



	City	City population thousands	Particulate matter concentration	Sulfur dioxide	Nitrogen dioxide
			Urban-population-weighted PM10 micrograms per cubic meter 2006	micrograms per cubic meter 2001 ^a	micrograms per cubic meter 2001 ^a
Argentina	Córdoba	1,452	55	..	97
Australia	Melbourne	3,728	12	..	30
	Perth	1,532	12	5	19
	Sydney	4,327	19	28	81
Austria	Vienna	2,315	39	14	42
Belgium	Brussels	1,743	25	20	48
Brazil	Rio de Janeiro	11,748	29	129	..
	São Paulo	18,845	34	43	83
Bulgaria	Sofia	1,185	63	39	122
Canada	Montréal	3,678	17	10	42
	Toronto	5,213	20	17	43
	Vancouver	2,146	12	14	37
Chile	Santiago	5,720	54	29	81
China	Anshan	1,639	83	115	88
	Beijing	11,106	90	90	122
	Changchun	3,183	75	21	64
	Chengdu	4,123	87	77	74
	Chongqing	6,461	124	340	70
	Dalian	3,167	50	61	100
	Guangzhou	8,829	64	57	136
	Guiyang	3,662	71	424	53
	Harbin	3,621	77	23	30
	Jinan	2,798	95	132	45
	Kunming	2,931	71	19	33
	Lanzhou	2,561	92	102	104
	Liupanshui	1,221	60	102	..
	Nanchang	2,350	79	69	29
	Pingxiang	905	67	75	..
	Qingdao	2,817	62	190	64
	Shanghai	14,987	74	53	73
	Shenyang	4,787	102	99	73
	Taiyuan	2,794	89	211	55
	Tianjin	7,180	126	82	50
	Wulumqi	2,025	57	60	70
	Wuhan	7,243	80	40	43
	Zhengzhou	2,636	98	63	95
	Zibo	3,061	75	198	43
Colombia	Bogotá	7,772	30	..	..
Croatia	Zagreb	908	32	31	..
Cuba	Havana	2,174	20	1	5
Czech Republic	Prague	1,162	21	14	33
Denmark	Copenhagen	1,085	19	7	54
Ecuador	Guayaquil	2,514	23	15	..
	Quito	1,701	30	22	..
Egypt, Arab Rep.	Cairo	11,893	149	69	..
Finland	Helsinki	1,115	19	4	35
France	Paris	9,904	11	14	57
Germany	Berlin	3,406	21	18	26
	Frankfurt	668	18	11	45
	Munich	1,275	19	8	53
Ghana	Accra	2,121	33	..	..
Greece	Athens	3,242	38	34	64
Hungary	Budapest	1,679	20	39	51
Iceland	Reykjavik	164	18	5	42
India	Ahmadabad	5,375	76	30	21
	Bengaluru	6,787	41	..	..

About the data

Indoor and outdoor air pollution place a major burden on world health. More than half the world's people rely on dung, wood, crop waste, or coal to meet basic energy needs. Cooking and heating with these fuels on open fires or stoves without chimneys lead to indoor air pollution, which is responsible for 1.6 million deaths a year—one every 20 seconds. In many urban areas air pollution exposure is the main environmental threat to health. Long-term exposure to high levels of soot and small particles contributes to a range of health effects, including respiratory diseases, lung cancer, and heart disease. Particulate pollution, alone or with sulfur dioxide, creates an enormous burden of ill health.

Sulfur dioxide and nitrogen dioxide emissions lead to deposition of acid rain and other acidic compounds over long distances, which can lead to the leaching of trace minerals and nutrients critical to trees and plants. Sulfur dioxide emissions can damage human health, particularly that of the young and old. Nitrogen dioxide is emitted by bacteria, motor vehicles, industrial activities, nitrogen fertilizers, fuel and biomass combustion, and aerobic decomposition of organic matter in soils and oceans.

Where coal is the primary fuel for power plants without effective dust controls, steel mills, industrial boilers, and domestic heating, high levels of urban air pollution are common—especially particulates and sulfur dioxide. Elsewhere the worst emissions are from petroleum product combustion.

Sulfur dioxide and nitrogen dioxide concentration data are based on average observed concentrations at urban monitoring sites, which not all cities have.

The data on particulate matter are estimated average annual concentrations in residential areas away from air pollution “hotspots,” such as industrial districts and transport corridors. The data are from the World Bank's Development Research Group and Environment Department estimates of annual ambient concentrations of particulate matter in cities with populations exceeding 100,000 (Pandey and others 2006b). A country's technology and pollution controls are important determinants of particulate matter concentrations.

Pollutant concentrations are sensitive to local conditions, and even monitoring sites in the same city may register different levels. Thus these data should be considered only a general indication of air quality, and comparisons should be made with caution. Current World Health Organization (WHO) air quality guidelines are annual mean concentrations of 20 micrograms per cubic meter for particulate matter less than 10 microns in diameter and 40 micrograms for nitrogen dioxide and daily mean concentrations of 20 micrograms per cubic meter for sulfur dioxide.

	City	City population	Particulate matter concentration	Sulfur dioxide	Nitrogen dioxide
		thousands	Urban-population-weighted PM10 micrograms per cubic meter	micrograms per cubic meter	micrograms per cubic meter
		2007	2006	2001 ^a	2001 ^a
India	Chennai	7,163	34	15	17
	Delhi	15,926	136	24	41
	Hyderabad	6,376	37	12	17
	Kanpur	3,162	99	15	14
	Kolkata	14,787	116	49	34
	Lucknow	2,695	99	26	25
	Mumbai	18,978	57	33	39
	Nagpur	2,454	50	6	13
	Pune	4,672	42	..	..
Indonesia	Jakarta	9,125	84	..	..
Iran, Islamic Rep.	Tehran	7,873	50	209	..
Ireland	Dublin	1,059	16	20	..
Italy	Milan	2,945	30	31	248
	Rome	3,339	29	..	..
	Turin	1,652	43	..	..
Japan	Osaka-Kobe	11,294	33	19	63
	Tokyo	35,676	38	18	68
	Yokohama	3,366	29	100	13
Kenya	Nairobi	3,010	40	..	..
Korea, Rep.	Pusan	3,480	35	60	51
	Seoul	9,796	37	44	60
	Taegu	2,460	40	81	62
Malaysia	Kuala Lumpur	1,448	23	24	..
Mexico	Mexico City	19,028	48	74	130
Netherlands	Amsterdam	1,031	34	10	58
New Zealand	Auckland	1,245	13	3	20
Norway	Oslo	802	18	8	43
Philippines	Manila	11,100	28	33	..
Poland	Katowice	2,914	39	83	79
	Lódz	776	38	21	43
	Warsaw	1,707	42	16	32
Portugal	Lisbon	2,812	21	8	52
Romania	Bucharest	1,942	16	10	71
Russian Federation	Moscow	10,452	19	109	..
	Omsk	1,135	19	20	34
Singapore	Singapore	4,436	41	20	30
Slovak Republic	Bratislava	456	15	21	27
South Africa	Cape Town	3,215	13	21	72
	Durban	2,729	25	31	..
	Johannesburg	3,435	26	19	31
Spain	Barcelona	4,920	33	11	43
	Madrid	5,567	29	24	66
Sweden	Stockholm	1,264	11	3	20
Switzerland	Zurich	1,108	24	11	39
Thailand	Bangkok	6,704	76	11	23
Turkey	Ankara	3,716	39	55	46
	Istanbul	10,061	46	120	..
Ukraine	Kiev	2,709	26	14	51
United Kingdom	Birmingham	2,285	14	9	45
	London	8,567	19	25	77
	Manchester	2,230	15	26	49
United States	Chicago	8,990	23	14	57
	Los Angeles	12,500	32	9	74
	New York-Newark	19,040	20	26	79
Venezuela, RB	Caracas	2,985	16	33	57

a. Data are for the most recent year available.

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 concentration** is fine suspended particulates of less than 10 microns in diameter (PM10) that are capable of penetrating deep into the respiratory tract and causing significant health damage. Data are urban-population-weighted PM10 levels in residential areas of cities with more than 100,000 residents. The estimates represent the average annual exposure level of the average urban resident to outdoor particulate matter. • **Sulfur dioxide** is an air pollutant produced when fossil fuels containing sulfur are burned. • **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.

Data sources

Data on city population are from the United Nations Population Division. Data on particulate matter concentrations are from Kiran D. Pandey, David Wheeler, Bart Ostro, Uwe Deichman, Kirk Hamilton, and Kathrine Bolt's "Ambient Particulate Matter Concentration in Residential and Pollution Hotspot Areas of World Cities: New Estimates Based on the Global Model of Ambient Particulates (GMAPS)" (2006). Data on sulfur dioxide and nitrogen dioxide concentrations are from the WHO's Healthy Cities Air Management Information System and the World Resources Institute.