Tracking Benzene and VOCs in Ambient Air in Montreal’s East End – 1989-2004

2006 National Air Monitoring Conference
United States Environmental Protection Agency
Las Vegas, Nevada
November 8, 2006

Anne-Marie Carter
André Germain
Air Quality
Environmental Protection Operations - Quebec
Contents

• Background
• Sampling stations
• National Pollutant Release Inventory (NPRI)
• Benzene and VOCs measured in ambient air
• Benzene and wind
• Conclusion
Background

- Benzene, individual VOCs and VOCs are listed on the Toxic Substances List of the Canadian Environmental Protection Act (CEPA)
- VOCs are O₃ and PM₂.₅ precursors
- Industrial sector located in Montreal’s East End
- Benzene: highest average and maximum values in Canada
- 60% reduction between 1989 and 2000
- In 2003, 2 new petrochemical facilities
Sampling stations

Prevailing winds (2001-2004)
Sampling station in Montreal’s East End
Methods

• Sampling every 6 days, on a 24-h period (every 2-3 days in Montreal’s East End for 2003)
• EPA’s TO-11 and TO-14 methods
• 171 VOCs
  – 46 alkanes, 43 alkenes/alkynes, 25 aromatics, 41 halogenated VOCs, 16 polar VOCs
• Meteorological station
Facilities reporting VOCs to the NPRI
1995-2002: total benzene releases reported declined by 86%
2002-2004: increase of 250%
2004-2005: decrease of 33%
Benzene concentrations – 1989-2005

[Graph showing benzene concentrations from 1989 to 2005, with data points for 90th percentile, average, median, and 10th percentile.]
Benzene concentrations and releases

![Graph showing benzene concentrations and releases over years]

- Benzene concentrations in µg/m³
- Benzene releases in t
- 90th percentile
- Average
- Median
- 10th percentile
- Total releases

Year: 89 to 05
### Reduction of benzene and VOCs in environment

<table>
<thead>
<tr>
<th>Year</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td>City of Montreal’s Bylaw 90-3: recovery of gasoline vapours at terminals and service stations</td>
</tr>
<tr>
<td>1999</td>
<td>CEPA’s Benzene in Gasoline Reg. prohibits sale with &gt;1.5%</td>
</tr>
<tr>
<td>1999</td>
<td>Coastal Petrochemical of Canada Ltd ceases operations</td>
</tr>
<tr>
<td>2000</td>
<td>City of Mtl (90-5): emission stds for manuf. org. products by oxidation</td>
</tr>
<tr>
<td>2001</td>
<td>City of Mtl (90-6): requirements for petrochem. plants (floating roofs)</td>
</tr>
<tr>
<td>2001</td>
<td>CEPA’s Gas. Dispensing Flow Rate Reg.: prohibits flow &gt;38 l/min</td>
</tr>
<tr>
<td>2004</td>
<td>CEPA’s On-Road Vehicle and Engine Emissions Reg.: new stds</td>
</tr>
<tr>
<td>2004</td>
<td>City of Mtl identified and corrected new emission sources in sector</td>
</tr>
<tr>
<td>2005</td>
<td>CEPA’s Off-Road Small Spark-Ignition Reg.: lawn + garden equipment</td>
</tr>
</tbody>
</table>
Concentration history at 3 sampling stations (1989-2004)

Median concentration (µg/m³)

- MAI
- East
- ONT

Year

- Total aromatics
- Total VOCs
- Benzene
Benzene, m/p-xylenes, toluene at 5 stations

Graph showing the concentration of Benzene, m and p-Xylene, and Toluene over different years and stations.
Variation in the rate of increase (decrease) in benzene concentration with wind direction
Benzene concentration when wind blows 15 hours or more per direction

Total of 173 sampling days from May 2003 to December 2004
## Conclusion

- 6 facilities reported benzene releases
- 2005 concentrations in air down to 2002 levels
- Benzene was 5 and 3 times higher when wind blew from W and SW compared to NE, reflecting the presence of industrial sector

<table>
<thead>
<tr>
<th>Year</th>
<th>NPRI Releases (t)</th>
<th>Concentrations in air (µg/m³)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Average</td>
<td>Median</td>
</tr>
<tr>
<td>1997</td>
<td>83</td>
<td>12</td>
<td>9</td>
</tr>
<tr>
<td>2002</td>
<td>14 (84%↓)</td>
<td>3 (74%↓)</td>
<td>3 (68%↓)</td>
</tr>
<tr>
<td>2004</td>
<td>47 (250%↑)</td>
<td>8 (160%↑)</td>
<td>4 (55%↑)</td>
</tr>
<tr>
<td>2005</td>
<td>37 (33%↓)</td>
<td>4 (51%↓)</td>
<td>3 (28%↓)</td>
</tr>
</tbody>
</table>
Thank you!