

# Chemical Emissions And Material Selection for Green Buildings

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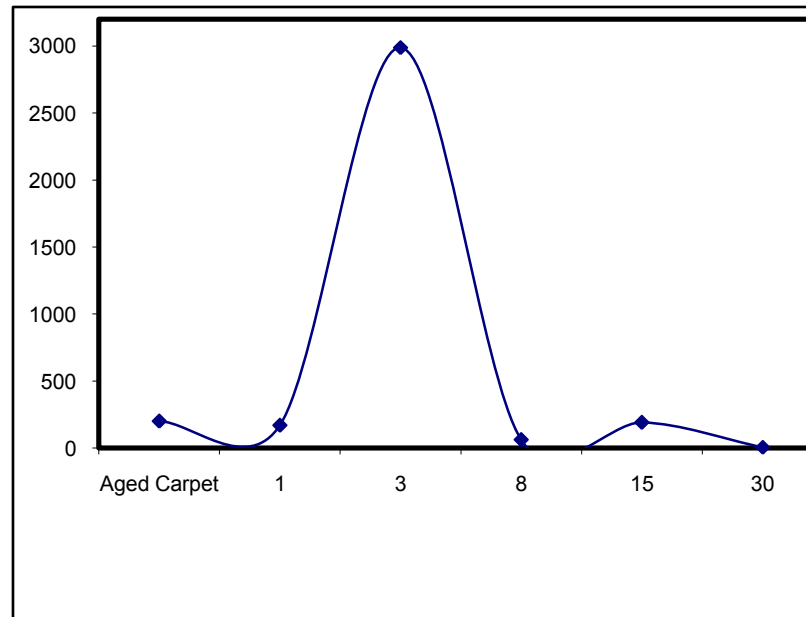
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## Key Messages

- In Australia voluntary schemes exist that are pro-actively driving awareness and product improvement.
- Covers a broad spectrum of building products used in construction, fittings and furnishings.
- Australian manufacturers of materials are meeting material emission requirements.
- The focus on material emission has been beneficial to improving the indoor environment.

# Formaldehyde/VOCs in Buildings

- Formaldehyde and VOCs are higher inside buildings than in outdoor air
- Higher Formaldehyde/VOC concentrations found in new or renovated buildings
- Emissions decay over time



# Regulating Material Emissions

- **South Korea**  
**Public Facility Indoor Air Quality Management Regulation**  
  
Applicable to public facilities or spaces. Includes a list of banned construction materials based upon emissions rates from building materials
- **Germany**  
**Committee for Health-related Evaluation of Building Products**  
**(Ausschuss zur gesundheitlichen Bewertung von Bauprodukten**  
**- AgBB)**

Mandatory scheme with regard to the use of selected construction products which may present a danger to human health or a significant deterioration of human comfort. Manufacturers of flooring products have to apply for approval for their product to be used indoors

# Regulating Material Emissions

- Australia

None

Voluntary schemes are filling the void to recommend guideline limits for building products and some are becoming a driving force for compliance by manufacturers/suppliers

Voluntary schemes do not cover all potential building products

# Voluntary Schemes in Australia

- Organisations

Green Building Council of Australia (GBCA) Green Star Rating Scheme

Indoor Environment Quality section lists criteria for:

- VOC emissions in flooring, furniture, furnishings and fittings and VOC content in paints/coatings/adhesives/sealants
- Formaldehyde minimisation in engineered wood products

Housing Industry Association GreenSmart Scheme

# Voluntary Schemes in Australia

- **Eco-Labels**

Good Environmental Choice (GECA)

Eco-labels for particular product groups contain requirements for VOC and/or Formaldehyde emissions

# Voluntary Schemes in Australia

- **Industry Associations**

Carpet Institute of Australia Australian Carpet Classification Scheme

Mandatory requirement to meet limits on total VOCs, Formaldehyde and specific chemicals of concern for carpet products

Australasian Furnishing Research & Development Institute (AFRDI)

Commercial furniture sustainability standard that considers limits on total VOCs and Formaldehyde

# Material Emission Test Methods

Throughout the world there are different approaches to testing the material emissions:

- Small chamber or large environmental chamber

Small chamber is more common approach

ASTM D5116 / ISO 16000-9 comparable emission chamber guides

- Sampling time for emissions and acceptance criteria do vary to a large degree

# Material Emission Test Methods

## Emission Sampling Time:

### USA

Carpet	24 hours (e.g. CRI GL)/14 Days (CRI GL Plus)
Furniture	7 Days (e.g. BIFMA)
Building Materials	14 Days (e.g. California Section 01350) 7 Days (e.g. GREENGUARD)

### Europe

Flooring	after 3 and 28 days (e.g. AgBB)
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### Australia

Carpet/Flooring	24 hours (e.g. GBCA, Carpet Institute)
Furniture	7 days (e.g. GBCA, AFRDI)

# Material Emission Test Methods

## Emission Acceptance Criteria:

### USA

TVOC (0.5 mg/m<sup>2</sup>/hr) plus selected toxics

e.g. CRI Green Label

TVOC plus toxicity profile

e.g. California Section 01350  
GREENGUARD

### Europe

TVOC (10 mg/m<sup>3</sup> and 1 mg/m<sup>3</sup>) and  
toxicity profile

e.g. AgBB

### Australia

TVOC (0.5 mg/m<sup>2</sup>/hr)

e.g. GBCA

TVOC (0.5 mg/m<sup>2</sup>/hr) plus toxics

e.g. Carpet Institute

# Green Buildings Major Driver

The Green Building Council of Australia Green Star Rating Scheme has been the major driving force in Australia for the testing of emissions of building construction, furnishings and furniture

The extent of reach has gone beyond those specific products specified to be tested as per Green Star

# Scope of Building Materials

- **Flooring**
  - Carpet
  - Vinyl Tile/Sheeting
  - Cork
  - Rubber
- **Insulation**
  - Fibreglass
  - Rockwool
  - Polyester
  - Foam Rubber
- **Other**
  - Clay Bricks
- **Fit Out**
  - Plasterboard
  - Fibre Cement Board
  - Ceiling Tiles
  - Composite Wood (plywood, particleboard, MDF, bamboo)
- **Furniture Components**
  - Natural Wood
  - Stained/Varnished/Coated Wood
  - Plastics
  - Upholstery Fabrics
  - Glues (solvent & water based)

# Typical Chemical Emissions

- CETEC through FORAY (NATA) Laboratories conducts emission testing of materials. Supplies documentation to manufacturers/suppliers for organisations (Green Star), eco-labels and industry associations
- Have amassed a database of the emission profile of materials used in the construction, fit out and furnishing of a building:
  - Chemical emission rates; and
  - VOC fingerprint

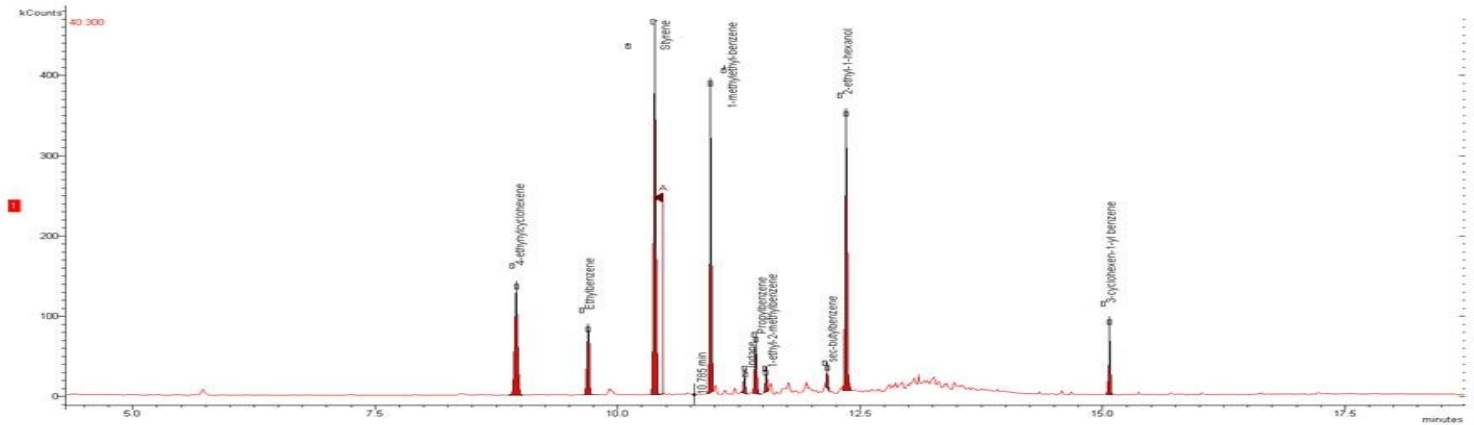
# Typical Chemical Emissions - Flooring

Flooring	Total VOC Emission mg/m <sup>2</sup> /hr
Carpet (Australian)	0.1 – 0.3
Carpet (non-Australian)	0.2 – 0.7
Vinyl (Australian)	0.05 – 0.2
Vinyl (non-Australian)	4
Rubber	0.5 – 2
Cork	0.1 – 0.4
Lacquered Timber	0.1 – 0.3

Acceptance criteria <0.5 mg/m<sup>2</sup>/hr (24 hours)

# Typical Chemical Emissions - Flooring

VOC fingerprint of a carpet



# Typical Chemical Emissions - Insulation

Insulation	Total VOC Emission mg/m <sup>2</sup> /hr	Formaldehyde mg/m <sup>2</sup> /hr
Fibreglass Insulation (Australian)	0.05 – 0.3	0.02 – 0.1
Fibreglass Insulation (non-Australian)	0.4	0.1
Polyester Insulation	0.05 – 0.15	<0.05
Rubber Insulation	0.1 – 0.5	<0.05

# Typical Chemical Emissions – Fit Out

Fit Out	Total VOC Emission mg/m <sup>2</sup> /hr
Plasterboard	0.05 – 0.2
Cement Fibre Board	0.02 – 0.1
MDF	0.1 – 0.3
Plywood	0.1 – 0.3
Particleboard	0.1 – 0.5
Bamboo	0.1
Ceiling Tiles	0.1 – 0.4

Acceptance criteria <0.5 mg/m<sup>2</sup>/hr (7 days)

# Typical Chemical Emissions – Furniture

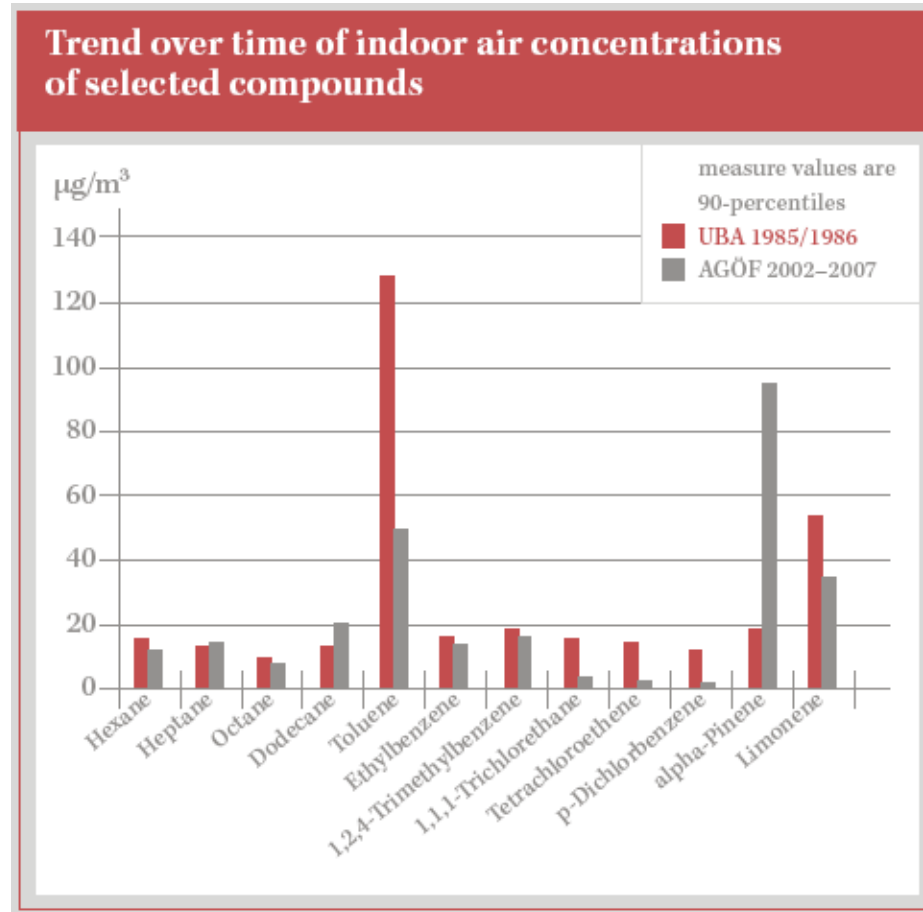
Furniture	Total VOC Emission mg/m <sup>2</sup> /hr
Natural Wood	0.2 – 0.5
Coated Wood	<0.1
Steel/Aluminium	<0.01
Plastic	<0.05 – 0.2
Upholstery Fabric	<0.05 – 0.2
Solvent Based Glue	5
Water Based Glue	<0.05

Acceptance criteria <0.5 mg/m<sup>2</sup>/hr (7 days)

# Indoor Air Quality in Green Buildings

- Has the emphasis upon material chemical emissions been beneficial to indoor air quality; i.e. airborne chemicals in new (green) buildings
- CETEC research program to investigate airborne VOCs/Formaldehyde levels in new buildings at post-construction pre-occupancy stage
  - Has TVOC been reduced in new buildings?
  - Has the profile of VOCs in new buildings changed?
  - What is health impact?

# European Experience



# Australian Trend

- TVOC (before)

4mg/m<sup>3</sup> (Brown et al 1994)

5mg/m<sup>3</sup> (Brown 2002)

- Formaldehyde (before)

0.12mg/m<sup>3</sup> (Brown 2002)

- TVOC (now)

0.3 – 1.5mg/m<sup>3</sup>

benchmark 0.5mg/m<sup>3</sup>  
(USGBC LEEDS)

- Formaldehyde (now)

0.03mg/m<sup>3</sup>

benchmark 0.1mg/m<sup>3</sup>  
(WHO)

- Some VOCs found at much lower airborne concentration

# Outcomes

- Voluntary schemes providing aspiration for improving indoor environment and there would appear to be indications of benefits
- Evolving knowledge by voluntary scheme stakeholders
- Little recognition of different toxicities of products
- Australian manufacturers/suppliers are able to comply with material chemical emission requirements

# Outcomes

- Voluntary schemes in Australia do not emphasize chemical emission testing of paints/coating/adhesives/sealants
- Is VOC content of paints/coatings/adhesives/sealants a suitable indicator of indoor environment impact
  - e.g. do zero VOCs actually exist, i.e. how do you measure zero
  - e.g. exempt VOCs as volatile organic compounds that are not considered as VOCs
  - e.g. little consideration of toxicities or time-emission profile