VOC emissions
Chemical industry and Refineries
Belgium

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VOC emission inventory

- 1990
- 2012
- 2010 ceiling

- Stationary
- Mobile
- TOTAL
Stationary VOC sources 1990 vs 2012

- Households: solvent use + heating (wood stoves!)
- Industrial solvent use: paint, oil extraction, …
- Refinery / chemical: process installations + storage
Evolution stationary sources: 1990 – 2012

[Bar chart showing the evolution of stationary sources from 1990 to 2012 for categories such as households, solvent use, refinery/chemical, and other. The chart includes data for 1990, 1995, 2000, 2005, and 2012.]
Emission reduction measures: emissions from stacks

General emission limit values for stack emissions:

<table>
<thead>
<tr>
<th>VOC</th>
<th>Mass threshold</th>
<th>ELV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class 1</td>
<td>100 g/h</td>
<td>20 mg/Nm³</td>
</tr>
<tr>
<td>Class 2</td>
<td>2000 g/h</td>
<td>100 mg/Nm³</td>
</tr>
<tr>
<td>Class 3</td>
<td>3000 g/h</td>
<td>150 mg/Nm³</td>
</tr>
</tbody>
</table>

+ extra ELV for specific processes
<table>
<thead>
<tr>
<th>Emission Source:</th>
<th>Measures taken:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storage</td>
<td>Vapour return/destruction/recovery + Floating roof tanks</td>
</tr>
<tr>
<td>Loading of ships, trucks,…</td>
<td>Vapour return/destruction/recovery</td>
</tr>
<tr>
<td>Leaks in process equipment</td>
<td>Leak Detection and Repair (LDAR)</td>
</tr>
<tr>
<td>Other</td>
<td>...</td>
</tr>
</tbody>
</table>
SOF measurements Antwerp Harbour

Measurements of VOC emissions at Port of Antwerp 2010

Jerker Samuelsson and Johan Mellqvist. FluxSense AB
Antwerp, 13 December 2011

This work was initiated by the Environmental Inspectorate Division of the Flemish Environment, Nature and Energy Department (Flemish Authority)
SOF measurements Antwerp Harbour
SOF measurements Antwerp Harbour
Discrepancy: reported versus SOF

Possible reasons
Different views!

1. SOF measurements are spot measurements: extrapolation needed.
2. Accuracy of SOF measurements

1. Accuracy of estimating methods: (1995 methodology)
2. Malfunctioning seals
3. Process equipment
4. Storage tanks (e.g. seals floating roof tanks)
5. Effectiveness of LDAR
Optical Gas imaging

Making VOC emissions visible

LEAKS IN PROCESS EQUIPMENT
20% of Leaks are not reachable with LDAR
LDAR: Labour intensive: targetted monitoring

LEAKS ON STORAGE TANKS
Many potential leaking points
Malfunctioning seals
Optical gas imaging techniques
Optical gas imaging techniques

Making VOC emissions visible

Normal “visible” sight  Camera “IR” sight
Optical gas imaging techniques
Optical gas imaging techniques
BAT is to monitor diffuse VOC emissions to air from the entire site by using all of the following techniques:

1. LDAR
2. optical gas imaging techniques;
3. calculations of chronic emissions based on emissions factors periodically validated by measurements.

The screening and quantification of site emissions by periodic campaigns with optical absorption based techniques, such as differential absorption light detection and ranging (DIAL) or solar occultation flux (SOF) is a useful complementary technique.