



3.13 Air pollution

City	City population	Total suspended particulates	Sulfur dioxide	Nitrogen dioxide	About the data	
					thousands 1995	micrograms per cubic meter 1995 ^a
Argentina	Córdoba City	1,294	97	..	97	
Australia	Sydney	3,590	54	28	..	
	Melbourne	3,094	35	0	30	
Austria	Perth	1,220	45	5	19	
	Vienna	2,060	47	14	42	
Belgium	Brussels	1,122	78	20	48	
Brazil	São Paulo	16,533	86	43	83	
	Rio de Janeiro	10,181	139	129	..	
Bulgaria	Sofia	1,188	195	39	122	
Canada	Toronto	4,319	36	17	43	
	Montreal	3,320	34	10	42	
	Vancouver	1,823	29	14	37	
Chile	Santiago	4,891	..	29	81	
China	Shanghai	13,584	246	53	73	
	Beijing	11,299	377	90	122	
	Tianjin	9,415	306	82	50	
	Shenyang	5,116	374	99	73	
	Chengdu	4,323	366	77	74	
	Wuhan	4,247	211	40	43	
	Guangzhu	4,056	295	57	136	
	Zibo	3,779	453	198	43	
	Liupanshui	3,615	408	102	..	
	Chongqing	3,525	320	340	70	
	Harbin	3,303	359	23	30	
	Quingdao	3,138	..	190	64	
	Dalian	3,132	185	61	100	
	Jinan	3,019	472	132	45	
	Changchun	2,523	381	21	64	
Taiyuan	2,502	568	211	55		
Pinxiang	2,040	276	75	..		
Zhengzhou	1,999	474	63	95		
Kunming	1,942	253	19	33		
Guiyang	1,792	330	424	53		
Lanzhou	1,747	732	102	104		
Anshan	1,648	305	115	88		
Nanchang	1,646	279	69	29		
Urumqi	1,643	515	60	70		
Colombia	Bogotá	6,079	120	
Croatia	Zagreb	981	71	31	..	
Cuba	Havana	2,241	..	1	5	
Czech Republic	Prague	1,225	59	32	23	
Denmark	Copenhagen	1,326	61	7	54	
Ecuador	Guayaquil	1,831	127	15	..	
	Quito	1,298	175	31	..	
Egypt, Arab Rep.	Cairo	9,690	..	69	..	
Finland	Helsinki	1,059	40	4	35	
France	Paris	9,523	14	14	57	
Germany	Frankfurt	3,606	36	11	45	
	Berlin	3,317	50	18	26	
	Munich	2,238	45	8	53	
Ghana	Accra	1,673	137	
Greece	Athens	3,093	178	34	64	
Hungary	Budapest	2,017	63	39	51	
Iceland	Reykjavik	100	24	5	42	
India	Mumbai	15,138	240	33	39	
	Calcutta	11,923	375	49	34	

About the data

In many towns and cities exposure to air pollution is the main environmental threat to human health. Winter smog—made up of soot, dust, and sulfur dioxide—has long been associated with temporary spikes in the number of deaths. Long-term exposure to high levels of soot and small particles in the air also contributes to a wide range of chronic respiratory diseases and exacerbates heart disease and other conditions. Particulate pollution, on its own or in combination with sulfur dioxide, leads to an enormous burden of ill health, causing at least 500,000 premature deaths and 4–5 million new cases of chronic bronchitis each year (World Bank 1992).

Emissions of sulfur dioxide and nitrogen oxides lead to the deposition of acid rain and other acidic compounds over long distances—often more than 1,000 kilometers from their source. Acid deposition changes the chemical balance of soils and can lead to the leaching of trace minerals and nutrients critical to trees and plants. The links between forest damage and acid deposition are complex. Direct exposure to high levels of sulfur dioxide or acid deposition can cause defoliation and dieback.

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 by plants with effective dust control, the worst emissions of air pollutants stem from the combustion of petroleum products.

The data on air pollution 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. For example, data are reported for just 5 cities in Africa but for more than 87 cities in China. 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. World Health Organization (WHO) annual mean guidelines for air quality standards are 90 micrograms per cubic meter for total suspended particulates, and 50 for sulfur dioxide and nitrogen dioxide.



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City	City population	Total suspended particulates	Sulfur dioxide	Nitrogen dioxide
	thousands 1995	micrograms per cubic meter 1995 ^a	micrograms per cubic meter 1995 ^a	micrograms per cubic meter 1995 ^a
Delhi	9,948	415	24	41
Chennai	6,002	130	15	17
Hyderabad	5,477	152	12	17
Bangalore	4,799	123
Ahmedabad	3,711	299	30	21
Pune	2,955	208
Kanpur	2,227	459	15	14
Lucknow	2,078	463	26	25
Nagpur	1,851	185	6	13
Indonesia	Jakarta	8,621	271	..
Iran, Islamic Rep.	Tehran	6,836	248	209
Ireland	Dublin	911	..	20
Italy	Milan	4,251	77	31
	Rome	2,931	73	..
	Torino	1,294	151	..
Japan	Tokyo	26,959	49	18
	Osaka	10,609	43	19
	Yokohama	3,178	..	100
Kenya	Nairobi	1,810	69	..
Korea, Rep.	Seoul	11,609	84	44
	Pusan	4,082	94	60
	Taegu	2,432	72	81
Malaysia	Kuala Lumpur	1,238	85	24
Mexico	Mexico City	16,562	279	74
Netherlands	Amsterdam	1,108	40	10
New Zealand	Auckland	945	26	3
Norway	Oslo	477	15	8
Philippines	Manila	9,286	200	33
Poland	Warsaw	2,219	..	16
	Lodz	1,063	..	21
Portugal	Lisbon	1,863	61	8
Romania	Bucharest	2,100	82	10
Russian Federation	Moscow	9,269	100	109
	Omsk	1,199	100	9
Singapore	Singapore	2,848	..	20
Slovak Republic	Bratislava	651	62	21
South Africa	Cape Town	2,671	..	21
	Johannesburg	1,849	..	19
	Durban	1,149	..	31
Spain	Madrid	4,072	42	11
	Barcelona	2,819	117	11
Sweden	Stockholm	1,545	9	5
Switzerland	Zurich	897	31	11
Thailand	Bangkok	6,547	223	11
Turkey	Istanbul	7,911	..	120
	Ankara	2,826	57	55
Ukraine	Kiev	2,809	100	14
United Kingdom	London	7,640	..	25
	Manchester	2,434	..	26
	Birmingham	2,271	..	9
United States	New York	16,332	..	26
	Los Angeles	12,410	..	9
	Chicago	6,844	..	14
Venezuela, RB	Caracas	3,007	53	33

a. Data are for the most recent year available in 1990–95. Most are for 1995.

Definitions

• **City population** is the number of residents of the city as defined by national authorities and reported to the United Nations. • **Total suspended particulates** refer to smoke, soot, dust, and liquid droplets from combustion that are in the air. Particulate levels indicate the quality of the air people are breathing and the state of a country's technology and pollution controls. • **Sulfur dioxide** (SO₂) 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** (NO₂) 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. NO₂ is emitted by bacteria, nitrogenous fertilizers, aerobic decomposition of organic matter in oceans and soils, combustion of fuels and biomass, and motor vehicles and industrial activities.

Data sources

The data in the table 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 United Nations Environment Programme and WHO's *Urban Air Pollution in Megacities of the World*, the Organisation for Economic Co-operation and Development's *OECD Environmental Data: Compendium 1997*, the U.S. Environmental Protection Agency's *National Air Quality and Emissions Trends Report 1995* and AIRS Executive International database, and the *China Environmental Yearbook 1997*.