Air Quality Standards

<table>
<thead>
<tr>
<th></th>
<th>O₃, ppbv</th>
<th>PM10, µg/m³</th>
<th>CO, ppmv</th>
<th>SO₂ ppmv</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>80 (8h)</td>
<td>150 (24h)</td>
<td>35 (1h)</td>
<td>0.14 (24h)</td>
</tr>
<tr>
<td>WHO</td>
<td>60 (8h)</td>
<td>/</td>
<td>26 (1h)</td>
<td>0.125 (24h)</td>
</tr>
<tr>
<td>Canada</td>
<td>50 (1h)</td>
<td>30</td>
<td>30 (1h)</td>
<td>0.06 (24h)</td>
</tr>
<tr>
<td>Mexico</td>
<td>110 (1 h)</td>
<td>150 (24h)</td>
<td>11 (8h)</td>
<td>0.13 (24h)</td>
</tr>
<tr>
<td>Europe</td>
<td>60 (8 h)</td>
<td>50 (24h)</td>
<td>35 (1h)</td>
<td>0.04 (24h)</td>
</tr>
<tr>
<td>China</td>
<td>60 (1 h)</td>
<td>50 (24h)</td>
<td>3.5 (24h)</td>
<td>0.019 (24h)</td>
</tr>
</tbody>
</table>

Air pollution around the world today

- New Delhi
- Seoul
- Mexico City
- Beijing
- Los Angeles
The urban and rural populations of the world: 1950-2030

World Urbanization Prospects: The 2003 Revision

Percentage of population living in urban areas: 1950, 1975, 2003 and 2030

World Urbanization Prospects: The 2003 Revision
R"eduction of CO emissions in smelting furnaces.


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Overview of air quality in 20 megacities (WHO/UNEP, 1992)

- Serious problem. WHO guidelines exceeded by more than a factor of 2
- Moderate to heavy pollution. WHO guidelines exceeded by up to a factor of 2.
- Low pollution. WHO guidelines normally met.
- No data available or insufficient data for assessment.

All 20 have at least one major pollutant exceeding WHO guidelines
15 megacities: at least 2
7 megacities: 3 or more pollutants exceeding WHO guidelines

Mexico City

Mexico City is one of the cities with the worst pollution worldwide. Sits in a basin surrounded by mountains and under influence of Pacific high pressure → frequent inversions: trapping of pollutants

Population:
1950: 3 million
2000: 18 million
Mexico City

Pollution sources: industry + cars (2.5 million vehicles = 44% of energy consumption)

Tropical latitudes: plenty of sunshine → ozone air pollution problem year-round

High altitude (2250 m): more air needs to be inhaled to get same O2 → higher dose of pollutants

Mexico City daily ozone trends: 1986-2005

Ozone standard violated 80% days of the year.
Peak ozone levels (~300 ppbv) similar to Los Angeles in 1970s.
PM$_{10}$ exceeded on 40% days of the year.

http://www.sma.df.gob.mx/simat/pnindicadores.htm
China

• Contains 7 out of 10 most polluted cities worldwide
• Two-thirds of 338 cities monitored are polluted
• Largest producer/consumer of coal
• Dust from Gobi Desert a problem - reaches U.S. in April
• Indoor burning of coal and biomass a major problem
• Pollution levels could triple or quadruple within 15 years if the country does not curb its rapid growth in energy consumption and automobile use.

Song Yang/Imaginechina; NY Times
Smog hovers over Urumchi, of the Xinjiang Uighur Autonomous Region.

Beijing

• 11 million people, surrounded by heavy industry.
• Ozone > standard for 100 days (1998)
• Observed levels of particulates are very high:
  Daily averages: PM10 = 190 µg/m³; PM2.5=136 µg/m³ (compare to US standards: 150 and 65 µg/m³);
  Annual averages: PM10= 230 µg/m³; PM2.5=106 µg/m³ (compare to US standards: 50 and 15 µg/m³)

• City considering restrictions on future growth: relocate industry and people into 20 towns outside Beijing.
• 2008 Olympics!

Greg Baker/Associated Press, NY Times