

An official website of the United States government.

We've made some changes to EPA.gov. If the information you are looking for is not here, you may be able to find it on the EPA Web Archive or the January 19, 2017 Web Snapshot.

Close



Ozone-Depleting Substances

Additional Information

[Basic Ozone Layer Science](#)

[Addressing Ozone Layer Depletion](#)

This page provides information on compounds recognized as ozone-depleting substances ([ODS](#)) under the [Montreal Protocol](#).

The ODS are split into two groups under the Clean Air Act: Class I ODS, such as [chlorofluorocarbons \(CFCs\)](#), and Class II ODS, such as [hydrochlorofluorocarbons \(HCFCs\)](#).

For each ODS, this page provides the compound's atmospheric lifetime, [Ozone Depletion Potential \(ODP\)](#), [Global Warming Potential \(GWP\)](#), and Chemistry Abstract Service (CAS) registry numbers.

Information on acceptable ODS alternatives (e.g., hydrofluorocarbons) is available through EPA's [Significant New Alternatives Policy \(SNAP\) Program](#).

Class I ODS

Class II ODS

Class I ODS

Class I ODS are divided into eight groups.

- Class I ODS listed in Groups 1 through 5 are identified in Title VI of the [Clean Air Act](#).
- Class I ODS listed in Groups 6 and 7, methyl bromide and hydrobromofluorocarbons, are identified in EPA's [Accelerated Phaseout final rule](#).
- Class I ODS listed in Group 8, chlorobromomethane, is identified in EPA's Chlorobromomethane Phaseout final rule.

Chemical Name	Lifetime, in years	ODP1 (Montreal Protocol)	ODP2 (WMO 2011)	GWP1 (AR4)	GWP2 (AR5)	CAS Number
Group I						
CFC-11 (CCl ₃ F) Trichlorofluoromethane	45	1	1	4750	4660	75-69-4
CFC-12 (CCl ₂ F ₂) Dichlorodifluoromethane	100	1	0.82	10900	10200	75-71-8
CFC-113 (C ₂ F ₃ Cl ₃) 1,1,2- Trichlorotrifluoroethane	85	0.8	0.85	6130	5820	76-13-1
CFC-114 (C ₂ F ₄ Cl ₂) Dichlorotetrafluoroethane	190	1	0.58	10000	8590	76-14-2
CFC-115 (C ₂ F ₅ Cl) Monochloropentafluoroethane	1020	0.6	0.5	7370	7670	76-15-3
Group II						
Halon 1211 (CF ₂ ClBr) Bromochlorodifluoromethane	16	3	7.9	1890	1750	353-59-3
Halon 1301 (CF ₃ Br) Bromotrifluoromethane	65	10	15.9	7140	6290	75-63-8
Halon 2402 (C ₂ F ₄ Br ₂) Dibromotetrafluoroethane	20	6	13.0	1640	1470	124-73-2
Group III						
CFC-13 (CF ₃ Cl) Chlorotrifluoromethane	640	1	1	14420	13900	75-72-9
CFC-111 (C ₂ FCl ₅) Pentachlorofluoroethane		1	1			354-56-3
CFC-112 (C ₂ F ₂ Cl ₄) Tetrachlorodifluoroethane		1	1			76-12-0
CFC-211 (C ₃ FCl ₇) Heptachlorofluoropropane		1	1			422-78-6
CFC-212 (C ₃ F ₂ Cl ₆) Hexachlorodifluoropropane		1	1			3182-26-1
CFC-213 (C ₃ F ₃ Cl ₅) Pentachlorotrifluoropropane		1	1			2354-06-5
CFC-214 (C ₃ F ₄ Cl ₄) Tetrachlorotetrafluoropropane		1	1			29255-31-0

Chemical Name	Lifetime, in years	ODP1 (Montreal Protocol)	ODP2 (WMO 2011)	GWP1 (AR4)	GWP2 (AR5)	CAS Number
CFC-215 (C3F5Cl3) Trichloropentafluoropropane		1	1			4259- 43-2
CFC-216 (C3F6Cl2) Dichlorohexafluoropropane		1	1			661-97- 2
CFC-217 (C3F7Cl) Chloroheptafluoropropane		1	1			422-86- 6
Group IV						
CCl4 Carbon tetrachloride	26	1.1	0.82	1400	1730	56-23-5
Group V						
Methyl Chloroform (C2H3Cl3) 1,1,1- trichloroethane	5	0.1	0.16	146	160	71-55-6
Group VI						
Methyl Bromide (CH3Br)	0.8	0.7	0.66	5	2	74-83-9
Group VII						
CHBr2		1	1			
HBFC-12B1(CHF2Br)		0.74				
CH2FBr		0.73	0.73			
C2HFBr4		0.3-0.8	0.3-0.8			
C2HF2Br3		0.5-1.8	0.5-1.8			
C2HF3Br2		0.4-1.6	0.4-1.6			
C2HF4Br		0.7-1.2	0.7-1.2			
C2H2FBr3		0.1-1.1	0.1-1.1			
C2H2F2Br2		0.2-1.5	0.2-1.5			
C2H2F3Br		0.7-1.6	0.7-1.6			
C2H3FBr2		0.1-1.7	0.1-1.7			
C2H3F2Br		0.2-1.1	0.2-1.1			

Chemical Name	Lifetime, in years	ODP1 (Montreal Protocol)	ODP2 (WMO 2011)	GWP1 (AR4)	GWP2 (AR5)	CAS Number
C2H4FBr		0.07–0.1	0.07– 0.1			
C3HFBr6		0.3–1.5	0.3–1.5			
C3HF2Br5		0.2–1.9	0.2–1.9			
C3HF3Br4		0.3–1.8	0.3–1.8			
C3HF4Br3		0.5–2.2	0.5–2.2			
C3HF5Br2		0.9–2.0	0.9–2.0			
C3HF6Br		0.7–3.3	0.7–3.3			
C3H2FBr5		0.1–1.9				
C3H2F2Br4		0.2–2.1	0.2–2.1			
C3H2F3Br3		0.2–5.6	0.2–5.6			
C3H2F4Br2		0.3–7.5	0.3–7.5			
C3H2F5Br		0.9–1.4	0.9–1.4			
C3H3FBr4		0.08–1.9	0.08– 1.9			
C3H3F2Br3		0.1–3.1	0.1–3.1			
C3H3F3Br2		0.1–2.5	0.1–2.5			
C3H3F4Br		0.3–4.4	0.3–4.4			
C3H4FBr3		0.03–0.3	0.03– 0.3			
C3H4F2Br2		0.1–1.0	0.1–1.0			
C3H4F3Br		0.07–0.8	0.07– 0.8			
C3H5FBr2		0.04–0.4	0.04– 0.4			
C3H5F2Br		0.07–0.8	0.07– 0.8			

Chemical Name	Lifetime, in years	ODP1 (Montreal Protocol)	ODP2 (WMO 2011)	GWP1 (AR4)	GWP2 (AR5)	CAS Number
C3H6FBr		0.02–0.7	0.02–0.7			
Group VIII						
CH2BrCl Chlorobromomethane	0.37	0.12	0.12			

Why are there multiple values given for the ODPs and GWPs?

The numbers in the “ODP1” column are from the Montreal Protocol. Some numbers have been updated as per amendments to the Protocol.

Data in the “ODP2” column come from WMO’s *Scientific Assessment of Ozone Depletion: 2010*.¹ ODP values listed are semi-empirical and can be found in Table 5-1 of the document.

The numbers in the “GWP1” column represent global warming potentials over a 100-year time horizon. The numbers are from the Intergovernmental Panel on Climate Change (IPCC) *Fourth Assessment Report: Climate Change 2007 (AR4)*.² The values listed are for direct radiative forcing and can be found in Table 2.14 of the “Physical Science Basis” contribution to the report.

The numbers in the “GWP2” column also represent global warming potentials over a 100-year time horizon. The numbers are from the IPCC *Fifth Assessment Report: Climate Change 2014 (AR5)*. The values listed are for direct radiative forcing and can be found in Table 8.A.1 of the “Physical Science Basis” contribution to the report.³

References

1. WMO (World Meteorological Organization), 2011: Scientific Assessment of Ozone Depletion: 2010. Global Ozone Research and Monitoring Project – Report No. 52, Geneva, Switzerland, 516 pp.
2. IPCC, 2007: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 996 pp.
3. IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

LAST UPDATED ON JULY 31, 2018