

# The Montreal Protocol: Annexes

## Annex A: Controlled substances

Group	Substance	Ozone-Depleting Potential*	100-Year Global Warming Potential
<i>Group I</i>			
$\text{CFCl}_3$	(CFC-11)	1.0	4,750
$\text{CF}_2\text{Cl}_2$	(CFC-12)	1.0	10,900
$\text{C}_2\text{F}_3\text{Cl}_3$	(CFC-113)	0.8	6,130
$\text{C}_2\text{F}_4\text{Cl}_2$	(CFC-114)	1.0	10,000
$\text{C}_2\text{F}_5\text{Cl}$	(CFC-115)	0.6	7,370
<i>Group II</i>			
$\text{CF}_2\text{BrCl}$	(halon-1211)	3.0	
$\text{CF}_3\text{Br}$	(halon-1301)	10.0	
$\text{C}_2\text{F}_4\text{Br}_2$	(halon-2402)	6.0	

\* These ozone depleting potentials are estimates based on existing knowledge and will be reviewed and revised periodically.

## Annex B: Controlled substances

Group	Substance	Ozone-Depleting Potential
<i>Group I</i>		
CF <sub>3</sub> Cl	(CFC-13)	1.0
C <sub>2</sub> FCl <sub>5</sub>	(CFC-111)	1.0
C <sub>2</sub> F <sub>2</sub> Cl <sub>4</sub>	(CFC-112)	1.0
C <sub>3</sub> FCl <sub>7</sub>	(CFC-211)	1.0
C <sub>3</sub> F <sub>2</sub> Cl <sub>6</sub>	(CFC-212)	1.0
C <sub>3</sub> F <sub>3</sub> Cl <sub>5</sub>	(CFC-213)	1.0
C <sub>3</sub> F <sub>4</sub> Cl <sub>4</sub>	(CFC-214)	1.0
C <sub>3</sub> F <sub>5</sub> Cl <sub>3</sub>	(CFC-215)	1.0
C <sub>3</sub> F <sub>6</sub> Cl <sub>2</sub>	(CFC-216)	1.0
C <sub>3</sub> F <sub>7</sub> Cl	(CFC-217)	1.0
<i>Group II</i>		
CCl <sub>4</sub>	carbon tetrachloride	1.1
<i>Group III</i>		
C <sub>2</sub> H <sub>3</sub> Cl <sub>3</sub> *	1,1,1-trichloroethane* (methyl chloroform)	0.1

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

## Annex C: Controlled substances

Group	Substance	No. of isomers	Ozone-Depleting Potential*	100-Year Global Warming Potential***	
<i>Group I</i>					
	CHFCI <sub>2</sub>	(HCFC-21)**	1	0.04	151
	CHF <sub>2</sub> Cl	(HCFC-22)**	1	0.055	1810
	CH <sub>2</sub> FCI	(HCFC-31)	1	0.02	
	C <sub>2</sub> HFCl <sub>4</sub>	(HCFC-121)	2	0.01–0.04	
	C <sub>2</sub> HF <sub>2</sub> Cl <sub>3</sub>	(HCFC-122)	3	0.02–0.08	
	C <sub>2</sub> HF <sub>3</sub> Cl <sub>2</sub>	(HCFC-123)	3	0.02–0.06	77
	CHCl <sub>2</sub> CF <sub>3</sub>	(HCFC-123)**	–	0.02	
	C <sub>2</sub> HF <sub>4</sub> Cl	(HCFC-124)	2	0.02–0.04	609
	CHFClCF <sub>3</sub>	(HCFC-124)**	–	0.022	
	C <sub>2</sub> H <sub>2</sub> FCI <sub>3</sub>	(HCFC-131)	3	0.007–0.05	
	C <sub>2</sub> H <sub>2</sub> F <sub>2</sub> Cl <sub>2</sub>	(HCFC-132)	4	0.008–0.05	
	C <sub>2</sub> H <sub>2</sub> F <sub>3</sub> Cl	(HCFC-133)	3	0.02–0.06	
	C <sub>2</sub> H <sub>3</sub> FCI <sub>2</sub>	(HCFC-141)	3	0.005–0.07	
	CH <sub>3</sub> CFCl <sub>2</sub>	(HCFC-141b)**	–	0.11	725
	C <sub>2</sub> H <sub>3</sub> F <sub>2</sub> Cl	(HCFC-142)	3	0.008–0.07	
	CH <sub>3</sub> CF <sub>2</sub> Cl	(HCFC-142b)**	–	0.065	2310
	C <sub>2</sub> H <sub>4</sub> FCI	(HCFC-151)	2	0.003–0.005	
	C <sub>3</sub> HFCl <sub>6</sub>	(HCFC-221)	5	0.015–0.07	
	C <sub>3</sub> HF <sub>2</sub> Cl <sub>5</sub>	(HCFC-222)	9	0.01–0.09	
	C <sub>3</sub> HF <sub>3</sub> Cl <sub>4</sub>	(HCFC-223)	12	0.01–0.08	
	C <sub>3</sub> HF <sub>4</sub> Cl <sub>3</sub>	(HCFC-224)	12	0.01–0.09	
	C <sub>3</sub> HF <sub>5</sub> Cl <sub>2</sub>	(HCFC-225)	9	0.02–0.07	
	CF <sub>3</sub> CF <sub>2</sub> CHCl <sub>2</sub>	(HCFC-225ca)**	–	0.025	122
	CF <sub>2</sub> ClCF <sub>2</sub> CHClF	(HCFC-225cb)**	–	0.033	595
	C <sub>3</sub> HF <sub>6</sub> Cl	(HCFC-226)	5	0.02–0.10	
	C <sub>3</sub> H <sub>2</sub> FCI <sub>5</sub>	(HCFC-231)	9	0.05–0.09	

$C_3H_2F_2Cl_4$	(HCFC-232)	16	0.008–0.10
$C_3H_2F_3Cl_3$	(HCFC-233)	18	0.007–0.23
$C_3H_2F_4Cl_2$	(HCFC-234)	16	0.01–0.28
$C_3H_2F_5Cl$	(HCFC-235)	9	0.03–0.52
$C_3H_3FCl_4$	(HCFC-241)	12	0.004–0.09
$C_3H_3F_2Cl_3$	(HCFC-242)	18	0.005–0.13
$C_3H_3F_3Cl_2$	(HCFC-243)	18	0.007–0.12
$C_3H_3F_4Cl$	(HCFC-244)	12	0.009–0.14
$C_3H_4FCl_3$	(HCFC-251)	12	0.001–0.01
$C_3H_4F_2Cl_2$	(HCFC-252)	16	0.005–0.04
$C_3H_4F_3Cl$	(HCFC-253)	12	0.003–0.03
$C_3H_5FCl_2$	(HCFC-261)	9	0.002–0.02
$C_3H_5F_2Cl$	(HCFC-262)	9	0.002–0.02
$C_3H_6FCl$	(HCFC-271)	5	0.001–0.03
<i>Group II</i>			
$CH_2Br_2$		1	1.00
$CHF_2Br$	(HBFC-22B1)	1	0.74
$CH_2FBr$		1	0.73
$C_2HFBr_4$		2	0.3–0.8
$C_2HF_2Br_3$		3	0.5–1.8
$C_2HF_3Br_2$		3	0.4–1.6
$C_2HF_4Br$		2	0.7–1.2
$C_2H_2FBr_3$		3	0.1–1.1
$C_2H_2F_2Br_2$		4	0.2–1.5
$C_2H_2F_3Br$		3	0.7–1.6
$C_2H_3FBr_2$		3	0.1–1.7
$C_2H_3F_2Br$		3	0.2–1.1
$C_2H_4FBr$		2	0.07–0.1
$C_3HFBr_6$		5	0.3–1.5
$C_3HF_2Br_5$		9	0.2–1.9

$C_3HF_3Br_4$		12	0.3–1.8
$C_3HF_4Br_3$		12	0.5–2.2
$C_3HF_5Br_2$		9	0.9–2.0
$C_3HF_6Br$		5	0.7–3.3
$C_3H_2FBr_5$		9	0.1–1.9
$C_3H_2F_2Br_4$		16	0.2–2.1
$C_3H_2F_3Br_3$		18	0.2–5.6
$C_3H_2F_4Br_2$		16	0.3–7.5
$C_3H_2F_5Br$		8	0.9–1.4
$C_3H_3FBr_4$		12	0.08–1.9
$C_3H_3F_2Br_3$		18	0.1–3.1
$C_3H_3F_3Br_2$		18	0.1–2.5
$C_3H_3F_4Br$		12	0.3–4.4
$C_3H_4FBr_3$		12	0.03–0.3
$C_3H_4F_2Br_2$		16	0.1–1.0
$C_3H_4F_3Br$		12	0.07–0.8
$C_3H_5FBr_2$		9	0.04–0.4
$C_3H_5F_2Br$		9	0.07–0.8
$C_3H_6FBr$		5	0.02–0.7
<i>Group III</i>			
$CH_2BrCl$	bromochloromethane	1	0.12

- \* Where a range of ODPs is indicated, the highest value in that range shall be used for the purposes of the Protocol. The ODPs listed as a single value have been determined from calculations based on laboratory measurements. Those listed as a range are based on estimates and are less certain. The range pertains to an isomeric group. The upper value is the estimate of the ODP of the isomer with the highest ODP, and the lower value is the estimate of the ODP of the isomer with the lowest ODP.
- \*\* Identifies the most commercially viable substances with ODP values listed against them to be used for the purposes of the Protocol.
- \*\*\* For substances for which no GWP is indicated, the default value 0 applies until a GWP value is included by means of the procedure foreseen in paragraph 9 (a) (ii) of Article 2.

## Annex D:\* A list of products\*\* containing controlled substances specified in Annex A

Products	Customs code No.
1. Automobile and truck air conditioning units (whether incorporated in vehicles or not)	.....
2. Domestic and commercial refrigeration and air conditioning/heat pump equipment***	.....
e.g. Refrigerators	.....
Freezers	.....
Dehumidifiers	.....
Water coolers	.....
Ice machines	.....
Air conditioning and heat pump units	.....
3. Aerosol products, except medical aerosols	.....
4. Portable fire extinguisher	.....
5. Insulation boards, panels and pipe covers	.....
6. Pre-polymers	.....

\* This Annex was adopted by the Third Meeting of the Parties in Nairobi, 21 June 1991 as required by paragraph 3 of Article 4 of the Protocol.

\*\* Though not when transported in consignments of personal or household effects or in similar non-commercial situations normally exempted from customs attention.

\*\*\* When containing controlled substances in Annex A as a refrigerant and/or in insulating material of the product.

## Annex E: Controlled substance

Group	Substance	Ozone-Depleting Potential
<i>Group I</i>		
CH <sub>3</sub> Br	methyl bromide	0.6

## Annex F: Controlled substances

Group	Substance	100-Year Global Warming Potential
<i>Group I</i>		
CHF <sub>2</sub> CHF <sub>2</sub>	HFC-134	1,100
CH <sub>2</sub> FCF <sub>3</sub>	HFC-134a	1,430
CH <sub>2</sub> FCHF <sub>2</sub>	HFC-143	353
CHF <sub>2</sub> CH <sub>2</sub> CF <sub>3</sub>	HFC-245fa	1,030
CF <sub>3</sub> CH <sub>2</sub> CF <sub>2</sub> CH <sub>3</sub>	HFC-365mfc	794
CF <sub>3</sub> CHFCF <sub>3</sub>	HFC-227ea	3,220
CH <sub>2</sub> FCF <sub>2</sub> CF <sub>3</sub>	HFC-236cb	1,340
CHF <sub>2</sub> CHFCF <sub>3</sub>	HFC-236ea	1,370
CF <sub>3</sub> CH <sub>2</sub> CF <sub>3</sub>	HFC-236fa	9,810
CH <sub>2</sub> FCF <sub>2</sub> CHF <sub>2</sub>	HFC-245ca	693
CF <sub>3</sub> CHFCHFCF <sub>2</sub> CF <sub>3</sub>	HFC-43-10mee	1,640
CH <sub>2</sub> F <sub>2</sub>	HFC-32	675
CHF <sub>2</sub> CF <sub>3</sub>	HFC-125	3,500
CH <sub>3</sub> CF <sub>3</sub>	HFC-143a	4,470
CH <sub>3</sub> F	HFC-41	92
CH <sub>2</sub> FCH <sub>2</sub> F	HFC-152	53
CH <sub>3</sub> CHF <sub>2</sub>	HFC-152a	124
<i>Group II</i>		
CHF <sub>3</sub>	HFC-23	14,800







