

Setting guidelines for indoor air

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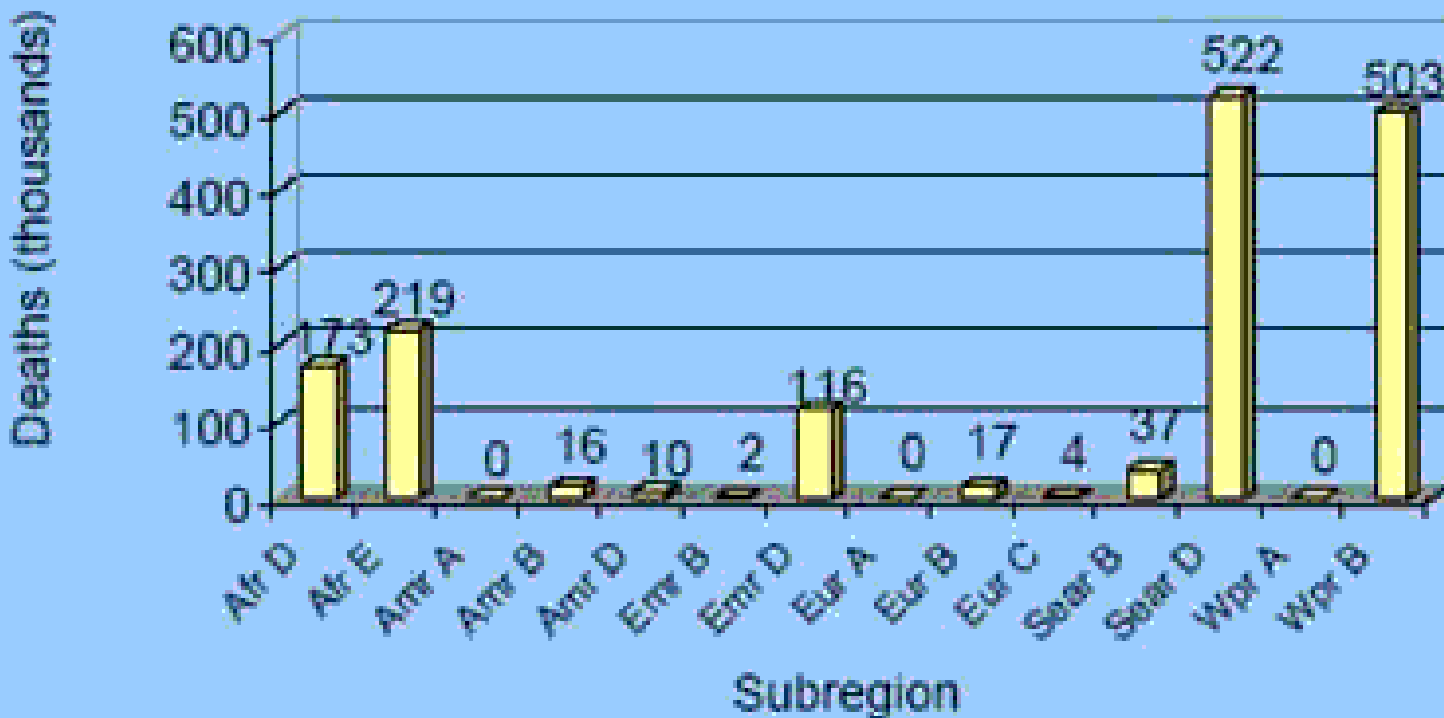
<http://www.euro.who.int/air>

This presentation:

- Why WHO IAQ Guidelines are needed?
- Development of IAQ Guidelines
- Use of IAQ Guidelines in risk management

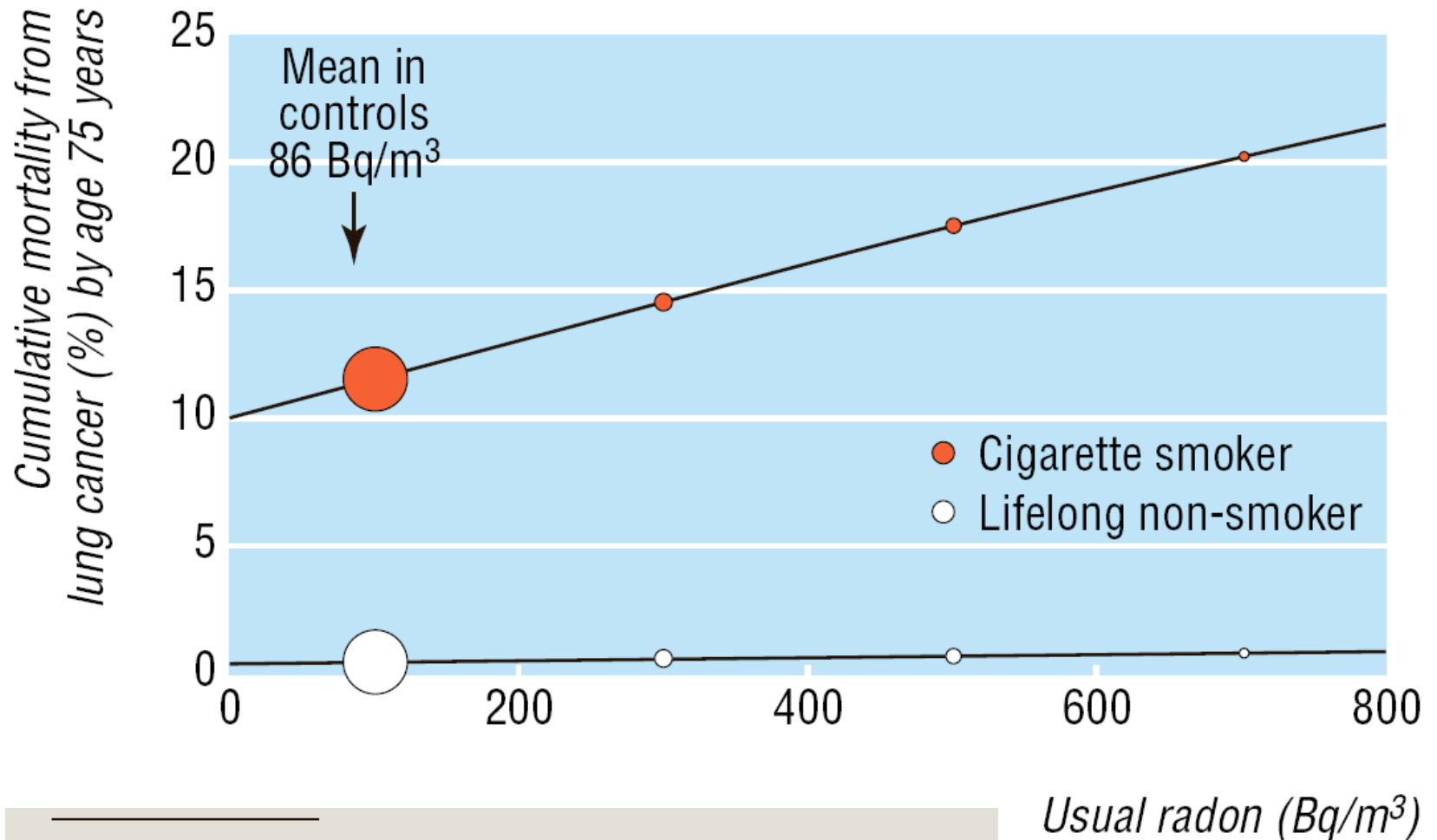
Burden of disease related to indoor air pollution from indoor combustion of solid fuels

Attributable mortality for indoor smoke from solid fuel use by WHO subregion, 2000



Source: WHO CRA project

Cumulative absolute risk of death from lung cancer by age 75 years vs Rn concentration at home



Radon in the home accounts for about 9% of deaths from lung cancer and about 2% of all deaths from cancer in Europe

Source: Darby et al, BMJ 2005

Children's Environment And Health Action Plan for Europe

4th Ministerial Conference on Environment
and Health, Budapest 2004

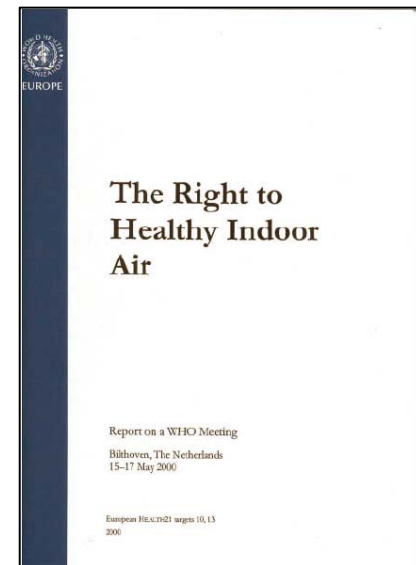


Regional Priority Goal III

We aim to prevent and reduce respiratory disease due to outdoor and indoor air pollution, thereby contributing to a reduction in the frequency of asthmatic attacks, in order to ensure that children can live in an environment with clean air

The Right to Healthy Indoor Air (WHO 2000)

Principle 6: Under the principle of accountability, all relevant organizations should establish **explicit criteria for evaluating and assessing building air quality and its impact on the health** of the population and on the environment.



<http://www.euro.who.int/document/e69828.pdf>

WHO Air Quality Guidelines: relevance to indoor spaces

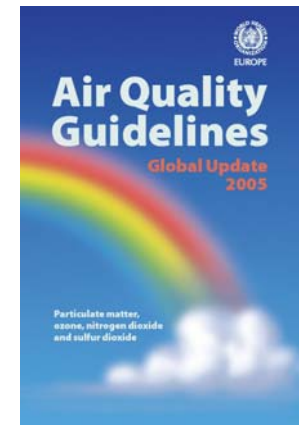
Guidelines on PM, NO₂, ozone and SO₂ applicable in all non-occupational environments, including indoors in households, schools, vehicles etc.

However

Management of AQ indoors required different approaches than outdoor AQ management

Therefore

“WHO to explore development of AQGs specifically designed to facilitate management of IAQ around the world”



<http://www.euro.who.int/Document/E90038.pdf>

Development of WHO Guidelines for Indoor Air Quality Working Group Meeting, Bonn, 23-24 October 2006

38 participants

(14 countries,
EC, WHO, IARC)



http://www.euro.who.int/Document/AIQ/IAQ_mtgrep_Bonn_Oct06.pdf

Development of
WHO Guidelines for
Indoor Air Quality

Report on a Working Group Meeting
Bonn, Germany
23-24 October 2006

Co-chairs: M. Jantunen, HR Anderson
Rapporteur: Kwok Wai Tham



Group B – Biological Agents

| Agent | Systematic reviews existent | Evidence Needs systematic re-evaluation | Guideline can be proposed | Guidance can be provided |
|---|-----------------------------|---|---------------------------|--------------------------|
| Pathogenic agents e.g. viruses & bacteria | Y | Y | N | Y |
| Bacteria (non pathogenic) | Y | Y | N | Y |
| Fungi | Y | Y | N | Y |
| Toxins & other microbial products (MIVOCs), microbial control agents | Y | Y | N | Y |
| Algae and amoebae etc. | Y | Y | N | Y |
| Mites (e.g. HDM, storage mites) | Y | Y | N | Y |
| Pet allergens (e.g. cats, dogs) | Y | Y | N | Y |
| Pest allergens (e.g. Cockroaches, insects, rats) | Y | Y | N | Y |
| Pollen | Y | Y | N | Y |
| Fungal allergens (e.g. Aspergillus, Cladosporium) | Y | Y | N | Y |
| Birds | Y | Y | N | N |
| Ventilation (Humidity control, Pollution removal) | Y | Y | Y | Y |
| Ventilation (Components – as source of contamination (e.g. filters, ductwork, condensation pans, etc...)) | Y | Y | N | Y |
| Dampness & Health | Y | Y | N | Y |
| Moisture control (envelope & building systems and components) | Y | Y | N | Y |
| Condensation | N | Y | Y | Y |
| Chemical degradation and microbial growth | N | Y | N | Y |
| Hygiene & cleanliness (Lack of) Cleaning | Y | Y | N | Y |
| Use and mis-use of cleaning & disinfection products | Y | Y | N | Y |
| Air fresheners | Y | N | N | Y |

Evidence needs systematic evaluation

More research needed before evaluation setting guidelines value

Guideline can be proposed?

NO

Guidance can be provided?

YES

WHO Indoor air quality guidelines

Selected chemicals

- Formaldehyde
- Naphtalene
- Benzene
- NO₂
- CO
- Particulate matter
- Halogenated compounds
- PAH
- Radon

*WG to recommend the
Guidelines: 30 March –
3 Apr 2009*

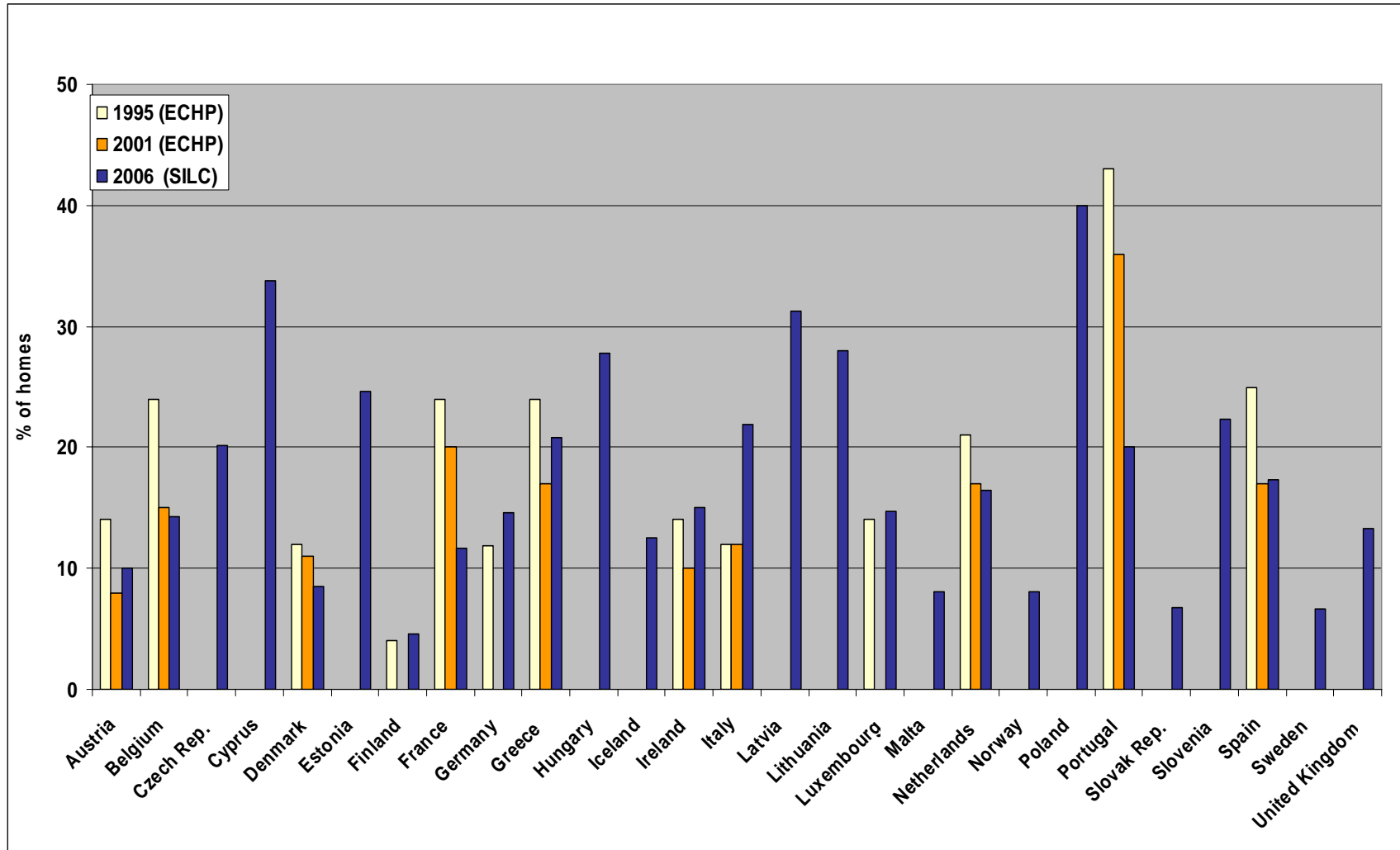
Biological agents

- Dampness and mould
- Allergens (from house dust mites, pets)

(WHO clearance on-going)

Indoor combustion

Homes with dampness problems in European countries



Associations of health outcomes with indoor dampness: review of 71 studies for WHO IAQG

| Outcomes | Evidence on association |
|---|---------------------------|
| <ul style="list-style-type: none">- Asthma: development, exacerbation, current- Respiratory infections- Upper respiratory tract symptoms- Cough- Wheeze- Dyspnea | Sufficient |
| <ul style="list-style-type: none">- Allergic rhinitis- Bronchitis | Limited / suggestive |
| <ul style="list-style-type: none">- Altered lung function- Allergy / atopy- Asthma ever | Inadequate / insufficient |

Meta-analysis of studies on risk of respirators symptoms and presence of dampness or mould at home (Fisk et al 2007)

| Outcome | Subjects | # of Studies | Odds Ratio (95% CI) | % increase of outcome prevalence in homes with dampness/mould* |
|----------------------------------|----------|--------------|---------------------|--|
| Upper respiratory tract symptoms | All | 13 | 1.70 (1.44-2.00) | 52 |
| Cough | All | 18 | 1.67 (1.49-1.86) | 50 |
| | Adults | 6 | 1.52 (1.18-1.96) | -- |
| | Children | 12 | 1.75 (1.56-1.96) | -- |
| Wheeze | All | 22 | 1.50 (1.38-1.64) | 44 |
| | Adults | 5 | 1.39 (1.04-1.85) | -- |
| | Children | 17 | 1.53 (1.39-1.68) | -- |
| Current asthma | All | 10 | 1.56 (1.30-1.86) | 50 |
| Ever-diagnosed asthma | All | 8 | 1.37 (1.23-1.53) | 33 |
| Asthma development | All | 4 | 1.34 (0.86-2.10) | 30 |

* visible dampness, mould, or mould odour

WHO Guidelines for Indoor Air Quality: Dampness and Mould

WG Meeting, Bonn, 17-18 October 2007

WG Recommendations (selected) (1 of 2)

- Persistent **dampness and microbial growth** on interior surfaces and in building structures **should be avoided** (or minimized) as they may lead to adverse health effects.
- Indicators of dampness and microbial growth include:
 - presence of condensation on surfaces or in structures,
 - visible mould,
 - perceived mould odour,
 - history of water damage, leakage or water penetration.
- No quantitative health based guideline values or thresholds can be recommended for acceptable levels of specific micro-organism **contamination** (no quantitative exposure-effect relationships available at present).

WHO Guidelines for Indoor Air Quality: Dampness and Mould

WG Meeting, Bonn, 17-18 October 2007

WG Recommendations (selected) (2 of 2)

- **Dampness and mould-related problems should be prevented.** When they do occur, they should be remediated because of the increased risk of adverse microbial and chemical exposures.
- Well-designed, constructed, and maintained **building envelopes are critical to the prevention and control of excess moisture and microbial growth** by avoiding thermal bridges and preventing intrusion by liquid or vapour phase water.
- **Management of moisture** requires proper **control of temperatures and ventilation** to avoid high humidity, condensation on surfaces, and excess moisture in materials. Ventilation should be distributed effectively in spaces and stagnant air zones should be avoided.

Air pollutants-specific guidelines – 2008/9

| Pollutant | Authors of background material |
|---------------------|--|
| Formaldehyde | C. Mandin (FRA), DA. Kaden (USA), P. Wolkoff, G.D. Nielsen (DEN) |
| Benzene | R. Harrison, J.D. Saborit (UK), F. Dor (FRA) |
| Naphtalene | D. Kotzias, S. Kephelopoulos (JRC), A. Buckpitt (USA) |
| NO ₂ | V. Ezratty, G. Guillosoou (FRA), F. Kelly, D. Jarvis (UK) |
| CO | D. Penney (US), D. Kotzias, S. Kephelopoulos (JRC), A. Verrier (FRA) |
| Radon | M. Kreuzer (GER), J. McLaughlin (IRE) |
| Trichloroethylene | M. Loh (FIN), N. Bonvallot (FRA) |
| Tetrachloroethylene | M. Loh (FIN), N. Nijhuis (NET) |
| PAH (BaP) | R. Harrison, J.D. Saborit (UK), H. Komulainen (FIN), H. Choi (USA) |

Air pollutants-specific guidelines – 2008/9

Time schedule:

| | |
|----------------------------|--|
| 15 Nov 08 | (Most of) background material drafted |
| 1 Dec 08 | Background material distributed for external review |
| 15 Jan 2009 | Comments returned |
| 31 March - 3 April 2009 | Working Group meeting – recommendation of guidelines |
| July 09 | Background material finalized / edited |
| Nov 09 | IAQG cleared and published |

*Funding available from France, Netherlands, UK
Contribution to WG meeting: JRC*

Development of WHO Guidelines on IAQ: Next steps

2009 - 10

Development of guidelines on:

- **combustion products**
- **allergens (from pets, mites)**
- **ventilation**

Funding needed

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- Why WHO IAQ Guidelines are needed?
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In which context IAQ guidelines could be used?

- **What policy / action the health-based IAQ guidelines could trigger?**
- **Can they be used for creation of:**
 - **IAQ standards,**
 - **Emission / ventilation standards**
 - **“Best practice” guidance?**
- **What are experiences of various countries in this respect?**

How to practically apply the guidelines?

Sampling strategy, measurement standards:

The variability of measurement of pollutants concentration indoors is high. Sampling strategy must take this into consideration. ISO standards (ISO series 16000) exist for some of the pollutants. Can they be extended to a wider set of IAQ problems?



Conclusions

- **WHO IAQ Guidelines set the benchmark for hazard assessment of most important IAQ problems**
- **Guidelines on determinant of IAQ problem (dampness; combustion source) may be more efficient than the pollutant-specific guideline**
- **Implementation of the IAQ Guideline in risk management will require new and novel tools and methods**

Thank you