



GHG Lifetimes and GWPs

For ozone-depleting substances and their replacements

Summary

The tables below show the lifetimes and direct (except for CH₄) 100-year **global warming potentials (GWP)** relative to CO₂ for ozone-depleting substances and their replacements. These tables are from the Intergovernmental Panel on Climate Change (IPCC), Fourth Assessment Report (AR4), Working Group 1, Chapter 2, *Changes in Atmospheric Constituents and in Radiative Forcing*, Table 2.14, page 212,

http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm

Tables



Note: The values for global warming potential in the AR4 WG1 Technical Summary reflect radiative forcing estimates and lifetimes that are improvements upon the values used in the IPCC Second Assessment Report (SAR) but which are still widely cited.

Key greenhouse gases (GHG)

Designation or Name	Chemical formula	Lifetime (years)	100 yr GWP (SAR)	100 yr GWP (AR4)
Carbon dioxide	CO ₂	Note ¹	1	1
Methane	CH ₄	12 ²	21	25
Nitrous oxide	N ₂ O	114	310	298

Substances controlled by the Montreal Protocol

Designation or Name	Chemical formula	Lifetime (years)	100 yr GWP (SAR)	100 yr GWP (AR4)
CFC-11	CCl ₃ F	45	3,800	4,750
CFC-12	CCl ₂ F ₂	100	8,100	10,900
CFC-13	CCIF ₃	640	10,800	16,400
CFC-113	CCl ₂ FCCIF ₂	85	4,800	6,130
CFC-114	CCIF ₂ CCIF ₂	300	8,040	8,730
CFC-115	CCIF ₂ CF ₃	1,700	5,310	9,990

¹ The CO₂ response function used in this report is based on the revised version of the Bern Carbon Cycle Model using a background CO₂ concentration value of 378 ppm. (See *CO₂ residence time graphs* following)

² The perturbation lifetime for methane is 12 years as in the IPCC Third Assessment Report (TAR). The GWP for methane includes indirect effects from enhancements of ozone and stratospheric water vapour.

Designation or Name	Chemical formula	Lifetime (years)	100 yr GWP (SAR)	100 yr GWP (AR4)
Halon-1301	CBrF_3	65	5,400	7,140
Halon-1211	CBrClF_2	16	4,750	575
Halon-2402	$\text{CBrF}_2\text{CBrF}_2$	20	3,680	503
Carbon tetrachloride	CCl_4	26	1,400	1,400
Methyl bromide	CH_3Br	0.7	17	1
Methyl chloroform	CH_3CCl_3	5	506	45
HCFC-22	CHClF_2	12	1,500	1,810
HCFC-123	CHCl_2CF_3	1.3	90	77
HCFC-124	CHClFCF_3	5.8	470	609
HCFC-141b	$\text{CH}_3\text{CCl}_2\text{F}$	9.3	2,250	220
HCFC-142b	CH_3CClF_2	17.9	1,800	2,310
HCFC-225ca	$\text{CHCl}_2\text{CF}_2\text{CF}_3$	1.9	429	37
HCFC-225cb	$\text{CHClFCF}_2\text{CClF}_2$	5.8	2,030	181

Hydrofluorocarbons

Designation or Name	Chemical formula	Lifetime (years)	100 yr GWP (SAR)	100 yr GWP (AR4)
HFC-23	CHF_3	270	11,700	14,800
HFC-32	CH_2F_2	4.9	650	675
HFC-125	CHF_2CF_3	29	2,800	3,500
HFC-134a	CH_2FCF_3	14	1,300	1,430
HFC-143a	CH_3CF_3	52	3,800	4,470
HFC-152a	CH_3CHF_2	1.4	140	124
HFC-227ea	$\text{CF}_3\text{CHF}_2\text{CF}_3$	34.2	2,900	3,220
HFC-236fa	$\text{CF}_3\text{CH}_2\text{CF}_3$	240	6,300	9,810
HFC-245fa	$\text{CHF}_2\text{CH}_2\text{CF}_3$	7.6	3,380	314
HFC-365mfc	$\text{CH}_3\text{CF}_2\text{CH}_2\text{CF}_3$	8.6	2,520	241
HFC-43-10mee	$\text{CF}_3\text{CHFCH}_2\text{CF}_2\text{CF}_3$	15.9	1,300	1,640

Perfluorinated compounds

Designation or Name	Chemical formula	Lifetime (years)	100 yr GWP (SAR)	100 yr GWP (AR4)
Sulphur hexafluoride	SF_6	3,200	23,900	22,800
Nitrogen trifluoride	NF_3	740	12,300	20,700
PFC-14	CF_4	50,000	6,500	7,390
PFC-116	C_2F_6	10,000	9,200	12,200
PFC-218	C_3F_8	2,600	7,000	8,830

Designation or Name	Chemical formula	Lifetime (years)	100 yr GWP (SAR)	100 yr GWP (AR4)
PFC-318	c-C ₄ F ₈	3,200	8,700	10,300
PFC-3-1-10	C ₄ F ₁₀	2,600	7,000	8,860
PFC-4-1-12	C ₅ F ₁₂	4,100	6,510	13,300
PFC-5-1-14	C ₆ F ₁₄	3,200	7,400	9,300
PFC-9-1-18	C ₁₀ F ₁₈	>1,000d	>5,500	>9,500
trifluoromethyl sulphur pentafluoride	SF ₅ CF ₃	800	13,200	21,200

Fluorinated ethers

Designation or Name	Chemical formula	Lifetime (years)	100 yr GWP (SAR)	100 yr GWP (AR4)
HFE-125	CHF ₂ OCF ₃	136	13,800	8,490
HFE-134	CHF ₂ OCHF ₂	26	12,200	1,960
HFE-143a	CH ₃ OCF ₃	4.3	2,630	230
HCFE-235da2	CHF ₂ OCHClCF ₃	2.6	1,230	106
HFE-245cb2	CH ₃ OCF ₂ CHF ₂	5.1	2,440	215
HFE-245fa2	CHF ₂ OCH ₂ CF ₃	4.9	2,280	200
HFE-254cb2	CH ₃ OCF ₂ CHF ₂	2.6	1,260	109
HFE-347mcc3	CH ₃ OCF ₂ CF ₂ CF ₃	5.2	1,980	175
HFE-347pcf2	CHF ₂ CF ₂ OCH ₂ CF ₃	7.1	1,900	175
HFE-356pcc3	CH ₃ OCF ₂ CF ₂ CHF ₂	0.33	386	33
HFE-449sl	C ₄ F ₉ OCH ₃	3.8	1,040	90
HFE-569sf2	C ₄ F ₉ OC ₂ H ₅	0.77	207	18
HFE-43-10pccc124	CHF ₂ OCF ₂ OC ₂ F ₄ OCHF ₂	6.3	6,320	569
HFE-236ca12	CHF ₂ OCF ₂ OCHF ₂	12.1	8,000	860
HFE-338pcc13	CHF ₂ OCF ₂ CF ₂ OCHF ₂	6.2	5,100	460

Perfluoropolyethers

Designation or Name	Chemical formula	Lifetime (years)	100 yr GWP (SAR)	100 yr GWP (AR4)
PFPME	CF ₃ OCF(CF ₃)CF ₂ OCF ₂ OCF ₃	800	7,620	12,400

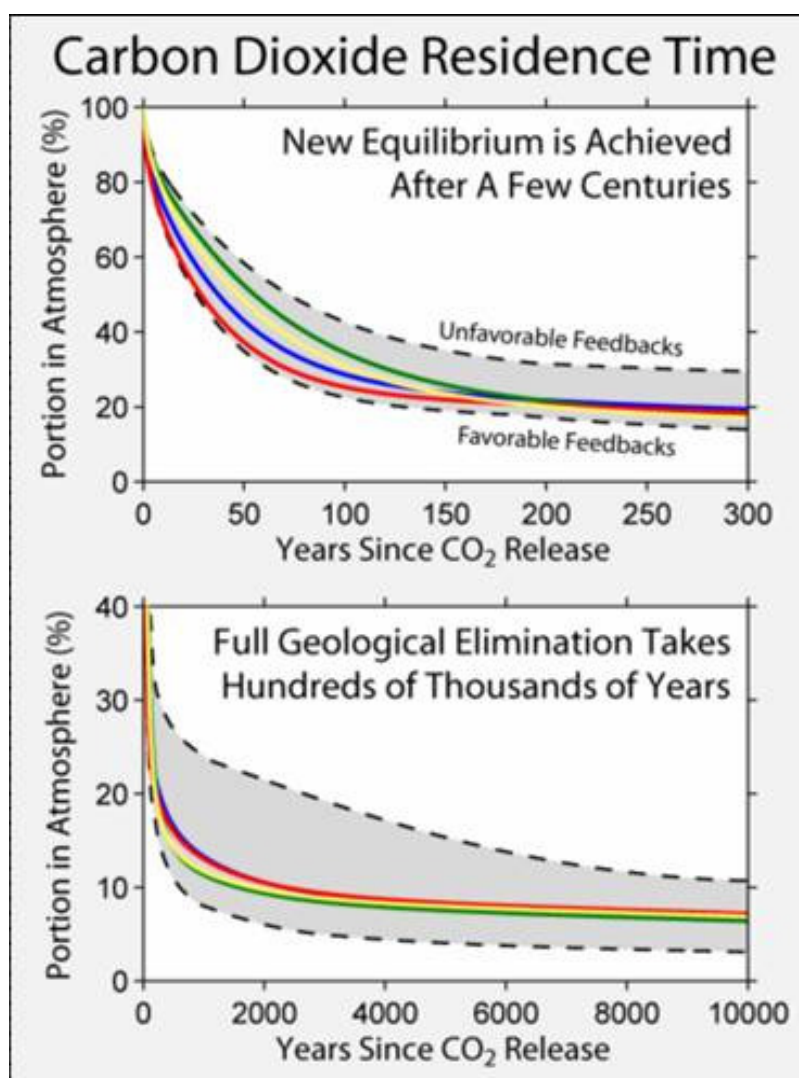
Hydrocarbons and other compounds - Direct Effects

Designation or Name	Chemical formula	Lifetime (years)	100 yr GWP (SAR)	100 yr GWP (AR4)
Dimethylether	CH ₃ OCH ₃	0.015	1	<<1
Methylene chloride	CH ₂ Cl ₂	0.38	31	2.7

Designation or Name	Chemical formula	Lifetime (years)	100 yr GWP (SAR)	100 yr GWP (AR4)
Methyl chloride	CH ₃ Cl	1.0	45	4

CO₂ residence time graphs

The figure below shows the degree to which carbon dioxide (CO₂) emissions persist in the atmosphere over time. The lifetime of a gas in the atmosphere is generally known as its "residence time", but unlike other greenhouse gases, carbon dioxide does not undergo a simple decline over a single predictable timescale. Instead, the excess carbon is first diluted by the carbon cycle as it mixes into the oceans and biosphere (e.g. plants) over a period of a few hundred years, and then it is slowly removed over hundreds of thousands of years as it is gradually incorporated into carbonate rocks.³



³ Global Warming Art, image created by Robert A. Rohde,
http://www.globalwarmingart.com/wiki/Image:Carbon_Dioxide_Residence_Time_png