



Chapter 2 Appendix 6

CFC/HCFC/Halon

Nomenclature

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Table A6-1 Substances controlled under the original Montreal Protocol adopted in September 1987 (UNEP 1991)

Substance	Chemical Formula	Ozone Depletion Potential
GROUP I		
CFC-11	CFCl_3	1.0
CFC-12	CF_2Cl_2	1.0
CFC-113	$\text{C}_2\text{F}_3\text{Cl}_3$	0.8
CFC-114	$\text{C}_2\text{F}_4\text{Cl}_2$	1.0
CFC-115	$\text{C}_2\text{F}_5\text{Cl}$	0.6
GROUP II		
CF_2BrCl	halon 1211	3.0
CF_3Br	halon 1301	10.0
$\text{C}_2\text{F}_4\text{Br}_2$	halon 2402	6.0

Table A6-2 Substances controlled under the amended Montreal Protocol adopted in June 1990 (UNEP 1991)

Substance	Chemical Formula	Ozone Depletion Potential
GROUP I		
CFC-13	CF_3Cl	1.0
CFC-111	C_2FCl_5	1.0
CFC-112	$\text{C}_2\text{F}_2\text{Cl}_4$	1.0
CFC-211	C_3FCl_7	1.0
CFC-212	$\text{C}_3\text{F}_2\text{Cl}_6$	1.0
CFC-213	$\text{C}_3\text{F}_3\text{Cl}_5$	1.0
CFC-214	$\text{C}_3\text{F}_4\text{Cl}_4$	1.0
CFC-215	$\text{C}_3\text{F}_5\text{Cl}_3$	1.0
CFC-216	$\text{C}_3\text{F}_6\text{Cl}_2$	1.0
CFC-217	$\text{C}_3\text{F}_7\text{Cl}$	0.6
GROUP II		
carbon tetrachloride	CCl_4	1.1
GROUP II		
1,1,1-trichloroethane (methyl chloroform)	$\text{C}_2\text{H}_3\text{Cl}_3^*$	0.1

* This formula does not refer to 1,1,2-trichloroethane

Table A6-3 Transitional Substances listed in the Amended Montreal Protocol adopted in June 1990 (UNEP 1991)

Substance	Chemical Formula
HCFC-21	CHFCl_2
HCFC-22	CHF_2Cl
HCFC-31	CH_2FCl
HCFC-121	C_2HFCl_4
HCFC-122	$\text{C}_2\text{HF}_2\text{Cl}_3$
HCFC-123	$\text{C}_2\text{HF}_3\text{Cl}_2$
HCFC-124	$\text{C}_2\text{HF}_4\text{Cl}$
HCFC-131	$\text{C}_2\text{H}_2\text{FCl}_3$
HCFC-132	$\text{C}_2\text{H}_2\text{F}_2\text{Cl}_2$
HCFC-133	$\text{C}_2\text{H}_2\text{F}_3\text{Cl}$
HCFC-141	$\text{C}_2\text{H}_3\text{FCl}_2$
HCFC-142	$\text{C}_2\text{H}_3\text{F}_2\text{Cl}$
HCFC-151	$\text{C}_2\text{H}_4\text{FCl}$
HCFC-221	C_3HFCl_6
HCFC-222	$\text{C}_3\text{HF}_2\text{Cl}_5$
HCFC-223	$\text{C}_3\text{HF}_3\text{Cl}_4$
HCFC-224	$\text{C}_3\text{HF}_4\text{Cl}_3$
HCFC-225	$\text{CH}_3\text{F}_5\text{Cl}_2$
HCFC-226	$\text{C}_3\text{HF}_6\text{Cl}$
HCFC-231	$\text{C}_3\text{H}_2\text{FCl}_5$
HCFC-232	$\text{C}_3\text{H}_2\text{F}_2\text{Cl}_4$
HCFC-233	$\text{C}_3\text{H}_2\text{F}_3\text{Cl}_3$
HCFC-234	$\text{C}_3\text{H}_2\text{F}_4\text{Cl}_2$
HCFC-235	$\text{C}_3\text{H}_2\text{F}_5\text{Cl}$
HCFC-241	$\text{C}_3\text{H}_3\text{FCl}_4$
HCFC-242	$\text{C}_3\text{H}_3\text{F}_2\text{Cl}_3$
HCFC-243	$\text{C}_3\text{H}_3\text{F}_3\text{Cl}_2$
HCFC-244	$\text{C}_3\text{H}_3\text{F}_4\text{Cl}$
HCFC-251	$\text{C}_3\text{H}_4\text{FCl}_3$
HCFC-252	$\text{C}_3\text{H}_4\text{F}_2\text{Cl}_2$
HCFC-253	$\text{C}_3\text{H}_4\text{F}_3\text{Cl}$
HCFC-261	$\text{C}_3\text{H}_5\text{FCl}_2$
HCFC-262	$\text{C}_3\text{H}_5\text{F}_2\text{Cl}$
HCFC-271	$\text{C}_3\text{H}_6\text{FCl}$

Table A6-4 ODPs of partially or fully halogenated compounds

Halogenated Trace Gas	ODP (WMO 1992,1995)	ODP (SRC 1998)	CAS-No.
CFC-11	1.0	1.0	75-69-4
CFC-12	0.9	1.0	75-71-8
CK-113	0.9	0.8	354-58-5
CK-114	0.85	1.0	76-14-2
CK-115	0.40	0.6	76-15-3
HCFC-141b	0.10	0.1	1717-00-6
HCFC-22	0.05	0.05	75-45-6
CCl ₄	1.20	1.1	56-23-5
CH ₃ CCl ₃	0.12	0.15	71-55-6
Halon 1301	13	10	75-63-8
Halon 2402	≈7	-	124-73-2
Halon 1211	5	3	353-59-3
CH ₃ Br	0.57	0.65	74-83-9

CFC Nomenclature

Chemical manufacturers and consumers have developed an 'industry code' for naming halogenated compounds. Chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) use a three-number code, which identifies the composition. The code is defined as follows:



where:

- x is the number of carbon atoms in the compound minus 1 (if $x=0$, then it is omitted from the code);
- y is the number of hydrogen atoms in the compound plus 1; and,
- z is the number of fluorine atoms.

For example, the formula for trichlorotrifluoroethane is CCl₂FCClF₂. Applying the naming convention to the formula, the code becomes:

$$\begin{array}{ll} x = 2 - 1 = 1 & \text{No. of carbon atoms} = 2 \\ y = 0 + 1 = 1 & \text{No. of hydrogen atoms} = 0 \\ z = 3 & \text{No. of fluorine atoms} = 3 \end{array}$$

Thus, this compound is labeled CFC-113.

1,1,1-Trichloroethane Nomenclature

1,1,1-trichloroethane is also known by several other names including methyl chloroform and 'trike'. The use of 'methyl chloroform' is somewhat confusing because it implies that the product contains chloroform, which is not the case. The use of 'trike' is also confusing because it has also been used for trichloroethylene.

Halon Nomenclature

The halon terminology is a convenient means to reference halogenated hydrocarbon fire extinguishants. Halogenated hydrocarbons are acyclic saturated hydrocarbons in which one or more of the hydrogen atoms have been replaced by atoms from the halogen series; fluorine, chlorine, bromine, iodine. The first digit of the halon numbering system represents the number of carbon atoms in the molecule; the second digit, the number of fluorine atoms; the third digit, the number of chlorine atoms; the fourth digit, the number of bromine atoms; and the fifth digit, the number of iodine atoms. Trailing zeros are not

expressed. Valence requirements not accounted for are assumed to be hydrogen atoms. Thus,

the number of hydrogen atoms = double the number of carbon atoms + 2 - the total number of halogen atoms

Example:

Bromotrifluoromethane - CF₃Br - halon 1301

Here there are 1 carbon atom, 3 fluorines, 0 chlorines and 1 bromine, hence halon 1301.

The number of hydrogen atoms is double the number of carbon atoms (2x1=2) plus 2 minus the number of halogen atoms (3+1=4) so 2+2-4=0 - there are no hydrogen atoms.

Overlapping CFC and Halon Nomenclature

CFCs, HCFCs, and carbon tetrachloride can be labeled as halons. Chemicals are only listed under the halon nomenclature if they contain chlorine and/or bromine and have been historically considered as halons or if they contain chlorine and/or bromine and are candidates to replace halons controlled by the Montreal Protocol. See Table A6-5.

Table A6-5 Overlapping CFC and halon nomenclatures

Chemical / Compound	CFC Nomenclature (UNEP 1991)	Halon Nomenclature
CFCl ₃	CFC-11	halon 113 ¹
CF ₂ Cl ₂	CFC-12	halon 122 ¹
C ₂ F ₃ Cl ₃	CFC-113	
C ₂ F ₄ Cl ₂	CFC-114	
C ₂ F ₅ Cl	CFC-115	
CF ₃ Cl	CFC-13	
C ₂ FCl ₅	CFC-111	
C ₂ F ₂ Cl ₄	CFC-112	
C ₃ FCl ₇	CFC-211	
C ₃ F ₂ Cl ₆	CFC-212	
C ₃ F ₃ Cl ₅	CFC-213	
C ₃ F ₄ Cl ₄	CFC-214	
C ₃ F ₅ Cl ₃	CFC-215	
C ₃ F ₆ Cl ₂	CFC-216	
C ₃ F ₇ Cl	CFC-217	
CHF ₂ Br	HBFC-22B1	halon 1201 ²
CF ₂ BrCl	CBFC-12B1	halon 1211 ¹
CF ₃ Br	BFC-13B1	halon 1301 ¹
C ₂ F ₄ Br ₂	BFC-114B2	halon 2402 ¹
CCl ₄	Carbon Tetrachloride	halon 104 ¹
CHFCl ₂	HCFC-21	
CHF ₂ Cl	HCFC-22	halon 121 ¹

¹ Chemicals containing chlorine and/or bromine that have been historically listed as 'halon'.

² Chemicals containing chlorine and/or bromine that are candidates to replace controlled halons.

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Table A6-5 continued

Chemical / Compound	CFC Nomenclature (UNEP 1991)	Halon Nomenclature
CH ₂ FCl	HCFC-31	
C ₂ HFCl ₄	HCFC-121	
C ₂ HF ₂ Cl ₃	HCFC-122	
C ₂ HF ₃ Cl ₂	HCFC-123	halon 232 ²
C ₂ HF ₄ Cl	HCFC-124	halon 241 ²
C ₂ HF ₅	HFC-125	halon 25 ²
C ₂ HF ₄ Br	HBFC-124B1	halon 2401 ²
C ₂ H ₂ FCl ₃	HCFC-131	
C ₂ H ₂ F ₂ Cl	HCFC-132	
C ₂ H ₂ F ₃ Cl	HCFC-133	
C ₂ H ₃ FCl ₂	HCFC-141	
C ₂ H ₃ F ₂ Cl	HCFC-142	
C ₂ H ₄ FCl	HCFC-151	
C ₃ HFCl ₆	HCFC-221	
C ₃ HF ₂ Cl ₅	HCFC-222	
C ₃ HF ₃ Cl ₄	HCFC-223	
C ₃ HF ₄ Cl ₃	HCFC-224	
C ₃ HF ₅ Cl ₂	HCFC-225	
C ₃ HF ₆ Cl	HCFC-226	
C ₃ H ₂ FCl ₅	HCFC-231	
C ₃ H ₂ F ₂ Cl ₄	HCFC-232	
C ₃ H ₂ F ₃ Cl ₃	HCFC-233	
C ₃ H ₂ F ₄ Cl ₂	HCFC-234	
C ₃ H ₂ F ₅ Cl	HCFC-235	
C ₃ H ₃ FCl ₄	HCFC-241	
C ₃ H ₃ F ₂ Cl ₃	HCFC-242	
C ₃ H ₃ F ₃ Cl ₂	HCFC-243	
C ₃ H ₃ F ₄ Cl	HCFC-244	
C ₃ H ₄ FCl ₃	HCFC-251	
C ₃ H ₄ F ₂ Cl ₂	HCFC-252	
C ₃ H ₄ F ₃ Cl	HCFC-253	
C ₃ H ₅ FCl ₂	HCFC-261	
C ₃ H ₅ F ₂ Cl	HCFC-262	
C ₃ H ₆ FCl	HCFC-271	
C ₂ H ₃ Cl ₃	1,1,1-trichloroethane	

1 Chemicals containing chlorine and/or bromine that have been historically listed as 'halon'.

2 Chemicals containing chlorine and/or bromine that are candidates to replace controlled halons.

References

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