EMISSIONS INVENTORIES

THE SOLVENTS MYSTERY

John Pearson, European Solvents Industry Group
AIR QUALITY MODELS

OZONE CONCENTRATION

- Meteorology Model
- Emissions Inventories
- Chemistry Model
OZONE ISOPLETHS

Diagram showing the relationship between NOx (ppm) and VOC (ppm) with isopleths for different VOC/NOx ratios (Urban VOC/NOx = 5, Current ozone level, Country VOC/NOx = 20).
US STRATEGIES IN THE 1990s

- VOC Emissions were underestimated
- Biogenic VOC emissions were too low
- Mobile Sources excluded VOC emissions from real cars on the road
- Super Emitters - the 10% of vehicles that gave 50% of emissions were excluded
- Instead of reducing NOx, US States reduced VOCs – the Ozone problem remained due to the wrong strategy
INVENTORY-VOC Emissions

- BIOGENIC-Isoprene  POCP = 109

- MOBILE SOURCES-Exhaust Emissions  POCP = 69

- COMBUSTION  POCP = 48

- SOLVENTS  POCP = 44
HISTORICAL VOC EMISSIONS
EU15 in Million Tonnes

- 1990:
  - Biogenic: 6.5
  - Mobile: 4.8
  - Solvents: 0.7

- 2000:
  - Biogenic: 4.5
  - Mobile: 3.2
  - Solvents: 1.3
HISTORICAL VOCs 1990-2000

- Biogenic VOC levels remain constant (until they are reassessed)
- Large Reduction in Mobile Source VOC levels due to new catalyst cars
- Small Reduction in Solvent VOC levels
HOW ARE VOC INVENTORIES CALCULATED?

- Mobile Sources
  Based on Vehicle registrations and emissions factors for each type of vehicle
  (Well established)

- Solvent VOC levels
  Based on Sales Volumes and emissions factors for each sector
  (Less well established)
MOBILE SOURCES

- After 80000km, a typical “catalyst car” has lost its efficiency in controlling emissions.
- Typically, VOC emissions increase by 40% due to this deterioration (Auto Oil).
- Gross Emitters—the 10% of all vehicles that contribute to 50% of emissions—are not taken into account in these inventories.
- Mobile source VOC inventories are underestimated by at least 50%.
Work done by ESIG in 2005 showed overall VOC emissions to be 67% of total VOC Solvent sales.

The Solvents Emissions Directive has been applied to all EU15 countries by 2008.

NECD 2010 has also been successful in VOC control.

SED amounts to a 67% reduction in Solvents VOC Emissions on the first 2.2Mtonnes for EU15.

Solvent VOC emissions are overestimated by about 60%.
## CURRENT INVENTORIES

<table>
<thead>
<tr>
<th></th>
<th>MOBILE</th>
<th>SOLVENT</th>
<th>BIOGENIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMEP MODEL</td>
<td>EU15</td>
<td>1.34</td>
<td>3.06</td>
</tr>
<tr>
<td></td>
<td>newEU12</td>
<td>0.37</td>
<td>0.52</td>
</tr>
</tbody>
</table>

**Corrected Emissions**

<table>
<thead>
<tr>
<th></th>
<th>MOBILE</th>
<th>SOLVENT</th>
<th>BIOGENIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU15</td>
<td>2.00</td>
<td>1.70</td>
<td>4.71</td>
</tr>
<tr>
<td>newEU12</td>
<td>0.55</td>
<td>0.38</td>
<td>1.29</td>
</tr>
</tbody>
</table>
EU27 EMEP INVENTORIES 2006

[Bar chart showing original and amended inventories for Mobile, Solvents, and Biogenics]
EU27 OZONE ESTIMATE 2006

The chart shows the comparison between original and amended estimates of ozone contributions from mobile, solvents, and biogenics sectors.
In German cities, Solvent VOC emissions are overestimated by as much as 55%.

Remote sensing in UK Urban areas suggests the emission factors for mobile sources are too low.

Main Source of VOC emissions is road transport in French Urban regions.

National Inventories are being challenged in urban areas of Zurich.
CONCLUSIONS

- There is a need to check the consistency of emissions inventories
- Clearly the error margins on National Inventories are too high
- Solvent and road transport VOC emissions are overestimated and underestimated respectively - both by more than 50%
- ESIG will make a detailed study of EU27 Solvent Emissions in 2010