



Foreword



Welcome to the September 2017 edition of the AIVC newsletter. In this issue you will find links and information on newly released AIVC publications and major upcoming AIVC events. Moreover, this issue outlines completed and on-going AIVC projects from 2011 to 2017 and redirects to more detailed information available on our website.

Last but not least, Dr. Andy Persily presents significant advance in the fields of IAQ and ventilation, with a new approach for estimating CO₂ generation rates from building occupants.

Please visit our website, follow us on twitter and Linked In and subscribe to our monthly newspaper "Energy Efficiency and Indoor Climate in Buildings" to find out more about our activities.

Also, don't forget to mark your agenda for the following upcoming major events:

- International Workshop "Ventilative cooling in buildings: now & in the future" on 23 October 2017, in Brussels, Belgium
- AIVC International workshop "Towards Higher Performing Homes: The Role of Ventilation and Airtightness" on March 19-20, 2018, in Wellington, New Zealand
- 39th AIVC Conference on September 18-19, 2018 in Juan-les-Pins, France

We wish you a pleasant reading and look forward to seeing you in our future events.



Peter Wouters, Operating Agent AIVC



no 12

September 2017

IAQ metrics workshop recordings & presentations available

The AIVC workshop: "Is ventilation the answer to indoor air quality control in buildings? Do we need performance-based approaches?" was held in Brussels, Belgium on 14-15 March, 2017. The event aimed to identify the pros and cons of performance-based approaches and metrics that can be considered to assess the indoor air quality (IAQ) performance of ventilation systems, as well as to draft guidelines for their use in standards and regulations.

The presentations of the workshop are now available at the AIVC website.

Recordings of the presentations that follow are also available on YouTube:

- Indoor carbon dioxide as metric of ventilation and IAQ: Yes or No or Maybe? Andrew Persily, NIST, USA
- What can ('t) perceived air quality indices tell you about indoor air quality? Pawel Wargocki, DTU, Denmark
- Considerations on IAQ metrics from regulatory and compliance point of view – Use of IAQ metrics in practice, Peter Wouters, BBRI, Belgium



AIVC Indoor Air Quality metrics workshop^h Brussels, Belgium, March 14-15 2017

In this issue

Foreword

IAQ metrics workshop recordings & presentations available

A New Approach to Estimating Carbon Dioxide Generation Rates from Building Occupants

AIVC projects (2011-2017)

23 October 2017, International Workshop, Brussels, "Ventilative cooling in buildings: now & in the future"

New AIVC Publications

AIVC International workshop on ventilation & airtightness

SAVE THE DATE: 18-19 September 2018, 39th AIVC conference, Juan-les-Pins, France

NEWSPAPER 'Energy Efficiency and Indoor Climate in Buildings'

List of AIVC board members



A New Approach to Estimating Carbon Dioxide Generation Rates from Building Occupants

Andrew Persily, NIST

Indoor CO₂ concentrations have been prominent in discussions of building ventilation and indoor air quality (IAQ) since the 18th century. More recent discussions have focused on the impacts of CO₂ on building occupants as well as the use of indoor CO₂ to estimate ventilation rates and to control outdoor air ventilation rates.

While the rates at which building occupants generate CO₂ are key to these applications, the rates currently in use are not based on recent concepts or data. However, the fields of human metabolism and exercise physiology have studied human activity for many decades, focusing on rates of energy expenditure, oxygen consumption and CO₂ generation. A new method for estimating CO₂ generation rates from building occupants, based on the principles and data from these fields, has recently been developed and is described in detail in Persily and de Jonge, 2017 [4].

The ventilation and IAQ fields have long used the following equation to estimate CO₂ generation rates from building occupants [2]:

$$V_{CO_2} = 0.00276 A_D MRQ / (0.23RQ + 0.77)$$

where V_{CO_2} is the CO₂ generation rate per person (L/s); A_D is the DuBois surface area of the individual (m²); M is the level of physical activity, sometimes referred to as the metabolic rate (met); and RQ is the respiratory quotient, i.e., the ratio of the rate at which CO₂ is produced to the rate at which oxygen is consumed. This equation first appeared in the ASHRAE Fundamentals Handbook in 1989 and was included in the recent 2017 version. The Handbook also contains a table of metabolic rates for various activities, which has remained unchanged since 1977 and is based on references predominantly from the 1960s.

The first step in the new approach is to estimate the basal metabolic rate (BMR in units of MJ/day) of the individuals of interest based on their sex, age and body mass. The next step is to estimate the occupants' level of physical activity, M . Persily and de Jonge [4] contain equations to estimate BMR and tables of M values for various activities from recent references [3], [1]. The product of BMR and M , in units of MJ/day, is then converted to L of oxygen consumed per unit time. The CO₂ generation rate can then be expressed in L/s at an air pressure of 101 kPa and a temperature of 273 K, assuming RQ equals 0.85, as follows:

$$V_{CO_2} = BMR M 0.000484$$

This new approach for estimating CO₂ generation rates from building occupants constitutes a significant advance in the fields of IAQ and ventilation and should be considered in future applications of CO₂ in ventilation and IAQ studies and standards. In addition, the sources of physical activity data identified should be incorporated into the references that currently use older and much more limited data sources.

References

- [1] Ainsworth, B., et al. (2011) *The Compendium of Physical Activities Tracking Guide*, Arizona State University: <https://sites.google.com/site/compendiumofphysicalactivities/>
- [2] ASHRAE. (2017). *Fundamentals Handbook*, Atlanta, GA, American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
- [3] FAO. (2001). *Human Energy Requirements. Report of a Joint FAO/WHO/UNU Expert Consultation*, Geneva, Food and Agriculture Organization of the United Nations, Food and Nutrition Technical Report Series 1.
- [4] Persily, A.K. and de Jonge, L. (2017). *Carbon Dioxide Generation Rates of Building Occupants*. *Indoor Air*, Accepted: 14 March 2017. 10.1111/ina.12383.

AIVC projects (2011-2017)

In line with AIVC's ambition to maximise its impact on the dissemination of information on research and development in the fields of ventilation and air infiltration, the AIVC Board has launched several projects since the beginning of 2011. So far 8 projects have been completed and 7 projects are in progress. Project outcomes include topical sessions at AIVC and other conferences, workshops, webinars, publications and many more.

Completed projects:

1. Development and applications of building air leakage databases
2. Philosophy for setting building airtightness requirements
3. Testing, reporting and quality schemes for building airtightness
4. Ventilative cooling
5. Improving the quality of residential ventilation systems
6. Ventilation and health
7. Quality of methods for measuring ventilation and infiltration in buildings

On-going projects:

1. Competent tester schemes for building airtightness testing
2. Residential cooker hoods
3. Fan energy use and eco-design requirements (under definition)
4. Rationale behind ventilation requirements and regulations (under definition)
5. Utilization of heat recovery
6. Integrating uncertainties due to wind and stack effect in declared airtightness results
7. Indoor Air Quality-IAQ metrics

Short descriptions and major outcomes of each project can be found at the AIVC website at:

<http://www.aivc.org/resources/collection-publications/aivc-projects>.



23 October 2017, International Workshop, Brussels, “Ventilative cooling in buildings: now & in the future”

The current development in building energy efficiency towards nZEB buildings represents a number of new challenges to design and construction. One of these major challenges is the increased need for cooling in these highly insulated and airtight buildings, which is not only present in the summer period but also in the shoulder seasons and in offices even in midwinter. Ventilative cooling can be an energy efficient solution to address this cooling challenge in buildings.

The objective of this workshop is to discuss the implementation of ventilative cooling and its role to guarantee good thermal summer comfort in commercial, educational and residential buildings.

Topics addressed:

- Design guidelines
- Solutions and technologies
- Demonstration in current buildings
- Energy performance calculation
- Recommendation for standards
- Future challenges and opportunities

This workshop will present the outcomes of IEA EBC Annex 62, discuss with experts from industry and interact with the audience through interactive voting and group discussion.

The event will be held on Monday October 23, 2017 at the BBRI offices (Boulevard Poincaré 79, 1060) in Brussels, Belgium.

The workshop is an initiative of IEA-EBC annex 62 & venticool and is hosted by INIVE-BBRI & KU Leuven.

Participation to the workshop is free, but requires you to register for the event. To register, please fill in the registration form and send to Mr. Stéphane Degauquier sd@bbri.be. Further information on the programme, speakers etc. is available here.

New AIVC Publications

The AIVC is very pleased to announce the release of three new publications!

- Contributed report 16: Towards compliant building airtightness and ventilation systems

A collection of 23 factsheets, specifically related to ventilation and airtightness issues, field data, and solutions, delivered in the framework of the EU QUALICheck project.

- Ventilation Information Paper 36: Metrics of Health Risks from Indoor Air

A summary of the discussions of the AIVC workshop on IAQ metrics held in March 2017

- Ventilation Information Paper 37: Impact of Energy Policies on Building and Ductwork Airtightness

An analysis of policy instruments used and changes observed in practice in terms of building and ductwork airtightness, using as reference mostly publications from AIVC and TightVent led events from 2011-2015.

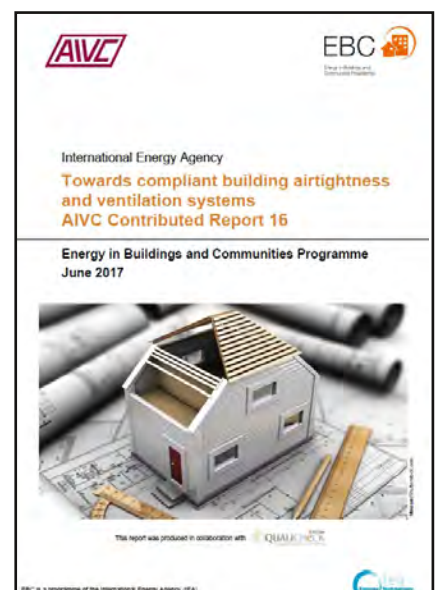
The documents are now available for download at: <http://aivc.org/resources/collection-papers/aivc-publications>.

AIVC International workshop on ventilation & airtightness

The workshop will be held on March 19-20, 2018 at the Museum of New Zealand Te Papa Tongarewa. The title of the workshop is: “Towards Higher Performing Homes: The Role of Ventilation and Airtightness”.

If you want to be kept informed please subscribe at: <http://news.inive.org>

More information will follow soon so stay tuned.





SAVE THE DATE: 18-19 September 2018, 39th AIVC conference, Juan-les-Pins, France

The 39th AIVC conference will be held on 18 and 19 September 2018 in Juan-les-Pins (France) together with the 7th TightVent conference and the 5th venticool conference. More information will follow so stay tuned.

13 -14 September 2017 - 38th AIVC & 6th TightVent conference in Nottingham, UK

Over 160 participants at the 38th AIVC conference. Final programme is available here. More information on the outcomes of this conference will be posted on the AIVC website

NEWSPAPER: "Energy Efficiency and Indoor Climate in Buildings"

The monthly online newspaper "Energy Efficiency and Indoor Climate in Buildings" contains relevant information on the Air Infiltration and Ventilation Centre (AIVC), the international platform on ventilative cooling (venticool) & IEA EBC annex 62-ventilative cooling, the building and ductwork airtightness platform (TightVent Europe), the Indoor Environmental Quality – Global Alliance (IEQ-GA), the QUALICheck project and the Dynastee network.

The paper is available at the first of every month at: <http://news.inive.org/>

Subscribe to get informed on a monthly basis on the various platforms' activities.



AIVC • List of board members

Belgium: Arnold Janssens, University of Ghent • Samuel Caillou, BBRI

Czech Republic: Miroslav Jicha, Brno University of Technology • Karel Kabele, Czech Technical University

Denmark: Alireza Afshari, Danish Building Research Institute, Aalborg University • Bjarne Olesen, Technical University of Denmark

France: François Durier, CETIAT • Nicolas Doré, ADEME

Germany: Hans Erhorn, Fraunhofer Institute for Building Physics • Heike Erhorn-Kluttig, Fraunhofer Institute for Building Physics

Italy: Lorenzo Pagliano, Politecnico di Milano

Japan: Shigeki Nishizawa, Building Research Institute • Takao Sawachi, NILIM

Netherlands: Wouter Borsboom, TNO

New Zealand: Manfred Plagmann, BRANZ

Norway: Kari Thunshelle, SINTEF Byggforsk

Republic of Korea: Yun Gyu Lee, Korea Institute of Construction Technology • Jae-Weon Jeong, Hanyang University

Spain: Pilar Linares Alemparte, The Eduardo Torroja Institute for Construction Science - CSIC • José Antonio Tenorio Ríos, The Eduardo Torroja Institute for Construction Science - CSIC

Sweden: Paula Wahlgren, Chalmers University of Technology

UK: Benjamin Jones, University of Nottingham • Maria Kolokotroni, Brunel University London

USA: Andrew Persily, NIST • Max Sherman, LBNL

Operating agent

INIVE EEIG, www.inive.org, info@aivc.org

Peter Wouters, operating agent • Rémi Carrié, senior consultant • Maria Kapsalaki, consultant • Stéphane Degauquier

AIVC board guests

Francis Allard • Willem de Gids • Laszlo Fulop • Zoltan Magyar • Pawel Wargocki • Hiroshi Yoshino

Representatives of organisations

Andreas Eckmanns, IEA EBC, www.iea-ebc.org

Jaap Hogeling, REHVA, www.rehva.eu

Jan Hensen, IBPSA, www.ibpsa.org

Ben Hughes, IJV, <http://www.ijvent.org.uk/>

Carsten Rode, IEA EBC Annex 68, <http://www.iea-ebc-annex68.org/>