The chemical composition of Earth's atmosphere VI: anthropogenic inputs

Mole %	*Name*	*Chemical formula*	*Residence Time*	*Anthro-pogenic input*
78.084	Nitrogen	N_2	10^6-10^7 yea	
20.948	Oxygen	O_2	3000-10,000 y	
0.934	Argon	Ar	Forever	
0.004 - 4	Water vapor	H_2O	~10 days	
0.0385 (385 ppm)	**Carbon dioxide**	**CO_2**	2-10 years	**A**
0.001818 (18.18 ppm)	Neon	Ne	Forever	
0.000524 (5.24 ppm)	Helium	He	~10^6 years	
0.00017 (1.7 ppm)	**Methane**	**CH_4**	2-10 years	**A**
0.000114 (1.14 ppm)	Krypton	Kr	Forever	
0.00005 - 0.0010	Stratospheric ozone	O_3		
0.000055 (0.55 ppm)	**Hydrogen**	**H_2**	4-8 years	**A**
0.000033 (0.33 ppm)	**Nitrous oxide**	**N_2O**	5-200 years	**A**
0.0000050 - 0.0000200	**Carbon monoxide**	**CO**	60-200 days	**A**
0.0000087 (87 ppb)	Xenon	Xe	Forever	
0.0000010 - 0.0000500	**Tropospheric ozone**	**O_3**		**A**
0.0000005 - 0.0000020	**NMHC (Non-methane hydrocarbons)**	**C_xH_y**		**A**
0.0000000540 (540 ppt)	**CFC12**	**CF_2Cl_2**	>80 years	**AA**
0.00000005 (500 ppt)	**Carbonyl sulfide**	**OCS**	~ 2 years	**A**
0.0000000265 (265 ppt)	**CFC11**	**$CFCl_3$**	~80 years	**AA**
0.00000001 - 0.000001	Hydrogen peroxide	H_2O_2	1 day	
0.00000001 - 0.0000001	Formaldehyde	CH_2O	5-10 days	
0.0000000098 (98 ppt)	**Carbon tetrachloride**	**CCl_4**	≥ decades	**AA**
0.0000000065 (65 ppt)	**Methylchloroform**	**CH_3CCl_3**	~7 years	**AA**
0.000000001 - 0.0001	**Nitrogen oxides**	**NO_x**	A few days	**A**
0.000000001 - 0.0000001	Ammonia	NH_3	A few days	
0.000000001 - 0.0000001	**Sulfur dioxide**	**SO_2**	hours to weeks	**A**
0.000000001 - 0.00000001	Dimethyl sulfide	CH_3SCH_3	<1 day	
0.0000000001 - 0.00000003	**Carbon disulfide**	**CS_2**	~40 days	**A**
0.0000000005 - 0.00000005	**Hydrogen sulfide**	**H_2S**	<5 days	**A**
0.0000000002 (2 ppt)	Hydroperoxyl radical	HO_2		
0.000000000005 (0.05 ppt)	Hydroxyl radical	OH	≤ a few se	

A = anthopogenic;
AA = all anthropgenic

Sources: see Part I of this series. The column labelled "anthropogenic input" is mostly from Prinn (2003).

In this series, we've aleady observed that the atmosphere's fifth and eighth most abundant components, CO_2 and methane, have major anthropogenic inputs. Methane's anthropgonic inputs are largely from agriculture, and the same is true for N_2O, in that bacteria attack fertilizers and animal waste. However, that's just the beginning, as the table at left shows with its rightmost column.

One striking group of components is the halogen-bearing carbon compounds (CFCs, carbon tetracloride, and methylchloroform). They're all components that come almost entirely from human rather than natural sources. They're all rather stable and thus have relatively long residence times (decades rather than days to years). CFCs were generated largely as refrigerants, and carbon tetraochloride and methylchloroform have major industrial applications, commonly as solvents.

Another source of anthropogenic inputs is partial combustion of carbon-based fuels and their minor components. That accounts for much of the output of CO, NO_x, and SO_2, and NMHC. NO_2 in sunlight breaks down to form NO and O, and the latter combines with O_2 to form O_3 (ozone). Even the human production of H_2 is related to burning of gasoline, via the reaction $CO + H_2O \rightarrow CO_2 + H_2$ (Barnes et al., 2003, Hydrogen in the atmosphere . . .: *JGR,* v. 108, p. 4197 ff).