Air Pollution in Cities

Environmental Protection Agency Monitors Six Pollutants

• Particulate Matter
• Lead (Pb)
• Sulfur Dioxide (SO₂)
• Nitrogen Oxides (NO, NO₂)
• Ozone (O₃)
• Carbon Monoxide (CO)

See http://www.epa.gov
Economic Cost of Pollution from Lomborg
Particle Sizes

Human Hair
~70 μm average diameter

PM$_{2.5}$
<2.5 μm in diameter

PM$_{10}$
<10 μm in diameter

90 μm in diameter
Fine Beach Sand

Image courtesy of EPA, Office of Research and Development
London Smog
Trend in UK PM$_{10}$ Particle Pollution
USA PM$_{10}$ Air Quality

1988–2003: 31% decrease
1999–2003: 7% decrease
Los Angeles PM$_{2.5}$ Air Quality
Lead Levels in Air in El Paso
(micrograms/meter cubed)
USA - Lead Levels in Air

90% of sites have concentrations below this line

10% of sites have concentrations below this line

1983–02: 94% decrease
1993–02: 57% decrease
USA - Sulfur Dioxide Air Levels

90% of sites have concentrations below this line

10% of sites have concentrations below this line

1983–02: 54% decrease
1993–02: 39% decrease
Japan sulfur dioxide levels

Annual average SO$_2$ concentration
(average from continued monitoring stations)

Average from 14 ambient air pollution monitoring stations
USA Nitrogen Dioxide

**NO₂ Air Quality, 1983–2002**

Based on Annual Arithmetic Average

- 90% of sites have concentrations below this line (NAAQS)

1983–02: 21% decrease
1993–02: 11% decrease
Los Angeles Ozone Pollution

1-hour Ozone

- Worst Site
- Average of 14 Sites

Days per Year


8-hour Ozone

Days per Year

Los Angeles Smog

- Subtropical High Pressure
- Cool Air Aloft
- Inversion Layer - Warm Air
- Cool Sea Breeze
USA - Trends in Six Air Pollutants

Comparison of Growth Areas and Emissions

- Gross Domestic Product
- Vehicle Miles Traveled
- Energy Consumption
- U.S. Population
- Aggregate Emissions (Six Principal Pollutants)
## Pollution in Major Cities - 1995

<table>
<thead>
<tr>
<th>City</th>
<th>Suspended Particles (µg / m³)</th>
<th>Sulfur Dioxide (µg / m³)</th>
<th>Nitrogen Dioxide (µg / m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Health Organization maximum levels</td>
<td>90</td>
<td>50</td>
<td>50</td>
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<tr>
<td>Athens</td>
<td>178</td>
<td>34</td>
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<td>Beijing</td>
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<td>Bombay</td>
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<td>Mexico City</td>
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<td>74</td>
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<td>Montreal</td>
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<td>10</td>
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<tr>
<td>EPA USA Average</td>
<td>~30</td>
<td>~8</td>
<td>~25</td>
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