

# Testing and Labelling of Construction Products in Europe According to Chemical Emissions into Indoor Air

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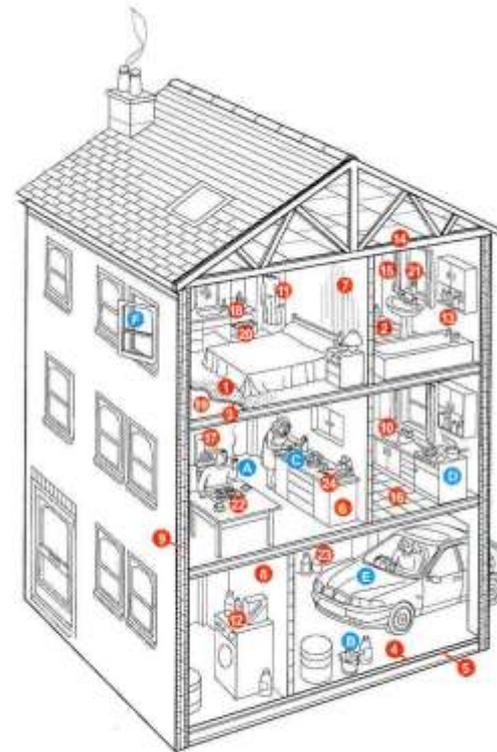
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# Indoor pollutant concentration

Concentration of pollutant indoors depends on level in outdoor air, release into indoor air, removal by ventilation, sorption to surfaces and reactions.



## ACTIVITIES

- A Cigarette smoking
- B Painting of windows, doors etc.
- C Furniture polishing
- D Cooking
- E Car exhaust/petrol vapour
- F Ventilation (outdoor air pollutants)

## PRODUCTS

- 1 Carpet
- 2 Vinyl flooring
- 3 Carpet underlay
- 4 Self-levelling screed
- 5 Liquid applied damp proof membrane
- 6 Particleboard furniture
- 7 Wallpaper
- 8 Walls painted with emulsion
- 9 Cavity wall insulation
- 10 Sealant around worktop in kitchen/bathroom
- 11 Dry-cleaned clothes
- 12 Store of cleaning materials
- 13 Toiletries in bathroom
- 14 Timber in joists
- 15 Curtains
- 16 Vinyl adhesive
- 17 Open fire
- 18 Perfume
- 19 Chipboard flooring
- 20 Moth repellent
- 21 Air freshener
- 22 Printing ink
- 23 Pesticides
- 24 Glues for hobby

# Control of sources

Therefore.... source control combined with appropriate ventilation with 'fresh' outdoor AQ achieves good IAQ

Construction, consumer and furnishing products are an important source of **organic vapour phase emissions** associated with IAQ problems in buildings;

**VOC, VVOC** (including formaldehyde), **SVOC**

Also Ammonia.

- ❖ Initiatives on source control are dominated by national schemes; primarily **construction products**
- ❖ National schemes act as barriers to trade, and a multitude of schemes confuse consumers
- ❖ Historically many technical and political challenges to harmonisation across Europe:
  - **test methods**
  - **data evaluation**

# Main labelling schemes in Europe

AgBB, Germany (regulatory)

M1, Finland (voluntary)

DICL, Denmark (voluntary)

Anses (regulatory), AFSSET (voluntary) France

Belgium (regulatory)

E class (formaldehyde only)

Plus a range of sector schemes such as ecolabel, nature plus, blue angel...



## Common features

- ❖ Environmental chamber test of product to determine chemical emission rate
- ❖ Tests based on ISO 16000 series standards (& EN 717-1)
- ❖ Evaluate after 28 days (but some schemes have additional evaluation points)

## Also many differences

e.g. TVOC definition, use of sensory tests, requirements for individual VOCs.

# Test Method

# Start of harmonised emission testing - 1989 - HCHO from wood based products



- ❖ Conditions 1ach, 23°C, 45%RH
- ❖ Loading ratio of 1 m<sup>2</sup> m<sup>-3</sup>
- ❖ Determine 'steady state' formaldehyde concentration in chamber
- ❖ Minimum test period of 10 days and maximum of 28 days
- ❖ Evolved into standard EN 717-1 primarily for wood based products

# Construction Products Directive/ Regulation

- ❖ CPD - European Council Directive 89/106/EEC
- ❖ Essential Requirement No.3; Hygiene, Health and the Environment
- ❖ A healthy indoor environment can be achieved by controlling sources and eliminating or limiting the release of pollutants into the air
- ❖ Superseded by CPR in 2013
- ❖ CEN/TC 351 mandated in 2006 to prepare harmonised EN standards.



# BS EN ISO 16000-9 & 10; 2006

- ❖ 23 °C, 50%RH
- ❖ Requirements for control of conditions and recovery of released chemical
- ❖ Minimum requirement for sampling of chamber / cell after 3 and 28 days
- ❖ Determine VOC emission rate per area product
- ❖ Informative annex defining model room (17.4 m<sup>3</sup>, 0.5 ach<sup>-1</sup>) and area specific air flow rate for product types



# BS ISO 16000-6: 2011

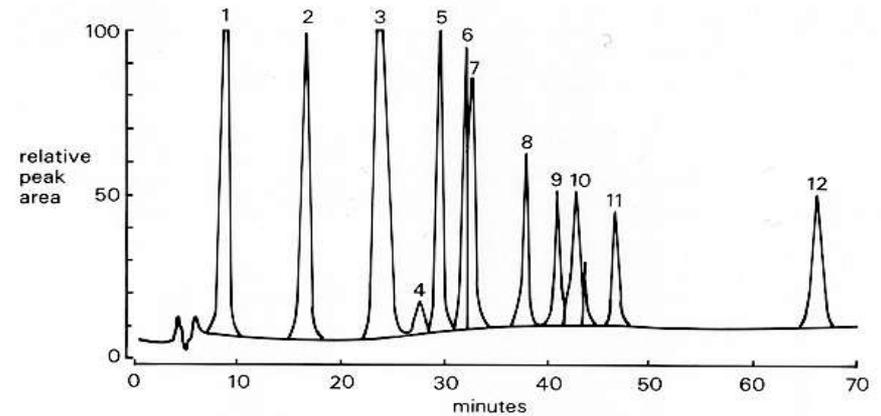


- ❖ VOC active sampling, thermal desorption and gas chromatography using MS or MS-FID
- ❖ Normative part requires use of Tenax TA adsorbent tube
- ❖ TVOC (FID &/or MS)(C6-C16), toluene equivalent
- ❖ Identify as many compounds as possible, particularly those representing the 10 highest peaks
- ❖ Informative annex on measurement of VVOC (<C6) and SVOC (>C16)
- ❖ Annex lists over 200 VOCs present in indoor air

# Formaldehyde analysis

BS ISO 16000-3:2011, Indoor air - Part 3: Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air - Active sampling method

Separation of eleven DNPH-carbonyl derivatives by gradient HPLC



- |                |                         |
|----------------|-------------------------|
| 1 DNPH reagent | 7 propanal              |
| 2 formaldehyde | 8 crotonaldehyde        |
| 3 acetaldehyde | 9 methyl vinyl ketone   |
| 4 acrolein     | 10 butanone             |
| 5 furfural     | 11 benzaldehyde         |
| 6 acetone      | 12 4-methylpentan-2-one |

# CEN TS 16516: 2013 and development of EN

- ❖ Voluntary 'harmonised' European 'Technical standard'
- ❖ Developed by CEN TC351 based on the EN ISO standards
- ❖ Requires use of chamber method as reference method with some limits on chamber parameters (e.g. >20 L volume)
- ❖ Reference /model room (30 m<sup>3</sup>) relating emission rate to concentration
- ❖ Data reporting as required by national labelling schemes
- ❖ TS revised by TC 351/WG2 during 2014/15; more requirements for analytical quality, specific TVOC definition, includes formaldehyde and SVOCs
- ❖ TC 351 WG2 recommended that revised pr EN proceeds to formal vote during 2016 for full EN status

# Data Evaluation



- ❖ Emission test is a regulatory requirement to demonstrate fitness for use of certain indoor products; flooring, coatings and adhesives
- ❖ Step 1 - registration and evaluation of ingredients  
Step 2 - testing and evaluation of emissions
- ❖ Chamber tests with thresholds for TVOCSUM (target+non-target+non-identified+carcinogens), sum of SVOCs, carcinogens, compounds with 'LCI' values and other 'non-assessable' compounds
- ❖ Assessment after 3 days and 28 days of product in chamber
- ❖ Pass or fail system

# AgBB 2015 update

- ❖ 196 compounds with listed **LCI (Lowest Concentration of Interest)** values, plus additional Cat 1 carcinogens listed.
- ❖ The assessment of some VVOCs and individual SVOCs are additional requirements; includes formaldehyde (LCI value  $100 \mu\text{g}/\text{m}^3$ ).
- ❖ The VVOC and SVOC LCI values must be included in the calculation of the R-value but not the TVOC value.

# Use of LCI in assessing mixtures



**R value** = sum of all  $R_i$  values

$R_i$  value = Ratio  $C_i / LCI_i$ , where

$C_i$  is the reference room mass concentration of compound  $i$ , and

$LCI_i$  is the LCI value of compound  $i$

*Requirement  $R < 1$*

# French mandatory labelling (Anses)

- ❖ DECREE relating to the labelling of construction and decoration products with their volatile pollutant emissions
- ❖ Labelling requirement since 1 September 2013 for all products
- ❖ Is a performance class system (not pass/ fail)

## TVOC at 28 days

<1.0 mg/m<sup>3</sup> = A+

<1.5 mg/m<sup>3</sup> = A

<2.0 mg/m<sup>3</sup> = B

>2.0 mg/m<sup>3</sup> = C

## Carcinogens

## 10 individual VOCs (LCI)

(A+ class defined by AFSSET LCIs)

ÉMISSIONS DANS L'AIR INTÉRIEUR *		
	<b>B</b>	A+
		A
		<b>B</b>
		C
Substances principales :		<b>B</b>
Émission totale :		<b>A+</b>

# Harmonisation of LCI values



- ❖ LCI values are applied in the evaluation and labelling of German, French and Belgian regulatory schemes
- ❖ LCI values have been independently derived by organisations resulting in different values for the same substance within labelling schemes
- ❖ Finland (M1) and Denmark (DICL) have committed to future inclusion of LCI values in product evaluation
- ❖ EU-LCIs are substance-specific values for the health-related evaluation of emissions from construction products

## EU LCI features

- ❖ EU-LCIs are health-based values used to evaluate emissions after 28 days from a single product during a laboratory test chamber procedure (as defined in the CEN TC 351 harmonised standard).
- ❖ EU-LCIs are applied in product safety assessment with the ultimate goal to avoid health risks from *long-term* exposure for the general population.
- ❖ EU-LCI values serve *a different purpose from IAQ guidelines*. They are intended only for evaluating emissions from building products and not for evaluating indoor air quality.

# EU LCI Features

- ❖ Since primary emissions decline with time, the 28-day timescale is considered a 'worst case' assumption for the long-term indoor air VOC emission scenario in the absence of oxidants.
- ❖ The test procedure (using chambers and correction factors relating to a 'reference' room) provides only an approximation to the situation in a real indoor environment; concentrations in actual rooms will depend on many factors including temperature, ventilation and the presence of other sources.
- ❖ EU-LCI values are usually expressed as  $\mu\text{g}/\text{m}^3$ .

# EU LCI setting rationale

- ❖ Substances that, for whatever reason, have identical or very similar (differing by 20% or less) AFSSET and AgBB LCI values are given an ‘**ascribed EU-LCI**’. If different, the lowest LCI value for the given substance in the two lists are used as the ascribed EU-LCI.
- ❖ Those substances with different values in the AgBB and AFSSET schemes are evaluated using an agreed protocol developed by an expert group (see ECA report no. 29) to derive a ‘**derived EU-LCI**’ value.
- ❖ In due course, the substances with ‘ascribed’ EU-LCIs will be re-evaluated using the protocol to produce ‘derived’ values. Other compounds will also be added to the list and evaluated.

# Substance evaluation using EU LCI protocol

A **summary fact-sheet** with a standardised format is generated for each substance. This comprises four main sections:

- ❖ General information
- ❖ Toxicological database (values derived from the data compilation process)
- ❖ Assessment factors used
- ❖ Rationale for the derivation of the EU-LCI value

The preparation of standardised *data compilation* and *fact sheets* ensures that the derivation of EU-LCIs is transparent.

# EU LCI progress and dissemination

- ❖ Full information about the **EU Sub Group on EU-LCI Values** and the current list of EU-LCI values is available at [www.EU-LCI.org](http://www.EU-LCI.org)
- ❖ The sub group is working under a mandate from DG Growth
- ❖ Currently there are ~58 ascribed EU-LCIs, ~38 with derived values and ~85 pending; therefore a considerable task remains.
- ❖ EU-LCIs form an integral part of the harmonisation framework for EU indoor products labelling schemes; performance classes for CE marking incorporating requirements for VOCs (&TVOC), SVOC, VVOC emissions based on the harmonised test method are under discussion.

# Conclusion

- ❖ Controlling indoor sources of pollutants has an increasing international profile driven in part by concerns about reduced rates of ventilation related to energy savings.
- ❖ The CPD recognised the need for control of indoor emissions 27 years ago. A harmonised EN emission test method supporting the CPR should be finalised in 2016.
- ❖ Harmonised methods of evaluating test data including EU-LCI values are an essential complementary activity.
- ❖ Products on the market in countries with no regulatory schemes could be labelled 'No Performance Declared'
- ❖ As well as the construction sector, emission tests are widely applied to in-car materials, and have been developed for furniture and other consumer products.

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