VOC Emissions under EU Construction Products Regulation

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Eurofins Product Testing A/S
Denmark, Germany, France, Netherlands, USA, China, …
World-wide largest lab for Volatile Organic Compounds (VOC) testing
Eurofins Product Testing – Locations

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Galten, Denmark near Arhus

Other business areas: Tests of food, feed, pharmaceuticals, genetics, environment

September 2011
European Construction Products Regulation

- Goal: Facilitate cross-border trade and overcome trade barriers in form of national rules and standards
- Provide a common technical language
  - mainly in harmonized European product performance standards, for use by manufacturers and regulators
- CE marking shows conformity with such standards, typically with declaration of a performance class
- Actual requirements still are specified by each EU Member State on its own
CPR specifies a.o. that

- any construction work must not pose any harm to hygiene or health of occupants or neighbors,
  - ...
  - by giving-off of toxic gas, or by presence of dangerous particles or gases in the air

- Further,
  - eliminate or limit the use of materials which may release pollutants, and the use of which results in concentrations greater than acceptable limits

**Interpretation into limit values for pollutants:**

- Done by each EU Member State
- Today only in France and Germany
Why are VOC emissions in focus?

- **VOC = Volatile Organic Compound**
  - e.g. solvents, additives, plasticizers, if volatile
  - under CPR / CEN: Any organic compound from n-hexane to n-hexadecane when analysed by GC/MS on a non-polar column - corresponding to a boiling range 69 – 287 °C with some exceptions

- **Excessive VOC emissions may contribute to**
  - Bad odour
  - Irritation
  - Total life dose of hazardous substances

- **Energy saving means reduced fresh air supply**
  - Less dilution of any emissions into indoor air results in
  - Higher air concentration of VOCs, if emissions are not restricted
**Low VOC emissions rating schemes**

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<td></td>
<td>Sustainable Building programs, e.g. LEED</td>
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</table>
VOC long-term emissions – schedule

- All programs evaluate in-use phase emissions
  - Evaluation mostly after 28 days in Europe, after 14 days in USA
  - Limits after 3 days cover renovation / refurbishing
  - Testing in ventilated test chambers; no correlation with VOC content

Example of a decay curve

Lifetime

Emissions
Test chambers

Photo: Eurofins Product Testing A/S
Emission Testing: VOC, formaldehyde ...

VOC = Volatile Organic Compounds: Solvents, plasticisers, ...
Air Sampling from test chamber

- Air is drawn from chamber exit through sampling tubes
  - different tubes for different substances
  - sampling duration is 1 – 2 hours

- Quality action
  - backup tube for avoiding loss of volatiles when you expect high emissions
  - 2 parallel sampling sets for avoiding random errors
Significance of test result

- **What you get from chamber testing is:**

  Test chamber air concentration at given time mg/m³, then we calculate from that:

  - **Emission rate** per hour, mg/h
  
  - **Specific emission rate** (emission factor),
    - per area mg/m²h
    - or per mass, per device, per unit
  
  - **Contribution to air concentration**, mg/m³ (source strength) in reference room or in real room after a specified time

  - **Compare with limit values** (always given as air concentration)
European Reference Room

- **Reference room - not a test room, but just a model**
  - Needed for comparing test result with air concentration limit values
  - European Reference Room (CEN TC 351):
    - Floor area 12 $m^2$, Height 2.5 m, Volume 30 $m^3$
    - 1 window, 1 door
      - From that we calculate **loading factors** ($m^2/m^3$) for walls etc.
    - $\frac{1}{2}$ air change per hour
    - 23 °C, 50% relative humidity
    - As most products can be used in various exposure scenarios, this room is used as general reference for all situations

- **Testing shall simulate those rooms in small scale**
  - Test chambers made of stainless steel or glass, 50 litres to several $m^3$
VOC emissions & CE marking

- **CE mark** = common language for declaration of product properties
  - CE mark is compulsory for many products for entry into EU market
  - Basis is a mandate from European Commission to CEN
  - Product specific Technical Committee then issues a performance standard

- **Compliance with that standard allows use of CE Mark**
  - Use of CE mark is meant to substitute national approvals
Present work goes for harmonized testing, for use and reference in product specific norms

- Draft document exists (CEN TC351 WG2 N0129)
- Status: Robustness validation of test method has started
  - Eurofins takes leadership role; 9 labs participate
- CEN Technical Specification available 2013
- Actual testing standard (prEN) expected in 2015 or 2016
- Harmonized testing standard shall be referenced by product TCs

BUT – the accepted limit values will be set by each EU Member State separately

- The CE mark will offer different VOC classes
- These VOC classes will cover the different national regulations:
  - Germany will accept certain performance levels,
  - France will require labelling in line with other performance levels, etc.
Construction products — Assessment of emissions of regulated dangerous substances from construction products — Determination of emissions into indoor air

Bauprodukte — Bewertung der Emission regulierter gefährlicher Stoffe aus Bauprodukten — Bestimmung von Emissionen in Raumluft

Produits de construction — Evaluation de l’émission de substances dangereuses réglementées par des produits de construction — Détermination d’émissions dans l’air intérieur
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Acceptable level of emissions will be defined by each EU Member State separately

- CE mark will be accompanied by several VOC classes
- These VOC classes shall mirror existing national regulation:
  - Germany will require a certain level of emissions,
    France will require labeling of certain other emissions levels, etc.
- User shall be able to read from CE mark whether he may use that product in a specific EU Member State.
- This is meant to substitute national regulations.
The VOC classes within CE marking have to mirror the national regulations, presently available in:

- **Germany**, approval by DIBt agency / Ü mark
- **France**, VOC class label
AgBB = basis for German low VOC regulation for construction products – comply or fail, no classes
- Approval by DIBT agency for use on German market, Ü mark
- After 3 days:
  - 10,000 µg/m³ TVOC, 10 µg/m³ each carcinogenic VOC
- After 28 days:
  "Health-related evaluation": Restriction of emission of
  - TVOC 1,000 µg/m³
  - 120 µg/m³ formaldehyde (in regulation, not in AgBB paper)
  - 1 µg/m³ each carcinogenic VOC
  - LCI values, R value, VOC without LCI
  - TSVOC (total semi-volatile organic compounds)

Voluntary labels, e.g. EMICODE, Blue Angel:
- TVOC, TSVOC and formaldehyde limits are much lower than AgBB
- LCI values are identical, or LCI lists may be expanded
Regulation covers:

- Textile, resilient, laminate and wooden floor coverings,
- Sports floors,
- Floor coatings,
- Parquet coatings,
- Wall coatings,
- Parquet adhesives,
- Flooring adhesives (from 1 Jan 2012),
- Flooring insulation underlays (from 1 Jan 2012),
- planned: more products.

- for use in regularly occupied spaces
  (commercial as well as residential)
Evaluation / approval upon application, on basis of

- VOC emissions testing after 3 and 28 days, tested following DIBt test method, European Reference Room

Procedure:
1. Contact DIBt
   - Report formulation (recipe)
   - Negotiate group authorisation for reducing costs
2. 3+28 days emission chamber test
3. Application, authorisation for 5 year period
4. Only for flooring – adhesives are exempted:
   - Contract with certification body, "ÜZ-Stelle"
     - In-factory production monitoring
   - Spot tests after ÜZ body took samples on-site, 1 x / year
     - Now: 3 days emission chamber test
     - In future possibly: Thermal extraction / Microchamber test
   - Eurofins offers both testing and ÜZ certification
ÉMISSIONS DANS L’AIR INTÉRIEUR*

* Information sur le niveau d’émission de substances volatiles dans l’air intérieur, présentant un risque de toxicité par inhalation, sur une échelle de classe allant de A+ (très faibles émissions) à C (fortes émissions)
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<th>C</th>
<th>B</th>
<th>A</th>
<th>A+</th>
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<td>&lt; 2000</td>
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<td>Formaldehyde</td>
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<td>&lt; 60</td>
<td>&lt; 10</td>
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<td>&lt; 300</td>
<td>&lt; 200</td>
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<td>Tetrachloroethylene</td>
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<td>Xylene</td>
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<td>&lt; 1500</td>
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<tr>
<td>Styrene</td>
<td>&gt; 500</td>
<td>&lt; 500</td>
<td>&lt; 350</td>
<td>&lt; 250</td>
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</table>
France – compulsory label – III:

Regulation covers:
- Walls, ceiling, floor coverings and coatings
- Panels for rooms partition and suspended ceiling
- Insulation products
- Doors and windows
- All products used for the installation of the products listed above.
- but NOT untreated metal or glass, lockers, iron, screws etc.

Evaluation / compliance by self-declaration on basis of
- VOC emissions testing after 28 days, ISO 16000 tested, calculated to European Reference Room
- or any other equivalent information
4 CMR substances:

- Benzene
- Trichloroethylene
- Dibutylphthalate DBP
- Diethylhexylphthalate DEHP

None of these must show emissions

- higher than 1 µg/m³ after 28 days,
- tested with ISO 16000-6/-9, calculated to European Reference Room.
Present state of discussion, **not finalised at all**

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<th>Parameters</th>
<th>Details</th>
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<th>Declaration format</th>
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<td>&gt; 2000</td>
<td>&lt; 2000</td>
<td>&lt; 1500</td>
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**Harmonized EU class**

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<th>Parameter</th>
<th>Value</th>
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<td>1</td>
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<tr>
<td>Q</td>
<td>Y</td>
</tr>
<tr>
<td>HCHO</td>
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<tr>
<td>ISL</td>
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<th>Individual substances</th>
<th>TVOC</th>
<th>ISL</th>
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<td>ethylbenzene</td>
<td>&gt; 1500</td>
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<tr>
<td>2-butoxyethanol</td>
<td>&gt; 2000</td>
<td>&lt; 2000</td>
</tr>
<tr>
<td>styrene</td>
<td>&gt; 500</td>
<td>&lt; 500</td>
</tr>
</tbody>
</table>
VOC emissions & CE marking

- **CE mark** = *common language* for declaration of product properties
  - **CE mark** is *compulsory* for many products for entry into EU market
  - Historically covering mechanical stability and fire safety
  - Basis is a mandate from European Commission to CEN
    - Today NO mandate for building adhesives
  - Product specific Technical Committee then issues a *performance standard*

- **Compliance with that standard allows use of CE Mark**
  - **VOC emissions** shall be included in many such norms in future
    - *For textile & resilient floorings*: Expansion of EN 14041 by TC 134
    - *For wood flooring*: Expansion of EN 14342 by TC 175
    - *For adhesives*: Expansion of EN 14259 by TC 193 – *meaningful ???*
  - **CE mark** is meant to substitute national approvals
Voluntary labels

Voluntary labels "on Top":
- Regulatory specifications = Minimum requirements
- Labels = very low emitting products
- Very most regulations and labels are strictly national

Market evaluation will determine use of such labels by individual manufacturers

Organization of voluntary labels:
- Proof of compliance by testing and by declaration of properties
- Application for a license against a fee
Low VOC emissions rating schemes

**EU Regulation:**
- Germany (DIBt / AgBB)
- French label and CMR
- CE marking
- E1 formaldehyde class

**EU Labels & Specifications:**
- EMICODE
- GUT
- Indoor Air Comfort
- EU ecolabel
- M1, Finland
- Blue Angel, Germany
- Several local labels

**US Regulation:**
- Formaldehyde (CARB, federal law)
- VOC content (SCAQMD and more)

**US Labels:**
- California CDPH "Section 01350"
- FloorScore
- Indoor Advantage
- ANSI/BIFMA X7.1/M7.1/level
- CRI Green Label Plus
- Greenguard
- Cradle-to-Cradle
- Sustainable Building programs, e.g. LEED
Eurofins services

- Consulting on selection of best VOC test
- VOC emission chamber testing
- Save costs by testing for several purposes in one test set-up only
- VOC content testing
- Pre-chamber tests (Microchamber, headspace tests)
- Communication with authorities and labels
- Certification and auditing:
  - CE mark (coming soon)
  - German Ü mark
  - Indoor Air Comfort
  - FloorScore (coming soon)
Combination of 4 issues:

1. Simplify life by covering all relevant emissions specifications in use in Europe if certification criteria are fulfilled (no re-invention of the wheel)
   - Combined testing only can also be performed as stand-alone service

2. Allowing use of low emission label where no such existed before

3. Increase public trust by higher control intensity

4. Third-Party Auditing will support reducing emissions from products
Indoor Air Comfort – product certification

- Certificate = VOC Emissions are sufficiently low that all national low VOC programs in EU can be applied for.

- Differentiation between good product and better product:
  - Indoor Air Comfort:
    - Low emissions, conform with all governmental specifications in EU:
      - AgBB, French class A or better, E1
  - Indoor Air Comfort GOLD
    - Very low emissions, in addition conform with all voluntary specifications in EU:
      - French class A+, M1, Blue Angel, Austrian UZ, GUT, EMICODE EC1 or better, AFSSET, …
  - IAC covers only product emissions into Indoor Air

www.indoor-air-comfort.com

September 2011
Products covered (as of June 2011):

- Floor coverings
  - textile
  - resilient
  - wooden
- Insulation material
- Gypsum boards
- Installation products (adhesives, sealants etc.)
- Furniture
- Paints and coatings

Market decides on next products involved.
Indoor Air Comfort – Organization

1. Initial Type Testing in test chamber
   (Testing schedule will be product type specific)

2. Evaluation of test result
   (Criteria will be product type specific)

3. Contract between manufacturer and certifier
   including agreements on exclusion of certain raw material, production
   parameters, factory production control, QC documentation

4. Third party auditing of production sites on regular basis
   including control of emission relevant documentation in QC

5. Certificate

6. Eurofins test reports are accepted by most EU labels

7. Repeated tests on a regular basis for more reliability of forecast

8. Continuous review and improvement
   of specifications, testing procedures and audit procedures

9. Database of certified products in the Internet
In Preparation:

- Another IAC class covering most relevant specifications for low emitting products world-wide
- First by integration of specifications in the USA
Thank you for your attention