AIR INFORMATION REVIEW

Vol 25, No. 1, December 2003 A quarterly newsletter from the IEA Air Infiltration and Ventilation Centre

Indoor Air Pollution in Urban Buildings. A Real Threat for Most of the World Population

M. Santamouris - University of Athens

Indoor environmental quality of urban buildings is seriously affected by the concentration of harmful pollutants in the indoor environment. The sources of indoor pollutants are: human activity, outdoor pollution and the presence of products and materials that emit a large variety of compounds.

In developed countries, the concentrations of indoor pollutants are very similar to those outdoors, with the ratio of indoor to outdoor concentration falling in the range 0.7-1.3. However, concentration of indoor pollutants may be two to five times higher than outdoor concentrations, (1).

Three basic strategies are proposed which can be used separately or in combination to reduce occupant exposure to indoor contaminants 1) building air tightening and pressure management, 2) ventilation and air filtration, and 3) contaminant removal, (2).

Because of high outdoor pollution and the nature of human activities, indoor air quality problems in urban buildings of developed countries are much more significant than in rural areas. A recent study reported in (3), the following table shows clearly that exposure in the indoor environment to particulate matter is 7 times higher in the indoor than in the outdoor environment while it is 3.5 times higher in urban than in rural areas. Higher concentration in rural areas of developing countries is due to the use of biomass as a fuel for cooking and heating.

Particle concentrations and exposures in the eight major global microenvironments, (3)

	Concentrations			**Exposures**	
Region	Indoor (µg/m³)	Outdoor (µg/m³)	Indoor (%)	Outdoor (%)	TOTAL (%)
Developed					
Urban	100	70	7	1	7
Rural	80	40	2	0	2
Developing					
Urban	250	280	25	9	34
Rural	400	70	52	5	57
TOTAL (%)		==	86	14	100

AIVC Conference Prague, 15-17 September 2004
first call for abstracts
More information on topics, hotel, fees, ... see www.aivc.org

Continued on p. 11

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.

Published by:
Air Infiltration and Ventilation Centre
Operating Agent and Management
INIVE EEIG, Boulevard Poincaré 79
BE-1060 Brussels, Belgium
Tel: +32 2 655 77 11
Fax: +32 2 653 07 29
inive@bbri.be, http://www.inive.org

Preparation:
Christophe Delmotte & Peter Wouters

Editing: Erika Malu

Contributions to AIR: Suggestions for contributions are welcomed.

Subscriptions: (See also the subscription form on page 15 or on the CD)

The subscription is for 4 issues of the newsletter, with accompanying CD, per year (starting in September) Issues are published in September, December, March and June.

1) AIVC Member Countries:
Belgium, France, Czech Republic, Greece, Norway, Netherlands, USA
200 EUR/year (renewals at 100 EUR)

2) Non-AIVC Member Countries
400 EUR/year (renewals at 200 EUR)

3) A free version of AIR without any links is available at *www.aivc.org*

INIVE members distribute AIR & AIVC-CD for preferential rates (even free of charge) in their countries (Belgium, France, Germany, Greece, Norway, Switzerland).
Contact INIVE for information (see page 16).

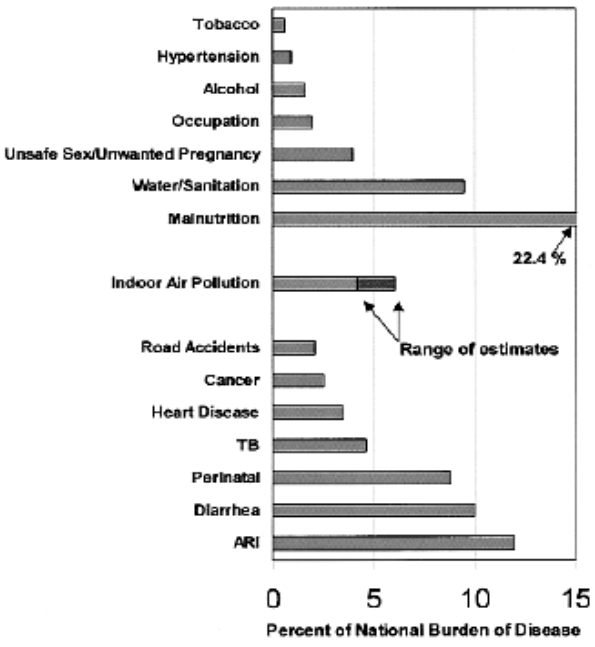
Indoor air quality problems in developing countries is an extremely serious problem. While in developed countries IAQ problems arise from low ventilation rates and the emission of building products and materials, the inhabitants of less developed countries face problems related to pollutants generated by human activities, in particular by combustion processes because of the use of ovens and braziers with imperfect kitchen and stove designs. As reported in (3), 'today about half the population of the world continues to rely for cooking and associated space heating on simple household stoves using unprocessed solid fuels that have high emission factors for a range of health-damaging air pollutants' Compared to modern fuels like gas, solid fuels produce 10-100 times more respirable particulate matter per meal, (3). Measurements made in kitchens of homes in India showed particulate levels 35 times the one hour standard and nearly 100 times the 24 hour standard recommended in industrialised countries, (4).

In parallel, other pollutants, like carbon monoxide, formaldehyde, polycylic aromatic hydrocarbons, benzene, and 1,3-butadiene also reach much high concentrations. As reported by the WHO, in some areas of China and India, the use of coal in houses leads to high indoor concentrations of fluorine and arsenic with consequent health effects, (3).

High indoor concentration of pollutants is a tremendous health threat to the population of the less developed countries. Worldwide, close to 2 million deaths per year are attributable to indoor air pollution from cooking fires, (5). Recent studies of the WHO have shown that 30 to 40 per cent of 760 million cases of respiratory diseases world-wide are caused by particulate air pollution alone. 'Mostly, these health effects are caused by indoor air pollution due to open stove cooking and heating in developing countries', (6). Studies in Latin America, Asia, and Africa have shown that indoor air pollution is also responsible for pregnancy-related problems such as stillbirths and low birth weight. It has also been associated with blindness (attributed to 18 percent of cases in India) and immune system depression, (7).

In particular in India, it is estimated that 500000 women and children die each year due to Indoor Air Pollution related causes as almost 75 % of the population relies on traditional biomass fuels, (8). This is close to 25 % of the deaths worldwide attributed to indoor air pollution problems.

Estimated burden of disease (DALYs) in India for selected major risk factors and diseases compared with that from indoor air pollution, (8)



Other studies show increases in the number of premature deaths in India because of the IAP problems, up to 3300000 per year. The following table summarises most of the recent estimates on premature mortality in India because of the IAP problems, (adapted from 8).
The severity of the problem is shown by studies aiming to estimate the burden of disease in India for selected major risk factors and diseases. As shown in the following figure, (8). mortality because of indoor air pollution problems is at a very high position.

Estimate of annual premature mortality from air pollution in India (thousands of deaths)

Outdoor exp., ('000)	Indoor exp., ('000)	Reference
50–300	850–3300	(18)
84	590	(19-20)
200	2000	(21)

It is evident that proper ventilation of urban buildings in these countries as well as in the developed world can contribute highly to reduce the concentration of indoor pollutants and protect public health. Given that indoor pollution problems, in the less developed countries affect mainly the poorest part of the population, the use of advanced ventilation and filtration techniques is not feasible at all. Thus, natural ventilation may be one of the more effective solutions, among others, on the condition that the outdoor air is less polluted than the indoor air. The development of appropriate strategies and techniques to enhance natural ventilation in urban buildings may save million of lives in the developing countries.

Recent European research studies carried out in the frame of the URBVENT and RESHYVENT research programs aim to develop tools and techniques to enhance natural and hybrid ventilation in urban buildings. It is expected that the results of this research will contribute to improve indoor environmental quality in developed countries and decrease the use of air conditioning while can highly contribute to improve indoor air quality in the less developed world.

References

1. L.A. Wallace, The total exposure assessment methodology (TEAM) study: Project Summary, US Environmental Protection Agency, EPA/600/S6-87/002, Sept. 1987.
2. M.H. Sherman and N.E. Matson : Reducing Indoor Residential Exposures to Outdoor Pollutants, AIVC Technical Note, In press, 2003.
3. Air quality guidelines, WHO, 1999.
4. Josef Leitman : Energy Environment Linkages in the Urban Sector. UNDP, Discussion Paper, April 1991.
5. WEHAB Working Group : A Framework for Action on Energy. World Summit on Sustainable Development, 2002.
6. World Bank: Indoor Air Pollution Newsletter Energy and Health for the Poor ,Issue No. 2; December 2000.
7. The World Bank : Indoor Air Pollution. Fighting a massive health threat in India.
8. Kirk R. Smith : National burden of disease in India from indoor air pollution, PNAS November 21, 2000 u vol. 97 no. 24 13293.

GUIDE TO THE NEWSLETTER

The Air Information Review is available in electronic format (PDF file) on the AIVC-CD. This electronic version is provided with hyperlinks to other documents located on the CD and to external web sites or e-mail addresses.

In the document, links are represented by small red icons or by red text.
To follow a link: position the pointer over the linked area on the page until the pointer changes to a hand with a pointing finger (the hand has a plus sign in it if the links point to the Web). Then click the link.

Content of the AIVC-CD
The AIVC-CD contains various AIVC products, such as the Air Information Review newsletter, Technical Notes, "Airbase" (the AIVC's bibliographical database) and recent conference proceedings. It also contains a lot of third party publications.

The content of the CD is summarised in a document called "What's on the AIVC-CD?". This document is also available on the CD and is provided with hyperlinks.

In order to have an overview of the content of all the AIVC-CD's, a compilation of their tables of content is also available on the CD.

How to find information on the AIVC-CD
Once you have introduced the AIVC-CD in the CD-Rom driver of your computer, the index.html file should open automatically. (If this is not the case, you can find the file on the main root of the AIVC-CD and open it yourself). This file is provided with hyperlinks to other documents located on the CD.

To find information in a PDF document, you can use the Find command (Edit > Find) to find a complete word or part of a word in the current PDF document.

You can also use the Search command (Edit > Search > Query) to search for a word a combination of words through all the PDF files located on the AIVC-CD.

WEBSITES

American documents on ventilation and energy savings

F. Durier - CETIAT
http://

The Office of Energy Efficiency and Renewable Energy (EERE) is a part of the US Department of Energy whose mission is to strengthen public-private partnerships that enhance energy efficiency and that bring clean, reliable and affordable energy technologies to the marketplace. EERE is organised around 11 programs, one of them being the Building Technologies Program. The EERE website contains many interesting documents that can be downloaded free of charge.

They include 25 technical reports (duct systems, indoor air quality, energy consumption of HVAC systems, …), 27 technology fact sheets (wall insulation, passive solar design, air distribution system, …), 11 documents describing high performance buildings, 14 brochures about the design of low energy schools, as well as several brochures for consumers information on energy savings.

Two of these EERE technology fact sheets are included on the AIVC CD, with the permission of the National Renewable Energy Laboratory, which was responsible for their writing. They concern «Spot Ventilation» and «Whole House Ventilation». They were published in December 2002.

CADDET Launches New Web site

http://www.

CADDET has just made it easier to find the latest information on energy efficiency and renewable energy technologies. Following the decision to merge the CADDET Energy Efficiency and Renewable Energy programmes earlier in 2003, a new Web site combining the two previous sites has now been launched, to provide the market with a "one-stop-shop" on sustainable energy projects and technologies.

CADDET is a programme funded by countries that are members of the Paris based International Energy Agency (the European Commission also participates). Its aim is to provide the latest information on innovative energy efficiency and renewable energy technologies that have been applied in a commercial environment, in order to promote their widespread uptake by the market. In addition to its database of over 1,600 projects (the InfoStore), the site provides access to CADDET's quarterly InfoPoint newsletter, 431 four-page case studies in pdf format (called Technical Brochures), 49 detailed reports on a wide range of energy efficiency and renewables topics, as well as news, events and links to other relevant Web sites. Together with its sister programme, GREENTIE (*http://www.*), which features a database of over 5,900 suppliers, CADDET provides one of the richest sources of free, independent information for those wishing to implement clean energy projects.

High-resolution European database on solar radiation

P. Wouters - BBRI
http://

Ventilation as part of a strategy for summer comfort control is gaining in importance. Reliable climatic data is important. Recently, the European Joint Research Centre in Ispra produced on the internet a publicly accessible version of a high resolution European solar database. The first purpose of this database is for PV applications, but this information can also be used in other domains. The spatial resolution of the database is 1x1 km and values represent averages from the period 1981 to 1990. Map-based queries allow estimations for any location in Europe. Global irradiation (monthly, yearly averages and daily profiles) and other climatic parameters are available.

NEWS FROM PRACTICE

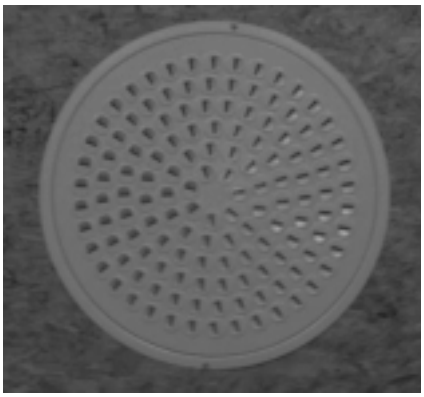
Laboratory test of measuring hoods for supply air

O. M. Solheim - NBI
http:/

A capture hood, also known as a flow measuring hood, is an instrument used to measure volumetric air flows from supply or exhaust air terminals. These have been the most common measuring method for exhaust for many years. For supply air terminals the normal method has been measurement of a local differential pressure in the air terminal device and k-factor calculation. There are now several hoods for supply air in the market. These have often been subject to suspicioun due to possible errors when used on different kinds of air terminals. The Norwegian Building Research Institute (NBI) has often experienced deviations of up to 50 % from calibrated values. However, the hoods have been continuously developed in order to meet these problems. NBI has therefore recently completed a test of the most common hoods on a number of different diffusers. The general conclusion is that in most cases satisfactory accuracy can be achieved by this measuring method.

It is the discharged air flow pattern from the supply air terminal that can cause errors in the measured value. Examples of difficult patterns to measure, are rotation, one-way discharge and high impulse jets. The sensibility to different flow patterns is dependent on the size and shape of the hood and design of the sensor. Some of the manufactures have now developed air straighteners for mounting inside the hood.

Example of diffuser with rotational pattern



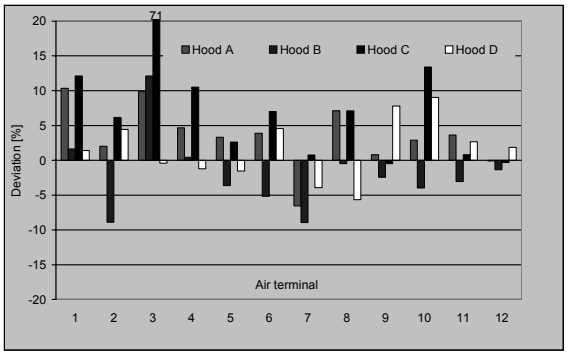
NBI invited hood suppliers and air terminal suppliers in Norway to participate in the project. Four hoods were tested with 11 different air terminals. The range of air flow rate was from 25 to 125 l/s. The hoods were first calibrated with a reference air flow rate discharged from a perforated plate of the same area as the air inlet of the hood. The same air flow rate was then discharged from the different air terminals and measured by the different hoods.

The tested hoods

The test results expressed by deviations from calibrated values are presented in the graph below.

Test results

The test results show that supply air flow rates can be measured by hoods for the most common air terminals in the Nordic market. However, individual correction factors for each terminal/hood combination can in some cases be necessary in order to achieve sufficient accuracy.



INFO FROM PROJECTS

Cooling performance of ground-coupled air intake ducts

M. Mysen - NBI

Hybrid or natural ventilation with ground-coupled fresh air intake ducts (or culverts) has become an increasingly popular way of conditioning air in schools in Norway and Sweden. Cooling of air is probably the most valuable property of ground-coupled ducts, but what cooling performance is it possible to achieve with ground-coupled ducts? An answer, or indication of an answer, has been found by analysing the data from Jaer School in the municipality of Nesodden and Mediå School in the municipality of Grong, both of which have been evaluated through the Norwegian HybVent-project underlying IEA ECBCS Annex 35 (International Energy Agency).

Ground-coupled ducts connect an air intake tower with the ventilated building. They are normally made of concrete and they should be easily accessible for inspection and cleaning, which makes it possible to discover and remove dust and mould before it has any severe negative impact on the indoor environment.

A ground-coupled duct can be divided into two parts: the first part transports air from the air-intake to the building (air-intake culvert), the second part is formed to distribute the air to the vertical shafts which lead to different rooms (air-distribution culvert).

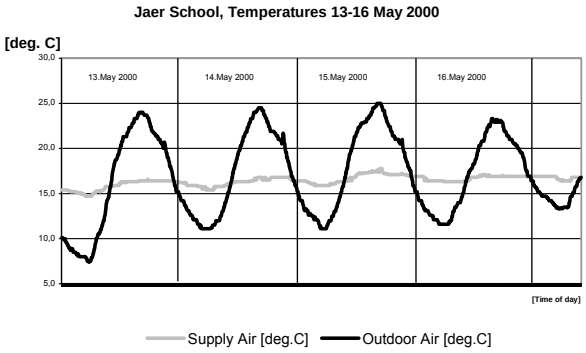
Ground-coupled ducts dampen diurnal temperature swings of the supplied fresh air, reducing the need for preheating and mechanical cooling.

The cooling effect during summer is considerably larger than the preheating effect in winter. Due to the low air velocity, ground-coupled ducts also have a beneficial filtration effect by sedimentation, for rain, snow, and particles (mostly larger than 10 µm).

Air temperatures throughout the culvert, and air flow rate (by means of anemometer), have been measured at Jaer and Mediå School.

The measurements at Jaer and Mediå School show that a culvert has significant cooling effect which is visualised by figure 1. In cold climates with cool night temperatures, the cooling flux from the culvert surfaces at Jaer School stabilizes at around 100 Wh/m² after a long warm period.

By increasing the airflow rate at nights, it should be possible to achieve a cooling effect of at least 200 W/m² of environmentally favourable cooling with no use of electricity and no risk for emission of toxic or harmful greenhouse gases. This correspond to 1.7 m^2/pupil culvert surfaces presupposed demand controlled displacement ventilation for buildings situated in the same environment as in the municipality of Nesodden, or 1.1 m^2/pupil in the same outdoor environment as in the municipality of Grong.



The maximum recorded peak loads led only to a small and negligible increase in the supply air temperature after the culvert, which indicates that culvert cooling is well suited for handling considerable peak loads.

The use of such concrete culverts will, together with suitable airflow regulation, ensure that the supply air is colder than room air, which is crucial for functional displacement ventilation.

Integrating Environmentally Responsive Elements in Buildings
IEA ECBCS Annex 44

P. Heiselberg - Aalborg University

The preparation phase of a new annex was approved at the 54th ECBCS ExCo meeting in Prague in November 2003. The annex working title is: "Integrating Environmentally Responsive Elements in Buildings".

Research into building energy efficiency over the last decade has focused on efficiency improvements of specific building elements like the building envelope, including its walls, roofs and fenestration components, and building equipment such as heating, ventilation, air handling, cooling equipment and lighting. Significant improvements have been achieved, and whilst most building elements still offer opportunities for efficiency improvements, the greatest future potential lies with technologies that promote the integration of responsive building elements and communication among building services.

In this perspective "*Whole Building Concepts"* are defined as solutions where responsive building elements together with building services are integrated into one system to reach an optimal environmental performance in terms of energy performance, resource consumption, ecological loadings and indoor environmental quality. "*Responsive Building Elements"* are defined as building construction elements which are actively used for transfer of heat, light and air. This means that construction elements (like floors, walls, roofs, foundation etc.) are logically and rationally combined and integrated with building service functions such as heating, cooling, ventilation and energy storage. The development, application and implementation of responsive building elements are considered to be a necessary step towards further energy efficiency improvements in the built environment. With the integration of responsive building elements and building services, building design completely changes from design of individual systems to integrated design of "whole building concepts, augmented by "intelligent" systems and equipment.

The annex will address the following objectives:

- Define state-of-the-art of responsive building elements and their integration with building services.
- Improve and optimise the integration of responsive building elements and building services.
- Develop and optimise new building concepts with integration of responsive building elements, building services as well as natural and renewable energy strategies.
- Develop guidelines for procedures and tools for detailed estimation of environmental performance of responsive building.

The annex will be divided into the following four subtasks to reach the objectives:

- Subtask A: Integration of Responsive Building Elements and Building Services
- Subtask B: Integrated Building Concepts
- Subtask C: Guidelines for Environmental Performance Assessment
- Subtask D: Implementation and dissemination

An annex preparation workshop will be arranged in March/April 2004. For more information about the Annex and the workshop please contact the Operating Agent, Per Heiselberg
(),
Aalborg University, Denmark.

Commissioning of HVAC systems for improved energy performance

M. Jandon - CSTB
http://www.

Annex 40 is a research project which develops, validates and documents tools for commissioning buildings and building services. The Annex 40 work is focused on developing tools for commissioning HVAC systems for improved energy performance. Ventilation which is of particular interest for AIR readers is clearly addressed by the Annex.

During the last 6 months large progress was made, the development of tools is well advanced and dissemination actions are continuing. A second newsletter is now available, it gives an overview of the Annex progress after its mid term and is attached on the AIVC-CD.

This work started in 2001 and draft results are available for comment on the annex web site.

The 6th annex meeting was held in Berkeley in October 2003 45 people representing 13 countries attended the meeting. It was organised in connection with the International Conference for Enhanced Building Operation (ICEBO). A large part of the Annex work was presented during that conference and 14 papers were prepared by the Annex 40 participants. The papers are available on the AIVC-CD.

An international conference organised in connection with the last Annex meeting in Paris in October 2004 is now planned.

AIVC Conference Prague, 15-17 September 2004
first call for abstracts
More information on topics, hotel, fees, … see www.aivc.org
Continued on p. 11

STANDARDS & REGULATIONS

Standard 62.2 Approved - ASHRAE Publishing Residential IAQ Standard

M. Sherman - LBL
http://
/

Requirements and guidance to make the air in homes healthier and safer without adding significant costs is provided in a newly approved standard from the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). ASHRAE Standard 62.2-2003, *Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings*, is the first and only recognized indoor air quality standard for residences in the United States.

The standard provides the minimum requirements necessary to achieve acceptable indoor air quality for dwellings. Acceptable IAQ means that the indoor air will not likely pose a significant health hazard and will not be irritating or have unacceptable odors.

Residential ventilation traditionally has not been a major concern in North America because it was felt that between operable windows and envelope leakage, occupants were getting enough air. That has changed as homes are built tighter to save energy. The need for the standard is driven by today's tighter-built houses, new knowledge about the relationship of IAQ and health, and a public that is placing more importance on IAQ and health in general.

The standard provides a variety of measures to improve IAQ at minimal cost:

- Source control of moisture and other specific pollutants through the use of local exhaust fans;
- Criteria to minimize backdrafting and other combustion related contaminants;
- Provisions for reducing contamination from attached garages;
- Minimum whole-house ventilation rates;
- Performance criteria for air moving equipment to help assure that equipment will operate as intended and will not be unacceptable to the occupants;
- Guidance on how to select, install and operate systems for maximum benefit.

ASHRAE writes consensus standards in the public interest, but these standards are not codes or regulations as they have no force of law in and of themselves. Standard 62.2, like many other ASHRAE standards, is written in code-intended language so it can be easily adopted by regulatory authorities. Efforts to adopt 62.2-2003 into regulation are beginning.

The standard may be applied to both new and existing houses, although it is not anticipated it would become a regulation in existing buildings. Even without legal force, professionals are expected to follow the standard of care of their profession and so Standard 62.2 should be followed by ventilation professional as part of their professional responsibilities. Other institutions such as utilities, home inspectors, homeowner associations, etc can use 62.2 to evaluate existing construction.

The standard was approved by ASHRAE's Board of Directors in early July, 2003 pending any appeals. An appeals hearing was held to consider multiple appeals from five appealants. On October 5 all appeals were denied and the standard become official. The standard, as well as their other publications can be purchased from ASHRAE through their on-line bookstore.

For more information on ASHRAE's recommendations on IAQ in homes see "ASHRAE & Residential Ventilation" in the January 2004 issue of *ASHRAE Journal* or their quarterly magazine *IAQ Applications.*

BOOKSHOP

Indoor Air Pollutants - Part 1: general description of pollutants, levels and standards

A new Ventilation Information Paper from the AIVC

AIVC VIP 02, 2003, 12 pp, H. Levin

Pollutants found in indoor air are often several times higher than outdoors. Indoor air pollutants cause effects ranging from odor, annoyance, and irritation to illness, cancer, and even death. Since people spend the majority of their time indoors, it is important to recognize and control indoor air pollution. Some indoor air pollutants also adversely affect materials in the building and the building structure itself. The majority of indoor pollution comes from the building itself, its contents, or its occupants and their activities. Building materials and consumer products are important sources of indoor air pollutants. Some outdoor air pollutants enter with ventilation air. Interactions between substances in indoor air can also produce pollutants and some of these are more odorous, irritating, or hazardous than the chemicals that form them. Reducing or eliminating pollution sources best achieves control of indoor air quality. Appropriate ventilation strategies can reduce concentrations of pollutants that can't be eliminated by source control.

For more information read the new Ventilation Information Paper.

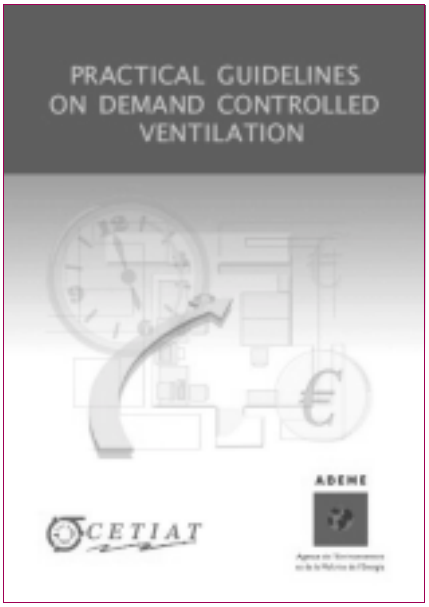
A new guide on demand controlled ventilation

F. Durier - CETIAT

Demand controlled ventilation systems allow energy savings while keeping acceptable indoor air quality. To obtain good performances, they must be correctly designed. This booklet intends to guide readers towards a high-performance demand controlled ventilation.

This guide was published in French language by ADEME (French Agency for Environment and Energy Management) and CETIAT (French Technical Centre for Heating, Ventilation and Air Conditioning Industries), in co-operation with ventilation systems manufacturers (AERECO, ALDES, FRANCE AIR, VIM). It was very recently translated into English.

This new English version of the guide is available on the AIVC CD.



MEETING AND EVENTS

FAN NOISE 2003:

a successful international conference

During the last decade, important progress has been made in understanding, predicting and reducing fan noise by improvements in design and installation together with the extended use of control devices.
The Second International Symposium on Fan Noise (FAN NOISE 2003) was held in September 2003 in Senlis (France) with 300 participants from 28 countries, including a lot of participants from the industry. It was organised by CETIAT and CETIM, two French Technical Centres involved in the acoustics of fans.
The programme of this three-days event included 60 high level technical papers, considering all types of fans (except high speed fans for aeronautic propulsion applications). The list of papers is available on the AIVC CD.

The main conclusions of the Symposium can be summarized as follows:

- the physical mechanisms for discrete frequency noise generation by fans are well known but the agreement between prediction and experiment is not yet always very good,
- the physical mechanisms for broadband noise generation by fans are better understood but work should continue in order to be able to predict broadband noise level,
- the installation effects in which fan noise is modified by the upstream or downstream air circuit can be predicted and quantified,
- progress in fan design in order to reduce their noise includes modifications of geometry, adding of specific devices (mesh for example) or active noise control using loudspeaker or air injection to modify the air flows on fan blades.

Four selected papers from Fan Noise 2003 are available on the AIVC CD. They concern broadband noise prediction (part 1, part 2), low noise fan design and installation effects.

The Proceedings of Fan Noise 2003 on CD Rom (500 pages) can be purchased at CETIAT (*cetiat.commercial@cetiat.fr*).

DAME BC

New Network to be set up and Workshop to be held in Warsaw

H. Bloem - JRC

http://www

A highly successful conference was organised on 13-14th November 2003, by EC-JRC (Renewable Energies Unit) and the PASLINK EEIG on the topic of "**Dynamic Analysis and Modelling to Energy Performance Assessment and Prediction of Buildings and Components**". A total of 51 participants attended from 20 countries, including 19 from seven New Member States. Interesting presentations were made by participants from both old and new countries. All participants expressed their appreciation on the CD hand-out which contained all the conference papers, together with system identification software tools and reference data for self training. The workshop session during the second day was also received very positively. Following the outcome of the event the organisers decided to start an informal network and organise a second event in May 2004 (13-14) in Warsaw.

Title of the Workshop "Dynamic Analysis Methods Applied to Energy Performance Assessment of Buildings"

The topics for the papers at the workshop are:
Application of dynamic analysis methods to:

1. Experimental research in the building sector
2. Building Components (traditional but innovative components also)
3. Buildings Energy Performance (towards labelling)
4. Ventilation
5. Building Energy Control
6. Building Stock Analysis
7. Building Energy Simulation (modelling dynamic behaviour)

People should regularly check the PASLINK web-site at *http://www.* for the latest information about this forthcoming event.

You are kindly asked to contact *hans.bloem@* for a copy of the CD "Proceedings of the DAME Conference" in Ispra.

AIVC/BETEC Conference Washington – October 2003

D. Grimsrud - University of Minnesota

At the end of the 24th AIVC conference, Dr. David T. Grimsrud made the summing-up of the conference.

David Grimsrud is a retired professor from the University of Minnesota. Before becoming a professor there he was head of the Indoor Environment Program at the Lawrence Berkeley National Laboratory. He is the co-author of the LBL Infiltration model (also known as the Sherman-Grimsurd model) used commonly in such places in the ASHRAE Handbook of Fundamentals. He has just become the chairman of SSPC 62.2, the committee responsible for maintaining ASHRAE's new Residential Ventilation Standard.

Dr. David Grimsrud

A summary of his summing up is given below. The papers mentioned in this article are available on the AIVC-CD.

The full set of these conference proceedings is available on CD-Rom and can be ordered to the AIVC.

Health and Building Science

Dr. Suellen Pirages gave an excellent summary ["Mold and Health Issues" by Suellen W. Pirages] of observations of indoor and outdoor mold concentrations and health effects associated with mould exposures. There has been considerable publicity generated concerning mould exposures and health effects associated with these exposures.

Dr. Suellen Pirages

She described what is known about these health effects, i.e., that mould exposures cause allergic reactions in about five percent of the population and noted that epidemiology that demonstrates other health effects associated with mould is lacking. Clearly there are situations where very large exposures occur (to farmers in a dusty environment when harvesting, for example) or when exposures to an individual with a non-functioning immune system occur (a patient receiving an organ transplant in a hospital). These exposures can lead to severe problems, even death. Most individuals, however, are not at a large risk from indoor exposures.

Prof. Hugo Hens ["Mold in Dwellings: Field Studies in a Moderate Climate"] described exploration of climate, living habits, and design and construction of 33 spaces that had been reported to have mould problems. A mould model that had been developed by his group at Leuven (Belgium) was applied to the spaces. In all cases the field observations were consistent with the factors deemed important in predicting the presence of mold. Major elements of the theory include indoor temperatures that are too low, insufficient ventilation and thermal bridging. These factors permitted the explanation of the mould conditions observed.

Prof. William Rose described revisiting a paper that is used to justify approval of unvented gas space heaters in 47 of the 50 states in the United States ["Model Replication to Challenge the Use of Unvented Combustion Heating Appliances"]. Rose and colleagues were unable to obtain the model that was used to generate the results in the DeWerth (1996) report so recreated it themselves. Qualitative agreements with the DeWerth results were demonstrated.

Rose and colleagues will extend the model to situations seen in typical US housing to test pollution concentration limits in these extended contexts.
This is an important test of a potentially significant indoor pollutant source.

Prof. William Rose

Building Evaluation

Armin Rudd and colleagues describe a careful evaluation of 20 homes built in the hot, humid climate of Houston, Texas ["Residential Dehumidification and Ventilation Systems Research for Hot-humid Climates"].

The authors describe a test involving six different options to control indoor humidity, provide ventilation, thermal comfort, and energy efficiency in these production homes. They found that a stand-alone dehumidifier in a hall closet with central-fan-integrated supply ventilation and 33% central fan cycling was the preferred system in this difficult climate. This conclusion is based on measured humidity control, first cost and operating costs.

Dr. Willem de Gids describes measurement results in a statistically valid sample of housing found in The Netherlands ["Ventilation in Dutch houses - A Study in a Representative Sample of the Dutch Housing Stock"]. These measurement results can be projected to the Dutch housing stock and form the basis for future policy initiatives.

Paraphrasing the author, the results demonstrate that ventilation in this housing stock is quite good; that better ventilation performance requires educating the occupants who control the ventilation; and high prevalence of respiratory diseases noted in the occupant surveys cannot be explained by ventilation results. Studies such as these should be undertaken in other countries, particularly in the United States.

Michael Lubliner and colleagues explore the performance of an important category of U.S. housing, manufactured homes ["Building Envelope, Duct Leakage and HVAC System Performance in HUD-Code Manufactured Homes"]. These buildings, comprising about 20% of the U.S. market have been upgraded in programs developed by HUD and the EPA.
The paper collects data about these homes and uses computer simulations to study the economic impact of the improvements. The authors demonstrate the cost effectiveness of the changes.

Also noted are the single-building studies of new manufactured homes reported in "Energy and Air Infiltration Monitoring of Manufactured Homes in Cold Dry Climates" by James E. Blakeley, William D. Richins, Thomas K. Larson and George A. Twitchell and "Ventilation Characterization of a New Manufactured House" by A. Persily, J. Crum, S. Nabinger & M. Lubliner. These studies provide a bridge to the topic of single-building studies.

Single-building Studies
Other single-building studies of note are "Passive Cooling in a Low-Energy Office Building, Importance of Night Ventilation in Passive Cooling" by H. Breesch, A. Bossaer, and A. Janssens, and the forensic investigation, "An Evaluation of Natural Ventilation and Comfort of a Multi-Storey University Office Building" by Mark B. Luther and Benedict Dozie Ilozor.

Breesch et al. demonstrate that the major contributor to passive cooling in the low energy office building in Belgium that they studied was night ventilation rather than an earth-to-air heat exchanger. Luther and Ilozor investigated a recently-constructed passively ventilated building at Deakin University in Australia.

The thermal comfort in the building was not acceptable to many occupants. The authors demonstrate design problems in the building that led to the poor thermal comfort. Recommendations for building modifications are provided.

Mrs. Hilde Breesch

Experimentation
Blazy and colleagues describe changes they made in nine flats of a collective building in France to improve ventilation and humidity control ["Humidity Controlled System in French Collective Buildings Refurbishment"]. Exhaust fans were installed in the kitchens and bathrooms of the flats; humidity-controlled inlets were installed in the bedrooms and living rooms. Energy use decreased while occupant satisfaction increased. This is one of a number of papers presented at the conference that demonstrated the effectiveness of these humidity-controlled ventilation systems that were developed in France.

The paper of Niachou and colleagues, "A First Study of Natural and Hybrid Ventilation Systems in the Urban Environment", describes a work in progress. Modeling and measurement issues associated with natural/hybrid ventilation application in difficult urban setting in Greece are described. Changes in pressure distributions with wind direction and location within the "urban canyon" of a densely occupied city street are presented.

Building Science
Building science is a somewhat pretentious title for this section since all the papers at the conference belong to this general category. However the papers of Bomberg et al. "Weather Resistive Barriers: New Methodology for Their Evaluation", and Walker and Sherman's, "Heat Recovery in Building Envelopes", seem to me to represent the best of what building science does -- identify a problem and work systematically toward a solution.

Bomberg and colleagues describe a new test procedure to evaluate weather resistive barriers -- barriers that shed water that penetrates building cladding, provide a drainage plane when defects occur, and control the flow of air through the building fabric.

Walker and Sherman report an extensive investigation of the impact of heat recovery in the building envelope on energy use in the infiltration process. The authors developed a theoretical model of the process, subjected the model to a CFD analysis to study it on a computer, set up a laboratory experiment to study it in a controlled environment, and finally studied it using field data collected at the Alberta Home Heating Research Facility.
They are now publishing the results. The authors conclude that infiltration heat recovery is not significant for typical wood frame houses with insulated cavities because little of the building envelope participates in infiltration heat recovery.

Strategies
Each of the ventilation strategies described below describes a different set of approaches and solutions to improving ventilation performance in houses. Jardinier ["Humidity Sensitive System is 20 Years Old"] described advances made in France with humidity-controlled devices responding to large sources of an important pollutant (water vapor) and, to some extent, as an occupancy sensor.

Mr. Laurent Jardinier

Temple and Holton ["Energy Efficient Residential Ventilation Control"] describe the need to improve the control of ventilation systems in a U.S. setting and appear to be moving toward a control strategy for quasi-hybrid systems. This type of system has not begun to penetrate the U.S. residential ventilation market.

Raymer ["User "Friendly", Residential Ventilation System Control Strategies and Effectiveness"] describes the successes and frustrations of attempting to do this in actual practice in the United States.

Finally, Jacobs and de Gids ["Reshyvent - Demand Controlled Residential Hybrid Ventilation"] describe and demonstrate an exciting combination of pressure-independent constant-flow inlets, low fan power central exhaust, and CO_2 sensing occupancy detectors to assemble a practical hybrid ventilation system that is widely used in The Netherlands. As suggested by comments above, a U.S. market for these devices is waiting.

New Directions

Finding strategies to provide thermal comfort in hot, humid climates where chillers are an expensive solution is a global problem. Kato and his co-workers ["Proposal for an Energy-efficient Cooling System for a Residential Building in Hanoi"] describe the use of passive ventilation schemes together with radiant cooling panels to provide improved thermal comfort in Hanoi. Field measurements of thermal conditions and CFD simulations of flow fields give credence to their designs.

A second paper in this category by Healy and colleagues ["Development of an Optical Fiber-based Moisture Sensor for Building Envelopes"] describe a promising new technology for sensing surface moisture using optical fibers. Alas, the author indicated in his presentation that the development efforts have been abandoned. We encourage review and reconsideration of this decision.

AIVC Conference 2004

More information on topics, hotel, fees, ...

see www.aivc.org

AIVC Conference 2004

The 25th Conference of the Air Infiltration and Ventilation Centre

First call for abstracts

The next conference of the AIVC will be held in Prague (Czech Republic) from Wednesday 15 to Friday 17 September 2004.

The topic of the conference is
"Ventilation and Retrofitting"

Programme

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

Abstracts

The one page abstract single spaced 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 web site: *http://www.aivc.org*.

Abstracts should be sent 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,
Boulevard Poincaré 79,
BE-1060 Brussels, Belgium.

Deadline for abstracts and papers

Receipt of abstracts 15 February 2004
Notification of abstract acceptance 15 March 2004.
Submission of papers 15 July 2004.

Conference secretariat

AIVC – c/o INIVE EEIG
Boulevard Poincaré 79
BE-1060 Brussels, Belgium
Tel. +32.2.655.77.70
Fax +32.2.653.07.29
E-mail: *conferences.inive@bbri.be*
Contact: Stéphane Degauquier

The second meeting of industry professionals operating in the ventilation industry and related businesses in Poland

T. Trusewicz -
Polish Ventilation Association
tomasz.trusewicz@
http://www.

The Polish Ventilation Association is pleased to invite participants to the VENTILATION FORUM 2004 – the second meeting of industry professionals operating in the ventilation industry and related businesses in Poland.
VENTILATION FORUM is an event devoted exclusively to the issues of ventilation and air-conditioning, addressed to all participants of the investment process.

The aim of FORUM is to enable the exchange of experience and the sharing of legal and technical knowledge. Invited to take part in VENTILATION FORUM are ventilation systems designers, technical universities, installers entrepreneurs, architects, power engineering auditors and representatives of authorities and institutions in the industry.

FORUM will take place in Warsaw on the 2-3rd of March. The two-days event will be focused on the following main topics:

- energy savings methods in ventilation and air-conditioning systems,
- hybrid ventilation,
- fire ventilation,
- air heating.

Independent seminars, focused on the above mentioned issues, will present comprehensive knowledge. Each seminar will provide theory and practise information, and will be supported by presentation of technologies. Extra seminaries will be directed to architects.

A special international seminar will be organized in close co-operation with RESHYVENT partners. The main issues of this seminar are the hybrid ventilation and latest achivements and trends in the ventilation industry in the EU countries. The main speakers have just confirmed their participation. We expect the following presentations:

- The European energy Performance Directive: overall status and relevance for ventilation communinity – Mr Peter Wouters (AIVC, INIVE EEIG),
- Classification of hybrid ventilation – Mr Willem de Gids (TNO),
- Hybrid ventilation in urban environments – Mr Mat Santarmouris (University of Athens),
- Presentation RESHYVENT, update positive Commissioning and Quality Control for ventilation systems concept – Mr Peter Op 't Veld (EC-RESHYVENT co-ordinator),
- Presentation of the Dutch RESHYVENT – Mr Andre Meester (Alusta),
- Presentation of the French/Belgium concept for hybrid ventilation – Mr Marc Jardinier (Aereco)

VENTILATION FORUM 2004 is the opportunity to present and exchange technical and legal accomplishments. It is an interesting opportunity because Poland will enter the EU in May 2004. A market of 40 million people will be opened to EU products and services. The Polish market will also be obliged to respect European regulations. Representatives of countries which will access the EU next year will be invited to the FORUM.

Speakers who want to share experiences and explore the Polish ventilation market are invited to participate in the VENTILATION FORUM 2004.

Current information is available at *http://www.* . This site will give details about the program, the list of speakers and presentations. Detailed questions should be sent to *forum@.*

Polish Ventilation Association
The Polish Ventilation Association is a group of professionals associated with the ventilation industry. It was founded at the end of 2001 by representatives of the Warsaw University of Technology and entrepreneurs dealing with manufacture, import and installation of ventilation systems for the building industry.

The mission of the Association is to promote knowledge of modern and effective methods of ventilation for the building industry, as well as to increase the public awareness on the quality of the air in buildings through providing information on the consequences of invalid ventilation. At the same time, the Association is involved in activities meant for improving the legal system regulating the use of ventilation, and thus the quality of the Polish building industry.
The Association also act to ready the ventilation industry for operation after Poland's accession to the European Community.

Our objective is to develop and promote initiatives, attitudes and activities encouraging development of the ventilation industry.

New Ways for Energy Systems in Sustainable Buildings

D. Schmidt - KTH
http://www.
http://www

The low exergy approach should be the key concept in any long term strategy aiming at creating a sustainable built environment.

A group of international experts discussed new perspectives for sustainable energy supplies and utilisation of energy in buildings, on the 11th of September 2003 at the Centre of Sustainable Building in Kassel, Germany. The focus of the event was to demonstrate how the use of low exergy systems for the heating and cooling of buildings helps to increase energy efficiency and, at the same time, improve indoor comfort. Approximately 70 German HVAC and building professionals attended the workshop on the ongoing work of the expert group of the Annex 37: "Low Exergy Systems for Heating and Cooling of Buildings"

In recent years, how to build sustainable houses has been a constant source of discussion. A highly efficient usage of energy and all of the potentials in the involved energy flows are undisputably mandatory for that. New modern regulations, i.e the new upcoming European Performance Directive 2002/91/EG, meet the challenge of further reducing primary energy use.

To find and to quantify further potentials in energy use, the thermodynamic concept of exergy can be beneficial.
Energy, which is entirely convertible into other types of energy, is known as exergy (high valued energy such as electricity and mechanical workload). Energy, which has a very limited convertibility potential, such as heat close to room air temperature, is low valued energy.

Low exergy heating and cooling systems use low valued energy, which could also easily be delivered by sustainable energy sources (e.g. by using heat pumps, solar collectors or others). Common energy carriers like fossil fuels deliver high valued energy.

As discussed during the workshop in Kassel, the idea of exergy not only enables us to estimate the amount of used or required energy, but in addition, the potentials and the quality of these can be calculated. Based on these principles, a calculation and analysing method for buildings, applying the exergy concept, was presented to the public. The importance of low temperature heating and high temperature cooling emissions systems, as well as heat recovery, for a more optimised system design, can be shown. For example, heat emission systems, that are often part of the building construction itself, have a much longer service lifetime than building service equipment, such as boilers or chillers. With emission systems, the overall system design of a building is flexible in meeting future requirements, and they are open to being supplied by low temperature energy sources, such as renewable ones. There are already a number of different low temperature components, systems and technologies on the market. During the workshop, an overview of this variety was presented. From the basics, to components, to being connected to whole buildings: German examples of buildings and various examples from all over the world and from all kinds of buildings, from newly erected to retrofit, from dwellings to commercial buildings, and also cultural monuments, such as churches and castles were showcased. A good example of an office building is the Centre for Sustainable Building itself, where the workshop took place.

An essential aim of the Annex 37 working group of the International Energy Agency (IEA) is to open up opportunities for increasing energy savings and reducing emission from buildings.
The group wants to promote a more efficient use of energy by means of facilitating and accelerating the use of renewable energy sources and energy sources of “lower quality” for the heating and cooling of buildings. Taking into account the qualitative aspects of energy uses leads to the introduction of the exergy concept, which is the key concept of the IEA Annex 37.

These goals are to be reached by:

- investigating the technical and market potentials for replacing high valued energy (e.g. fossil fuels and electricity) with low valued energy sources and revealing the impact on global resources and environment;
- accessing existing technologies and components for low exergy heating and cooling in buildings, enhancing the development of new technologies, and providing the necessary tools for the analysis and evaluation of low exergy systems;
- developing strategic means for the introduction of low exergy solutions in buildings through case studies, design tools and guidelines.

Further information about the IEA Annex 37 can be found at:
http://www

More detailed information from the Centre for Sustainable Building, which hosted the event and is also involved in the Annex 37 work as a demonstration project, can be found at
http://www..

Forthcoming conferences

Energy and Fuel Conservation in Buildings
Tehran, Iran
15-20 January 2004
Mr. Khalili
No. 14 Sayeh Avenue
Valye Asr Street, PO Box 19395-1477
E-mail: *hamayesh@*

Colloque Technique sur l’Anémométrie
22 January 2004
CETIAT France
Domaine Scientifique de la Doua - 25, Avenue des Arts, PB 2042
FR-69603 Villeurbanne Cedex
Tel: +33.4.72.44.49.00
Fax: +33.4.72.44.49.49
E-mail: *cetiat.commercial@cetiat.fr*
Website: *http://www.cetiat.fr*

8th Arab International Solar Energy Conference and the World Renewable Energy Conference
Bahrain
8-10 March 2004
Dr. A A Al-karaghouli
Energy Research Centre,
University of Bahrain
PO Box 32038 Bahrain
Tel: +973.78.23.02
Fax: +973.68.32.78
E-mail: *aalkaraghouli@*

Power-Gen Europe
25-27 May 2004
Barcelona, Spain
Mrs. Vicky Devereux
Tel: +44.19.92.65.66.38
Fax: +44.19.92.65.67.04
E-mail: *attendingpge@*

World Renewable Energy Forum
30-31 May 2004
Bonn, Germany
Eurosolar
Website: *http://www.*

World Renewable Energy Congress VIII & Expo
Denver Mariott Hotel, City Center,
Colorado 80202, USA
28 August - 3 September 2003
Ms. Ivilina Thornton
National Renewable Energy Laboratory
Tel: +1.303.275.37.81
Fax: +1.303.275.43.20
E-mail: *ivilina_thornton@*

AIVC Conference 2004
Prague, Czech Republic
15-17 September 2004
AIVC - c/o INIVE EEIG
Mr. Stéphane Degauquier
Boulevard Poincaré 79
BE-1060 Brussels, Belgium
Tel: +32.2.655.77.70
Fax: +32.2.653.07.29
E-mail: *conferences@inive@bbri.be*
Website: *http://www.aivc.org*

AIR + AIVC CD

The Air Information Review (AIR) is a quarterly newsletter containing topical and informative articles on air infiltration and ventilation research and application. The newsletter is distributed with the AIVC-CD.

This set contains the printed version of the Air Information Review and a CD-Rom with :

- Current Air Information Review (with annex documents)
- Related newsletters;
- Airbase (AIVC bibliographical database);
- AIVC publications;
- AIVC conference proceedings.

The set is available through subscription. Subscriptions are for 4 consecutive issues of AIR (from September issue to June issue). See selling prices on the order form.

Enquirers in INIVE countries (Belgium, France, Greece, Norway) can obtain AIR and the AIVC-CD at preferential rates (even free of charge in some countries). Please contact INIVE for practical information (*inive@bbri.be*).

AIRBASE

The full version of AIRBASE, the bibliographical database of AIVC, is available on the AIVC CD Rom. It contains more than 15,000 references and abstracts of articles and publications related to energy efficient ventilation.

New additions to AIRBASE include references of numerous papers from the recent IBPSA International conference and exhibition on building simulation (The Netherlands – August 2003), from the recent AIVC international conference on ventilation, humidity control and energy (USA – October 2003), from the recent international conference on Cold Climat HVAC (Norway, June 2003), as well as references of papers from many technical and research journals.

Conference proceedings - CD

A CD-Rom with the proceedings of the last AIVC conferences is available. At present, the CD contains the proceedings of AIVC conferences 1998, 1999, 2000, 2001, 2002 and **2003**. See selling prices on the order form.

AIVC publications – CD

A CD-Rom with all the guides (5), annotated bibliographies (12), ventilation information papers (2) and technical notes (46 – only some old superseded ones are missing) published by the AIVC between 1979 and 2003 is available.
See selling prices on the order form.

The free publication of the month

One of the AIVC publications is available for free on the Internet (*http://www.aivc.org*). The publication is available for 1 month and afterwards replaced by another one.

Printed version of old technical notes

Since June 2001, the new publications of the AIVC are no longer produced in a printed version. However remaining printed copies of previous AIVC documents are still for sale at ECBCS Bookshop (£ 15 + postage).

An overview of the remaining stock is available at *http://www.aivc.org/Publications/clearance.html*
(mainly: Technical notes 39 to 51; Guide to energy efficiency ventilation; Improving ductwork: a time for tighter air distribution systems; Annotated Bibliographies 5 to 10, Conference proceedings 1995 to 2000).

Send orders by e-mail at *essu@ecbcs.org* (for printed AIVC publications only), or by fax at +44(0)121.262.1994, marked for the attention of Janet Blacknell.

Mailing Address:
ECBCS Bookshop (ESSU)
C/o FaberMaunsell Ltd
Beaufort House
94-96 Newhall Street
Birmingham B3 1PB
United Kingdom

* *Note: The CD Roms have been developed for use in a Microsoft Windows environment. There is no guarantee that they will work with other operating systems.*

THE AIVC SPONSOR

RENSON
INNOVATION IN VENTILATION

Renson
Innovation in ventilation
I.Z. Flanders Field
BE-8790 Waregem
Belgium
Tel: +32.56.62.71.11
Fax: +32.56.60.28.51
e-mail: *info@renson.be*
website: *http://www.renson.be*

- ORDER FORM -

Valid until March 2004

Please complete and return this form to INIVE EEIG – Operating Agent AIVC
*by fax to **+32 2 653 07 29** or by mail to Boulevard Poincaré 79, BE-1060 Brussels, Belgium*
On receipt of your order we will forward an invoice, and the order will be dispatched on receipt of payment.

Mr ❑ Mrs ❑ Name .....

Organisation / Firm .....

Address .....

Town ..... Postcode .....

Country ..... E-mail .....

Telephone ..... Telefax .....

VAT .....

Selling prices for AIVC countries (Belgium, Czech Republic, France, Greece, Norway, The Netherlands, USA)				
Item **		**Qty**	**Unit Price***	**Total**
Proceedings of AIVC conferences 1998, 1999, 2000, 2001, 2002 and 2003 (1 CD-Rom)			75 EUR	
AIVC publications CD-Rom – Edition 2003			100 EUR	
Air Information Review & AIVC-CD (Sept. 2003, Dec. 2003, March 2004 & June 2004 issues)	First subscription		200 EUR	
	Subscription renewal		100 EUR	
			Total	

Selling prices for non AIVC countries				
Item **		**Qty**	**Unit Price***	**Total**
Proceedings of AIVC conferences 1998, 1999, 2000, 2001, 2002 and 2003 (1 CD-Rom)			150 EUR	
AIVC publications CD-Rom – Edition 2003			200 EUR	
Air Information Review & AIVC-CD (Sept. 2003, Dec. 2003, March 2004 & June 2004 issues)	First subscription		400 EUR	
	Subscription renewal		200 EUR	
			Total	

* Excl. VAT 21 % ** CD-Roms have been developed for use in a Microsoft Windows 95 or 98 environment

I hereby forward the amount of ..... EUR
- ❑ by **bank transfer**, payable to INIVE EEIG, bank account Nr 434-8208921-09
  KBC bank, Stationstraat 131, 1930 Zaventem, Belgium - Int. Code KRED BE BB
- ❑ by **certified bank cheque** in EUR to the order of INIVE EEIG
- ❑ by **credit card**:
  - ❑ VISA
  - ❑ Eurocard-Mastercard
  - ❑ American Express

I herewith authorise INIVE EEIG to use my credit card information to charge the total amount due for the order
Credit card number ..... Exp. Date .....
Surname and first name of cardholder .....
Date ..... (Cardholder's) signature .....

Delivery address (if different)
Name ..... Country .....
Address .....
.....
Town ..... Postcode .....

AIVC CONTACTS

Belgium
P. Wouters & Ch. Delmotte
Belgian Building Research Institute
Boulevard Poincaré 79
BE-1060 Brussels - Belgium
Tel: +32.2.655.77.11
Fax: +32.2.653.07.29
e-mail: aivc@bbri.be
website: http://www.bbri.be

Czech Republic
M. Jicha
Technicka 2
CZ-61669 Brno - Czech Republic
Tel: +42.541.14.32.71
Fax: +42.541.14.33.65
e-mail: jicha@dt.fme.vutbr.cz

I. Plockova
U Sovovych mlynu 9
CZ-118 00 Praha 1
Czech Republic
Tel: +420.257.53.21.51
Fax: +420.257.53.04.78
e -mail: plockova@mpo.cz

France
M-C Lemaire
ADEME,
Département Bâtiment et Collectivités
500 Route des Lucioles
Sophia Antipolis
FR-06560 Valbonne - France
Tel: +33.4.93.95.79.56
Fax: +33.4.93.65.31.96
e-mail: marie-claude.lemaire@ademe.fr
website: http://www.ademe.fr
Contact for the diffusion of AIR in France:
francois.durier@cetiat.fr

Greece
M. Santamouris
Building Environmental Studies
Applied Physics Section
Department of Physics
University of Athens
University Campus, Building Physics 5
GR-15784 Athens - Greece
Tel: +30.1.727.68.41
Fax: +30.1.729.52.82
e-mail: msantam@cc.uoa.gr
website: http://www.uoa.gr

Norway
J. T. Brunsell
Norwegian Building Research Institute
Forskningsveien 3b
PO Box 123, Blindern
NO-0314 Oslo - Norway
Tel: +47.22.96.55.00
Fax: +47.22.96.57.25
e-mail: jorn.brunsell@byggforsk.no
website: http://www.byggforsk.no

Netherlands
W. F. de Gids
TNO Building and Construction Research
Division of Building and Systems
PO Box 49
NL-2600 AA Delft - Netherlands
Tel: +31.15.26.95.300
Tel direct: +31.15.269.52.80
Fax: +31.15.269.52.99
e-mail: w.degids@bouw.tno.nl
website: http://www.bouw.tno.nl

USA
M. Sherman
Indoor Air Quality Division
Buildings 90
Room 3074
Lawrence Berekeley Laboratory
Berekeley, California
USA-94720 - United States of America
Tel: +1.510.486.40.22
Fax: +1.510.486.66.58
e-mail: mhsherman@lbl.gov
website: http://www.lbl.gov

Operating Agent
INIVE eeig
P. Wouters & Ch. Delmotte
Boulevard Poincaré 79
BE-1060 Brussels - Belgium
Tel: +32.2.655.77.11
Fax: +32.2.653.07.29
e-mail: inive@bbri.be
website: http://www.inive.org

Newsletters

State of the Art Publications

Forthcoming Conferences and Publications

Bookshop publications

AIVC Publications

Bibliographic Database AIRBASE

Conference proceedings

Air Information Review

AIR

AIR INFORMATION REVIEW
December 2003

The AIVC CD
No 10

The AIVC CD

If the AIVC CD is not attached here,
you have missed accessing
a wealth of ventilation related information.
Contact INIVE at inive@bbri.be for information.