFbased products.

- 2. Date the finished good was produced
- 3. A statement of compliance
- 4. Additional note if NAF/ULEF resins used



Deconstructive Test Method

CARB Standard Operating Procedure for Finished Good Test Specimen Preparation Prior to Analysis of Formaldehyde Emissions from Composite Wood Products:



Planing or sanding the surface materials off of the composite wood core will typically increase the formaldehyde emissions.

However, testing deconstructed products can be a good indicator with proper context.

Warning - Finished Good Testing May Yield Higher Results than Original Panel Test!



Potential Due Diligence Program for "Fabricators" and "Retailers"

Review your products to determine if plywood, PB, or MDF are used

Review "statements of compliance" from all composite wood suppliers (or suppliers of components that contain composite wood)

Determine risk rating for each type of composite wood and supplier (based on locations, purchasing history, and other factors)

Conduct independent testing of raw composite wood (prior to laminating or coating) or deconstructive testing



Emissions Testing and Certification for Finished Products

Product Emissions Testing Process

Air Purification and Conditioning

Environmental Chamber Testing Predicting Indoor Exposure Levels



Sample Preparation Analysis and Reporting

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Measurement Technology

VOC Measurement

- ASTM D 6196 / ISO 16000 Part 6
- Collect chamber air on Tenax Sorbent Media, thermally desorb chemicals and analyze by GC/MS
- Applicable to thousands (1000s) of chemicals

Aldehyde Measurement

- ASTM D 5197 / ISO 16000 Part 3
- Collect chamber air on DNPH Cartridge, elute with acetonitrile and analyze by HPLC
- Primarily for formaldehyde and acetaldehyde





Exposure Modeling

Chamber measurements are used to calculate product emission rates.

Emission rates are used to calculate indoor exposure concentrations in typical usage environment (home, office, classroom, etc.).





UL 2821: GREENGUARD Test Method for Building Products and Furnishings

Measurements methodology follows <u>BIFMA</u> and <u>California DPH</u> guidelines.

GREENGUARD test includes additional measurements over a 7 to 14 day period to fully characterize emissions.







GREENGUARD Standards

GREENGUARD Certification

TVOC < 500 ug/m3 IVOC < 1/10th ACGIH TLV (occupational limit) Formaldehyde < 50 ppb Total Aldehydes < 100 ppb

GREENGUARD Gold Certification

TVOC < 220 ug/m3 IVOC < 1/100th ACGIH TLV or ½ CREL* Formaldehyde < 7.3 ppb (9 ug/m3) Total Aldehydes < 43 ppb *CREL covers ethylene glycol, napthalene, acetaldehyde, and a few others







What is GREENGUARD?

- Certifying products for low chemical emissions since 2001
- Acquired by Underwriters Laboratories (UL) in 2011
- Recognized North American leader in indoor air quality certifications
- Approximately 500+ participating manufacturers across 28 product categories
- More than 14,000 products represented in our free online product guide
- Science based testing and health
 assessments



PRODUCT CERTIFIED FOR LOW CHEMICAL EMISSIONS UL.COM/GG UL 2818





Why Third Party Certification Matters

- Indoor air issues are exceedingly complex
- Demonstrates a manufacturer's commitment to sustainability and concern for customer's well-being
- The marketplace is increasingly demanding substantiation of product claims
- Helps purchasers and consumers identify legitimate green products





Achieving GREENGUARD Certification

- Extensive review of raw materials and manufacturing processes
- Products are tested for more than 10,000 chemicals
- Testing according to ISO and ASTM guidelines in state-of-the-art laboratories around the world
- Products are certified to the UL GREENGUARD Standards, which are based on emission criteria from the US EPA, State of California and other reputable public health agencies









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