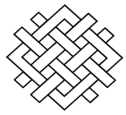
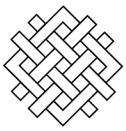
Emissions of Common Anthropogenic Pollutants

Source: The Emission Database for Global Atmospheric Research (EDGAR)



	Sulfur Dioxide (thousand metric tons SO2)		Nitrogen Oxides (thousand metric tons NOx)		Carbon Monoxide (thousand metric tons CO)		Non-methane Volatile Organic Compounds (thousand metric tons VOCs)	
	1990	1995	1990	1995	1990	1995	1990	1995
WORLD	**154,280.3**	**141,875.4**	**99,282.5**	**99,270.8**	**841,082.2**	**852,414.7**	**153,244.5**	**159,634.4**
ASIA (EXCL. MIDDLE EAST)	**43,864.6**	**55,129.3**	**22,422.4**	**28,962.0**	**248,975.4**	**258,324.8**	**38,891.5**	**42,036.1**
Armenia	86.3	15.3	59.6	18.2	563.2	83.0	95.2	37.0
Azerbaijan	174.0	261.8	171.3	85.2	898.2	253.4	376.0	202.4
Bangladesh	186.2	194.0	311.7	357.8	7,134.3	7,514.3	978.4	1,043.0
Bhutan	3.7	3.8	5.7	5.5	203.2	180.8	18.5	17.9
Cambodia	16.5	18.2	61.8	66.5	2,093.9	2,300.8	152.8	167.8
China	25,375.6	34,359.5	8,563.1	12,181.4	85,316.8	88,447.7	10,378.7	11,081.3
Georgia	42.8	5.7	64.2	13.0	794.7	132.8	151.6	52.9
India	5,019.5	6,484.3	4,035.0	5,346.8	51,118.6	55,099.0	7,368.7	8,123.5
Indonesia	711.8	797.4	1,147.2	1,386.7	27,458.2	28,783.6	4,069.4	4,581.7
Japan	2,084.9	2,162.1	2,586.9	2,864.8	10,331.3	10,915.0	5,435.6	5,851.6
Kazakhstan	2,604.2	2,112.4	722.2	652.7	3,582.7	1,412.4	869.7	503.8
Korea, Dem People's Rep	1,363.8	1,044.1	475.8	354.0	1,876.3	1,638.4	327.3	258.9
Korea, Rep	2,429.9	3,290.7	914.8	1,514.9	5,234.9	6,208.0	871.1	1,402.6
Kyrgyzstan	71.7	22.5	51.4	18.6	451.4	126.3	75.9	37.1
Lao People's Dem Rep	11.8	12.9	41.6	44.5	1,643.8	1,770.9	108.0	117.3
Malaysia	369.6	429.9	417.8	531.5	9,285.8	10,333.7	1,636.9	1,938.2
Mongolia	14.9	12.6	45.6	42.8	949.7	957.1	132.1	132.2
Myanmar	56.9	56.2	188.2	200.0	6,627.0	6,785.5	559.4	583.8
Nepal	56.0	67.5	84.4	98.9	2,592.4	2,920.9	299.6	339.2
Pakistan	415.3	567.3	510.3	654.5	7,121.3	8,024.7	1,023.4	1,165.2
Philippines	619.0	633.5	392.0	466.3	7,619.5	7,731.8	965.2	1,013.6
Singapore	334.8	418.4	113.4	160.5	190.0	270.3	124.7	156.1
Sri Lanka	38.4	43.7	64.3	77.0	1,183.6	1,225.8	158.5	165.8
Tajikistan	11.4	5.3	28.5	32.5	459.0	527.3	69.5	79.6
Thailand	760.9	1,233.4	592.9	933.4	5,181.5	5,578.9	898.9	1,196.0
Turkmenistan	166.1	65.2	139.7	81.5	524.4	321.0	328.3	188.0
Uzbekistan	476.3	419.1	216.3	285.8	1,976.9	1,489.1	513.5	502.6
Viet Nam	165.6	193.6	250.6	289.8	6,251.9	6,881.4	725.1	876.2
EUROPE	**61,400.4**	**40,121.8**	**31,105.1**	**21,990.9**	**138,272.8**	**95,924.5**	**41,903.0**	**35,487.8**
Albania	97.5	15.0	34.5	13.5	244.6	258.6	62.9	61.0
Austria	287.1	212.0	244.2	202.0	926.6	856.8	310.4	304.2
Belarus	1,194.0	378.9	701.5	252.5	2,192.9	958.9	524.3	365.7
Belgium	2,034.2	1,799.7	422.8	371.4	1,525.7	1,484.2	352.6	365.7
Bosnia and Herzegovina	104.2	109.9	64.0	25.5	213.0	402.6	52.6	44.7
Bulgaria	1,759.3	1,637.0	267.2	195.0	1,178.4	499.5	221.5	111.5
Croatia	213.3	81.6	102.1	76.0	589.5	518.0	166.0	149.0
Czech Rep	2,511.0	1,420.2	463.6	270.7	1,917.6	1,178.9	320.1	323.2
Denmark {d}	303.0	173.5	273.2	223.0	713.4	730.5	255.1	294.0
Estonia	414.7	166.4	151.6	60.6	382.8	168.1	68.4	42.8
Finland	412.5	331.2	254.7	207.6	872.2	902.1	230.8	235.0
France	1,804.9	1,468.4	1,709.9	1,482.7	10,179.8	8,200.8	2,564.8	2,297.6
Germany 7,285.4		3,604.2	3,526.0	2,001.2	7,288.8	3,214.9	2,480.0	2,284.6
Greece	808.9	740.5	333.9	327.8	1,604.4	1,525.7	375.4	368.8
Hungary	661.3	995.0	209.4	222.1	1,771.9	1,344.7	427.7	372.7
Iceland	8.7	9.4	8.7	8.5	42.6	43.1	12.2	12.3
Ireland	225.3	89.9	116.2	122.3	608.9	514.6	120.2	125.0
Italy	2,421.8	1,963.3	1,776.5	1,533.1	7,511.2	7,918.6	2,183.3	2,321.6
Latvia	282.8	80.3	107.4	49.6	333.7	200.1	88.3	76.5
Lithuania	773.4	111.9	278.3	81.5	1,254.2	487.1	150.0	100.1
Macedonia, FYR	109.2	93.9	39.7	33.6	336.6	248.1	49.4	36.0
Moldova, Rep	312.2	49.8	160.4	55.2	801.5	215.5	107.1	51.0
Netherlands	546.2	527.0	549.2	450.3	1,464.2	1,585.5	669.2	708.2
Norway	293.4	420.9	188.7	157.9	872.9	1,182.0	932.1	1,475.3
Poland	4,100.4	4,022.7	1,206.4	1,135.3	4,763.5	5,342.7	680.2	764.7
Portugal	387.3	192.1	236.3	282.0	1,592.9	2,013.0	378.9	445.8
Romania	1,366.0	1,050.1	520.3	371.5	2,297.5	1,395.0	672.9	502.3
Russian Federation	17,551.2	9,772.7	8,761.7	5,148.1	40,228.9	18,967.1	13,894.0	8,479.7
Serbia and Montenegro	801.3	525.0	230.8	161.3	825.9	408.8	135.9	97.3
Slovakia	640.9	469.7	174.8	155.7	753.5	580.9	127.3	125.4
Slovenia	101.4	89.8	51.7	62.3	389.1	481.8	111.2	138.1
Spain	2,062.6	1,544.0	1,171.9	1,204.2	5,587.9	4,932.9	1,427.4	1,356.7
Sweden	339.1	293.9	348.5	234.0	1,286.2	1,259.6	393.6	397.1
Switzerland	105.9	93.7	187.8	124.5	885.4	825.3	182.3	176.9
Ukraine	4,887.5	2,581.4	3,453.1	2,411.9	24,690.9	16,206.9	7,769.3	6,865.7
United Kingdom	4,123.8	2,953.9	2,707.4	2,220.1	9,710.7	8,604.9	3,360.8	3,567.1
MIDDLE EAST & N. AFRICA	**6,467.1**	**7,334.6**	**4,169.3**	**5,071.3**	**27,240.0**	**31,879.0**	**13,812.8**	**15,711.5**
Afghanistan	115.7	131.8	52.4	69.6	1,614.2	2,412.8	162.8	223.5
Algeria	223.8	290.2	273.8	305.9	2,086.9	2,193.8	842.7	854.7
Egypt	603.4	543.4	372.0	408.0	2,980.4	3,122.0	850.4	883.8
Iran, Islamic Rep	1,155.0	1,233.5	734.7	908.1	5,222.9	6,118.6	2,205.4	2,596.1
Iraq	363.4	395.3	366.3	416.9	1,885.4	1,870.9	1,204.4	551.0
Israel	280.7	370.4	148.3	205.5	774.9	994.5	140.1	171.6
Jordan	75.7	105.9	49.4	62.8	267.5	322.5	28.2	32.3
Kuwait	130.3	237.3	99.1	118.2	451.5	597.7	648.7	1,060.3
Lebanon	56.2	89.3	39.1	59.4	333.7	640.7	46.2	86.4
Libyan Arab Jamahiriya	216.9	242.2	123.6	169.5	718.1	935.8	728.6	793.7
Morocco	213.7	238.7	110.6	133.9	700.1	584.4	119.3	109.4
Oman	51.1	96.3	27.2	39.9	269.9	357.1	361.1	451.8
Saudi Arabia	636.2	717.1	548.7	675.1	3,152.3	4,061.7	3,664.4	4,641.4
Syrian Arab Rep	259.0	351.8	164.3	218.0	954.7	1,024.2	323.4	427.2
Tunisia	205.3	215.6	77.3	88.7	440.0	487.8	118.0	123.5
Turkey	1,594.3	1,771.3	645.3	784.9	3,985.3	4,465.3	717.7	809.0
United Arab Emirates	154.3	159.6	168.7	207.3	539.8	644.1	1,081.5	1,167.8
Yemen	35.0	37.7	50.3	59.3	487.7	594.4	247.9	388.6



	Sulfur Dioxide (thousand metric tons SO2)		Nitrogen Oxides (thousand metric tons NOx)		Carbon Monoxide (thousand metric tons CO)		Non-methane Volatile Organic Compounds (thousand metric tons VOCs)	
	1990	1995	1990	1995	1990	1995	1990	1995
SUB-SAHARAN AFRICA	**6,217.5**	**5,344.7**	**9,022.0**	**9,308.8**	**170,532.4**	**177,267.7**	**16,397.4**	**17,375.4**
Angola	128.1	129.7	506.4	511.5	9,271.7	9,486.9	879.7	914.8
Benin	13.2	14.0	57.1	58.2	1,163.4	1,198.0	106.0	109.8
Botswana	57.3	55.7	235.3	235.2	3,921.9	3,921.8	277.3	279.5
Burkina Faso	27.2	28.3	102.0	103.8	2,128.8	2,230.5	197.1	208.8
Burundi	5.9	6.2	21.7	22.1	502.6	529.3	59.0	62.2
Cameroon	46.4	51.3	180.2	184.9	3,803.6	3,960.8	449.9	414.6
Central African Rep	38.3	38.8	190.4	190.9	3,785.0	3,804.9	259.6	262.6
Chad	41.7	42.5	199.5	200.9	3,701.0	3,755.8	271.3	277.1
Congo	14.0	14.8	55.0	56.5	1,247.7	1,334.7	223.7	242.3
Congo, Dem Rep	514.8	267.7	933.7	946.4	22,289.6	22,792.0	1,560.7	1,617.9
Côte d'Ivoire	43.6	45.9	124.1	127.2	2,470.3	2,402.2	243.9	250.4
Equatorial Guinea	2.4	2.6	9.0	9.5	221.6	241.0	15.1	18.5
Eritrea 9.3		9.7	32.3	32.9	578.7	595.9	54.8	57.4
Ethiopia 126.4		145.4	324.2	354.2	6,879.0	7,677.4	637.5	725.7
Gabon	44.0	56.5	48.1	47.3	1,657.5	1,521.0	222.1	262.7
Gambia	1.9	2.1	4.2	4.4	94.6	104.1	11.4	12.5
Ghana	29.7	32.4	105.9	112.9	2,227.1	2,319.7	204.2	218.7
Guinea	25.1	26.7	99.2	101.9	1,988.3	2,068.0	163.2	174.7
Guinea-Bissau	4.0	4.2	14.4	14.3	301.9	297.9	25.2	25.6
Kenya	63.4	61.8	195.6	199.8	4,102.5	4,338.7	438.6	468.5
Lesotho	1.7	1.9	5.1	5.9	136.2	152.0	17.6	19.5
Liberia	7.4	6.8	27.4	25.8	701.3	678.1	55.2	51.5
Madagascar	36.5	38.8	139.4	142.2	3,188.3	3,305.1	263.7	278.8
Malawi	15.5	16.4	42.7	43.5	1,267.7	1,299.9	123.0	126.5
Mali	50.8	52.9	225.8	228.6	4,276.9	4,381.5	327.0	338.6
Mauritania	20.5	23.0	47.9	47.5	768.0	784.5	68.2	70.3
Mozambique	83.7	86.4	364.5	370.8	7,047.7	7,213.0	549.2	571.9
Namibia	740.6	97.5	141.6	142.6	2,417.1	2,428.8	170.1	171.6
Niger	28.4	30.0	95.5	97.6	1,799.7	1,885.1	156.7	167.1
Nigeria	681.7	764.3	779.3	835.3	19,346.1	21,423.8	3,086.7	3,424.3
Rwanda	15.1	12.0	35.1	27.1	1,116.8	854.5	138.1	106.0
Senegal	36.4	37.9	104.2	107.2	1,747.7	1,767.0	147.5	150.5
Sierra Leone	14.8	16.1	62.4	64.2	1,290.5	1,380.5	106.2	111.4
Somalia	23.1	23.2	129.6	130.3	2,648.9	2,697.6	227.2	234.0
South Africa	1,738.8	1,853.7	1,337.9	1,452.5	8,016.1	8,954.4	950.7	1,068.0
Sudan	134.9	132.4	588.6	591.8	14,132.1	14,383.1	1,306.1	1,352.4
Tanzania, United Rep	102.7	105.1	585.8	603.8	12,378.7	12,946.7	1,103.6	1,182.3
Togo	11.8	12.6	42.4	42.9	851.0	882.8	76.1	80.4
Uganda	37.6	41.1	141.3	147.3	3,138.6	3,356.9	298.1	325.1
Zambia	1,010.5	765.8	399.2	396.9	7,525.6	7,417.3	535.5	534.7
Zimbabwe	166.1	163.5	253.5	254.7	3,938.7	3,986.7	326.9	334.6
NORTH AMERICA	**24,983.5**	**20,903.6**	**21,516.8**	**21,803.0**	**106,913.5**	**142,736.7**	**23,230.6**	**28,689.1**
Canada	2,526.6	2,760.5	2,066.1	3,748.5	12,475.2	52,488.0	3,601.5	9,189.8
United States	22,455.4	18,142.2	19,447.0	18,051.2	94,435.1	90,245.5	19,626.8	19,497.0
C. AMERICA & CARIBBEAN	**2,869.7**	**3,021.0**	**2,399.1**	**2,588.1**	**23,566.4**	**24,105.5**	**4,531.7**	**4,679.0**
Belize	1.3	1.3	3.8	4.0	81.8	89.3	5.8	6.4
Costa Rica	19.1	25.5	60.1	75.4	666.5	658.4	72.0	78.1
Cuba	335.0	267.5	264.3	206.7	953.8	806.0	222.3	178.0
Dominican Rep	70.6	87.6	71.4	85.5	609.4	602.2	80.4	82.8
El Salvador	16.0	27.8	39.8	58.9	409.2	567.4	53.9	77.2
Guatemala	26.7	41.5	91.5	100.5	1,993.9	2,023.0	175.2	183.1
Haiti	6.2	3.8	17.3	17.8	249.9	264.6	36.2	38.5
Honduras	22.1	25.3	75.0	89.1	1,447.7	1,459.8	119.2	125.7
Jamaica	88.8	101.1	36.1	47.3	315.9	299.5	34.8	38.9
Mexico	2,106.4	2,250.5	1,477.6	1,584.0	12,987.1	13,267.8	3,242.2	3,356.0
Nicaragua	30.0	35.6	80.4	90.9	1,820.0	1,973.3	122.7	133.9
Panama	19.3	27.9	33.0	55.1	854.5	888.2	66.3	73.0
Trinidad and Tobago	38.4	29.8	37.3	42.9	240.4	194.7	114.6	106.7
SOUTH AMERICA	**5,933.4**	**7,061.8**	**6,128.6**	**6,722.2**	**104,827.7**	**100,453.5**	**11,157.9**	**12,143.0**
Argentina	346.4	330.9	455.0	609.8	4,392.8	4,421.1	1,020.5	1,251.1
Bolivia	71.1	81.7	262.7	266.6	6,931.2	6,760.1	448.2	446.5
Brazil	1,892.9	2,050.1	3,770.1	3,869.9	66,104.5	61,710.5	5,669.8	5,694.3
Chile	2,296.2	3,003.2	256.1	314.0	2,996.9	3,334.9	308.7	366.0
Colombia	207.4	246.3	420.8	481.2	7,052.7	7,006.8	906.1	1,022.3
Ecuador	111.8	127.0	154.7	164.5	3,166.0	2,988.5	413.6	457.0
Guyana	4.3	3.0	11.3	9.7	271.2	210.1	21.8	18.6
Paraguay	16.1	19.7	59.2	73.9	1,502.4	1,420.5	141.4	141.4
Peru	557.7	723.1	184.4	289.5	3,874.8	3,648.7	374.1	377.4
Suriname	5.3	4.7	9.8	9.5	245.2	240.2	19.9	20.2
Uruguay	26.0	27.2	25.7	56.2	242.9	326.2	44.8	62.9
Venezuela	395.9	443.0	514.3	573.0	7,967.7	8,300.5	1,781.0	2,277.5
OCEANIA	**1,595.3**	**1,695.8**	**2,053.3**	**2,167.4**	**18,205.2**	**18,486.7**	**2,745.3**	**2,800.2**
Australia	1,484.6	1,573.5	1,815.6	1,887.2	15,419.7	15,472.5	2,377.0	2,390.7
Fiji	3.2	3.1	4.7	4.7	106.9	107.8	12.3	12.7
New Zealand	76.5	85.0	152.0	189.5	602.8	706.8	159.4	173.2
Papua New Guinea	20.2	22.2	63.4	66.8	1,851.6	1,978.9	173.4	200.1
Solomon Islands	0.9	0.9	1.9	2.0	66.8	68.5	6.7	7.1
DEVELOPED	**95,680.6**	**69,976.5**	**60,112.0**	**51,577.6**	**289,578.2**	**280,046.5**	**76,673.8**	**75,432.9**
DEVELOPING	**57,650.9**	**70,636.1**	**38,704.6**	**47,036.1**	**548,955.3**	**569,132.0**	**75,996.3**	**83,489.1**

VARIABLE DEFINITIONS AND METHODOLOGY:

Sulfur dioxide, or SO_2, is a primary contributor to acid rain. High concentrations of sulfur dioxide affect breathing and may aggravate existing respiratory and cardiovascular disease. Sulfur dioxide forms when fuel containing sulfur, such as coal and oil, is burned, when gasoline is extracted from oil, or when metals are extracted from ore. Petroleum refineries, cement manufacturing facilities, metal processing facilities, locomotives, large ships, and some off-road diesel equipment burn high-sulfur fuel and release large quantities of SO_2 into the air.

Nitrogen oxides, or NO_x, is the generic term for a group of highly reactive, acidifying gases, all of which contain nitrogen and oxygen in varying amounts. Nitrogen oxides are a precursor to ground-level ozone, which can trigger serious respiratory problems. NO_x also contributes to acid rain and global warming. It forms when fuel is burned at high temperatures, as in a combustion process. The primary sources of NO_x are motor vehicles, electric utilities, and other industrial, commercial, and residential fuel-burning sources.

Carbon monoxide, or CO, is a precursor gas of ground-level ozone, which can trigger serious respiratory problems. When CO enters the bloodstream, it reduces the delivery of oxygen to the body's organs and tissues. Exposure to elevated CO levels can cause impairment of visual perception, manual dexterity, learning ability and the performance of complex tasks. CO is formed when carbon in fuel is not burned completely and is a component of motor vehicle exhaust. Other sources of CO emissions include industrial processes (such as metals processing and chemical manufacturing), residential wood burning, and natural sources such as forest fires.

Non-methane VOCs (Volatile Organic Compounds) are chemicals that vaporize at room temperature, including benzene, toluene, methylene chloride and methyl chloroform. Common sources that emit VOCs include housekeeping and maintenance products, cars, and building and furnishing materials, such as solvents, paints, and glues. In sufficient quantities, VOCs can have adverse health effects on humans; some are suspected or known carcinogens. VOCs are also precursors to ground-level ozone, which can trigger serious respiratory problems.

The Dutch National Institute of Public Health and the Environment (RIVM) and the Netherlands Organization for Applied Scientific Research (TNO) gather disparate data on greenhouse gases and atmospheric pollutants and compile them into complete sets of emissions data for the Emission Database for Global Atmospheric Research (EDGAR).

To ensure a consistent approach across countries, RIVM obtains activity data from a range of international statistic data sources (IEA, UN, FAO, OLADE, etc.), and selects emission factors from international publications (Intergovernmental Panel on Climate Change (IPCC) Guidelines, US-EPA reports, etc.). For example, production data for industrial processes are based on UN Industrial Commodity Statistics, supplemented with data from the USGS, SRI, and IISI. For some nations, interpolations and extrapolations are necessary to arrive at complete time series, with special attention given to new Economies in Transition countries to match the older totals for the former countries. Emission factors for CO_2, CH_4, and N_20 are described in Sectoral Emissions Inventories published in ***Environmental Science & Policy***, while those for nitric acid production are based on Intergovernmental Panel on Climate Change (IPCC) Guidelines.

For further information on variables and collection methodologies, refer to the documentation provided by the EDGAR site at: http://arch.rivm.nl/env/int/coredata/edgar/edgar32-datasources-methods.doc. Information on the IPCC methodologies utilized by RIVM and TNO is available at http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm.

FREQUENCY OF UPDATE BY DATA PROVIDERS:

The Emission Database for Global Atmospheric Research (EDGAR) updates emissions data depending on the availability of international statistics. Currently, data are available for 1990 and 1995.

DATA RELIABILITY AND CAUTIONARY NOTES:
RIVM and TNO use the same methodologies for calculating emissions as the IPCC. In addition, global totals comply with budgets used in atmospheric studies, and the data were based on international information sources. However, data for some countries are uncertain, especially in the categories of methane and nitrous oxide emissions. The uncertainty is caused by the limited accuracy of both international activity data and national emission factors.

SOURCES:
Dutch National Institute for Public Health (RIVM) and Netherlands Organization for Applied Scientific Research (TNO). 2001. The Emission Database for Global Atmospheric Research (EDGAR) 3.2. Precursors: NMVOC (Non-Methane Volatile Organic Compounds): Aggregated Emissions 1990/1995. The Netherlands: RIVM. Electronic database available online at: http://arch.rivm.nl/env/int/coredata/edgar/.