



Fluorocarbons

Substances and main applications

Major HFC - HFO – HCFC molecules

Major HFC molecules

Designation	Complete Name	Formula	CAS number	GWP (1)		Atmospheric lifetime (3)	Main Applications
				F-Gas Regulation AR4 (2)	AR5 (3)		
HFC-23	trifluoromethane	CHF ₃	75-46-7	14800	12400	222 years	<ul style="list-style-type: none"> • Very low temperature specialist refrigerant • By product in production of HCFC-22 and aluminium smelting
HFC-32	difluoromethane	CH ₂ F ₂	75-10-5	675	677	5.2 years	<ul style="list-style-type: none"> • Refrigerant for air-conditioning • Component of refrigerants for air-conditioning, commercial refrigeration and heat pumps



Designation	Complete Name	Formula	CAS number	GWP (1)		Atmospheric lifetime (3)	Main Applications
				F-Gas Regulation AR4 (2)	AR5 (3)		
HFC-125	pentafluoroethane	CHF ₂ CF ₃	354-33-6	3500	3170	28.2 years	<ul style="list-style-type: none"> • Blend component for stationary air-conditioning, commercial refrigeration and heat pumps • Firefighting agent
HFC-134a	1,1,1,2-tetrafluoroethane	CH ₂ FCF ₃	811-97-2	1430	1300	13.4 years	<ul style="list-style-type: none"> • Refrigerant for mobile air-conditioning applications (servicing only for cars) • Blend component for stationary-air conditioning and commercial refrigeration • Propellant for pharmaceutical aerosols (MDIs); and for technical aerosols, to meet national safety standards from 2018



Designation	Complete Name	Formula	CAS number	GWP (1)		Atmospheric lifetime (3)	Main Applications
				F-Gas Regulation AR4 (2)	AR5 (3)		
							<ul style="list-style-type: none"> • Blowing agent component for extruded polystyrene foams (XPS)
HFC-143a	1,1,1-trifluoroethane	CH ₃ CF ₃	420-46-2	4470	4800	47.1 years	<ul style="list-style-type: none"> • Blend component for commercial refrigeration
HFC-152a	1,1-difluoroethane	CH ₃ CHF ₂	75-37-6	124	138	1.5 years	<ul style="list-style-type: none"> • Propellant for specialized industrial aerosols • Blowing agent component for extruded polystyrene foams (XPS)
HFC-227ea	1,1,1,2,3,3,3-heptafluoropropane	CF ₃ CHFCF ₃	431-89-0	3220	3350	38.9 years	<ul style="list-style-type: none"> • Propellant for Pharmaceutical Aerosols (MDIs) • Firefighting Agent • Refrigerant for high-temperature environments



Designation	Complete Name	Formula	CAS number	GWP (1)		Atmospheric lifetime (3)	Main Applications
				F-Gas Regulation AR4 (2)	AR5 (3)		
HFC-236fa	1,1,1,3,3,3-hexafluoropropane	$\text{CF}_3\text{CH}_2\text{CF}_3$	290-39-1	9810	8060	242 years	<ul style="list-style-type: none"> • Firefighting Agent • Refrigerant for high-temperature environments
HFC-245fa	1,1,1,3,3-pentafluoropropane	$\text{CHF}_2\text{CH}_2\text{CF}_3$	460-73-1	1030	858	7.7 years	<ul style="list-style-type: none"> • Foam Blowing agent for Polyurethane (PUR) foams • Working fluid for organic rankine cycles (ORC)
HFC-365mfc	1,1,1,3,3-pentafluorobutane	$\text{CF}_3\text{CH}_2\text{CF}_2\text{CH}_3$	406-58-6	794	804	8.7 years	<ul style="list-style-type: none"> • Foam Blowing agent for Polyurethane (PUR) and phenolic foams • Blend component for Solvents • Working fluid for organic rankine cycle (ORC)
HFC-43-10mee	1,1,1,2,2,3,4,5,5,5-decafluoropentane	$\text{CF}_3\text{CHFCHFCF}_2\text{CF}_3$	138495-42	1640	1650	16.1 years	<ul style="list-style-type: none"> • Solvent for specialized applications



Major HFO molecules

Designation	Complete Name	Formula	CAS number	GWP (1)		Atmospheric lifetime (3) unless stated	Ozone Depleting Substance (ODS)	Main Applications
				F-Gas Regulation AR4 (2) unless stated	AR5 (3) unless stated			
CFO-1224yd(Z)	2,3,3,3 Tetrafluoro-1-chloroprop-1-ene	$\text{CF}_3\text{-CF=CHCl}$	111512-60-8	<i>na</i>	< 1 (4)	21 days (4)	No, a VSLS (5)	<ul style="list-style-type: none"> Refrigerant for centrifugal chillers, high temperature heat pumps working fluid for organic rankine cycle (ORC) Blowing agent for polyurethane foams
HBFO-1233xfB	2-bromo-3,3,3-trifluoropropene	$\text{CF}_3\text{CBr=CH}_2$	1514-82-5	<i>na</i>	0.26 (4)	7 days (4)	No, a VSLS (5)	<ul style="list-style-type: none"> Fire extinguishant streaming agent (also known as 2-BTP)



Designation	Complete Name	Formula	CAS number	GWP (1)		Atmospheric lifetime (3) unless stated	Ozone Depleting Substance (ODS)	Main Applications
				F-Gas Regulation AR4 (2) unless stated	AR5 (3) unless stated			
HCFO-1233zd(E)	Trans 1-Chloro-3,3,3-trifluoroprop-1-ene	Trans-CHCl=CHCF ₃	2730-43-0	4.5	1	26 days	No, a VSLS (5)	<ul style="list-style-type: none"> Refrigerant for chiller applications, high temperature heat pumps Working fluid for organic rankine cycle (ORC) Blowing agent for Insulation foams Precision solvents
HFO-1234yf	2,3,3,3-tetrafluoroprop-1-ene	CF ₃ CF=CH ₂	754-12-1	4 (6)	<1	10.5 days	No	<ul style="list-style-type: none"> Refrigerant for mobile air-conditioning, stationary air conditioning and refrigeration Blend component for HFC-HFO blends
HFO-1234ze(E)	Trans-1,3,3,3-tetrafluoroprop-1-ene	Trans-CF ₃ CH=CFH	29118-24-9	7 (6)	<1	16.4 days	No	<ul style="list-style-type: none"> Refrigerant for chillers, refrigeration Blend component for HFC-HFO blends Aerosol propellant



Designation	Complete Name	Formula	CAS number	GWP (1)		Atmospheric lifetime (3) unless stated	Ozone Depleting Substance (ODS)	Main Applications
				F-Gas Regulation AR4 (2) unless stated	AR5 (3) unless stated			
								<ul style="list-style-type: none"> • Blowing agent for insulation foams
HFO-1336mzz(Z)	Cis-1,1,1,4,4,4-hexafluorobut-2-ene	Cis- $\text{CF}_3\text{CH}=\text{CHCF}_3$	692-49-9	9	2 (7 & 3)	22 days (8 & 3)	No	<ul style="list-style-type: none"> • Refrigerant for chillers, high temperature heat pumps • Working fluid for organic rankine cycle (ORC) • Fire extinguishant • Blowing agent for insulation foams • Solvent • Aerosol propellant
HFO-1336mzz(E)	Trans-1,1,1,4,4,4-hexafluorobut-2-ene	Trans- $\text{CF}_3\text{CH}=\text{CHCF}_3$	66711-86-2		7 (7)	67 days (7)	No	<ul style="list-style-type: none"> • Refrigerant for high temperature heat pumps • Working fluid for organic Rankine cycle (ORC) • Blowing agent for Insulation foams



Major HCFC molecules

Designation	Complete Name	Formula	CAS number	GWP (1)		Atmospheric lifetime (3) unless stated	Ozone Depleting Potential (ODP)	Main Applications
				AR4 (2)	AR5 (3)			
HCFC-22	chlorodifluoromethane	CHClF ₂	75-45-6	1810	1760	11.9 years	0.055	<ul style="list-style-type: none"> Used as feedstock for the production of PTFE and other fluorocarbons polymers
HCFC-123	2,2-dichloro-1,1,1,1-trifluoroethane	CHCl ₂ CF ₃	306-83-2	77	79	1.3 years	0.020	<ul style="list-style-type: none"> No longer used in the EU
HCFC-124	1-chloro-1,2,2,2-tetrafluoroethane	CHClF ₂ CF ₃	20837-89-0	609	527	5.9 years	0.022	<ul style="list-style-type: none"> No longer used in the EU
HCFC-141b	1,1-dichloro-1-fluoroethane	CH ₃ CCl ₂ F	1717-00-6	725	782	9.2 years	0.11	<ul style="list-style-type: none"> No longer used in the EU



Designation	Complete Name	Formula	CAS number	GWP (1)		Atmospheric lifetime (3) unless stated	Ozone Depleting Potential (ODP)	Main Applications
				AR4 (2)	AR5 (3)			
HCFC-142b	1-chloro-1,1 - difluoro-ethane	CH ₃ CClF ₂	75-68-3	2310	1980	17.2 years	0.065	<ul style="list-style-type: none"> No longer used in the EU

NOTES

- 1) See [Selecting and Using GWP Values](#). IPCC AR6 is scheduled to be published in 2021, when it is expected that GWPs and lifetimes will be reviewed and revised where necessary. This major-molecules table gives AR4 and AR5 values and will be updated when AR6 values are published. Although the SAP2018 has GWPs and lifetimes, IPCC has typically been the reference source for this data. The SAP2018 can be accessed here [2018 Scientific Assessment of Ozone Depletion](#)
- 2) [IPCC Fourth Assessment Report GWP values](#)
- 3) IPCC Working Group I – [The Physical Science Basis](#) – Chap.8 Annex 8.A.1, 5th Assessment Report
- 4) Measured by the [National Institute of Advanced Industrial Science and Technology \(AIST\)](#), Japan, GWP calculated according to the IPCC AR5 method
- 5) Very short-lived substances (VSLS) have chemical lifetimes comparable with tropospheric transport time scales, with the result that the amount of the substance in the atmosphere depends on where and when (time of year) it is released. In practice, this happens for species with atmospheric lifetimes of a few months or less. From a regulatory point of view this means that VSLS cannot be included in the normal categories of the Montreal Protocol; not only is their contribution to ozone depletion very low but it is highly variable between countries and regions. For more detail see [Learn About HCFO-1224yd\(Z\), HCFO-1233zdE, HBFO-1233xfB, Stratospheric Ozone and Climate Change](#)



- 6) GWP according to the Report of the 2010 Assessment of the Scientific Assessment Panel (SAP) of the Montreal Protocol, Tables 1-11, citing two peer-reviewed scientific references.
- 7) Atmospheric chemistry of Z- and E-CF₃CHQCHCF₃, Freja F. Østerstrøm, Simone Thirstrup Andersen, Theis I. Sølling, Ole John Nielsena and Mads P. Sulbaek Andersen, *Phys. Chem. Chem. Phys.*, 2017, 19, 735—750, <https://pubs.rsc.org/en/content/articlehtml/2017/cp/c6cp07234h>
- 8) M. Baasandorj, A. R. Ravishankara and J. B. Burkholder, *J. Phys. Chem. A*, 2011, 115, 10539–10549