Indoor Air Quality Audit for modern office buildings-
The OFFICAIR Project Experience

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OFFICAIR: On the reduction of health effects from combined exposure to indoor air pollutants in modern office buildings (2010-2013)

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# OFFICAIR Project Partners

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Audits: Assessing Indoor Environmental Quality (IEQ) and health implications for possible improvements

- Building occupants are exposed to a combination of environmental factors:
  - air quality related factors (incl. gaseous chemical compounds, and biological contaminants, particulates, radon etc),
  - noise,
  - thermal and lighting conditions,
  - electromagnetic radiation
- which may contribute to adverse health and comfort effects.
Audits in office and office building

- **Audits for assessment and possible improvements on:**
  - indoor air quality
  - micro-climatic conditions
  - perceived air quality and comfort

- **Audits through:**
  - checklists
  - questionnaires
  - measurements
IEQ Dependencies

- Outdoor stressors and infiltration
- Indoor stressor sources and mitigation measures
- Ventilation patterns and control
- Heating/cooling conditions and control
- Humidity level and control
Office Building vs IEQ

Building Location, orientation and design:
  - defines the specific outdoor stressors
  - influences the ventilation pattern
  - affect the energy budget
  - influence the lighting conditions
  - affect the outdoor/indoor interaction
Important outdoor stressors

- The background level of the outdoor air chemicals
- Nearby (e.g. <100m) potential sources of:
  - outdoor air pollution
  - noise
  - electromagnetic radiation
- Contamination of the mechanical ventilation system
- Radon affected soils
- Solar radiation
- Local Meteorology
Indoor stressors sources in offices

- Chemical emissions of building material
- Chemical and PM Emissions from consumer products use (e.g. cleaners, office equipment)
- Mold, bacteria build-up
- Noise generation by devices or/and occupants
- Outdoor stressors infiltration
- Electromagnetic radiation by devices used indoors
Reducing the sources of pollution in offices: Building Material and Products

By knowing which building materials, furnishings and other products contain and or emit certain pollutants, decisions can be made to avoid the use of some products and replace them with low emission building materials and furniture.
Reducing the sources of pollution in offices: Building Material and Products -II

- Choose appropriate materials before starting renovation or maintenance work. Try to limit exposure to building materials that contain substances, which may constitute a health risk.

- Check whether low emission emulsion paint (e.g. water-based paint) can be used instead of paints based on organic solvents.

- Following renovation, increased levels of VOCs can generally be temporarily measured in the indoor air. It is recommended to wait some few days before occupying the building.
OFFICAIR: Floor, walls and ceiling
(provided by TNO, CSTB)

n=161

Figures in %; % higher than 100 because of possible multiple choice
Reducing the sources of pollution in offices: Cleaners

- Choose less emitting cleaning products (marked with an eco-label). There are many environmentally friendly cleaning products that can be used.
- Organize cleaning in each location in the office building at the end of each working day, rather than just before the start of the day.
- Maintain your working environment clean and report any notice of dampness and mold problems.
Reducing the sources of pollution in offices

Consumer Products:

- Limit exposure to consumer products that contain substances linked to asthma or other respiratory diseases.
- Choose appropriate low emitting decoration materials and consumer products.
- Limit or avoid the use of air fresheners.
Reducing the sources of pollution in offices: Printers

- Printing electronic equipment can be a major source of particulate matter. Prefer to place the printers and photocopiers in separate rooms rather than having them inside the office.

- Try to work away from any printing electronic equipment. Use the printers and photocopiers only when this is necessary.
OFFICAIR: Location of printers/copy machines in general

(provided by TNO, CSTB)

n=161; results in %

- In the office
- In a separate printing room
- On the corridor
- Missing
Ventilation- I

- Proper ventilation is, after source control, key to ensuring comfort on warm days, and reducing concentrations of polluting contaminants indoors, such as particulate matter, VOCs, CO2, etc.

- HVAC systems may be contaminated (e.g. mold build up in duct lining or bacteria on coil or filters). Regular maintenance and duct sealing can help minimize these problems.
Ventilation -II

- Natural ventilation of an office building can be seen as an effective means to dilute indoor air pollutants, provided the outdoor air is clean and for as long as the outside weather conditions allow it.
- The use of a combination of natural and mechanical ventilation can ensure efficient use of energy.
The OFFICAIR Study: Ventilation
(provided by TNO, CSTB)

All (n=161)

- Mechanical ventilation
- Hybrid / Mixed mode
- Openable window

GR (n=21)

FI (n=17)
OFFICAIR General Survey: Occupants perceived air quality and comfort

Ordinal Logistic Regression - ODD RATIOS

- Noise within the building***
- Layout***
- Noise from building Systems***
- Stuffy or Fresh air***
- Natural Light***
- Artificial Light***
- Too Cold or Too Hot Temperature***
- Noise Outside the Building***
- Cleanliness***
- Reflection or Glare***
- Humid or Dry air***
- Smelly or Odorless air***
- View from the windows**
- Air Movement**

***p ≤ 0.001; **p ≤ 0.01; *p ≤ 0.05; (n) p > 0.05
Health and comfort in ‘modern’ office buildings

N. Buildings 156; N. workers 7192
Fig. 4 Prevalence of building-related health symptoms in the OFFICAIR study
IAQ : Awareness raising

IAQ can be improved enormously by educating the building occupants and cleaning staff about its importance for health and productivity. This requires structured awareness raising—that is, a mechanism that is routinely repeated over a certain period of time rather than individual events. Education on cleaning, good hygiene practices, windows opening and use of consumer friendly individual building products can influence behavior and lead to improvements in health and comfort. Smoking must be definitely banned.
Concluding Remarks

- Various issues are raised here that need to be addressed in relevant office and office buildings audits.
- Various interventions are discussed coming from the experience of the OFFICAIR Project.
Thank you for your attention

Ευχαριστώ για την προσοχή σας