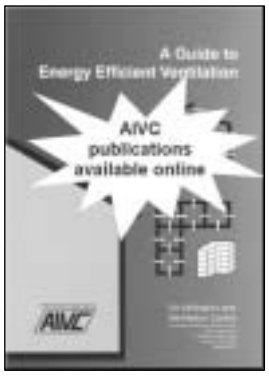
AIR INFORMATION REVIEW

Vol 26, No. 2, March 2005 A quarterly newsletter from the IEA Air Infiltration and Ventilation Centre

New services on AIVC Website

The concept of the AIVC-CD was introduced in September 2001. The target was 'more information – more users – low cost'. An essential element in this strategy was the possibility to distribute all collected information through the AIVC-CD. It was considered as the best available technology from a cost-benefit point of view.
Since the first AIVC-CD in 2001, a lot has changed:



- For more than 1 year it has no longer been possible to include all the information on 1 CD. A DVD could solve this problem but it is more expensive and, eventually, we will still be confronted with the same type of limitations.
- Whereas in 2001, a large part of the potential users had only a relatively slow internet connection by telephone, today most of our users have broadband internet connection.
- Our users now have lots of CD's with lots of information, so it is often not easy to quickly find the appropriate CD.
- We observe an increased need for a flexible and central support environment for dissemination of ventilation related information.

Therefore, we decided in 2004 to progressively move to a full availability of the present AIVC services on the internet in combination with new internet based services.

http://www.aivc.org

Continued on page 7

All ECA publications available!

Since the end of the eighties, European collaboration around the topic "**Indoor Air Quality and its impact on man**" has been carried out, first as a European Concerted Action, later as a European collaborative action. Over all this time, some 23 reports have been published. Unfortunately, the large majority of these publications was only available in printed form and most of the publications are out of print.

In 2004, INIVE EEIG reached an agreement with the Joint Research Centre (JRC) in Ispra to produce pdf-files of all the existing documents and to make these documents available. From now on, all reports are available on the AIVC website and on the AIVC CD. A special ECA CD is in preparation.

Continued on page 10

2005 AIVC Conference

Brussels - Belgium - 21-23 September 2005
«Ventilation in Relation to the Energy Performance of buildings»

More information on pages 8 and 9

AIR
AIR INFORMATION REVIEW

The newsletter of the AIVC, the Air Infiltration and Ventilation Centre. This newsletter reports on air infiltration and ventilation related aspects of buildings, paying particular attention to energy issues. An important role of the AIVC and of this newsletter and CD is to encourage and increase information exchange among ventilation researchers and practitioners worldwide.

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News from practice

EUROVENT certifies Air to Air Plate Heat Exchangers

J. Benoist
http://www.eurovent-cecomaf.org
http://www.eurovent-certification.com

EUROVENT/CECOMAF, the European Committee of Air Handling and Refrigeration Equipment Manufacturers includes 15 member associations from 11 European countries. Together they represent more than 1 000 companies, employing 150 000 employees and having a yearly turnover of 20 Billion €.

Eurovent certification, a fully owned subsidiary company of EUROVENT / CECOMAF was established and is administering voluntary certification programmes. Comparison of product performance by third party testing, based on well-defined procedures, ensures healthy, solid competition within a market which is open to all manufacturers.

The purpose of the Eurovent Certification Programmes (*http://www.eurovent-certification.com*) is to create a common set of criteria for rating products. Through specification of certified products, the engineer's tasks are made easier, since there is no need for carrying out detailed comparison and performance qualification testing. Consultants, specifiers and users can select products with the assurance that the catalogue data is accurate. More than 180 manufacturers participate in 14 programmes covering most equipment used in air conditioning and refrigeration. The latest programme covers air to air plate heat exchangers.

The following certification programmes are at present operational:

Comfort air conditioners < 12 kW	51 companies
Comfort air conditioners 12 – 45 kW	31 companies
Comfort air conditioners 45 - 100 kW	7 companies
Close control air conditioners	2 companies
Fan coil units	43 companies
Liquid chilling packages	39 companies
Air coolers and refrigeration	12 companies
Air cooled condensers	1 company
Dry coolers	9 companies
Cooling towers	-
Air handling units	38 companies
Refrigerated display cabinets	10 companies
Cooling and heating coils	1 company
Air to air plate heat exchangers (new!)	5 companies

Info from projects

European Energy Performance Assessment Method for Certification of Dwellings

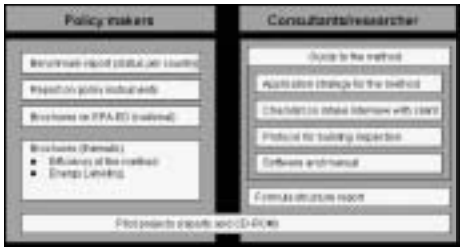
MSc. B. Poel, EBM-consult
http://www.epa-ed.org

The Alterner project EPA-ED (Energy Performance Assessment of Existing Dwellings) was finalised in September 2004. A European method for assessing the energy performance of existing dwellings, together with application strategies for the method were developed and information on a policy framework is available for policy makers on a national and local level. The EPA-ED method and tools facilitate and support the implementation of EC Directive 2002/91/EG "Energy performance of buildings" (**EPBD**) with respect to existing dwellings. This is particularly valuable, as a number of Member States have no method and tools for the energy performance of existing buildings available yet.

EPA-ED: a complete methodology
The EPA-ED method is a complete consultancy process suitable for issuing an Energy Performance Certificate for existing houses or apartment buildings, based on a set of tools that can be easily certified. The available tools enable the consultants to audit and assess a dwelling or an entire building in a uniform way.

The consultant is then supported to provide homeowners with client tailored advice for energy conservation measures that can improve energy performance (thermal insulation, double glazing, high-efficiency boilers, active solar systems etc.).
The EPA-ED calculation model is the core of the available tools, and can be used to calculate the energy consumption of an existing dwelling or residential building and identifies potential energy-saving measures (based on cost-effectiveness) related to the building. After selecting 'energy-saving measures' the software calculates the new energy consumption based on the actual energy consumption of the occupants, including the investments, savings, CO_2 emission reduction and annual savings on energy costs.

Overview of EPA-ED products
The EPA-ED project produced a number of products directed to policy makers, consultants and researchers. The EPA-ED method is a consultancy approach in line with the Energy Performance Directive for Buildings established by the European Commission. Reports, brochures and a CD-ROM accompany this method in order to facilitate policy makers in implementing the method on national or regional level.



The main characteristics:
- The EPA-ED method is a robust consultancy method for existing dwellings and apartment buildings in all European member states.
- It provides the necessary data for the Energy Performance Certificate according to the EPBD.
- It also provides additional energy saving advice tailored to customers, based on the actual use of the building.
- In line with the CEN-standards available and anticipated the expected CEN-standards.
- The structure of the method and the tools is flexible and enables adaptation to the local context and future CEN-standards easily.

The method has been tested successfully in six pilot projects in the four participating countries. Recommendations from these pilots have resulted in adjustment of the software.

The consortium
- EBM-consult (*project co-ordinator*), The Netherlands
- Danish Building and Urban Research, Denmark
- National Observatory of Athens, Greece
- Österreichisches Ökologie Institut, Austria
- OTB Research Institute for Housing, Urban and Mobility studies, The Netherlands

More information is available on the AIVC-CD.

Concerted Action for the Implementation of the European Directive on the Energy Performance of Buildings (EPBD)

Within its Intelligent Energy for Europe programme, the European Commission approved a Concerted Action for the Member States (MS) to help them with the transposition of the EPBD (Directive 2002/91/EC, of 16 December 2002) by its 4 January 2006 deadline. This Directive requires MS to:
- Adopt a Common Framework for the calculation of energy needs in Buildings;
- Set mandatory energy performance requirements for new buildings and for major renovations of large buildings, and procedures for periodic reviewing them;
- Set mandatory Energy Certification of Buildings, carried out by recognized experts;
- Set mandatory inspections of boilers and air-conditioners, carried out by accredited inspectors.

The common framework includes, among other issues, mandatory consideration of the thermal characteristics of the building shell, including airtightness, as well as details of the HVAC systems, ventilation and natural ventilation. As such, the implementation of this directive can be a major driving force for the implementation of energy efficient ventilation systems.

The EU Member States face important challenges, as only a few already have an operational certification and inspection system. Moreover, the common methodology for calculating building energy needs is quite complex and every MS needs to introduce significant changes to their national methods.

The main objectives of this Concerted Action are:
- To enhance and structure the sharing of information and experiences among participants and to promote good practice concepts for implementation of the Directive:
  - To discuss and prepare a structure for the Energy Certification of Buildings that maximizes similarities and reduces the range of different options selected by MS;
  - To discuss and prepare a coherent basis for the methodologies for inspection of heating boilers and air-conditioning equipment, including unitary air-conditioners;
  - To discuss and prepare ways to implement adequate schemes for accreditation of energy audit and inspection experts;
  - To discuss criteria for implementation of the Common Methodology for calculation of the Energy Performance of Buildings with similar criteria.
- To create favourable conditions for an accelerated degree of convergence of National procedures in EPBD related matters.

The first meeting took place in Rome in January, where a total of 85 participants from 22 MS, Norway, Bulgaria and the European Commission, in addition to updating the status of implementation in each country, held two days of useful discussions on the following topics:
- Identification of the main issues where most countries have difficulties or different approaches are being considered
- Practical organization of Certification Schemes and Inspections of Boilers and Air-conditioners
- Integration of Renewables in the national building codes and standards
- Alternative methods for energy performance characterization in the new CEN standards
- Quality Assurance for Experts

The participants are representatives from the institutions in charge of preparing the transposition and the technical and administrative procedures that must be implemented in each country.

Discussions on these and other related topics shall continue in meetings already scheduled for the Slovak Republic in April and in September in Brussels, along with the AIVC conference, where the EPBD shall receive particular attention.

For more information, please contact the CA coordination: ADENE – Portuguese Energy Agency
Carlos.Nascimento@adene.pt.

Bookshop

Sheltering in Buildings from Large-Scale Outdoor Releases

A new Ventilation Information Paper from the AIVC
AIVC VIP 10, 2004, 8 pp,
W.R. Chan, P.N. Price, A.J. Gadgil

An intentional or accidental large-scale airborne toxic release (e.g. terrorist attacks or industrial accidents) can cause severe harm to nearby communities. Under these circumstances, taking shelter in buildings can be an effective emergency response strategy. Some examples where shelter-in-place was successful at preventing injuries and casualties have been documented.

As public education and preparedness are vital to ensure the success of an emergency response, many agencies have prepared documents advising the public on what to do during and after sheltering. This new Ventilation Information Paper focuses on the role buildings play in providing protection to occupants.

For more information on indoor sheltering in buildings, read the new Ventilation Information Paper.

Assessment of ventilation efficiency for the study of indoor air quality

J-J Akoua Aké Ahiman
(PhD Civil Engineering)

This article presents the main results of the PhD study of J-J Akoua undertaken at CSTB (France). This thesis has been supervised by the professor F. Allard and the research assistant professor C. Beghein from the LEPTAB of La-Rochelle University, and the research engineer B. Collignan from the CSTB (France).
An efficient ventilation system provides a good indoor air quality by eliminating air pollutants and ensuring a satisfactory air renewal. Unlike most research works that deal with test cells with controlled boundary conditions, this PhD study focuses on ventilation efficiency in a real environment. In situ experiments are performed and provide the boundary conditions necessary for CFD (Computational Fluid Dynamics) computations. Using CFD for predicting indoor air quality in a real environment is thus analyzed. The influence of permeability on numerical predictions quality is shown. Since it is difficult to quantify accurately the air leakages and their airflow rates, our study proposes a simplified model that includes air infiltration rates in the CFD computations, and that yields satisfactory results.

However, a good phenomenological analysis of the internal air flow and sufficient mesh refinement are necessary to obtain such accurate results.

A critical analysis of ventilation efficiency indices is then performed. It is shown that it is currently impossible to evaluate the air change efficiency (ε_a) in an occupied zone.

Concerning the air pollutants removal effectiveness, it is shown that the usual index ε_C is not suited to ventilation systems with variable airflow rates. For such cases, a new formulation of this index is given. The ratio between the airflow rate and the nominal airflow rate of the ventilation system is also taken into consideration.

A coupled analysis of this new index and of this airflow rate ratio enables us to assess the air pollutants removal effectiveness while considering the energetic cost of ventilation. We finally show that there is no universal index. The choice of the index depends on the pollutant, on the pollutant's concentration, and on the airflow rate. A tool of decision-making aid is thus proposed in order to evaluate the air pollutants removal effectiveness for various ventilation systems. This tool is flexible and rather simple to use.

The thesis (in French) is available on the AIVC-CD.

Demand Controlled Ventilation Systems -

A Case Study for Existing Swedish Multifamily Buildings: New PhD Thesis

Vitalijus Pavlovas of Chalmers Tekniska Högskola completed a thesis for the degree of Licenciate of Engineering, on the use of demand-controlled ventilation (DCV) in Swedish multifamily buildings with mechanical exhaust ventilation. He analysed different ventilation control strategies such as CO2, RH control and presence of occupants (door lock microswitch).
Simulations were conducted with IDA Climate & Energy simulation software (ICE), which showed potential energy savings of up to 50 %. Based on these simulation results, a simple DCV system was developed and implemented in a number of occupied apartments in an existing building.

The study confirms that DCV has a positive influence on energy use, as previous work has also shown. However, the study adds some aspects regarding the negative influence on indoor climate from different DCV strategies and rather demanding occupant loads. The economic feasibility of the proposed DCV system residential applications was also studied, and found to be positive or near-positive; the energy savings depending on a large extent on occupant behavior. The main outcome of the study is thus a rather simple DCV system that was tested under realistic conditions in an occupied building.

The thesis is available on the AIVC-CD.

Determining wind-driven rain on building facades

a boundary condition for the design and testing of ventilation louvers against rain penetration

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Introduction

The co-occurrence of wind and rain causes wind-driven rain (WDR). WDR is one of the most important boundary conditions governing the hygrothermal performance and durability of building facades. Knowledge of the quantity of WDR falling onto building facades is essential as a boundary condition for Heat-Air-Moisture transfer analysis in building parts and for the design and testing of building components (e.g. ventilation louvers) against rain penetration. However, unlike most requirements of buildings where the design data can be expressed in quantitative terms, appropriate quantitative design data for WDR are lacking. This is due to the complexity of WDR.

It is influenced by a large number of parameters: building geometry, environment topology, position on the building facade, wind speed, wind direction, horizontal rainfall intensity (i.e. the rainfall intensity falling through a horizontal plane), raindrop-size distribution, etc. Therefore, a Ph.D. study has been conducted at the Laboratory of Building Physics, Katholieke Universiteit Leuven, by the first author, with the aim being to develop a quantification method for WDR on building facades [1]. This article briefly presents the contents and the results of the thesis and its relevance to the Air Infiltration and Ventilation Community. The thesis itself is available on the AIVC-CD.

Aim, contents and results of the thesis

The principal aim of the thesis was the development of a method to quantify the spatial and temporal distribution of WDR on building facades based on the building geometry and on standard meteorological data: wind speed, wind direction and horizontal rainfall intensity. A review of the literature pointed out that three categories of methods exist for WDR quantification: (1) measurements, (2) semi-empirical models and (3) numerical simulation models based on Computational Fluid Dynamics (CFD). The numerical models are based on the calculation of the wind flow around the building and of raindrop trajectories in this wind-flow field.

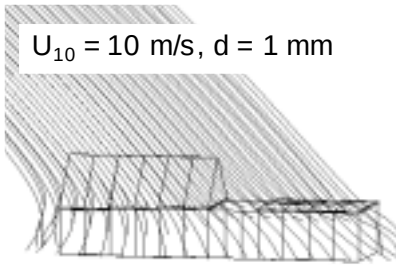
Each of these quantification methods has been studied in the thesis and the study has resulted in the development of an extended numerical method for WDR quantification and the suggested use of a WDR catalogue for general and practical WDR quantification. The contents of the chapters of the thesis are briefly described below.

Chapter 2 presents general aspects about wind and rain and a detailed literature review and state-of-the-art of WDR research in building physics. It is the basis for the research in the following chapters. It also includes an introduction to CFD, which is the major research tool used in the thesis. In Chapter 3, the experimental set-up for wind, rain and WDR at the site of the VLIET test building is described (figure hereafter).

Specific attention is paid to the accuracy of WDR measurements, a topic that has received very little attention in the past. Chapter 4 focuses on the numerical modelling of wind flow around buildings with CFD. Validation is an essential part of CFD simulations. Therefore the model is applied and validated for three simplified building geometries by comparing the numerical results with available wind-tunnel measurements. The satisfactory outcome of the validation study provides the basis for the calculation of the wind flow around the VLIET test building, which in turn is the basis for numerically modelling WDR in the next chapter. In Chapter 5, the extended numerical WDR quantification method is developed.

Measurement set-up for wind, rain and wind-driven rain. Main figure: South-west facade of the VLIET test building equipped with 20 wind-driven-rain gauges (white squares). Details (from left to right): wind-driven-rain gauge on building facade, rainwater reservoir at inside of building facade, rain-gauge installation, meteorological mast situated 20 m south-west of the building, ultrasonic anemometer on top of mast.

It is applied to calculate the WDR falling onto the south-west facade of the VLIET building for a number of on-site recorded rain events (following figures).



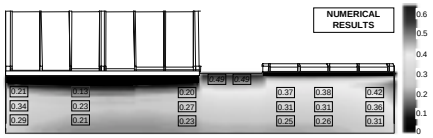
CFD simulation of wind-driven rain on the VLIET building: raindrop trajectories for a reference wind speed U_{10} = 10 m/s and for a raindrop diameter d = 1 mm. The wind direction is perpendicular to the facade.

The numerical results are validated by comparison with the corresponding WDR measurements. In spite of the complexity of the building geometry (roof overhang, protruded and recessed facade parts), the complexity of the surroundings (low agricultural constructions, row of trees) and the inherent complexity of conducting CFD simulations, a satisfactory agreement has been obtained for different types of rain events.

All three quantification methods, including the extended numerical method developed in this thesis, suffer from a number of drawbacks that prevent them being generally suitable for practical use by building researchers and designers.

Chapter 6 indicates that the use of the semi-empirical WDR relationship, which is universally adopted for WDR quantification - mainly because of its ease-of-use - may lead to erroneous results.

Therefore, in Chapter 7, the construction of a WDR catalogue for the quantification of WDR on building facades is suggested and initiated.



CFD simulation results of wind-driven rain on the south-west facade of the VLIET building: contours of the ratio of total wind-driven-rain sum to total horizontal rainfall sum for a given rain event. The wind direction is perpendicular to the facade. A complex wetting pattern is found. The part of the facade that is coloured black is sheltered from rain by the roof overhang. The calculated values at the positions of the wind-driven-rain gauges are additionally indicated.

The catalogue is based on a onetime extensive series of numerical WDR simulations for a large number of typical building configurations.
For the user, it combines the power of the numerical simulation method with the ease-of-use that is characteristic of semi-empirical methods and it avoids most of the drawbacks of both methods. Finally, Chapter 8 and 9 contain applications of the extended numerical WDR method including its use to provide the WDR boundary condition for Heat-Air-Moisture transfer analysis in building components.

Relevance to the AIV Community
The quantification of WDR can be of direct use to provide a boundary condition for the design and testing of ventilation louvers against WDR penetration. Currently, various rain and pressure drop test standards exist by which louver manufacturers test the resistance of their products to WDR [2]. In these tests, very little or no attention is given to the actual amount and intensity of WDR to which the louver will be exposed.
This amount and intensity is very dependent on the building geometry and the building surroundings, on the position on the building facade and on the meteorological conditions (co-occurrence of wind and rain) that can vary considerably with the climate. The use of the extended numerical method or of the WDR catalogue in combination with standard meteorological data allows taking into account these parameters when quantifying WDR for the design and testing of louvers.
The numerical WDR model could also be applied to calculate and study the wind flow and the trajectories of raindrops and other particles (e.g. snow, sand) through the louver to optimise its design.
In a more general context, CFD simulations of the wind-flow pattern around buildings can be used to determine the wind-speed and/or pressure-inlet and pressure-outlet conditions at ventilation louvers, as a boundary condition for interzonal and intrazonal air-flow models.

References
[1] Blocken, B. 2004. Wind-driven rain on buildings – measurements, numerical modelling and applications. Ph.D. thesis, Laboratory of Building Physics, Department of Civil Engineering, Katholieke Universiteit Leuven, 323p.
[2] Lichtenwald, R., Van Becelaere, R. 1998. Testing louver resistance to wind-driven rain. AMCA Supplement to ASHRAE Journal. September 1998, pp. 48-52.

Energy Efficiency and Certification of Central AirConditioners:

a comprehensive report available
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Air-conditioning constitutes a rapidly growing electrical end-use in the European Union (EU), yet the possibilities for improving its energy efficiency have not been fully investigated. Within the European EECAC study twelve participants from eight countries including the EU manufacturers' association, Eurovent, engaged in identifying the most suitable measures to improve the energy efficiency of commercial chillers and AC systems. Definitions of all central air conditioning (CAC) systems found on the EU market have been given. All CAC equipment test standards have been reviewed and studied to assess their suitability to represent energy efficiency under real operating conditions. European CAC market and stock data have been assembled for the first time. We can keep a few figures in mind: 1200 Mm² cooled in year 2000 (3 m²/inhabitant), 2200 Mm² in 2010 (5 m²/inhabitant), with a share of reversibility around 25 %.

The present Energy Efficiency efforts have been reviewed. They play a negligible role, in a situation that may be called BAU and leads to electricity consumption around 51 TWh for all AC in 2000 (18 Mt CO_2) becoming 95 TWh in 2010 (33 Mt CO_2). One thing can be done rapidly: all the elements of a possible grading of chillers on the market, based on full load behaviour, have been assembled. Is there a margin for further improvement?

Optimisation of a chiller for its least life cycle cost shows a large possibility, namely thanks to part load control. The optimal level of performance for the chiller considered is about 40 % more efficient than the present «bottom» of the market: it has an SEER between 3.00 and 3.50 and an initial overcost of +12 % paying for itself rapidly. For manufacturers, there are certainly other ways to reach 3.25 SEER than the ones investigated less expensive, but our objective was to find out if there is a margin for improvement. Impact of load reduction on the efficiency of a chiller may be positive but has to be certified by Eurovent: a reporting format has been proposed to Eurovent as well as a European SEER method (ESEER) for quantification.
Packaged units can also be improved a lot. The study shows that the life cycle cost minimum occurs for large packaged units with an EER of 3.22 W/W.
In terms of market transformation in the direction of Energy Efficiency, EER at full load is a poor selection tool; the US IPLV (hyperlink?) and the Italian EMPE (hyperlink?) are more accurate than EER for classification but do not give enough accuracy for comparison of chillers. The proposed ESEER method allows perfect grading and ranking of chillers by order of merit. Energy efficiency options have been defined for each system configuration and for the components outside the chiller. Scenarios for energy efficiency have been established and quantified. All the elements for an action plan on Air Conditioning are available in the full report for Member States willing to have an influence in this domain.

The full report is available on the AIVC-CD (Volume 1 - Volume 2 - Volume 3).

Performance of Exterior Envelopes of Whole Buildings

M. Sherman,
Lawrence Berkeley National Laboratory

The ninth international conference on the Performance of Exterior Envelopes of Whole Buildings was held from 5 to 10 December in Clearwater Beach, Florida, USA. This conference is held every three years and brings together the world's experts on the performance of building envelopes from the perspective of moisture, energy, and comfort. It is sponsored by the U.S. Department of Energy (DOE: *http://www.doe.gov/engine/content.do*), the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE: *http://www.ashrae.org/*) and the Building Environment and Thermal Envelope Council (BETEC: *http://www.nibs.org/betechm.html*) and a host of other co-sponsors.

The conference drew participants from all over the world. There were over 200 registered participants most of which came from the U.S. and Canada, but over 25 % of which came from various European countries. There were also participants from Asia and Africa.

The foreign visitors were treated to fine Florida weather, but also learned something about rain penetration impacts in extreme climates because of the unusual number of major hurricanes that hit Florida this summer.
The conference contains several special purpose workshops and seminars, but the core of the conference is 4 days of technical presentations on current work. There are two simultaneous tracks of 13 sessions for these presentations: one track is called the "Principles" track and presents peer-reviewed research papers. The other track is the "practices" track where current results are presented and peer-reviewed papers are optional. This two-track philosophy is similar to the one that will be used at the next AIVC Conference.

The presentations in the conference covered all aspects of building envelope performance, but by far the most discussed topic was moisture. There were papers describing new moisture modeling techniques, simulations of various construction types and climates as well as case studies and lessons learned.

Even moisture experts such as Professor Hugo Hens - who is a member of the organizing committee - learned new things. (In this particular case, Professor Hens learned that standard American wall construction had worse weather protection than he thought possible.)
Session topics included roofs; attics; materials); air leakage; indoor environment, whole building performance, walls; basements, and windows. One relatively new topic for this conference was looking at interactions between the HVAC system and the building envelope. Specifically, there were several papers that looked at how ducts penetrating the thermal envelope impacted performance. Standard practice in much of the United States is to have space conditioning ducts outside of the conditioned space. Several speakers addressed this topic and presented methods for resolving it.

The conference produced a lot of new information on moisture and thermal performance of building envelopes and generated a great deal of productive discussion between the participants. The procedures for this conference and the 8th conference (held in 2001) are available for purchase on CD from the ASHRAE Bookstore: *http://resourcecenter.ashrae.org/store/ashrae/*. More information can be found on the conference website: *http://www.ornl.gov/buildings*

Smart Controls and Thermal Comfort Project

Smart Controls and Thermal Comfort (SCATS) is a Joule III project which was built around the adaptive effect in thermal comfort. This effect, which has been noticed in a number of field surveys, has to do with the way the temperature which people find comfortable changes with the outdoor climate.
Its objective was to reduce energy consumption in air-conditioned (AC) buildings and to encourage the use of naturally ventilated (NV) buildings (which typically use less than half as much energy) through the development of control systems for indoor temperature which use this adaptive effect.

The report available on the AIVC-CD presents the work done on of each of the seven tasks, the results and lessons of the individual tasks and of the project as a whole.

Continued from page 1

New services on AIVC Website

In practice, this transition will be done in several steps:

- Since January 2005, all AIVC publications (technical notes, ventilation information papers, guides, …) are as pdf-files available on the AIVC-website. Access to these files is password controlled.
  Personal access codes are available upon subscription. During the introductory period, a 50 % reduction in the subscription price is given.
  Subscriptions for Belgium, France, Germany, Greece, Norway and Switzerland are subsidized by INIVE EEIG (BBRI, CETIAT, CSTB, EMPA, ENTPE, IBP, NBI, NKUA) and can therefore be delivered free of charge on request.
- In March 2005, the database AIRBASE (which contains more than 16.000 references) will be made available on-line whereby the users can on-line search through the database
- Before June 2005, we will gradually add full pdf-documents to the various AIRBASE references, so that users not only can find the abstracts but also the full articles. Of course, we will only include pdf-documents for which AIVC or INIVE have the copyrights or for which permission is obtained to make the publications available. This will include e.g. the proceedings of the AIVC conferences.
- Also before June 2005, it is envisaged to make the standards database available on-line.
- In order to reduce the administrative workload, electronic payment should also be operational during the coming months.

We expect that before the end of 2005, all information which normally is available on the AIVC-CD should be available on-line. Then, it probably will not longer be necessary to distribute the AIVC-CD. However, if there is sufficient interest, it might be useful to produce e.g. yearly a DVD with all available information.

Second announcement & call for papers

26th AIVC conference
Ventilation in relation to the Energy Performance of Buildings

Hotel President WTC
Brussels, Belgium

21-23 September 2005

Sub-theme
"Whole building heat, air and moisture transfer"

The conference is organized by the International Network for Information on Ventilation (INIVE EEIG) on behalf of the Air Infiltration and Ventilation Centre (AIVC).

Purpose
Since 1980, the AIVC conferences have been the meeting point for presenting and discussing interesting developments and results regarding ventilation in buildings. For each conference a specific theme is selected and a substantial part of the presentations relate to this theme. The theme of this 26th conference is 'Ventilation in relation to the energy performance of buildings'.

There are several reasons for selecting this theme:
- Buildings represent in many countries of the order of 30…50 % of the total energy and pollution load. The improved insulation of new and existing buildings in combination with an increased number of buildings with ventilation systems risk to lead to a higher percentage of the energy consumption due to ventilation;
- An increased number of countries are implementing so-called energy performance regulations, whereby limit values are imposed on the total energy consumption of a building for clearly defined boundary conditions. For the 25 EU countries, this process is substantially accelerated due to the Energy Performance of Buildings Directive which imposes all countries to have in January 2006 an energy performance regulation in place with e.g. energy performance requirements for ALL new buildings as well as energy performance certification for all buildings when constructed, rent or sold. This conference is an excellent occasion for having a clear picture regarding the status of implementation just a few months before January 2006.
- During the last decade, a lot of attention has been given to the development of innovative ventilation systems. Energy Performance regulations can be a stimulus for the market introduction of innovative systems but also a barrier.

As during previous conferences, there is also a sub-theme of the conference. This year, the topic is 'Whole building heat, air and moisture transfer'. This topic is also the title of IEA Annex 41.

A new feature of this conference is the organisation of **2 parallel sessions**. Indeed, most of the conference will consist of 2 parallel sessions:
- One session can be considered as the 'practice track': presentations and discussions focused on information for practitioners. We expect that most of the papers regarding energy performance of buildings will be presented here;
- The other session can be considered as the 'research track': presentations which are more focused on the researcher community, specialised consultants, ….

Of course, all participants will receive all conference papers and both tracks are open for all participants.

Topics of the conference
Abstracts are invited regarding interesting work in the areas of research, development and application of ventilation in buildings. Preference will be given to abstracts focusing on one of the following topics:
- Treatment of ventilation aspects in standards and regulations
- Handling of ventilation in energy performance regulations outside Europe
- Airtigthness of buildings and ducts
- Energy for transport of air
- Innovative ventilation systems and energy performance regulations
- Impact of regulations on ventilation market
- Good indoor climate and energy performance
- Ventilation in the context of energy certification of buildings
- Commissioning and inspection of ventilation systems
- Ventilation related challenges for the existing building stock
- Ventilation in very low energy buildings
- Ventilation aspects in warm and cold climates
- Economics of indoor climate

- Coupling, in terms of heat, air and moisture flows, between building and building fabric, consequences for energy consumption and durability
- Combined effect of ventilation and hygric inertia on indoor climate and energy consumption.

Interesting papers on other ventilation related issues can also be submitted.

Programme
The programme for this conference will consist of:
- *Invited* presentations;
- *Papers*: 15 to 20 minute extended oral presentations followed by discussion;
- *Posters:* 5 minute short oral presentations followed by exhibit and discussion;
- *Summing*-up at the end of the conference.

Abstracts
Full oral presentations or short oral presentations with poster are welcome on the conference topics.

The one page abstract single spaced, with the mentioned concerned topic(s) and in English, should include:
- Full title
- Author's full name, affiliation, address, phone, fax & e-mail
- Purpose of the work
- Method of approach
- Results and assessment of their significance
- Conclusions.

In addition, authors may include up to 2 explanatory pages which will facilitate the reviewer's assessment.
A standard form for the abstract can be found on the website
http://www.aivc.org

Interested contributors are kindly asked to submit their abstracts by 15 March 2005 by one of the following ways:
- by E-mail: Word, RTF or ASCII (text only) to: *conferences.inive@bbri.be*
- by fax to +32.2.653.07.29
- by post mail to INIVE EEIG, Lozenberg 7, BE-1932 St-Stevens-Woluwe, Belgium

All presenting authors must register with payment by 15 July 2005, for their papers to appear in the proceedings.

Deadline for abstracts and papers

- Receipt of abstracts 15 March 2005
- Notification of abstract acceptance 30 March 2005
- Submission of papers 15 July 2005

Conference proceedings
All accepted papers will be inserted in the Conference Proceedings which will be available at the start of the Conference.

Venue
AIVC Conference 2005 will be held at the Hotel President WTC
Boulevard du Roi Albert II, 44
Koning Albert II-laan, 44
BE-1000 Brussels, Belgium
Tel: +32.2.203.20.20
http://www.presidenthotels.be

Dates
The Conference will start on Wednesday 21 September 2005 (at 9.00) and will end on Friday 23 September 2005 (about 16.00).

Conference fee

	before 1st July 2005	from 1st July 2005
Conference fee (without accomodation)	726 € (600 € excl. VAT)*	847 € (700 € excl. VAT)*
Conference fee for students (without accomodation)	423,5 € (350 € excl. VAT)*	484 € (400 € excl. VAT)*

* *VAT-registered customers should include their VAT registration number with their subscription. All prices are in EURO (€)*

Precise information will soon be available on the AIVC website:
http://www.aivc.org.

Language
English will be the official language.

Hotel information
A contingent of rooms is being reserved for conference participants and accompanying persons at the Hotel President WTC and a special group rate will be offered (140 €/night, single room and 165 €/night, double room, breakfast and taxes included, special price 95 € for the week-end night).

To obtain the preferential price, please mention the reference code 'AIVC Conference'.
Hotel President WTC
Boulevard du Roi Albert II, 44
Koning Albert II-laan, 44
BE-1000 Brussels, Belgium
Tel: +32.2.203.20.20
http://www.presidenthotels.be

Conference secretariat
If you would have any further questions, please contact the conference secretariat:
INIVE EEIG
Lozenberg, 7
BE-1932 St-Stevens-Woluwe, Belgium
Tel. +32.2.655.77.70
Fax +32.2.653.07.29
E-mail: *conferences.inive@bbri.be*
Contact: Stéphane Degauquier

Additional information
Information about the conference can also be found on the AIVC website: *http://www.aivc.org*.

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ATIC

How to get to the hotel President WTC?
As conference location, the hotel President WTC is located within walking distance from Brussels North station and just 15 minutes away from the airport. Moreover, there are direct high speed trains from Paris Charles De Gaulle (about 1h30), Schiphol (2h30) and Frankfurt (3h30).

Local scientific committee
- D. Berckmans, University Leuven
- A. De Herde, University Louvain
- M. De Paepe, University Ghent
- J.-M. Hauglustaine, University Liège
- H. Hens, University Leuven
- A. Janssens, University Ghent
- J. Lebrun, University Liège
- J. Mampaey, ATIC
- B. Vandermarcke, Wenk St-Lucas
- P. Wouters, BBRI, INIVE

EUROPEAN COMMISSION
DIRECTORATE-GENERAL
Joint Research Centre

European Collaborative Action on
"Urban Air, Indoor Environment and Human Exposure"
(formerly "Indoor Air Quality & it's Impact on Man").

For more than 16 years now the European Collaborative Action ECA "Indoor Air Quality & it's Impact on Man" has been implementing a multidisciplinary collaboration of European scientists the ultimate goal of which was the provision of healthy and environmentally sustainable buildings.

To accomplish this task ECA has dealt with all aspects of the indoor environment including thermal comfort, pollution sources, the quality and quantity of chemical and biological indoor pollutants, energy use, and the ventilation processes, which may all interact with indoor air quality. The work of ECA was directed by a Steering Committee.

To provide a broader view on air pollution exposure in urban areas, both indoors and outdoors, in 1999 the ECA Steering Committee decided to put more emphasis on the links between indoor and outdoor air quality and to focus its further work under a new title "*Urban Air, Indoor Environment and Human Exposure*". The focus of the renewed activity is urban & indoor air pollution exposure assessment, seen as part of environmental health risk assessment and also considering the needs of urban and indoor air quality management. The new approach is hosted by and supporting the activities of the Joint Research Centre's Institute for Health & Consumer Protection in Ispra (Italy) dealing with Physical and Chemical Exposure.

This focused activity will proceed within the broader framework of (i) health and comfort of the citizens, (ii) building technologies and source controls, and (iii) requirements of sustainability, energy efficiency and conservation of natural resources.

Specific examples of the working areas of ECA are:
- the relative importance of outdoor and indoor sources of pollution,
- the building-related interaction between outdoor urban air and indoor air,
- exposure to pollutants from the different urban outdoor and indoor sources and its relation to health and comfort.

By addressing such topics ECA will lay the ground for air quality management to minimize exposures to air pollutants. It will thus continue to contribute to prenormative research needed by EC services and national authorities responsible for preventing pollution and promoting health, comfort and quality of life.

In the series of Indoor Environment and Human Exposure the following reports have already been published.

They are available on the ECA-CD delivered with this issue of AIR.

Report N° 1 - Radon in indoor air (EUR 11917 EN)
Considering the likelihood of contributions of various indoor air pollutants to detrimental health effects, the Community-COST Concertation Committee of the Concerted Action "Indoor Air Quality and its Impact on Man" (COST Project 61 3) decided that indoor radon is a well studied indoor pollutant both in terms of occurring concentrations and expected adverse health effects. In July 1985 the Article 31 Euratom Treaty Group of Experts set up a Working Party to study and report on this matter. Their investigations were published in May 1987 as the report "Exposure to Natural Radiation in Dwellings of the European Communities".

The following text is largely based on the above report but also includes other recent evaluations of this problem. The Community-COST Concertation Committee by publishing this text would like to provide further support to the work of the General Directorate XI (Environment, Consumer Protection and Nuclear Safety) in this matter and offer it to the Commission of the European Communities for its consideration.

Report N° 2 - Formaldehyde emission from wood-based materials: guideline for the determination of steady state concentrations in test chambers (EUR 12196 EN)
This guideline has been prepared by a working group of the concerted action "Indoor Air Quality and Its Impact on Man" (COST project 613) and describes a method for the determination of formaldehyde emissions from wood based materials using large scale, walk-in type environmental chambers. The guideline describes essential features of the chambers to be used, such as size, inner wall and sealing materials, tightness, air circulation and position of sensors for temperature and humidity. Moreover values for temperature, relative humidity, air exchange rate, loading factor and air velocity in the chamber are recommended.
The guideline also deals with sample preparation and positioning in the chamber, and with formaldehyde sampling and analysis In addition questions of quality control are discussed.

Report N° 3 - Indoor pollution by NO_2 in European countries (EUR 12219 EN)
The report summarizes information on indoor pollution by nitrogen dioxide (NO_2) In European countries participating in the concerted action "Indoor Air Quality and Its Impact on Man" (COST project 61 3). The main scope of the report IS to give concise information to people involved In research planning, policy making and regulatory activities and to help to identify a European view of the issue. The summary includes a short review of health effects of NO_2 and of existing air quality guidelines and standards. For those countries for which information has been made available the more important sources, occurring indoor concentrations and national polices have been collated. Preventive measures are briefly discussed and research needs are identified.

Report N° 4 - Sick building syndrome - A practical guide (EUR 12294 EN)
The report aims at giving a guide to those facing the problem of "sick building syndrome". After a description of the other building related illnesses, which must not be confused with the syndrome in object, the extent of the problem is presented, with particular emphasis on the economic implications. The report deals also with the symptoms which must be present in order to diagnose the syndrome and with the various environmental and personal factors possibly contributing to the development of the trouble. Finally, the report contains a rather detailed, stepwise procedure for the detection and mitigation of the most frequently observed causes.

Report N° 5 - Project inventory (S.P.I. 89.33)
Information on the projects is contained on formatted sheets three of which are accommodated on each page. The projects of each country are grouped together.
An identification number has been attributed to each project composed of the country code as used for automobiles and a number. Numbers are sequential and start from 1.
They are attributed arbitrarily and may differ from one edition of the inventory to the next.
The project descriptions (section 5) are preceded by an alphabetic list (section 4) of all keywords occurring in the project descriptions together with the corresponding project identification number(s) and (in parentheses) the number of times the keyword is occurring.
Section 6 contains the project title and the name and address of the principal investigator for projects which were completed more than two years previously or whose description is lacking important information (see introduction section). These projects are also grouped according to their country of origin.

Report N° 6 - Strategy for sampling chemical substances in indoor air (EUR 12617 EN)
The document addresses the questions when, for what period of time, how often and where samples should be taken for the in-field analysis of chemical compounds in indoor air. It is divided into two parts.
In the first part, a more detailed discussion of the dynamics of the indoor environment and of the objectives of Indoor pollution measurements is given In addition, general rules are derived for an optimal strategy to answer the above mentioned questions.
In the second part the general rules are applied to those pollutants or pollutant classes which for the time being are considered of major Importance, and specific recommendations are given.

Report N° 7 - Indoor air pollution by formaldehyde in European countries (EUR 13216 EN)
The report summarizes information on indoor pollution by formaldehyde (HCHO) in European countries participating in the concerted action "Indoor Air Quality and Its Impact on Man" (COST project 613). The main scope of the report is to give concise information to people involved in research planning, policy making and regulatory activities and to identify a European view of the issue.
The summary includes a short review of health effects of formaldehyde, of existing air quality guidelines and standards and of indoor sources of formaldehyde. For those countries for which information has been made available occurring indoor concentrations and national policies have been collated. Preventive measures are briefly discussed and unresolved problems are identified.

Report N° 8 - Guideline for the characterization of volatile organic compounds emitted from indoor materials and products using small test chambers (EUR 13593 EN)
The report describes procedures for determining emissions of volatile organic compounds from indoor materials and products using small environmental test chambers. Consideration is given to facilities and equipment, sample collection and analysis, experimental design and procedures and to data analysis. The techniques presented are useful for both routine product testing and in depth investigations by indoor air quality researchers.

Report N° 9 - Project inventory - 2nd updated edition (EUR 13838 EN)
This report gives short descriptions of 325 research projects and investigations originating from 14 European countries and the Joint Research Centre aimed at understanding causes and/or effects of inadequate indoor air quality and at removing or mitigating such causes. The descriptions contain the project title, keywords, name, address and phone number of the principal investigator(s) and the year of the project start and expected project end. A list of keywords and for each of these keywords the identification numbers of the project reports in which they are referenced, an alphabetical list of the principal investigators along with the identification numbers of their projects and a list of projects completed before the end of 1988 and reported in the first edition of the inventory are also included.

Report N° 10 - Effects of indoor air pollution on human health (EUR 14086 EN)
The report contains a summary discussion of human health effects linked to indoor air pollution (IAP) in homes and other non-industrial indoor environments. Rather than discussing the health effects of the different pollutants which can be found in indoor air, the approach has been to group broad categories of adverse health effects in separate chapters, and describe the relevant indoor exposures which may give rise to these health effects.

The following groups of effects have been considered: effects on the respiratory system; allergy and other effects on the immune system; cancer and effects on reproduction; effects on the skin and mucous membranes in the eyes, nose and throat; sensory effects and other effects on the nervous system: effects on the cardiovascular system; systemic effects on the liver, kidney and gastro-intestinal system. For each of these groups effects associated with IAP, the principal agents and sources, evidence linking IAP to the effect(s), susceptible groups, the public health relevance, methods for assessment, and major research needs are briefly discussed.

Report N° 11 - Guidelines for ventilation requirements in buildings (EUR 14449 EN)

These Guidelines recommend the ventilation required to obtain a desired indoor air quality in a space. The first step is to decide the air quality aimed for in the ventilated space. A certain air quality is prescribed to avoid adverse health effects while a decision is required on the level of perceived air quality aimed for in the ventilated space. Three different comfort levels are suggested. The next step is to determine the pollution load on the air caused by pollution sources in the space. The total pollution load is found by adding the loads caused by the building and by the occupants. The available outdoor air quality and the ventilation effectiveness of the ventilated space are also considered. The ventilation rate required to provide the desired indoor air quality is then calculated based on the total pollution load, the available outdoor air quality and the ventilation effectiveness. The ventilation rates required for health and comfort are calculated separately and the highest value is used for design.

Report N° 12 - Biological particles in indoor environments (EUR 14988 EN)

This report is concerned with the strategy and methodology for investigating four major categories of biological particles in the indoor air of private houses, non-industrial workplaces and public buildings (excluding hospitals). These particles are mites and their faeces; dander from pets and other furred animals; fungi, including moulds and yeasts; and bacteria, including actinomycetes.

For each of these categories the following items have been considered: health effects; occurrence; available sampling methods; available methods of analysis; recommendations for different studies; and observed values and evaluation of results. Health effects, occurrence and sampling and analysis of Legionella are also briefly discussed.

Report N° 13 - Determination of VOCs emitted from indoor materials and products. Interlaboratory comparison of small chamber measurements (EUR 15054 EN)

An interlaboratory comparison using three materials has been organized to assess the agreement among laboratories undertaking tests to characterize the emission of volatile organic compounds from indoor materials and products using small test chambers. The twenty participating laboratories showed the following main results. Chambers of different materials (glass and stainless steel) and of widely different capacity (0.035 to 1475 l) appeared equally suitable. The repeatability of duplicate measurements (including sampling) within each laboratory was good. The test with a known n-dodecane source showed, for most laboratories, an unexpected and yet unexplained discrepancy. The interlaboratory agreement appeared reasonable (coefficient of variation 26-42 %) when testing a PVC tile, but for a wax the scatter was very high.

Report N° 14 - Sampling strategies for volatile organic compounds (VOCs) in indoor air (EUR 16051 EN)

Strategies for sampling chemical substances in indoor air have been discussed in a previous report in this series (Report No 6). This report gives more specific guidance for the development of sampling strategies for volatile organic compounds (VOCs).
The report is divided into three sections:
(a) General considerations which highlight the sampling objectives of indoor VOC measurements, the numerous sources of VOCs and their emission characteristics, the dynamic character of indoor pollution by VOCs, and the interpretation of VOC measurements in relation to health and comfort. These considerations are a prerequisite for the development of sampling strategies.
(b) Discussion of the elements of sampling strategies for VOCs.
These elements include the type and number of objects (buildings) and spaces in which air samples should be taken, the types and status of sources in these spaces, the environmental conditions before and during sampling, the position of the sampler in the selected spaces, the sampling duration, the time and frequency, sampling and analytical methods, and quality control and assurance.
The common choices of the abovementioned elements are discussed.
(c) Outline of sampling strategies, i.e. selections of the abovementioned elements, for the more frequent sampling objectives.

Report N° 15 - Radon in indoor air (EUR 16123 EN)

In an attempt to overcome the increasing difficulty of having concise essential information on important indoor pollutants at hand, the European Collaborative Action 'Indoor Air Quality and Its Impact on Man' has published several reports amongst which a short report on radon in indoor air was published in 1988. Since then, considerable new information has become available.
This report summarizes and discusses the actual state of knowledge on sources of radon in indoor air, typical concentrations, health effects and radon risk estimates, indoor radon measuring methodology, instrumentation, remedial and preventive measures to reduce indoor radon, and recommended and regulatory radon levels. The report concludes that the cost of remedial actions and the lack of public interest are major obstacles in the reduction of population exposure. Appendices which have a decay scheme of radon-222 and its short-lived progeny and which explain special quantities and units for radon and radon decay products complement the report.

Report N° 16 - Determination of VOCs emitted from indoor materials and products; second interlaboratory comparison of small chamber measurements (EUR 16284 EN)

The results of the first interlaboratory comparison, carried out in 1991-92 in the framework of the European collaborative Action "Indoor Air Quality and Its Impact on Man", showed unacceptable interlaboratory discrepancies in the case of a thin layer fast decreasing source.
A second interlaboratory comparison was subsequently organized and, in order to improve the agreement, the design included: (1) control of the chamber air velocity; (2) control of the source layer thickness; (3) adoption of both dilution and sink mathematical models. The concentrations of 2-(2-butoxyethoxy)-ethanol and of the two Texanol isomers emitted from a water-based paint had to be determined over 13 days to derive the initial emission factor.

The results of the 18 participating laboratories from 10 countries can be summarized as follows. The preparation of the paint sample contributed markedly to the variance, because of differences in the paint film thickness. The impact of the chamber itself on the results, if any, was less evident: in fact, a satisfactory agreement of the results has been obtained with chambers of widely different features (capacity range 35 cm^3 to 1.5 m^3). Despite the use of calibration solutions prepared from the same batch of pure compounds, the analysis of the compound concentrations contributed markedly to the variance, as confirmed by the results of an analytical comparison carried out in parallel with the main comparison.
Model fitting has produced a reasonably good description of the data sets, apparently accounting also for the sink due to chamber wall adsorption. The maximum ranges of the estimated emission factors, expressed as a ratio of the highest to the smallest reported value, are 52, 9 and 9 respectively for 2-(2-butoxyethoxy)-ethanol, Texanol-1 and Texanol-2; however, the scattering is markedly reduced if only results obtained with the same GC detector (FID) and from paint samples within a narrow thickness range (50.8-70.6 pm) are considered.

Report N° 17 - Indoor Air Quality and the use of Energy in Buildings (EUR 16367 EN)

This report provies information and advice to policy and decision makers, researchers, architects, designers, and manufacturers on (i) strategies for achieving a satisfactory balance between good indoor air quality (IAQ) and the rational use of energy, (ii) guidelines on the use of energy in buildings and IAQ currently available, (iii) significant trends in the building sector with implications for IAQ and energy use and (iv) current research concerns.
The report discusses the relationships and potential conflicts between IAQ and the efficient use of energy in buildings and related factors such as the influence of occupancy and occupant activities, energy use and sustainability, indoor air pollution and its control, and health and comfort aspects of indoor air quality and climate.
The influence of climatic conditions and their variations across Europe on IAQ and energy use, socio-economic costs of poor IAQ and its relation to the use of energy and trends for the future in the building sector are also briefly addressed. Current research concerns in the field of IAQ and energy use in buildings are highlighted and gaps in knowledge and research needs are identified. Key elements of a strategy by which designers, engineers, manufacturers and other decision makers can achieve a good balance between energy use in buildings and indoor air quality (IAQ) are proposed. Following the recommended procedure will reduce the risk of poor IAQ and waste of energy.

Report N° 18 - Evaluation of VOC emissions from building products

This report outlines the principles of a general evaluation procedure for emissions of volatile organic compounds (VOCs) from building materials with respect to their potential effects on health and comfort. Using available knowledge, the principles have been applied to a simplified case, i.e. a procedure for the evaluation of VOC emissions from solid flooring materials. The procedure IS intended for the classification and/or labeling of these materials and may serve for both voluntary and regulatory purposes. The procedure Includes (i) the selection and handling of appropriate test specimens; (ii) the determination of emission factors of individual VOCs and of TOVC (Total Volatile Organic Compounds) using small test chamber measurements; (iii) modeling of indoor relevant VOC concentrations; (iv) their toxicological evaluation and (v) measurements of sensory irritation and odour or perceived air quality of the emissions. An overall scheme of how to combine the different elements of the procedure and rules how to use the information obtained for labeling of building materials have been established.

New Chapter 5 of Report Nr. 18 (EUR 17334 EN)

This booklet contains an updated version of Chapter 5 of Report Nr. 18 (EUR 17334 EN), published in 1997 in the series of reports issued by the European Collaborative Action 'Indoor Air Quality & Its Impact on Many (ECA-IAQ).
Chapter 5 deals with sensory evaluation of emissions from flooring materials. The reason for updating this chapter (and not the whole report) is the following. A working group of the ECA-IAQ has undertaken the remarkable work of collating and evaluating the many pieces of information existing on the "sensory evaluation of indoor air quality" and a report with this title (m20 in the series) is in press. This work has brought to light enough information to induce the Steering Committee of the ECA-IAQ to update Chapter 5 in Report 18.
The chapter has been entirely rewritten in a more logical way and the main innovations concern the explicit description of criteria and methods for sensory evaluations of air quality and the introduction of a section "quality assurance".
The opportunity of this publication has been used also to correct a few errors and inconsistencies encountered in other parts of Report No. 18. These corrections are reported on the pages following chapter 5. A larger number of errors and inconsistencies have occurred in Appendix 6 to Report No 18. The entire appendix is therefore reprinted.

Report N° 19 - Total volatile organic compounds (TVOC) in indoor air quality investigations (EUR 17675 EN)

The amount of volatile organic compounds (VOCs) in indoor air, usually called TVOC (Total volatile organic compounds), has been measured using different definitions and techniques which yield different results. This report recommends a definition of TVOC referring to a specified range of VOCs and it proposes a method for the measurement of this TVOC entity. Within the specified range, the measured concentrations of identified VOCs (including 64 target compounds) are summed up, concentrations of non-identified compounds in toluene equivalents are added and, together with the identified VOCs they give the TVOC value.
The report reviews the TVOC concept with respect to its usefulness for exposure assessment and control and for the prediction of health or comfort effects. Although the report concludes that it is today not possible to use NOC as an effect predictor it affirms the usefulness of TVOC for characterizing indoor pollution and for improving source control as required from the points of view of health, comfort, energy efficiency and sustainability.

Report N° 20 - Sensory evaluation of indoor air quality (EUR 18676/EN 1999)

This report presents background to and advice on methodologies for sensory evaluation of indoor air quality (IAQ). The report gives a short introduction to sensory mechanisms and responses and to the theory of measurement underlying sensory evaluations and discusses in detail available sensory evaluation techniques.

After a critical methodological analysis of some recently published documents on IAQ, sensory methods best suited for the evaluation of material emissions and of IAQ and for population response studies are recommended. Also non-sensory techniques for the evaluation of odour and mucosal irritation are briefly discussed. However, it is concluded that, at present, human subjects are indispensable in the measurement of perceived indoor air quality. The proposed methods will enable designers, manufacturers, chemical and ventilating engineers, consumers, building and health authorities, and other decision makers to compare and select appropriate building materials, furnishings etc. Thereby the design, supply and control for good perceived air quality in indoor spaces will be made easier which will lower the costs and minimise waste of energy.

Report N° 21 - European Interlaboratory Comparison on VOCs emitted from building materials and products (EUR 18698/EN 1999)

Eighteen laboratories from 10 European countries participated in a comparison organized in the framework of the project VOCEM, a 2.5 year research collaboration among 4 research institutes and 4 industrial companies. The VOCEM project ("Further development and validation test chamber method for measuring VOC emissions from building materials and products") has been partially funded by the European Commission (Contract no. SMT4-VT95-2039).

The scope of the project was to improve the procedure used to measure VOC emitted from building materials and products in small test chambers. The inter-laboratory comparison included the GC-MS determination of 5 target compounds from carpet , 8 from PVC cushion vinyl and 2 from paint; for the first time, chamber recovery (sinks), homogeneity of solid materials and possible contamination during transport were tested.

The results show that the intra-laboratory variance (random errors) is much smaller than the inter-laboratory variance (systematic errors). Causes of the largest inter-laboratory discrepancies were: (a) analytical errors; (b) losses of the heaviest compounds due to sorption on the chamber walls; (c) non homogeneity of the materials.

The output of this work concerns both the objective of labeling materials with regard to their VOC emissions and the pre-standard drafted by CEN for this type of determination.

Report N° 22 - Risk assessment in relation to indoor air quality (EUR 19529/EN 2000)

People will never live in a risk free environment. Still we must aim at minimizing all risks and most importantly risks that are imposed on them without their consent or even knowledge. A building is built for and perceived as shelter - against weather and unwanted intruders, for thermal comfort, privacy and property. Health threatening risks that the dwellers of a building cannot sense or expect contradict directly the whole concept of a building.

Risk assessment is a scientific multidisciplinary paradigm to identify, quantify, describe and compare risks. Risk management is an administrative paradigm to develop and compare risks reduction priorities and alternatives, to organise and manage risk-controlling practices and to evaluate the achievements. Risk assessment and management have always existed. The general formal paradigms that are being applied in today's societies however are quite recent, and still under continuous development.

This main body of this report presents the state of the art of modern risk assessment and risk management paradigms, highlighting also the historical development that has lead to the present practices, and applies them specifically into building environments.

The examples section in the end of this report applies the formal risk assessment protocol of the EC (and similarly USEPA), to a variety of building related health risk. These examples are not intended as recommendations; instead they are selected to highlight the level of success (or failure) in applying one strict protocol to multiple extremely different problems.

Report N° 23 - Ventilation, good Indoor air quality and rational use of energy (EUR 20741/EN 2003)

The aim of this report is to provide information and advice to policy and decision makers, researchers, architects, designers, and manufacturers on strategies for achieving a good balance between good indoor air quality (IAQ) and the rational use of energy in buildings, available guidelines and assessment techniques on energy and IAQ, significant trends for the future with implications for IAQ and the use of energy in buildings; and an indication of current research issues.

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