Approaches to harmonisation of emission tests for the huge variety of quality labels

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ABSTRACT

The variety of quality labels and classifications dealing with emission into indoor air require many similar tests to be done if a company wants to apply for more than one these. If we want to reduce the necessary number of tests and thus the costs then it is essential that these voluntary labels consider to adapt the international standards and try to harmonise. There are many different approaches in the respective testing protocols but also some common tracks. At the present stage it is already possible to combine testing requirements of some labels to a certain degree.

1. INTRODUCTION

Today, it may not be enough to manufacture a construction product that fulfils its purpose and then to sell it to competitive prices. There is much more to take into account. One factor is a growing number of marks and labels that were created for limiting the emission of chemical substances and odours into indoor air.

Most of these labels are of voluntary nature. But there is also an initiative in Germany for having all approved construction products tested within the framework of the Construction Products Directive (EEC/89/109). And a similar project is just about to start on the level of the European Union and CEN.

Many countries have at least one national label; some national labels even are in competition to each other. For the end-user this situation may cause confusion. This confusion may also occur in the office of the industrial product manager who has to face a huge variety of requirements from the national markets.

2. ECOLABELS WITH FOCUS ON THE GENERAL ENVIRONMENT

All these labels are operated on a voluntary basis and allow to mark products that show less impact on the environment than comparable products do. Some of them have a strong recognition in the market and there is a certain demand for products containing these labels. Other labels are almost unknown in the public.

Some of the requirements for floorings, paints, adhesives, furniture etc. contain restrictions for emissions into air.

- Global Ecolabelling Network GEN

The GEN combines member organisations from 26 countries on four continents. The informal network was created for information mainly, and the Internet homepage gives a good overview and links to national ecolabels, see www.gen.gr.jp. In the meantime also some activities occur for establishing harmonised criteria.

- Europe

A flower is the logo of the official European Union Ecolabel, for details see europa.eu.int/comm/environment/ecolabel. The interest in and the activities for this label had been low in the first time. But in the last years, a number of product criteria were added, and in some countries the EU ecolabel meets increasing acceptance on the market.

A special label for sustainable construction products mainly made from regenerating or mineral sources with Europe-wide ambitions is the natureplus label - see www.natureplus.org.

- National labels

One of the best-known labels in Europe is the German Blue Angel, see www.blauer-engel.de. Another label with a long tradition is the Scandinavian label with the Nordic Swan logo, see www.svanen.nu. In other European countries some of the national labels just adopt the European label, but most national labels set up their own specifications, and there does not seem to be any plan to harmonise or even close national ecolabels and use the EU ecolabel instead. There is a growing number of ecolabels and of product criteria in the Pacific region with some international cooperation.

- Requirements regarding emissions

Requirements for limited emissions of chemicals and odours into indoor air are part of only some of these labels, as can be seen in the following chapter.

3. LABELS WITH FOCUS ON THE INDOOR ENVIRONMENT

Most of these labels are used on a voluntary basis and focus on a classification of emissions into indoor air, sometimes in combination with restrictions of some ingredients in the product. Some of these labels have a strong recognition in the market and there is a certain demand for products classified low-emission.

There are three basic approaches. Some classifications start from quality criteria for indoor air and then derive maximum average emissions into indoor air. Examples for this type of labels are the Finnish Emission Classification and the Danish Indoor Climate Label.

Other classifications define a no-effect level of air concentrations. These levels then are set as limit values that may not be exceeded in the test chamber air - under experimental parameters that resemble the situation in a model indoor room. Typically these classifications refer to the results of the former European Collaborative Action (ECA) research project "Indoor Air and its Impact on Man" as described in the report: Evaluation of VOC Emissions from Building Products – Solid Flooring Materials[1]. Examples for these classifications are the German AgBB assessment scheme and the French CSTB C-classification. The French classification just refers to the ECA LCI list. In Germany the AgBB added more compounds and corrected some LCI values in a task force with toxicological expertise. They plan to revise the German LCI list (the so called NIK list) every year.

Other classifications are based on a comparison of products for a specific purpose, e.g. carpets. These labels define low-emission requirements that can only be met by the most advanced products. Examples for these labels are GUT, EMICODE, and some criteria of German Blue Angel and Austrian Umweltzeichen.

CEN, ASTM, JIS, and ISO issue testing standards that contain just the testing procedures, no requirements. These standards are used by some of the classification systems, but some of these define their own testing protocols.

4. VARIETY OF APPROACHES

The different emission classifications and labels are defined on a national level, sometimes on an industry branch level. There is not much coordination and harmonisation between these labels. Most times just informal contacts between the involved experts exist when they meet at international conferences. In some cases there is even some competition when a new label wants to be "better" than established classifications.

If the criteria require expensive tests in an emission test chamber then this lacking harmonisation will demand double testing if a manufacturer wants to apply for more than one label in different countries, even if the involved classification criteria would allow to apply just one test only.

[1] Report No. 18, EUR 17334 EN, European Commission, Joint Research Centre, Environment Institute

In the following we compare the requirements of the following emission classifications and labels as far as they use chamber tests:

Table 1: Reviewed Emission Classification Schemes

Classification / Label	Internet
Austrian Umweltzeichen, the criteria UZ 07, 35 and 42	www.umweltzeichen.at
DICL Danish Indoor Climate Labelling	www.dsic.org
EMICODE for floorings installation products (EC1, EC2, EC3)	www.emicode.de
Finnish "Emission Classification of Building Materials" (M1, M2, M3)	www.rts.fi/english.htm
French CSTB C-classification	.
German AgBB assessment scheme for construction products that is used by German DIBT for establishing requirements for specific product groups	www.umweltbundesamt.de/uba-info-daten-e/daten-e/voc.htm
German Blue Angel, especially the criteria RAL UZ 38 and 113	www.blauer.engel.de
GUT label for textile floorings, revised in 2004	www.gut-ev.de
Hong Kong Green label scheme for flooring materials GL-008-002	www.greencouncil.org
Natureplus label for sustainable products (Minimum 85% regenerative or mineral raw material)	www.natureplus.org
Nordic ecolabel ("Swan") for adhesives	www.svanen.nu
US Green label for carpets, other floorings, adhesives, and vacuum cleaners	www.carpet-rug.com
US Greenguard label for construction products, office furniture, textiles, appliances, and vacuum cleaners	www.greenguard.org

The European ecolabel ("flower"), http://europa.eu.int/comm/environment/ecolabel, is not on this list because its criteria do not require emission chamber testing.

4.1. VARIETY OF TESTING REQUIREMENTS

In the following we compare the testing schedule of different emission classifications.

Table 2a: Testing schedules (product specific classifications)

Classification / Label	Testing after 1 day	after 3 days	in between	after 28 days
GUT (textile flooring) (new version, year 2004)	Odour	Carcinogens VOC, SVOC LCI (German)	-	-
Austrian UZ 35 (textile flooring)	VOC Formaldehyde Specific subst. Odour	-	-	-
Austrian UZ 42 (elastic flooring)	-	-	-	VOC Specific subst.
US Green label for textile and elastic flooring *	VOC Formaldehyde Specific subst.	-	-	-
Hong Kong label GL-008-002 (flooring)	Carcinogens VOC Formaldehyde Specific subst.	-	during 4 days: VOC	-
German DIBT First regulated product group: Approved floorings	-	Carcinogens VOC	-	Carcinogens VOC, SVOC LCI (German) Formaldehyde
German Blue Angel RAL UZ 38 (wooden products)	CMT	-	-	Carcinogens VOC, SVOC Formaldehyde
Austrian UZ 07 (wooden products) (plus tests for emissions from binders)	CMT	-	-	Carcinogens VOC, SVOC Formaldehyde
Nordic Swan, Adhesives	-	-	-	VOC
EMICODE *	7 carcinogens VOC (only for underlays + tapes)	7 carc. - only cement based products	10 days: VOC	-
German Blue Angel RAL UZ 113 (Adhesives)	-	Carcinogens Formaldehyde Acetaldehyde VOC	-	Carcinogens VOC, SVOC LCI (German)

*: The specifications are slightly different for some product groups.
For more abbreviations - see next page.

Table 2b: Testing schedules (more general classifications)

Classification / Label	Testing after 1 day	after 3 days	in between	after 28 days
DICL *	-	VOC and more	after 8-10 days: VOC + more	VOC and more
Finnish M1	-	-	-	Carcinogens VOC Formaldehyde Ammonia Odour
French CSTB C classification There are some more requirements on possible growth of fungi and bacteria, and on radon	Carcinogens	VOC Formaldehyde Odour	-	Carcinogens VOC LCI (French) Formaldehyde Odour
German AgBB * General assessment scheme for construction products	-	Carcinogens VOC	-	Carcinogens VOC, SVOC LCI (German) Formaldehyde
Natureplus * *The parameters in italic deviate from one product group to the next*	CMT *Odour*	*VOC* *Formaldehyde* *Specific subst.* *Odour*	-	*VOC* *LCI (own list)* *Formaldehyde* *Specific subst.*
US Greenguard label *	-	-	during 5 days: VOC Carcinogens Formaldehyde Specific subst.	-

*: There are slightly different specifications for some product groups, and there may be additional parameters for some product groups.
CMT: Carcinogenic, mutagenic and teratogenic substances, also called CMR
VOC: Volatile Organic Compounds
SVOC: Semi-Volatile Organic Compounds
LCI: Lowest Concentration of Interest
NIK: German version of LCI values (Niedrigste Interessierende Konzentration)
UZ: Umweltzeichen (German word for ecolabel)
RAL: Name of the German institute that administers the Blue Angel label
GUT: German acronym for Gemeinschaft umweltfreundlicher Teppichboden

4.2. VARIETY OF TESTING PARAMETERS

In the following we compare the parameters for chamber emission testing.

Table 3: Testing parameters

Classification / Label	Air exchange rate / Loading 1/h / m²/m³	Temp. °C	Relative humidity %	TVOC calculation method
Austrian UZ 07 (wooden products) (plus tests for emissions from binders)	1 / 1	23	45	UZ 38
Austrian UZ 35 (textile flooring)	0.5 / 0.4	23	50	GUT old
Austrian UZ 42 (elastic flooring)	1.25	23	50	ECA
DICL	specific for product group	23	50	not applied
EMICODE	0.5 / 0.4	23	50	GEV
Finnish M1	EN 13419-3	23	50	ISO 16000-6
French CSTB C classification	EN 13419-3	23	50	ISO 16000-6
German AgBB/DIBT	specific for product group	23	50	DIBT
German Blue Angel RAL UZ 38 (wooden products)	1 / 1	23	45	UZ 38
German Blue Angel RAL UZ 113 (Adhesives)	1.25	23	50	ECA-like
GUT (textile flooring)	0.5 / 0.4	23	50	ECA-like
Hong Kong Green label for textile and elastic flooring	0.5 / 0.4	23	50	ISO 16000-6 accepted
Natureplus	EN 13419-3	23	50	ISO 16000-6
Nordic Swan, Adhesives	1.25	23	50	ISO 16000-6
US Green label for textile and elastic flooring and adhesives	0.5 / 0.4	23	50	not reported
US Greenguard label	not reported	not reported	not reported	not reported

Air exchange rate: This figure says how often per hour the test chamber air is exchanged by fresh air
Loading: Area of test specimen per test chamber volume
Air exchange rate / Loading = Area specific air flow rate (unit: m³/(m² x h))
TVOC calculation methods: For details see the respective methods.
ECA: European Collaborative Action research project "Indoor Air and its Impact on Man", Report No. 18, EUR 17334 EN, European Commission, Joint Research Centre, Environment Institute

4.3. VARIETY OF REQUIREMENTS - CMT

Most labels exclude the active use of carcinogens, and some labels exclude mutagenic and teratogenic substances. They still require testing for these substances - for control purposes, and for detecting any traces that may become part of the product unintentionally. But the criteria differ between these labels.

Table 4: Criteria for carcinogenic substances

Criteria	Classification / Label	Used subcategories
European list of carcinogens [1]	AgBB/DIBT CSTB GuT (2004)	C1, C2
German list of carcinogens [2] (extended European list)	Blue Angel RAL UZ 113	C1, C2
German list of carcinogens [2] (extended European list) plus European M and R list [1, 2]	Austrian UZ 07 Blue Angel RAL UZ 38 Natureplus	C1, C2, MAK III1 + III2 M1, M2 R1, R2
Specified list	EMICODE	C1, C2, C3 [3]
IARC	Finland M1 Greenguard	M1: Category 1 Greenguard: all
California Proposition 65, NTP	Greenguard	all

C1: Carcinogenic effect proven
C2: Carcinogenic effect probable (seen with animal testing, or other severe indication)
MAK: III1 + III2: Carcinogenic substances as listed in the German MAK liste (MAK = OEL)
M1, M2: Mutagenic effect proven / probable
R1, R2: Teratogenic effect proven / probable
IARC: International Agency for Research on Cancer, see www.iarc.fr
California Proposition 65: see http://www.oehha.ca.gov/prop65.html
NTP: National Toxicology Program, see ntp-server.niehs.nih.gov

4.4. VARIETY OF REQUIREMENTS - FORMALDEHYDE, OTHER ALDEHYDES

Most labels apply monitoring of either formaldehyde or volatile aldehydes after 1, 3 or 28 days, using the DNPH method (ISO 16000-3 or similar). Only the wood specific requirements refer to EN 717-1 where you determine the formaldehyde steady-state concentration in an emission test chamber with numerous analyses during 10 or 28 days at 23 °C and 45 % relative humidity.

[1] Directive EEC/67/548 and amendments
[2] TRGS 905. See also www.hvbg.de/d/bia/fac/kmr/kmr.pdf
[3] Benzene, 1-4-Dioxane, Acrylo amide, Acrylo nitrile, Vinyl acetate, Formaldehyde, Acetaldehyde

4.5. VARIETY OF REQUIREMENTS - ODOUR

Some labels require an odour determination. There are 3 basic testing methods:

no 1. Static odour test following SNV 195 651, GUT or similar: A test piece is stored in a desiccator at 37 °C and 90 % relative humidity. After 24 hours 3-6 test persons rate the smell using a scale that may have 3, 5 or 6 criteria. This test gives a combination of odour intensity and hedonic odour character.

no 2. Dynamic odour test by taking air samples from the chamber outlet air, then using EN 13725, NF-X 43-103 (French standard) or similar. The odour strength is determined by use of a dynamic or static olfactometer. The results are expressed as odour units, as concentration of a reference odorous substance, or as decipol.

no 3. Dynamic odour test directly at the chamber outlet. In Finland (M1) you will rate the acceptability alone (on a floating scale from -1 to +1). In Denmark (DICL) you measure both the acceptability and the intensity (on a 5 criteria scale) of the odour (Denmark). The odour strength can also be determined as decipol.

Table 5: Odour Testing

Classification / Label	Method	Testing after … days
Austrian UZ 35	no 1 - GUT	1
GUT (textile flooring)	no 1 - GUT	1
Natureplus	no 1 - Natureplus	1 or 3
French CSTB C classification	no 2 - (NF X 43-103)	3 + 28
DICL	no 3 - DICL	typically 28
Finnish M1	no 3 - M1	28

4.6. A SPECIAL CASE: THE DANISH INDOOR CLIMATE LABEL DICL

The Danish Indoor Climate Labelling, which is in use also in Norway, is based on a test chamber evaluation of chemical and odour emissions. The results are converted to a standard room and compared to half the lowest irritation threshold, and half the lowest odour threshold, of all emitted substances.

The result is expressed as the time period that will go until none of these thresholds are exceeded - and no more nuisance by odours or irritation is expected to occur. The shorter this time value - the better the rating of the product. The results are linked to specific test methods. For more details see www.dsic.org.

5. HARMONISATION OR DIFFERENTIATION ?

If a company wants to apply for several ecolabels then it will need to order several emissions tests that are very similar to each other. This does not make any other sense than to generate additional tasks for the involved laboratories. The cumulative costs may even hinder a company from applying for all these labels.

The complexity of the different national and trade specific requirements is still higher when you compare the quantitative classification criteria (the limit values). But this would not be a severe problem if the test methods were harmonised to such an extent that one test may be used for different labels just by calculating the results in different ways, according to the specific requirements. One example is that you may transfer the concentration in the test chamber (as used for e.g. GuT, EMICODE, Blue Angel) into the emission rate (also called emission factor, used by e.g. Finnish M1, Austrian UZ 42, Hong Kong GL-008-002) by multiplication with the area specific airflow rate.

Harmonisation should be relatively easy for these parameters:

- VOC, TVOC, SVOC determination:
  The existing international standard ISO 16000-6 (present version: FDIS of 2003) could serve as basis for harmonising, as is the intention of ISO and CEN. Today, four out of 16 reviewed classifications refer to this standard and a fifth one accepts its use.
- Aldehydes determination:
  The existing international standard ISO 16000-3 (present version of 2001) could serve as basis for harmonising, as is also the intention of ISO and CEN. Today, most of the reviewed classifications refer either to this standard or to a very similar method.
- Test chamber parameters:
  The existing European standards ENV 13419 parts 1, 2 and 3 could serve as basis for harmonising, as is the intention of ISO and CEN. Today, most of the reviewed classifications refer to this standard - but some are deviating in detail as regards the test specimen. Testing temperature is 23 °C in all classifications. Relative humidity deviates from 50 % only for Blue Angel RAL UZ 38 and Austrian UZ 07 (45 %).
- Testing times:
  Most common is testing after 3 days for short-term emissions and carcinogenic substances, and after 28 days for long-term emissions. Earlier testing times may be applied if the emissions do not change significantly any more after that early testing date. In the USA and in Asia it is more common to require the emission decay profile for estimating steady-state emissions from 3 or 6 measurements within 4 or 5 days.
- Carcinogenic compounds:
  It would facilitate testing at least within Europe if always the European legal classification (see Annex I of European directive EEC/67/548 and amendments[1]) of carcinogenic chemicals were used, instead of different national lists.
- LCI Values:
  Instead of using the 10 years old LCI[2] list as published by the ECA research project (see above) an updated list would be more helpful[3], especially if agreed upon at least between the involved European countries.
- Odour:
  There is still some controversy about how meaningful the different tests and ratings can be. Therefore harmonisation looks difficult for odour testing.

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[1] Search 28th_ATP.pdf at http://ecb.jrc.it/classification-labelling - Documents

[2] Report No. 18, EUR 17334 EN, European Commission, Joint Research Centre, Environment Institute

[3] e.g. in www.umweltbundesamt.de/uba-info-daten-e/daten-e/voc.htm

There is a CEN project on the way for harmonising official regulations on this field for achieving harmonised testing standards (Construction Sector Network within CEN, see www.cenorm.be/cenorm/businessdomains/businessdomains/construction). But the voluntary classifications and labels are not involved, they can use any test method and do not need to comply with international testing standards.

If we want to reduce the necessary number of tests and the costs then it is essential that these voluntary labels consider to adapt the international standards and try to harmonise. At least in Germany, neither DIBT nor Blue Angel support this attitude, their latest classification schemes again are using non-harmonised TVOC calculation methods.

At the present stage it is already possible to combine testing requirements of some labels to a certain degree. There are many different approaches in the respective testing protocols but also some common tracks. Both M1 and GuT changed their test protocols recently such that more harmonisation was achieved.

There are some harmonised standards between the Austrian Umweltzeichen and the German Blue Angel. You may conduct testing for the Austrian Umweltzeichen, Blue Angel RAL UZ 38 or UZ 113 after 1 / 3 and 28 days and then transform the 28 days results into M1 results - just by another mode of calculation of the analytical raw data. But some compromise then is necessary as regards details of the different test methods. Also some Natureplus criteria may be subject to combined testing along with some other test methods. For the CSTB test method you just need to add one more testing point. In other cases such combinations still remain difficult. The testing requirements in the USA and in Far East are not easily combined with European test protocols so far.

The Eurofins testing laboratory applied successfully for approval for a number of the mentioned labels and now offers tests that are harmonised as far as possible. The more similar the involved methods are, the more costs can be saved, when compared to conducting one test each for all involved emission labels.

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