

Securing adequate indoor air quality (IAQ) across Europe: Developing the health-based ventilation guidelines (HealthVent project)

Pawel Wargocki and
HealthVent Group

www.healthvent.eu

HealthVent Group

- Technical University of Denmark, coordinator
- Friedrich-Schiller-University Jena
- University of Milan
- Association Asthma
- European Federation of Allergy and Airways Diseases Association
- National Institute of Health and Welfare, Helsinki
- Faculty of Engineering, University of Porto
- National and Kapodistrian University of Athens
- University of La Rochelle
- (Sintef Energy AS)
- REHVA
- Joint Research Centre, Ispra (collaborating partner)
- WHO, Office in Bonn (collaborating partner)

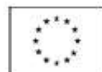
Reporting, in preparation

EUROPEAN COLLABORATIVE ACTION
URBAN AIR, INDOOR ENVIRONMENT AND HUMAN EXPOSURE

Environment and Quality of Life

Report No 30

**Guidelines for health-based ventilation in Europe
(HealthVent)**



EUROPEAN COMMISSION
JOINT RESEARCH CENTRE
Institute for Health and Consumer Protection
Chemical Assessment Unit

2013

EUR 100000 EN

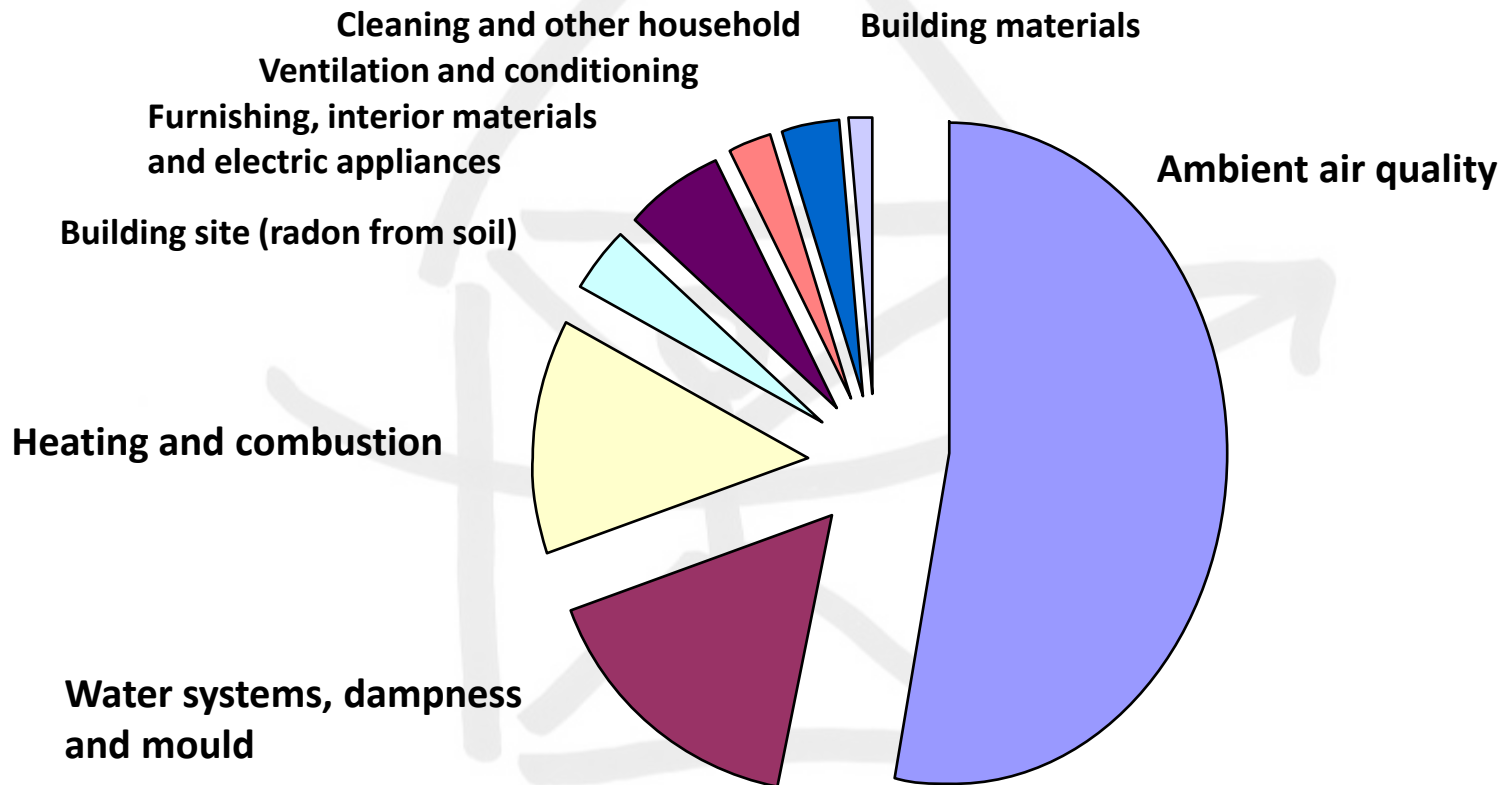
Outline

- Background and motivation
- Founding premises and definitions
- Implementation
- Implications
- Summary and research gaps
- Acknowledgments
- Guidelines in a nut shell

Background and motivation



Exposure **INDOORS** has been recognized as a significant determinant of population health



ETS excluded!

Source: EnVIE Project (2009); IAIAQ (2011)

Strategic priorities to control exposures

- Policies re. energy efficiency, building materials, products and maintenance
- Policies re. the impact of outdoor environment
- Policies re. specific building construction and equipment

Development of health-based ventilation guidelines has been recognized as a strategic priority to reduce BOD associated with exposure to air pollution

Source: EnVIE Project (2009)

Current ventilation standards do not adequately address the health-relevant aspects of IAQ

- Ventilation rates based on sensory comfort (different classes of comfort), not based on "hard" health data
- Requirements are defined for different classes of building users (visitors and occupants) and modified based on the strength of pollution sources (classes of building materials)
- Ventilation rates not defined on target values for exposures
- There have been no (formal) requirements for air used for ventilation (ambient air assumed to be clean) and there are no requirements for compliance with the requirements in the standard

Objective of HealthVent

- Development of health-based ventilation guidelines (to control exposure to pollutants) for new and existing non-industrial buildings (offices, homes and public buildings schools, nurseries and day-care centers)

Founding premises and definitions



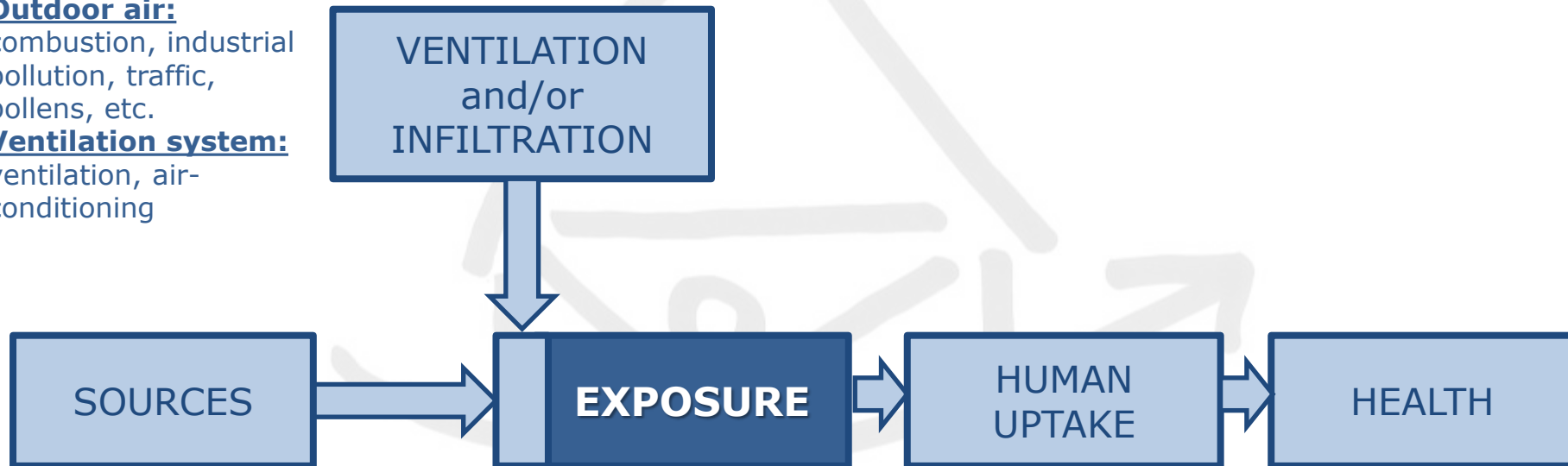
Health-Exposure-Ventilation

Outdoor air:

combustion, industrial pollution, traffic, pollens, etc.

Ventilation system:

ventilation, air-conditioning



Building: building materials, furnishing, equipment, consumer products, etc.

Humans: occupants & their activities

Prerequisites for Creating the Guidelines

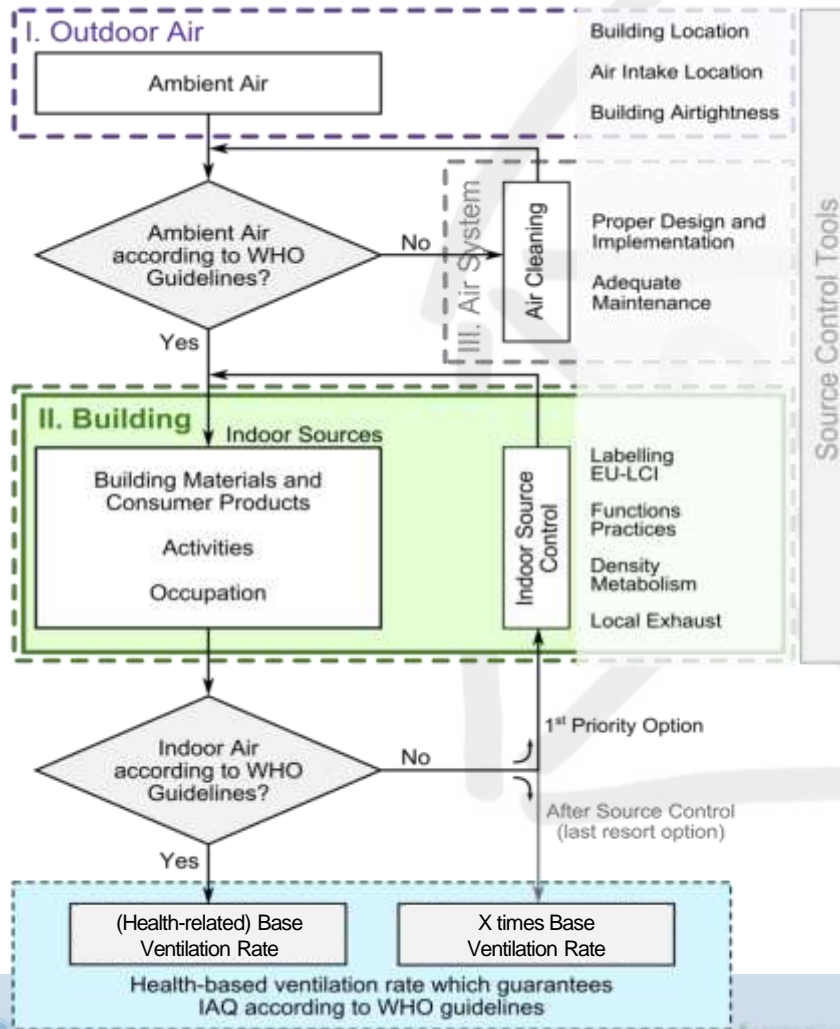
- Coordinated framework
- Exposure must respect WHO guidelines (scientific “state of the art”)
- The priority is given to source control outdoors and indoors
- Ventilation is the ultimate (last resort) strategy



Definition of Health-Based Ventilation

- Health-based ventilation rate" is defined for a specific building when exposures to pollutants meet the WHO air quality guidelines guideline values through a double sequential approach integrating at first source control measures and then the appropriate ventilation rate

Decision Diagram for Defining Health-Based Ventilation Rates

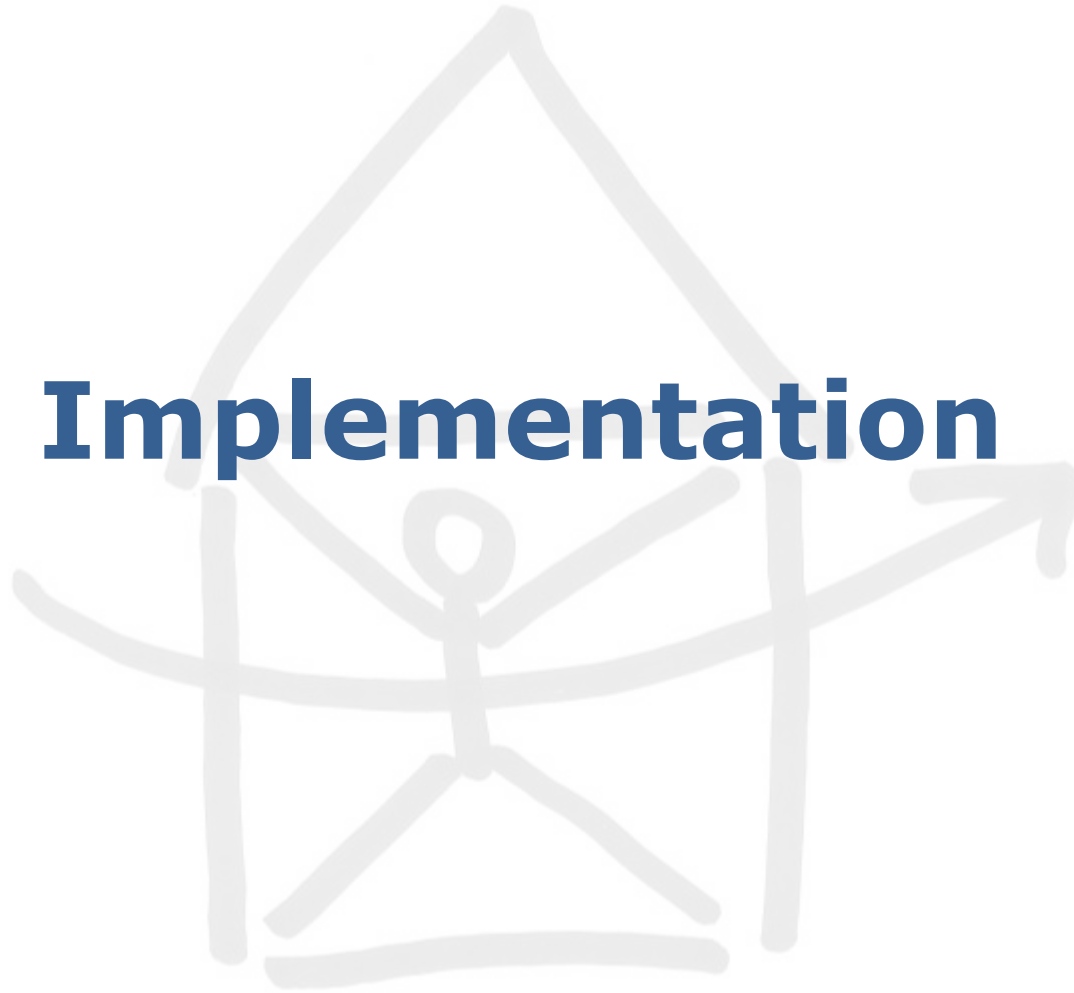


- Air supplied must always meet WHO AQ Guidelines

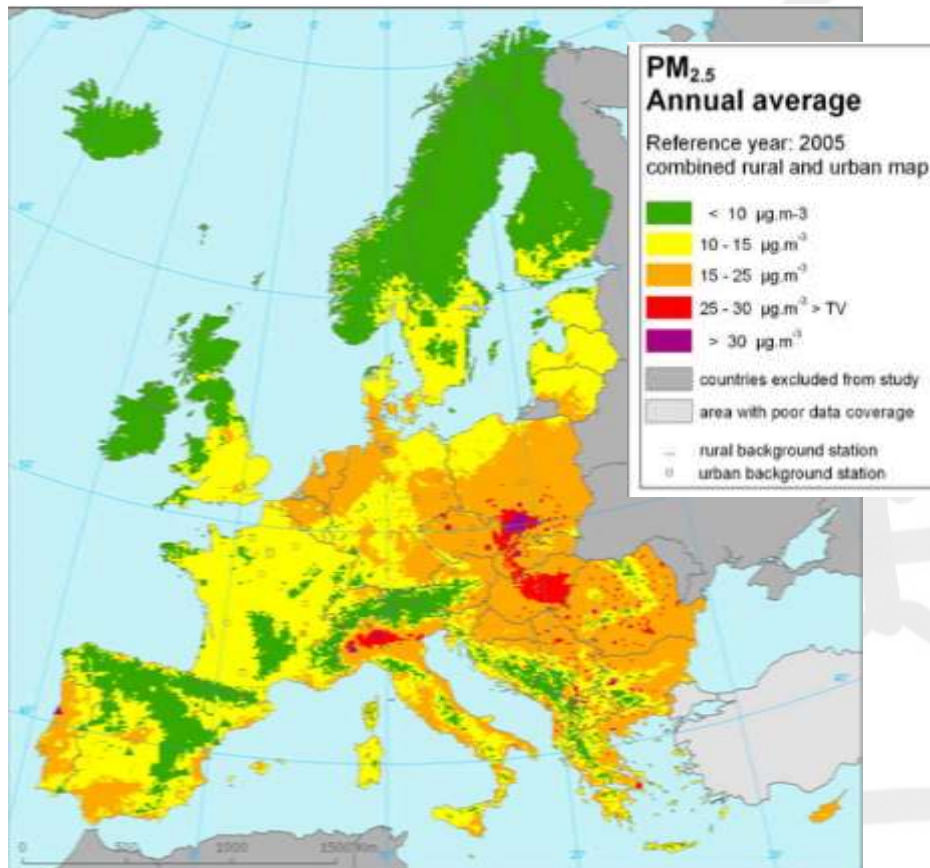
- When WHO AQ Guidelines met through control of sources then health-based ventilation rate equals base rate

- When WHO AQ Guidelines cannot be met through control of sources then health-based ventilation rate is a multiply of base rate

Implementation



Ambient Air + Indoor Air = One Air!



- Indoor air quality issues need to be integrated in the review of Ambient Air Directive accounting for the associated environmental, health, social and economic impacts

Source: ETC/ACC Technical Paper (2008)

Labeling of building and consumer products

- Harmonized product labeling criteria need to be used as a part of ventilation rate design specification

EUROPEAN COLLABORATIVE ACTION

URBAN AIR, INDOOR ENVIRONMENT AND HUMAN EXPOSURE

Environment and Quality of Life

Report No 27

Harmonisation framework for indoor material labelling schemes in the EU



EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR ENVIRONMENT
Directorate for Health and Consumer Protection
Chemical Innovation Unit

2010

EUR 1000000000

Definition of base rate

- The base ventilation rate is a basic requirement that should always be satisfied when people are present indoors.
- It is the rate intended to dilute and exhaust occupant bioeffluents.
- The health-based ventilation rate cannot be lower than the base rate.

Selection of base rate

- There is limited data available and more research is needed.
- Modeling of ventilation needs to remove bioeffluents (moisture and CO₂) and the review of epidemiological literature has been used to estimate the base rate.
- 4 L/s per person is **PROPOSED** as a result.

Ventilation systems must support ventilation guidelines

- Guidelines for design, operation and maintenance of systems used to supply air for ventilation
- Health-based ventilation always refer to person (not to room volume)
- Health-based ventilation is decoupled from ventilation for achieving thermal comfort

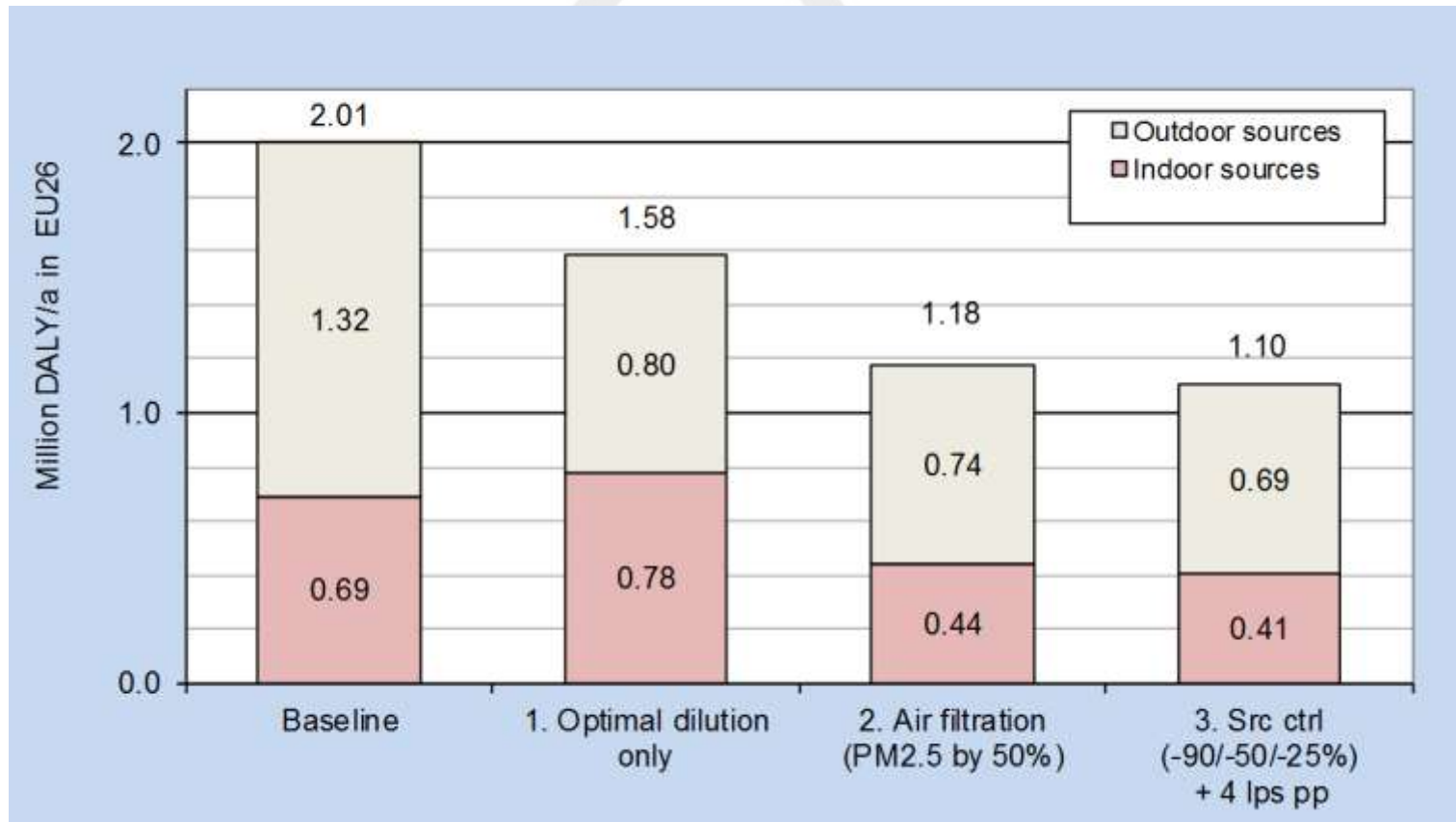
GUIDELINES FOR DESIGN, OPERATION AND MAINTENANCE OF SYSTEMS USED TO SUPPLY AIR FOR VENTILATION (1/2)

- The air supplied by any system used for ventilation should comply with the principles of the health-based ventilation guidelines. The systems should meet these requirements from the initiation and through the entire life-time of the building.
- Ventilation systems should be decoupled from heating/cooling systems as the rather low air heat capacity does not entitle it as an adequate energy efficient heat/cool carrier. Otherwise the levels of ventilation are exacerbated high and the energy efficiency and the IAQ are not adequately cared of.
- Low-emitting, certified and durable materials should be used in any system used for ventilation. Emission from fibrous materials should be reduced to a minimum.
- Systems used for ventilation should be kept clean for the whole building lifetime. They should be cleaned at regular intervals using certified products for wet and dry cleaning which do not elevate exposures relevant for the health-based ventilation guidelines.
- The performance of mechanical ventilation systems should be verified at the commissioning phase and shall be granted by the deliverers at any time for their all lifelong.
- Condensation in the systems used for ventilation should be minimized to avoid microbial growth. Systems should be properly drained and kept dry. Outdoor air intakes should prevent against rain and snow entrainment. Systems creating risk of condensation and moisture should be separated from the systems supplying the air for health-based ventilation.
- Air cleaning producing ozone in the systems used for ventilation should be avoided.
- The rate of ventilation should cope with the actual needs and demands and should not only be based on the design parameters. The rate should be determined following the principles for determining health-based ventilation.
- In case a mechanical system is used for ventilation, there should be contingency plan for ensuring ventilation (e.g., by opening the windows or other measures) in case of the system failure. This also applies to blocking and shutting down the systems by the users and operators.
- All outdoor air intakes including openings for natural ventilation should be located to minimize the direct entrainment of pollutants from nearby sources.

Implications

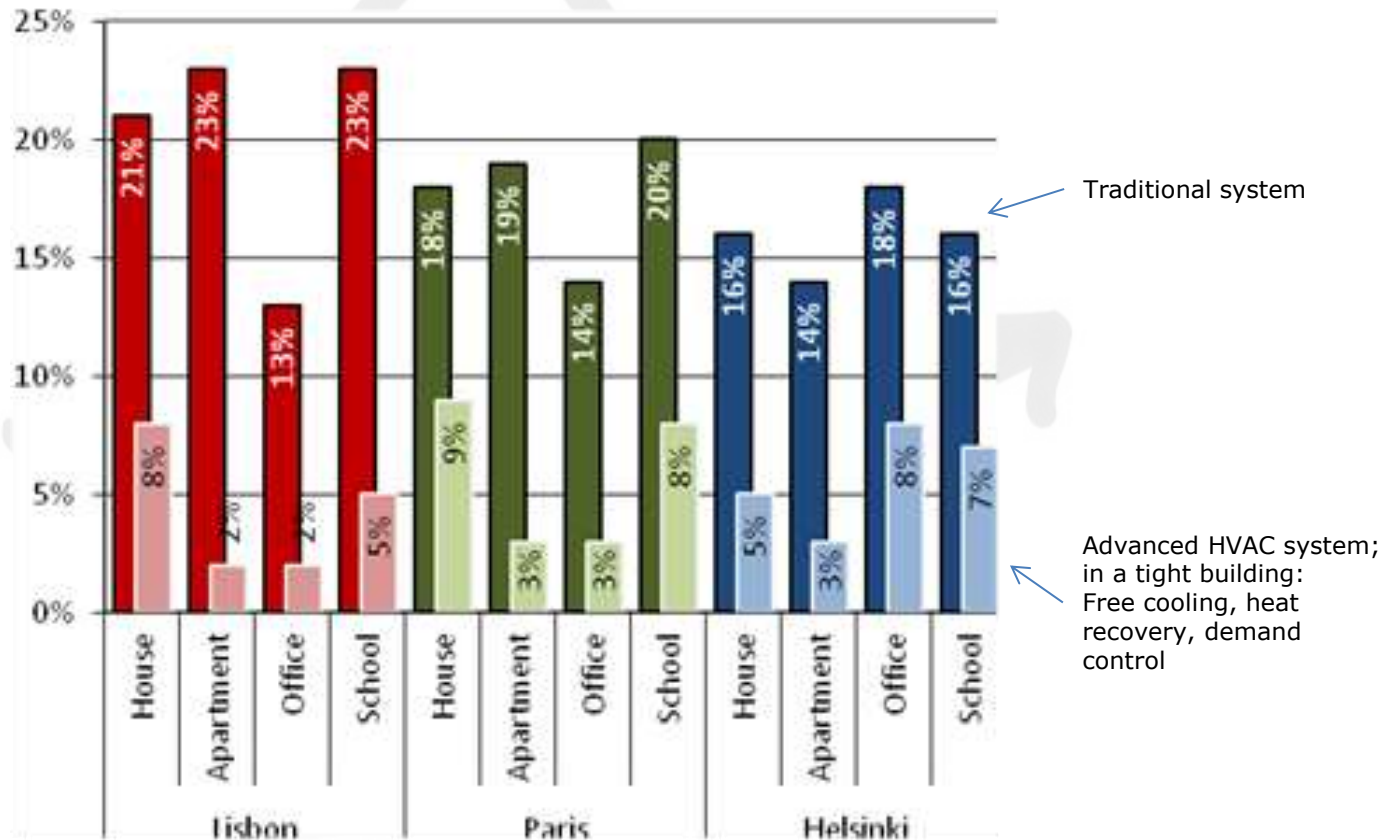


Health Implications



Energy Implications

Impact of changing ventilation rate by 2 L/sp from 4 L/s p



Summary



Future research

- Proper characterization of exposures and ventilation.
- Chronic health effects.
- Subpopulations with special needs (i.e. vulnerable groups).

Acknowledgments

- Funded in the framework of the Second Programme of Community Action in the Field of Health (2008-2013), European Commission – Directorate General for Health and Consumers
- July 1, 2010 to March 31, 2013
- €495,000 (total €750,707)
- Based on experience, findings and recommendations of EnVie, IAIAQ, WHO Air Quality Guidelines and other relevant projects in the field of IAQ and health
- 11 partners, multidisciplinary team of experts from medicine, engineering, indoor air sciences, exposure and risk assessment, energy, ventilation practices and patients groups

HealthVent Group

Francis ALLARD

Arja ASIKAINEN

Dimosthenes ASIMAKOPOULOS

Margarita-Niki ASIMAKOPOULOU

Wolfgang BISCHOFF

Mattias BRAUBACH

Nejc BRELIK

David BRENNAN

Paolo CARRER

Annaclara FANETTI

Eduardo DE OLIVEIRA FERNANDES

Thomas HARTMANN

Otto HÄNNINEN

Marie-Eve HÉROUX

Matti JANTUNEN

Stylianos KEPHALOPOULOS

Vitor LEAL

Tihomir MUSTAKOV

Susanna PALKONNEN

Ted POPOV

Christine ROLLAND

Maria SALARI

Mats SANTAMOURIS

Hugo SANTOS

Roberta SAVLI

Olli SEPPÄNEN

Pawel WARGOCKI

Guidelines in a Nut Shell

Roadmap for achieving health-based ventilation requirements

- Air represents a bigger exposure burden and health threat indoors than outdoors.
- Outdoor air is an important source of exposures occurring indoors.
- Indoor air quality must comply with WHO guidelines being the scientific 'state of the art' leading to the criteria to manage air quality indoors as well as outdoors.
- Source control is the priority strategy in controlling exposures.
- Ventilation regulations are based on and justified by health criteria.
- The base ventilation rate is defined to be 4 L/s per person and is related to human bioeffluents.
- Health-based ventilation rate in a specific buildings can not be lower than the base rate.
- Health-based ventilation is decoupled from ventilation for controlling thermal comfort.
- Ventilation systems must support health-based ventilation.
- Legislative framework needs to be developed and research implemented to support the guidelines
- Gaps in knowledge are defined