Diffusive samplers
PASSIVE SAMPLERS

- surrogate surfaces
- diffusive samplers
- flux samplers
- throughfall collectors
- bulk collectors

Teflon-filter
Silicon-tubing
Allen screw
surrogate surfaces
diffusive samplers
flux samplers
throughfall collectors
Advantages with diffusive sampling

- Samplers are small, light weight
- Silent
- Don’t need electricity (mains power)
- 100% time coverage (without data losses)
- Technical personnel is not needed at sampling site
- No field calibration is needed
- *In Situ* measurements (inlet tubing is not used)
- Very large measuring range
- Cost efficient measurements
- A geographical concentration distribution can be obtained

New applications for diffusive samplers
Drawbacks

- Real-time measurements not yet possible
- The results are not obtained immediately
- Particulate concentrations cannot be measured
Validation of a diffusive sampler for ozone in workplace atmospheres according to EN 838
UV-instrument

Diffusive μg O₃ m⁻³ at STP

Vavihill
Rörvik
Vindeln

1:1
<table>
<thead>
<tr>
<th>gas</th>
<th>µg m(^{-3})</th>
<th>ppb</th>
</tr>
</thead>
<tbody>
<tr>
<td>sulphur dioxide, SO(_2)</td>
<td>0.2-100</td>
<td>0.1-35</td>
</tr>
<tr>
<td>nitrogen dioxide, NO(_2)</td>
<td>0.1-100</td>
<td>0.05-50</td>
</tr>
<tr>
<td>nitric oxide, NO(_2^*)</td>
<td>2-150</td>
<td>2-150</td>
</tr>
<tr>
<td>ammonia, NH(_3)</td>
<td>0.2-30</td>
<td>0.3-40</td>
</tr>
<tr>
<td>ozone, O(_3)</td>
<td>1-100</td>
<td>0.5-50</td>
</tr>
<tr>
<td>nitric acid, HNO(_3)</td>
<td>0.02-10</td>
<td>0.01-4</td>
</tr>
<tr>
<td>formic acid, HCOOH</td>
<td>0.7-150</td>
<td>0.4-70</td>
</tr>
<tr>
<td>acetic acid, CH(_3)COOH</td>
<td>1-250</td>
<td>0.4-100</td>
</tr>
<tr>
<td>hydrogen fluoride, HF</td>
<td>0.2-70</td>
<td>0.2-80</td>
</tr>
<tr>
<td>hydrogen chloride, HCl</td>
<td>0.7-100</td>
<td>0.5-60</td>
</tr>
<tr>
<td>formaldehyde, HCHO</td>
<td>0.2-20</td>
<td>0.2-20</td>
</tr>
<tr>
<td>mercury, Hg(^0)</td>
<td>0.01-</td>
<td></td>
</tr>
</tbody>
</table>

* = max 2 weeks exposure time
Highway with heavy traffic

- Blue line: NO₂
- Red line: NO
- Light blue line: h.a.s.l.

Distance in meters (m a.s.l.)

Concentration in parts per billion (ppb)
Atmospheric corrosion is a long-term effect. Diffusive sampling is therefore very suitable.
$HNO_3 \ \mu g/m^3$
**Mapping of Air Pollution in Johannesburg, South Africa**

**Nitrogen dioxide**

NO₂ emissions are dominated by industrial sources in the north and traffic in the downtown area.

**Sulphur dioxide**

Soweto SO₂ emissions are dominated by domestic use of coal.
PASSIVE SAMPLING IN THE TROPICS
Mean ozone concentration in µg/m³

- Missing values
Percentage of Mercantour Arolla pines by defoliation classes and mean ozone categories in 1999.

Percentage of Mercantour Arolla pines by discoloration classes and mean ozone categories in 1999.
A multi-component diffusive sampler for acidic gases

HF
HCl
HCOOH
CH$_3$COOH
SO$_2$
Bus using ethanol as fuel

0.4 ppb acetic acid
Storage room of museums

0.2 - 58 ppb acetic acid
0.2 - 46 ppb formic acid
Masaya volcano, Nicaragua

2 - 600 ppb HF
2 - 2600 ppb HCl
10 - 7000 ppb SO₂
New applications for diffusive samplers

Mount Etna, Italy
Which measurement technique will be most common in the future?

My image is diffuse! I think diffusive sampling will be the most common.