Green Week 2013

ACTIONS FOR HEALTHY INDOOR AIR QUALITY: IAIAQ PROJECT

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The EnVIE concept, linking health impact to exposure, source and policy.
<table>
<thead>
<tr>
<th>Health impact</th>
<th>Disease/symptom</th>
<th>Exposure agent</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Allergy &amp; asthma</td>
<td>bioaerosols, PM, VOCs, (ETS)</td>
<td>attributable fraction</td>
</tr>
<tr>
<td></td>
<td>Lung cancer</td>
<td>radon</td>
<td>relative risk</td>
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<tr>
<td></td>
<td></td>
<td>PM of ambient and indoor combustion origin, (ETS)</td>
<td>attributable fraction</td>
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<tr>
<td></td>
<td>CVD</td>
<td>PM of ambient and indoor combustion origin, ETS</td>
<td>relative risk</td>
</tr>
<tr>
<td></td>
<td>COPD</td>
<td>PM of ambient and indoor combustion origin, (ETS)</td>
<td>attributable fraction</td>
</tr>
<tr>
<td></td>
<td>Respir. infections</td>
<td>home dampness, (ETS)</td>
<td>attributable fraction</td>
</tr>
<tr>
<td></td>
<td>Intoxication</td>
<td>CO</td>
<td>incidence</td>
</tr>
</tbody>
</table>

**Note:** For comparability all health effects [DALY] are estimated against zero exposure assuming linear dose/response.
European indoor exposure data

- **National surveys:**
  - German Environmental Survey (GerES I...IV), 1985-2006
  - French IAQ Observatory (OQAI), 2003-05

- **EU Projects:**
  - EC FP-3, Audit study, 1993-94
  - EC FP-4, EXPOLIS, 1996-98
  - EC/JRC, Macbeth, 1998; People, 2002-04; AirMex, 2003-07

- **EU Data surveys:**
  - DG-SANCO: THADE, 2002-03
  - DG-SANCO/JRC: IndEx, 2002-04, PM IndEx and IndEx update 2008-10
  - EC FP-5, EnVIE WP-2 (Exposure), 2004-08
  - JRC: Radonmapping (EUR RADON 2005)
Public health impact from without the 2010 public and workplace smoking bans, DALY/million*a

Scaled to other countries from the results of Cesaroni et al. 2008 from Rome, Italy
IAQ associated BoD in DALY/a attributed to sources – in total 2.2 MDALY/a, excluding ETS

EUROPE-26
- Ambient air quality
- Heating and combustion equipment/appliances
- Water systems, leaks, condensation
- Building site (radon from soil)
- Furnishings, decoration materials and electrical appliances
- Cleaning and other household products
- Building materials
IAQ associated BoD
31 European countries
DALY/a*million (2005)

Contribution of pollutants originating from outdoor air
Contribution of pollutants originating from indoor sources
Policy impact assessment

- The affected building stock at any year after the beginning of the implementation varies depending on the policy:
  - Policy which is implemented in only new or extensively renovated buildings exerts 1.8 – 3.6% of its full influence potential per year
  - Policy which is implemented of furnishings, carpets, paints, etc., 5 – 10% per year
  - Policy which is implemented on household chemicals, behaviour, etc., up to 100% per year

- For comparability all policy impacts are assessed at 10\textsuperscript{th} year of implementation
Public health benefits of IAQ policies within 31 European countries, DALY/a*million

- Radon safe construction
- Extract ventilation for kitchens, extract ventilation and waterproofed surfaces for bathrooms
- European protocols for IAQ testing & labelling for materials, equipment and products
- European moisture control guidelines to prevent persistent dampness and mould growth
- Mandatory flues, CO detectors & regular maintenance/inspection for all combustion devices
- European health-based ventilation guidelines to control pollution, moisture and temperature
- Regular inspection and maintenance for all HVAC systems
- Tight building envelopes, balanced ventilation, air cleaning when AQA below WHOAQQ
- Documentation, operating, inspection and maintenance manuals for building installations & qualified building managers
- Integrate IAQ into the EPBD procedure for buildings
Conclusions

• Highest public health benefits at lowest direct cost and smallest delay by smoking restrictions.
• High long term benefits at high cost by building and ventilation policies, which control indoor exposure to PM, allergens, O₃, and Rn (and noise) from outdoor environment.
• Substantial medium term benefits at medium cost from policies that ensure better building documentation, management, inspection, task assignment and training of the responsible individuals.
• Substantial medium to long term benefits also from policies to
  – prevent moisture accumulation and, thus, mould growth in buildings and
  – prevent exposure to exhausts of indoor combustion sources.
• Substantial short to medium term benefits at low cost from harmonised testing and labelling of indoor materials and consumer products.
Consider also

- **Time and cost:** The high building technology related costs are significantly reduced when policies are implemented along normal renewal and renovation schedules.
- **Invasiveness:** Some policies affect only certain product manufacturers, others set requirements for every citizen.
- **Interdependence:** Policy benefits cannot be summed because they – more or less – overlap, depend on and may even contradict each other.
- **Individual vs. population:** Policies that appear marginal for public health may be critical for individual risks – and *vice versa*.
- **Here vs. there:** Health benefits of new policies will be an order of magnitude higher (costly and invasive) in the most backward compared to the most advanced countries.
This is how clean air looks like

Oops, you cannot see it
## IAIAQ estimates vs. two other studies, DALY/a*million

<table>
<thead>
<tr>
<th>Study Indoor Exposure</th>
<th>IAIAQ, 2011 (indoor)</th>
<th>EBoDE, 2013 (total exp)</th>
<th>WHO: EBD 2011 (inadeq housing)</th>
<th>note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Countries</td>
<td>Eu-26</td>
<td>BeDeFiFrItNL(^1)</td>
<td>Euro-45</td>
<td>(^1) representing EU-26</td>
</tr>
<tr>
<td>Fine PM</td>
<td>300</td>
<td>450 - 1000</td>
<td>80 (^2)</td>
<td>(^2) indoor sources only</td>
</tr>
<tr>
<td>ETS</td>
<td>100 - 300(^3)</td>
<td>60 - 120</td>
<td>81 (^3)</td>
<td>(^3) with 2010 tobacco policies – without policies</td>
</tr>
<tr>
<td>Traffic noise</td>
<td></td>
<td>40 - 150</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Lead</td>
<td></td>
<td>10 - 90</td>
<td>79</td>
<td></td>
</tr>
<tr>
<td>Damp &amp; Mould</td>
<td>50</td>
<td></td>
<td>38</td>
<td></td>
</tr>
<tr>
<td>Indoor cold</td>
<td></td>
<td></td>
<td>30 – 70 (^4)</td>
<td>(^4) 11 European countries</td>
</tr>
<tr>
<td>Radon</td>
<td>34</td>
<td>45 - 110 (^5)</td>
<td>25 (^6)</td>
<td>(^5) discounted &amp; age adjusted (^6) only Germany</td>
</tr>
<tr>
<td>Carbon monox</td>
<td>24</td>
<td></td>
<td>60 (^7)</td>
<td>(^7) 28 European countries acute deaths only - underestimate</td>
</tr>
<tr>
<td>VOC</td>
<td>6</td>
<td>0.2 - 0.6 (^8)</td>
<td></td>
<td>(^8) benzene and formaldehyde</td>
</tr>
</tbody>
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