3.13 Air pollution

	City	City population	Particulate matter	Sulfur dioxide	Nitrogen dioxide
		thousands 2005	micrograms per cubic meter 1999	micrograms per cubic meter 1995–2001[a]	micrograms per cubic meter 1995–2001[a]
Argentina	Cordoba City	1,592	52	..	97
Australia	Melbourne	3,663	15	..	30
	Perth	1,484	15	5	19
	Sydney	4,388	22	28	81
Austria	Vienna	2,190	39	14	42
Belgium	Brussels	1,027	31	20	48
Brazil	Rio de Janeiro	11,469	40	129	..
	Sao Paulo	18,333	46	43	83
Bulgaria	Sofia	1,045	83	39	122
Canada	Montreal	3,511	22	10	42
	Toronto	5,060	26	17	43
	Vancouver	2,125	15	14	37
Chile	Santiago	5,623	73	29	81
China	Anshan	1,459	99	115	88
	Beijing	10,849	106	90	122
	Changchun	3,093	88	21	64
	Chengdu	3,478	103	77	74
	Chongquing	4,975	147	340	70
	Dalian	2,709	60	61	100
	Guangzhu	976	74	57	136
	Guiyang	2,467	84	424	53
	Harbin	2,898	91	23	30
	Jinan	2,654	112	132	45
	Kunming	1,748	84	19	33
	Lanzhou	1,788	109	102	104
	Liupanshui	2,118	70	102	..
	Nanchang	1,742	94	69	29
	Pinxiang	1,563	80	75	..
	Quingdao	2,431	..	190	64
	Shanghai	12,665	87	53	73
	Shenyang	4,916	120	99	73
	Taiyuan	2,516	105	211	55
	Tianjin	9,346	149	82	50
	Urumqi	1,467[b]	61	60	70
	Wuhan	6,003	94	40	43
	Zhengzhou	2,250	116	63	95
	Zibo	2,775	88	198	43
Colombia	Bogota	5,442[b]	33	..	..
Croatia	Zagreb	908[b]	39	31	..
Cuba	Havana	2,192	28	1	5
Czech Republic	Prague	1,164	27	14	33
Denmark	Copenhagen	1,091	24	7	54
Ecuador	Guayaquil	2,387	26	15	..
	Quito	1,514	34	22	..
Egypt, Arab Rep.	Cairo	11,146	178	69	..
Finland	Helsinki	1,103	22	4	35
France	Paris	9,854	15	14	57
Germany	Berlin	3,328	25	18	26
	Frankfurt	668[b]	22	11	45
	Munich	2,318	22	8	53
Ghana	Accra	1,970	31	..	..
Greece	Athens	3,238	50	34	64
Hungary	Budapest	1,670	26	39	51
Iceland	Reykjavik	164[b]	21	5	42
India	Ahmedabad	5,171	104	30	21
	Bangalore	6,532	56	..	..

About the data

In many towns and cities exposure to air pollution is the main environmental threat to human health. Long-term exposure to high levels of soot and small particles in the air contributes to a wide range of health effects, including respiratory diseases, lung cancer, and heart disease. Particulate pollution, on its own or in combination with sulfur dioxide, leads to an enormous burden of ill health.

Emissions of sulfur dioxide and nitrogen oxides lead to the deposition of acid rain and other acidic compounds over long distances. Acid deposition changes the chemical balance of soils and can lead to the leaching of trace minerals and nutrients critical to trees and plants.

Where coal is the primary fuel for power plants, steel mills, industrial boilers, and domestic heating, the result is usually high levels of urban air pollution—especially particulates and sometimes sulfur dioxide—and, if the sulfur content of the coal is high, widespread acid deposition. Where coal is not an important primary fuel or is used in plants with effective dust control, the worst emissions of air pollutants stem from the combustion of petroleum products.

The data on sulfur dioxide and nitrogen dioxide concentrations are based on reports from urban monitoring sites. Annual means (measured in micrograms per cubic meter) are average concentrations observed at these sites. Coverage is not comprehensive because not all cities have monitoring systems.

The data on concentrations of particulate matter are estimates, for selected cities, of average annual concentrations in residential areas away from air pollution "hotspots," such as industrial districts and transport corridors. The data have been extracted from a complete set of estimates developed by the World Bank's Development Research Group and Environment Department in a study of annual ambient concentrations of particulate matter in world cities with populations exceeding 100,000 (Pandey and others 2003).

Pollutant concentrations are sensitive to local conditions, and even in the same city different monitoring sites may register different concentrations. Thus these data should be considered only a general indication of air quality in each city, and cross-country comparisons should be made with caution. The current World Health Organization (WHO) air quality guidelines for annual mean concentrations are 50 micrograms per cubic meter for sulfur dioxide and 40 micrograms for nitrogen dioxide. The WHO has set no guidelines for particulate matter concentrations below which there are no appreciable health effects.

3.13 Air pollution

	City	City population	Particulate matter	Sulfur dioxide	Nitrogen dioxide
		thousands 2005	micrograms per cubic meter 1999	micrograms per cubic meter 1995–2001[a]	micrograms per cubic meter 1995–2001[a]
India	Calcutta	14,299	153	49	34
	Chennai	6,915	..	15	17
	Delhi	15,334	187	24	41
	Hyderabad	6,146	51	12	17
	Kanpur	3,040	136	15	14
	Lucknow	2,589	136	26	25
	Mumbai	18,336	79	33	39
	Nagpur	2,359	69	6	13
	Pune	4,485	58		
Indonesia	Jakarta	13,194	103	..	..
Iran, Islamic Rep.	Tehran	7,352	71	209	..
Ireland	Dublin	1,033	23	20	..
Italy	Milan	4,007	36	31	248
	Rome	2,628	35	..	..
	Torino	969[b]	53	..	..
Japan	Osaka	2,626[b]	39	19	63
	Tokyo	35,327	43	18	68
	Yokohama	3,366[b]	32	100	13
Kenya	Nairobi	2,819	49	..	..
Korea, Rep	Pusan	3,527	43	60	51
	Seoul	9,592	45	44	60
	Taegu	2,510	49	81	62
Malaysia	Kuala Lumpur	1,392	24	24	..
Mexico	Mexico City	19,013	69	74	130
Netherlands	Amsterdam	1,157	37	10	58
New Zealand	Auckland	1,152	15	3	20
Norway	Oslo	808	23	8	43
Philippines	Manila	10,432[b]	60	33	..
Poland	Lodz	944	45	21	43
	Warsaw	2,204	49	16	32
Portugal	Lisbon	1,977	30	8	52
Romania	Bucharest	1,764	25	10	71
Russian Federation	Moscow	10,672	27	109	..
	Omsk	1,132	28	20	34
Singapore	Singapore	4,372	41	20	30
Slovak Republic	Bratislava	456[b]	22	21	27
South Africa	Capetown	3,103	15	21	72
	Durban	2,643	29	31	..
	Johannesburg	3,288	30	19	31
Spain	Barcelona	4,424	43	11	43
	Madrid	5,145	37	24	66
Sweden	Stockholm	1,729	15	3	20
Switzerland	Zurich	984	24	11	39
Thailand	Bangkok	6,604	82	11	23
Turkey	Ankara	3,594	53	55	46
	Istanbul	9,760	62	120	..
Ukraine	Kiev	2,623	45	14	51
United Kingdom	Birmingham	2,215	17	9	45
	London	7,615	23	25	77
	Manchester	2,193	19	26	49
United States	Chicago	8,711	27	14	57
	Los Angeles	12,146	38	9	74
	New York	18,498	23	26	79
Venezuela, RB	Caracas	3,276	18	33	57

a. Data are for the most recent year available. b. Data are for 2000.

Definitions

• City population is the number of residents of the city or metropolitan area as defined by national authorities and reported to the United Nations. • Particulate matter refers to fine suspended particulates less than 10 microns in diameter that are capable of penetrating deep into the respiratory tract and causing significant health damage. The state of a country's technology and pollution controls is an important determinant of particulate matter concentrations. • Sulfur dioxide is an air pollutant produced when fossil fuels containing sulfur are burned. It contributes to acid rain and can damage human health, particularly that of the young and the elderly. • Nitrogen dioxide is a poisonous, pungent gas formed when nitric oxide combines with hydrocarbons and sunlight, producing a photochemical reaction. These conditions occur in both natural and anthropogenic activities. Nitrogen dioxide is emitted by bacteria, motor vehicles, industrial activities, nitrogenous fertilizers, combustion of fuels and biomass, and aerobic decomposition of organic matter in soils and oceans.

Data sources

City population data are from the United Nations Population Division. The data on sulfur dioxide and nitrogen dioxide concentrations are from the WHO's Healthy Cities Air Management Information System and the World Resources Institute, which relies on various national sources as well as, among others, the Organisation for Economic Co-operation and Development's (OECD) OECD Environmental Data Compendium 1999, the U.S. Environmental Protection Agency's National Air Quality and Emissions Trends Report 1995, the Aerometric Information Retrieval System (AIRS) Executive International database, and the United Nations Centre for Human Settlements' (UNCHS) Urban Indicators database. The data on particulate matter concentrations are from a recent World Bank study by Kiran D. Pandey, Kathrine Bolt, Uwe Deichman, Kirk Hamilton, Bart Ostro, and David Wheeler, "The Human Cost of Air Pollution: New Estimates for Developing Countries" (2003).