International Conference

Construction Products and Indoor Air Quality

Berlin, June 2007
Conference Report

Umwelt Bundes Amt
Für Mensch und Umwelt

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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The Berlin Conference and its Objectives

Emissions from construction products have been identified as a significant source of indoor air pollution since the beginning of the 1980's. At the end of 1988, the European Council adopted the Council Directive 89/106/EEC on the approximation of laws, regulations and administrative provisions of the Member States relating to construction products. This became known as the *Construction Products Directive.* The Directive, in Annex I, defines six essential requirements that construction products shall fulfil. Among them is *Essential Requirement no. 3* on health, hygiene and the environment.

It is obvious that harmonised procedures are essential to facilitate a uniform evaluation of construction products properties in the Member States of the European Union. Consequently, since the promulgation of the *Construction Products Directive,* various efforts have been made in Europe to find practical solutions for the measurement, health-related evaluation and reduction of emissions from construction products.

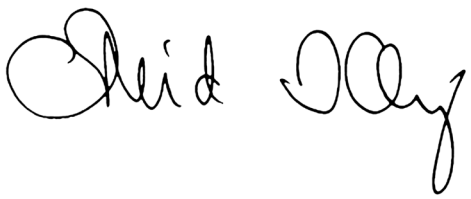
Different approaches to evaluate construction products have emerged over time, and considerable practical experience has been gained during recent years. In some markets, emissions originating from indoor construction products have been noticeably reduced.

Under the German EU presidency the Federal Environment Ministry decided to stimulate an EU-wide discussion process about the different existing approaches and on possible ways forward for the EU. Consequently, a two-day conference "Construction Products and Indoor Air Quality – Emissions reduction in the EU" was held in Berlin, 4–5 June 2007.

The conference was designed to provide a platform for dialogue for the different approaches used to measure and assess the health related quality of indoor construction products. It also aimed to exchange experience regarding the reduction of emissions in practice.

Based on the discussion and the information exchange the intention was to discuss possible ways forward towards a harmonised approach and to outline first steps in this process.

The following text provides an overview on the major issues discussed during the Berlin Conference.



Astrid Klug – Parliamentary State Secretary,
German Federal Ministry for the Environment

The Policy Context

The impact of indoor construction products on human health

The participants of the opening panel, representing different stakeholder groups, generally agreed that there is a need to develop a strategy on Indoor Air Quality (IAQ) and Health at Community level. Work on this topic has already started under the lead of Directorate General for Health and Consumer Affairs (DG SANCO).
One of the important tasks identified was to get better information on the relationship between the emission testing of construction products, modelled (or measured) exposure to chemicals in real indoor spaces and predictable (or observed) impacts on health and comfort.
However, most speakers also agreed that uncertainty related to cause-effect-links will in principal remain. This is due to the complexity of substance transport and conversion processes, as well as to the variety of factors impacting on the air quality in indoor environments.

The nature of the Construction Products Directive (CPD) in relation to other instruments

The opening panel also highlighted the function of the CPD in relation to other regulatory instruments: The CPD is a market instrument intended to generate reliable and harmonised information on how a single construction product fulfils the six essential requirements laid down in the legislation. This is needed to promote the free exchange of construction products within the EU. The Essential Requirement no. 3 relates to health and environment, in particular to the emission of dangerous substances from products. The related standardisation work aims to generate the corresponding information in a comparable and reproducible ("reliable") way within and across the different product groups. However, the desired level of health protection is to be determined separately at community and/or member state level, e.g., by defining health based concentration levels in order to assess product emissions.
Also, approval of building products will continue to take place under national law, and not at community level.

What to harmonise?

To the greatest possible extent, harmonised methodology should be provided for testing and evaluating the emission behaviour of construction products across products or European countries. Important factors determining the test results and their communication into the market include:

- Preparation of representative product samples and specimens to be tested
- Point in time for testing once the product has left the manufacturing site
- Conditions in testing chamber

- Analysis of emitted substances
- Emission prediction for real housings based on the test results
- Exposure prediction depending on the conditions of use of real housings
- Criteria and parameters to characterise the emission behaviour
- Determination of reference values for evaluation of predicted exposure; health based or technical benchmarking
- Complexity of the scheme to communicate the emission behaviour of the product to the user.

The different elements mentioned above are not independent from each other but closely interrelated. For example, the analytical efforts needed depend on which criteria or parameters are used in the evaluation of the emission behaviour. Such criteria can be used in parallel or sequentially in a tiered process, and may include:

- Technical minimisation of the emissions characterised by the TVOC value (Total Volatile Organic Compounds),
- Prevention of toxic effects expressed as concentration of single substances compared to a corresponding toxicological threshold,
- Prevention of sensory annoyance (odours), expressed as the concentration above which a testing panel indicates as annoyance,
- Setting of emission limits for compounds that cannot be identified and assessed
- Declaration of product quality criteria.

Standardisation work based on ISO 16000 covers those elements highlighted in red in Figure 1. Although this work aims to develop a test standard independent from the desired level of protection, certain policy requirements have nevertheless an impact on the testing approach. This regards for example the extent to which the emissions shall be assessed against LCI values and the role non-assessable substances emitted from a product play in the overall judgement on the product's quality.

The labelling of a construction product should be as informational as possible for those designing, setting up and operating buildings. For these addressees, the performance of the whole building is important, not just the emission behaviour of materials and compounds. Thus, it was stated several times at the conference that the focus should be on the optimisation of system performance rather than on that of single materials and compounds.

Actors contributing to harmonisation

All stakeholders expressed their preference for a harmonised approach to testing and communicating the emission behaviour of construction products across the European market. However, the key question is how to integrate the contributions of the different stakeholders and institutions towards an effective process of harmonisation.

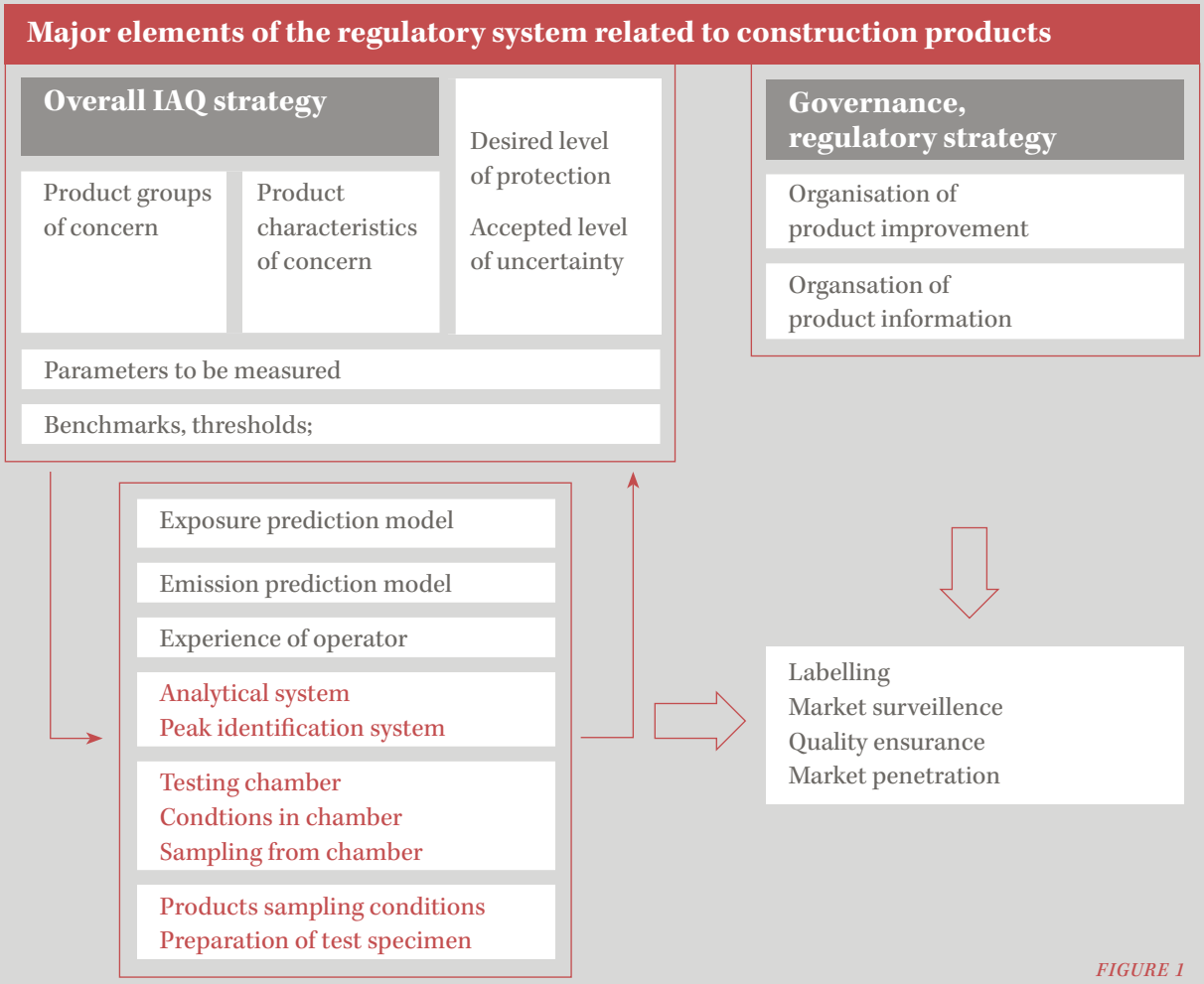


FIGURE 1

- The European Commission (COM) may reduce barriers to trade by facilitating a standardisation process related to product information, or to propose minimum standards (= minimum quality targets) related to health and/or environment.
- The European member states (MS) may contribute experience related to established Type I labelling of construction products, public procurement, product approval, market surveillance and laboratory accreditation
- Industry associations may promote harmonisation of methodology via the standardisation work, including promotion of consensus building among European producers.
- Science may contribute i) well founded LCI values (Lowest Concentrations of Interest) based on agreed, harmonised methodology, ii) validated indoor exposure models and iii) robust analytical methods to identify substances of concern.
- Non-Governmental Organisations (NGOs) may support awareness raising and understanding among designers of buildings, users of building products and users of buildings with regard to both, i) the available information on the emission behaviour of building products and ii) the ways to ensure a healthy indoor environment.

Developments over the past years

In 1989, the Construction Products Directive 89/106/EEC was published. As early as in 1986 the European Collaborative Action "Indoor Air Quality and its Impact on Man" (ECA) had been launched, and a series of reports on testing and evaluation of construction products has been issued since then. The ECA report no. 18 (1997) was and still is the basic reference for ongoing efforts to evaluate VOC emissions from building products. ECA report no. 24 (2005) provides an overview on 10 labelling concepts, all using the ISO 16000 standard as a basis for product testing. As a consequence of the public debate on pollutants in indoor air in the 1980's, parts of the flooring and the coating industry started to develop their own concepts to evaluate the emission behaviour of their products. Today, the success of the 15-year long efforts to improve product quality with regard to emissions is clearly visible. In the course of this work a good deal of harmonisation across the different labelling schemes has already been achieved. In 2006, Working Group 2 under the CEN Technical Committee 351 started to work on the development of a harmonised European Standard on testing of building products related to indoor air quality.

One of the first industry concepts was the GUT system for flooring materials brought into being by 13 carpet manufacturers in 1990. Today, about 80 companies participate in the system, representing the majority of the European production volume for textile floor coverings. The system is also supported by 17 raw material suppliers. Figure 2 illustrates the increasing stringency of the emission thresholds between 1990 and 1997 before the publication of the report ECA 18 and the development of the AgBB scheme resulted in a more harmonised procedure of testing textile floor coverings.

Figure 3 illustrates the findings of studies presented at the conference by a German cooperation of ecological research institutes AGÖF. It illustrates the shift in concentrations of pollutants of concern over the last 20 years. Since the German Federal Environment Agency (UBA) carried out its first systematic indoor measurements in the mid-1980, toluene and volatile halocarbons have significantly decreased. However, other substances are now found at higher concentrations than in the past. This is in particular true for aliphatic hydrocarbons with longer carbon chains which have to a large extent substituted other more volatile and toxic solvents. Also, emissions of substances from wood products are an issue today. This is partly due to rising awareness on the health effects of and partly to the fact that the market share of wooden indoor materials has greatly increased over the past years.

Development of GUT system emission thresholds

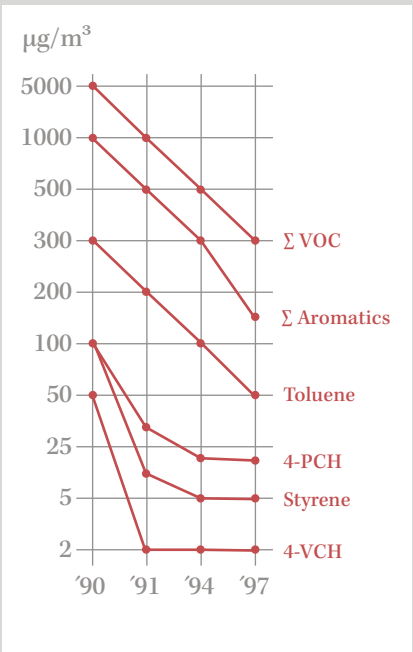


FIGURE 2 • VANKANN 2007

Trend over time of indoor air concentrations of selected compounds

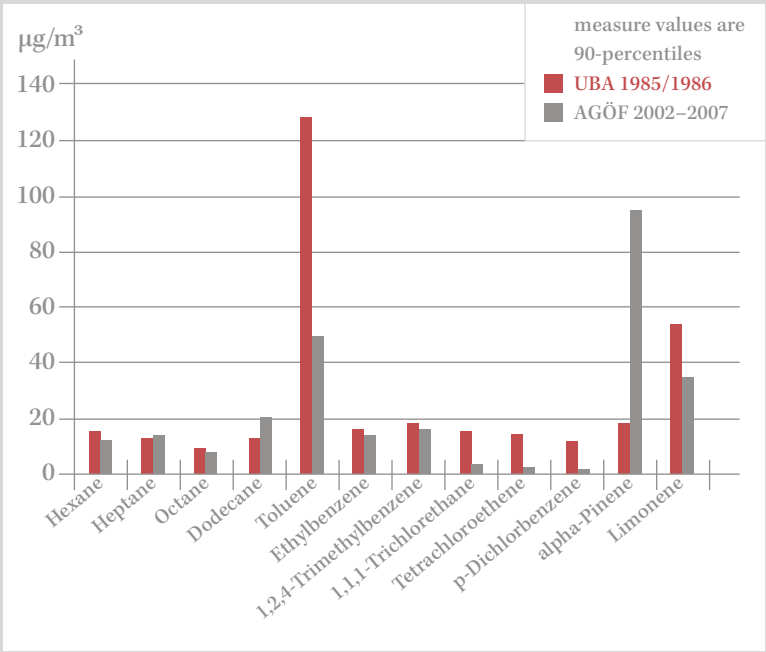


FIGURE 3 • KÖHLER 2007

The Finnish concept – M1 classification

The Emission Classification of Building Materials (M1 classification) is part of the "Classification of Indoor Climate 2000" published first in 1996. Based on the criteria set in this classification, the Building Information Foundation RTS which is a private, non-profit foundation started M1-labelling of building products in 1996. The classification is voluntary and possible for all building materials. The classifications are granted by impartial working group nominated by principal committee PT17 Indoor Air Classification of Building Information Foundation RTS.

The classifications are granted for 3 + 3 years (altogether six years). Continuation is granted without testing if the production or testing methods have not changed. Testing has to be performed in laboratories approved by PT17 and listed in the internet at www.rts.fi. Product quality control is an essential part of the classification. Quality of classified products is verified also through sample testing. There are currently (October 2007) 1060 classified building materials from a total of 115 companies in, for example, the Nordic countries, Europe, the USA and Asia.

Steps in product testing

Test chamber

Testing after …	Criteria	If not fulfilled
28 days	• TVOC < threshold • Sum of carcinogens < threshold • Formaldehyde < threshold • Ammonia < threshold • Dissatisfaction with odour < 15%	⇨ No label

If yes

Assign label!

The Danish concept – DICL scheme

The Danish Indoor Climate Labelling (DICL) scheme is a voluntary labelling scheme to characterise construction products according to their emissions. The scheme has been in effect since 1995. The scheme has been applied to 10 product areas so far (see www.dti.dk/building/13268).

The emission testing is carried out by independent laboratories and labelling licenses are issued by the DICL secretariat associated with the Danish Technological Institute. The emission test results are valid for a 5-year period after which the product has to be tested again. Every year the manufacturer is required to undergo a compliance check in order to maintain the labelling license.

Steps in product testing

Test chamber A

Testing after …	Criteria	If not fulfilled
Initial analyses 1 … 3 … 10 … 28 +/- 2 days Days needed to meet threshold	• No carcinogens identified in emissions • No increasing emission rate over time for individual compounds • Individual VOCs < threshold for irritation	⇨ No label depending on exclusion criteria

Test chamber B

Testing after …	Criteria	If not fulfilled
1 … 3 … 10 … 28 Days needed to meet threshold	• Odour perceived by test panel	⇨ No label depending on exclusion criteria

Test chamber C

Testing after …	Criteria	If not fulfilled
3 hours and 15 hours	• Release of particles and fibres corresponds with one of three classes (low, medium, high particle emission)	⇨ No label depending on product area in question

max number of days all requirements fulfilled ⇩ If yes

Assign label!

The German concept – AgBB scheme

The AgBB scheme has been integrated into the approval procedure for selected construction products in Germany since 2004. It is a 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. These products are designated by the competent authorities responsible for the permission and supervision of construction works.

The scheme has been applied so far to floor coverings (including related adhesives). The manufacturers of such products have to apply for approval at the German Institute for Construction Techniques (DIBt). This Institute operates on behalf of the German Länder and issues the approval as a basis to use the "Ü" label for usually 5 years. The testing has to be performed in a laboratory designated by DIBt. During the 5-year period, the manufacturer is required to undergo an external compliance check once a year.

Steps in product testing

Pre-assessment

	Information on product composition (as provided by applicant) suggest rejection of product	⇨ No approval
	⇩ If no	
	Information available on harmlessness of product or product analogue to a product already evaluated positively	➡ Approval!

⇩ If no

Test chamber

Testing after …	Criteria	If not fulfilled
3 days	TVOC < threshold Sum of carcinogens < threshold	⇨ No label
28 days	• TVOC < threshold • SVOC < threshold • Sum of carcinogens < threshold • Sum of single substance concentration divided by LCI < threshold • Sum of compounds without toxicological info < threshold	⇨ No label

⇩ If yes

Approval!

The French concept – AFSSET protocol

The AFSSET (French Agency for Environmental and Occupational Health Safety) protocol was presented in October 2006. It was established within the framework of the French National Environment and Health Action Plan and has not been applied so far. At present, a proposal is being considered as to whether to introduce it as a voluntary labelling scheme. It is foreseen to introduce the requirements in certification or technical procedures of building products. The concept applies to 12 building products.

Steps in product testing

Test chamber

Testing after …	Criteria	If not fulfilled
3 days	TVOC < threshold Sum of carcinogens < threshold	⇨ No label
	⬇ If yes	
28 days	• TVOC < threshold • Formaldehyde < threshold • Sum of carcinogens < threshold • Sum of single substance concentration divided through LCI < threshold • Sum of compounds without toxicological info < threshold	⇨ No label

⬇ If yes

Assign label!

Technical comparison of test and evaluation methodologies

In their report ECA 18 (1997), the European Collaborative Action "Indoor Air Quality and its Impact on Man" published an evaluation scheme for VOC emissions from solid flooring materials (see section "Developments over the past years" above). The scheme provides the principles for the evaluation of VOC emissions from building materials with regard to their potential effects on health and comfort. It suggests a sequence of test steps and establishes rules on how to use the information generated. When published in 1997, the scheme was meant to be a pre-normative, science-based proposal and did not include any link to a regulatory or voluntary framework. Figure 4 provides a brief comparison of the technical aspects of the four national concepts introduced above with the ECA 18 approach.

Criterion	ECA 18	M1	DICL	AgBB	AFSSET
Pre-assessment considering product composition and ancillary information about harmlessness	no	no	no	yes	yes
Chamber	ISO 16000	ISO 16000	ISO 16000	ISO 16000	ISO 16000
Testing after ... days	1-3-28	28	3-10-28	3-28	3-28
TVOC measured	yes	yes	no	yes	yes
SVOC measured	no	no	no	yes	no
Single VOC measured	yes	yes	yes	yes	yes
Carcinogens assessed – effect threshold	yes	no	no	no	no
Carcinogens assessed – concentration threshold:	no	yes	yes	yes	yes
Irritants assessed – effect threshold	yes 69 LCI	Formaldehyd Ammonia	yes	yes 166 LCI	yes 216 LCI
Other substances assessed – effect threshold			no		
Odour, sensory assessment	yes	yes	yes	no	yes
Consideration of analytically identified VOC without information about their effect	yes	no	no	yes	yes

FIGURE 4

Case-study A	Case-study B	Case-study C
Older office building, renovated 6 months before the investigation, one room with extreme odour annoyance (same materials as in other rooms)	Older office room, renovated 8 months before investigations (linoleum flooring)	Newly constructed building, medical practice
TVOC: 280 µg/m³ Naphthalene: 17 µg/m³ EGMP: 26 µg/m³ Benzaldehyde: 14 µg/m³	TVOC: 590 µg/m³ Pinene: 50 µg/m³ Styrene: 9 µg/m³	TVOC: 830 µg/m³ Pinene: 160 µg/m³ Styrene: 24 µg/m³ Hexanal: 70 µg/m³
Odour nuisance, health complaints (headaches, nausea)	Odour nuisance	Odour nuisance, health complaints (headaches, nausea, dizziness)

⇨ TVOC < 1.000 µg/m³ is no guarantee for lack of indoor air problems.

FIGURE 5 • KÖHLER 2007

Odour

At the conference, a number of presenters pointed out that odour (sensory) testing is needed to label the emission behaviour of construction products.

Mr. Lundgren, Chalmers University of Technology, Sweden, presented a comparison between the odour threshold of certain substances in the emissions from flooring material and the "lowest concentration of interest" (here NIK) in the AgBB scheme. It became apparent that the odour thresholds can be well below the thresholds based on toxicological data (Lundgren, 2007).
Mr. Köhler, AGÖF, Germany, presented a number of case studies illustrating the situation in which a product meets the TVOC criteria (1000 and 300 µg/m³ as given in the AgBB scheme or other labels) although health complaints and odour annoyance were reported (see Figure 5).
Mrs. Saarela, Technical Research Centre of Finland (VTT), presented an example of a poor correlation between chemical and sensory assessment, and pointed out that it is in the first instance odours which define indoor air quality from the perspective of the users of the building (Saarela, 2007).
The need for odour or sensory testing was among the arguments most often mentioned by participants when they commented on the pros and cons of the different concepts using a questionnaire distributed at the workshop. While one group of participants highlighted the weaknesses of the methodology in establishing "objective" and reproducible test results, others pointed out that odour is a very important factor in triggering building occupants complaints about bad indoor air quality.

TVOC emission from PVC flooring materials 1994

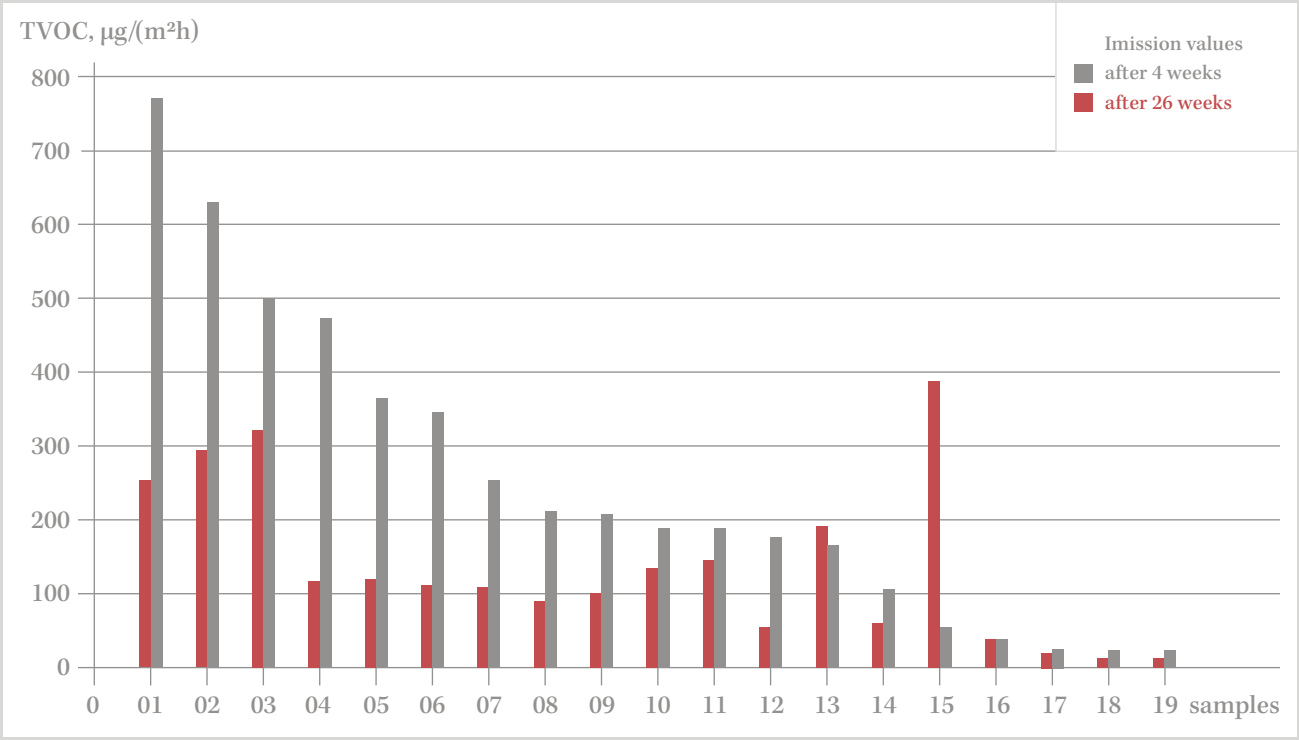


FIGURE 6 • LUNDGREN 2007

Surface products

When translating the results of emission testing into a prediction of indoor air quality, the question arises to which extent products deep in the structure of the building and covered by other construction products will contribute to indoor air quality. At the conference Mrs. Saarela reported that in the M1 concept all products are treated as if they were surface products. This is based on the experience that emitting substances will find their way into the indoor air sooner or later anyway (Saarela, 2007). From this perspective it is doubtful whether technical barriers (like coatings or gypsum boards) can prevent emissions into indoor air in the long run.

This approach was supported by Mr. Lundgren who gave an illustrative example from coated PVC flooring materials, where for some products the VOC emission after 6 months (characterised by the TVOC value) was equal or higher than after four weeks. Figure 6 shows the VOC emissions of 19 coated PVC flooring materials studied after 4 weeks and 26 weeks. Note the situation for sample no. 13 and – especially – sample no. 15.

Trend in indoor concentration of selected substances after renovation

FIGURE 7 • KÖHLER 2007

Time pattern

A widely discussed issue still is how to reflect the time pattern of emission from construction products and the factors that govern it (e.g., temperature or humidity) in the standard test conditions. The AgBB scheme for example prescribes 3-day and 28-day testing time which is just a convention to make tests comparable among each other. As illustrated in presentations by Mr.Lundgren and Mr. Köhler each substance has its own indoor concentration time pattern. Substances like Propyleneglycol, Butoxyethoxyethanol and Butylacetate show overall an "ideal", well predictable behaviour: The indoor concentration decreases after an initial peak. Other substances reach the peak concentration only after 28 days or even later, e.g., TXIB or Dioctylether. Figure 8 shows the concentration trends of dominating chemical compounds in the air of a living room after painting (day zero). Also, the decrease of concentration over time takes place with different speed. Figure 7 shows the indoor air concentrations over a period of about five years after renovation. Finally, temperature, humidity and other interactions in the building may influence the concentration under the conditions of use. As a consequence, the degree of sophistication of any emissions testing regime should be well balanced taking into account that there are uncertainties in the factors that govern the actual exposure in a room.

Chemical compounds in air of a living room after painting

Days	TVOC [µg/m³]	Propylene-glycol [µg/m³]	Butoxyethoxy-ethanol [µg/m³]	Trimethylsilyl-oxybensoate [µg/m³]	"TXIB" [µg/m³]	Dioctylether [µg/m³]
-2	155	8	<155	13	15	10
1	590	365	28	9	18	12
2	440	240	25	8	15	10
7	230	80	11	10	22	16
14	210	70	7	7	18	14
28	370	80	10	147	52	42
57	210	18	2	17	23	18

FIGURE 8 • LUNDGREN 2007

Principal aspects of substance identification

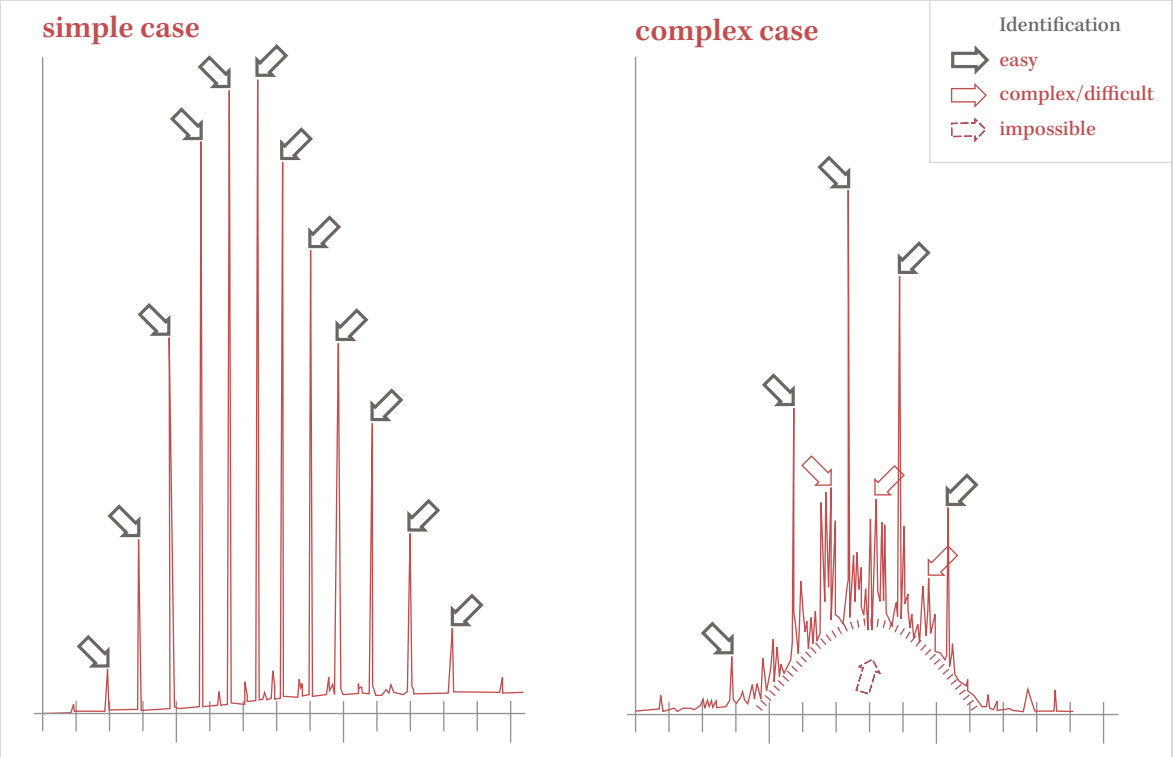


FIGURE 9 • VANKANN 2007

Substance identification and non-assessable compounds

Another element adding uncertainty to the results of testing is the identification of single substances in the air of the testing chamber. Figure 10 compares the number of substances identified in indoor air across various studies (from an AGÖF Database) with the number of substances for which a toxicological reference value (LCI) is available in the different assessment systems. Depending on the analytical efforts and the quality of the laboratory, detection of single substance concentration may be more or less reliable. In addition, emissions from products with naturally occurring constituents may often be very complex compound mixtures and vary more easily in composition. Generally, such products emit more compounds difficult to assess. Information on the analytical situation was provided by Mr. Vankann, GUT, Germany (see Figure 9)
Again, the level of sophistication in single substance identification and concentration measurements should be well balanced with the goal being to introduce a robust testing methodology to the broad market of building products.

Identified substances	LCI values
336 AGÖF	69 (ECA 18)
	216 (AFSSET)
	166 (AgBB)

FIGURE 10

Akcrostab stabiliser's oven volatility at 150°C

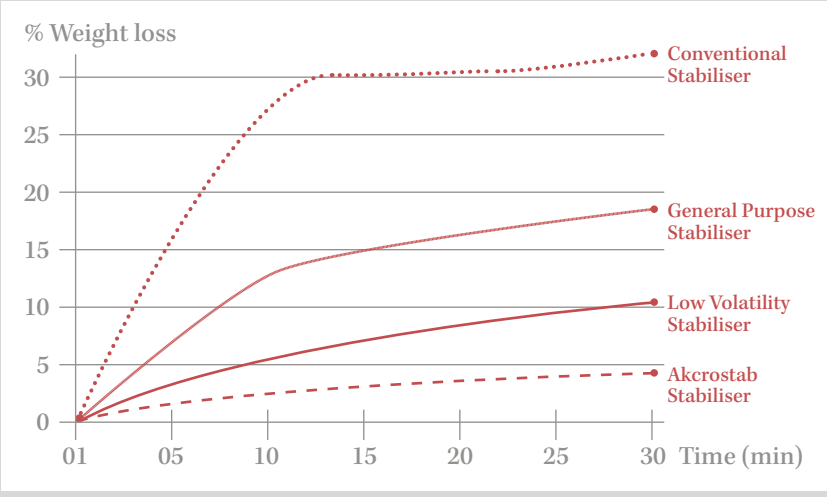


FIGURE 11 • HOWICK 2007

Optimisation of product design

Once product manufacturers have been informed of the emission related requirements, optimisation of product design can become a relatively straight forward exercise.

At the workshop Mr. Howick, Ineos Vinyls, UK, presented an example of such successful product optimisation with regard to the emission behaviour of stabilisers in PVC systems (see Figure 11). Compared to traditional multi-purpose stabilisers Ineos Vinyls could reduce the emission from its products by a factor of 9.

It can be assumed that such product optimisation related to VOC emissions has taken place in many sectors over the past years.

VOC and SVOC emissions of various building products – Experience with the AgBB scheme

Building products	Number of products tested	Label assigned after pre-assessment	Label assigned after chamber test	No label assigned
Silicone sealing compounds	21	15	–	6
Acrylic sealing compounds	15	8	4	3
Lacquers and wall paints	17	6	10	1
Wood (pine, OSB, parquet) and Cork	14	1	12	1
Synthetic resin premixed plasters, levelling screed, plaster boards	14	7	3	4
Adhesives, wall covering, primer	10	4	6	–
Sum	91	41	35	15

FIGURE 12 • JANN 2007

Wood products

Trees are a natural source of VOC emissions, as everyone can experience when walking through the forests, especially on a warm summer day. Most people like this smell and that of cut wood. Due to changes in consumer preferences and in building practices, wooden products have also become a relevant source of emission into indoor air (see alpha-Pinene trend noticeable in Figure 3 on page 7). However, the increase in the use of wooden materials is not always without negative impact on health and comfort. The emissions stem from the wood itself and from oils and waxes used for surface treatment.

The emission dynamics of a wooden product are driven by both, a "drying process" (emission of contained oils) and an "aging process" (products of chemical reactions) over a long time span. Mr. Lundgren, Sweden, presented an example which showed that even after three centuries the heartwood of fir wood beams was found to emit various substances like alpha-Pinene, 3-Carene, Toluene, and 2-Butoxyethanol at rates from 10 to100 µg/m^{2*}h (Lundgren 2007).

Whether wooden construction materials fail to pass product testing schemes due to their emissions of "natural" origin also depends on seasoning time of timber and storage conditions (e.g., temperature and duration) before the product is delivered to the consumer. Recent examples from various product groups presented at the conference (Mr. Jann, BAM, Germany) suggest that wooden flooring materials emissions compared to those of other products do not include a particular "handicap" to remain below the thresholds of the AgBB scheme (see Figure 12)

Evaluation parameters

Based on the plenary discussion and the answers given in the questionnaire distributed to the conference participants a summary of arguments related to the strengths and weaknesses of the existing concepts has been compiled.

Many participants highlighted as strength of a concept the fact of it being based on a simple and robust methodology, accepted by industry and directly applicable to many products. However, with regard to the (simple) TVOC criterion it was pointed out that its exclusive use is not sufficient and needs to be complemented with information on the analytical profile of the emissions and toxicological evaluation related to (selected) single substances. Some participants saw a relation between a demanding "pass" level for TVOC and correspondingly limited needs to regularly assess the analytical profile of the emitted substances in detail.

The TVOC value is the sum of the concentrations of identified and unidentified volatile organic compounds. In ISO 16000 nothing is said about the required minimum ratio between identified and unidentified compounds of a TVOC value. Some evaluation schemes, however, go 2 steps further: As many compounds as possible have to be identified and the individual substances have to be assessed against LCI-values. Quite a number of participants highlighted it as a strength when a system is largely LCI based. But also two arguments were brought forward against an extensive list of single substances to be compared with LCIs.

- Too many LCI values increase the analytical efforts and vulnerability of the system to errors. The evaluation scheme should match practical testing abilities and harmonised test methods (including reproducible results). Too demanding LCIs may overstretch the testing abilities
- The evaluation scheme should not be too sensitive towards uncertainties in the toxicological profile of substances: Quite a number of LCIs have a weak toxicological basis and are not harmonised across the different concepts and between the EU member states

The inclusion of sensory assessment in two of the four concepts was highlighted as a strength of these concepts as well. However, quite a number of participants pointed out that they consider the test methodology being weak and not workable in practise.

Also the inclusion of SVOC in one of the concepts was considered important, although requiring more practical experience and research.

Perspectives for the Future

Overall views of participants

To learn more about the views of the participants, a questionnaire was distributed at the conference. About 50% of the participants responded and gave their views on how to proceed in the future. Figure 13 summarises the views of the respondents. Except for the regulatory status, these views are relatively homogenous: An evaluation and information system on health related properties of constructions products is needed, and actions towards harmonisation taken by the European Commission would be welcome. At the same time, the need for further testing under practical conditions of the existing concepts and further research is highlighted.

Questions	Yes	No	No answer
1. Do you think that the health-related properties of construction products should be controlled?	46	0	0
2. Do you think that there are elements in the available concepts that would still need further testing under practical conditions?	38	2	5
3. Would you recommend that the EC undertake to harmonise the health related evaluation of construction products in the EU?	42	3	1
4. In your opinion, should preference be given to a non-regulatory control system?	14 [1]	20 [1]	4
5. Do you see a need for more research?	38	5	3

FIGURE 13

1) Additional 8 persons were in favour of a smart combination of both approaches.

The need for further testing and research was mainly related to three issues:

- Learn more about factors limiting reproducibility of tests; improve reproducibility of emission behaviour of a product or product group.
- Improve the links between emission testing, exposure modelling and prediction of health effects in real buildings.
- Harmonise the LCI values and possibly concentrate on a limited number of LCIs for the time being.

There seems to be a common understanding that emission testing should include TVOC, carcinogens (Categories 1 and 2) and a limited set of single VOC. The views related to including SVOC, odour and more extensive lists of single substances to be considered (up to >200 values/substances) were more diverse: quite a number of participants expressed their doubts whether odour testing and inclusion of a large number of single substances into testing would lead to reliable and reproducible results.

Regarding the question whether preference should be given to a non-regulatory control system, participant's responses split into two groups of more or less the same size. One group favoured such an approach, one opposed it. Some participants were even in favour of a smart combination of both approaches.

Strategies needed

Based on the presentations, the discussion rounds at the conference and the participants' answers to the questionnaire, the authors of the present documentation have identified strategies addressing a number of problems that need to be solved.

The ISO 16000 standard series forms the common ground for all testing regimes and aims to provide manufacturers, builders and end users with emission data. With this background the standard is useful for the evaluation of the impact of construction products on indoor air quality and also aims to promote the development of improved products. There is, however, a clear need for test procedures which are concisely laid down and harmonised in an EU wide way. Such procedures should be adapted to the particularities of the various groups of building products. Making them available would increase the comparability of test results within the EU.

The evaluation as to whether the emission characteristic of a product is "good" enough should however be left with the member states or voluntary quality schemes. Although harmonisation is also desirable in this respect, there is no process yet in place among the member states. The same applies to the implementation strategy (mandatory requirements or voluntary schemes).

Thus, a key factor is a separation of on the one hand, harmonisation of product information (testing and labelling related to the emission behaviour) and on the other hand, evaluations on the acceptability of a product. The latter usually include political and socio-economic considerations. For example, for a certain product the emission behaviour may be well characterised based on harmonised testing. Nevertheless the emissions quality may be regarded as acceptable in one member state and unacceptable in another.
Despite this, testing methods, evaluation criteria and indoor air quality targets must fit to each other. This also includes a better integration of the emission behaviour of construction products and the expected performance of whole buildings (e.g energy effectiveness).

Therefore, a platform and the moderation of the process are needed for consensus building among the EU member states. This includes a comparison of the current approaches to provide information about the characteristic of construction products with regard to health and environment .In addition it includes a process towards harmonisation of health based LCI values.

Assuming, a harmonised system for construction product labelling could be established over the years to come, there are two important pre-requisites for such a system promoting a practical change in emission related product qualities: First of all the labelling information must be understandable and directly relevant to product designers, designers of buildings and managers of buildings. In this context, also training on the correct interpretation of information provided may be needed.

Secondly, the information must be reliable. Thus a quality assurance system for laboratory testing is need.

The way forward ..... Concluding remarks by Alexander Nies, German Federal Ministry for the Environment

"After such a fruitful and substantial panel discussion with distinguished panellists I am afraid that the closing remarks will now bring you back to the somewhat simplified views of an administrator...
What have we seen during these two days?
First of all your attendance made us happy! Participation included representatives from many EU member states and our esteemed colleagues from the Commission, from authorities, research institutions and non-governmental organisations. This broad attendance made it possible for us to look at our topics from different perspectives and helped develop an integral view.
Existing approaches to identify and reduce emissions from construction products have been presented and thoroughly discussed in the marketplace. I share the view of this morning's chairman – our charming colleague from the incoming presidency – that these concepts do not show insurmountable differences which could prevent us from harmonisation. Moreover, it was extremely satisfying to observe that there was no tendency on the part of participants to push "own" approaches as the only EU solution. Rather, a spirit of constructive contributions to a possible common solution prevailed.
Today's session provided interesting examples from practical application and for valuable insight into achievements and experiences gained during the recent years.

The conference has clearly demonstrated that indoor air quality is an important factor when striving for public health and sustainable quality of life.
While indoor air quality needs an integrated approach which takes all important factors into account, building products definitely are an important emission source for indoor air pollution.
Reducing emissions from building products is necessary and feasible.
Approaches to evaluate emissions from building products are available - we have seen different concepts from four EU member states. All approaches have their advantages: For instance, the Danish concept includes particles, the French concept includes biological contaminants, and the Finnish concept takes into account a building as a whole. These observations almost naturally lead us to the central conclusion of this conference.

The time is now right for the concrete development of an EU-wide harmonised approach to evaluate harmful emissions from building products.

Let me elaborate a bit more on this conclusion. First, the intention is to separate the evaluation concept from its implementation. The step to be taken now is the development of a harmonised evaluation concept. The decision can be made later as to how it will be applied in labelling – on a voluntary basis or as part of a new regulation.
The German presidency would sincerely appreciate it if the European Commission would convene a specific group on health-related evaluation of construction products open to all member states. To avoid misunderstandings: the request is not that the Commission, on the basis of the available information, decides on the proper evaluation scheme. Rather, the Commission is requested to provide for the organisational framework and to foster a substantial discussion among the member states on the desired harmonisation process.
The resulting approach, while remaining scientifically sound, should be simple and easily understandable to the public we want to protect.
We are convinced that a harmonised evaluation concept would be an important step towards improvement of indoor air quality and public health.

Let me conclude my remarks by expressing my thanks to all contributors: to the session chairs, to the speakers, to the organisation team and to all of you for your most valuable contributions. It's time to say goodbye. Have a safe trip home.

Thank you"

Abbreviations

AFSSET	Agence française de sécurité sanitaire de l'environnement et du travail French Agency for Environmental and Occupational Health Safety
AgBB	Ausschuss zur gesundheitlichen Bewertung von Bauprodukten Committee for Health-related Evaluation of Building Products
AGÖF	Arbeitsgemeinschaft Ökologischer Forschungsinstitute e.V.
BAM	Bundesanstalt für Materialforschung und -prüfung Federal Institute for Materials Research and Testing
CEN	Comité Européen de Normalisation
COM	European Commission
CPD	Construction Products Directive
DG SANCO	European Commission, Directorate General for Health and Consumer Affairs
DIBt	Deutsches Institut für Bautechnik German Institute for Construction Technology
DICL	Danish Indoor Climate Label
ECA	European Collaborative Action
GUT	Gemeinschaft Umweltfreundlicher Teppichboden
IAQ	Indoor Air Quality
LCI	Lowest Concentration of Interest
M1	Emission Classification of Building Materials (M1-classification)
MS	European Member State
NGO	Non-Governmental Organisation
NIK	Niedrigste Interessierende Konzentration Lowest Concentration of Interest
PVC	Polyvinylcloride
SVOC	Semi-Volatile Organic Compounds (C6 – C16)
TC	Technical Committee
TVOC	Total Volatil Organic Compounds
Type I Labeling	Voluntary, multiple criteriabased, third-party programme that awards labels to products with overall environmental preferability based on life cycle considerations (ISO 14024)
UBA	Umweltbundesamt (German) Federal Environment Agency
VOC	Volatile Organic Compounds
VTT	Technical Research Centre of Finland

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Cited extracts from presentations held during the conference:
Jann (2007): VOC/SVOC-emissions from construction products: Experiences with the AgBB scheme
Köhler (2007): Indoor air quality – investigations in relation to construction products
Lundgren (2007): Emissions from materials and products
Saarela (2007): Finnish Classification of Indoor Climate 2000, Material emission testing

The agenda, the participants' list and all presentations held at the conference are available on the CD enclosed in this brochure.

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