



OzonAction Kigali Fact Sheet 15

Substances ^{Not} Controlled Under the Montreal Protocol



Background:

The Montreal Protocol controls the production and consumption of a range of chemicals that damage the ozone layer (i.e. ozone depleting substances, ODS). In the Kigali Amendment the Protocol was extended to control the production and consumption of HFCs. These are not ODS, but they are very powerful greenhouse gases (GHGs). This Fact Sheet provides details of which substances are controlled under the Montreal Protocol and gives examples of related substances that are not included in these controls.

Controlled Substances:

The Montreal Protocol contains the following definition:

"Controlled substance" means a substance in Annex A, Annex B, Annex C, Annex E or Annex F to this Protocol, whether existing alone or in a mixture. It includes the isomers of any such substance, except as specified in the relevant Annex, but excludes any controlled substance or mixture which is in a manufactured product other than a container used for the transportation or storage of that substance.

The only controlled substances in the original 1987 Montreal Protocol were in Annex A. Annexes B, C, E and F were added as amendments were made to the original Montreal Protocol. For example, under the Kigali Amendment, Annex F was added to include a list of controlled HFCs.

The ODS phase-out schedules vary between substance types and which Annex each substance is listed in. The number of substances listed in relevant Annexes is summarised in the table below. For a full list of each substance see:

<http://ozone.unep.org/en/handbook-montreal-protocol-substances-deplete-ozone-layer/5>

Families of substances	Annex A	Annex B	Annex C	Annex E	Annex F
Chlorofluorocarbons (CFCs)	5	10			
Bromochlorofluorocarbons (Halons)	3				
Hydrochlorofluorocarbons (HCFCs)			40		
Hydrobromofluorocarbons (HBFCs)			34		
Hydrofluorocarbons (HFCs)					18
Single Substances					
Carbon tetrachloride		1			
1,1,1-trichloroethane		1			
Methyl Bromide				1	
Bromochloromethane			1		

The Annexes include reasonably comprehensive lists of substances including many that are used in only tiny quantities. For example, just 5 of the 40 HCFCs listed in Annex C represent well over 95% of world consumption (excluding feedstock applications). However, the Annexes do not include every relevant substance and they do not include other families of gases that might be used as replacements for controlled substances. The most widely used substances in the families listed above are summarised in Table 2.

Table 2: Most commonly used controlled substances

Chlorofluorocarbons (CFCs)	CFC-11, CFC-12, CFC-113, CFC-114, CFC-115
Bromochlorofluorocarbons (Halons)	Halon-1211, Halon 1301
Hydrochlorofluorocarbons (HCFCs)	HCFC-22, HCFC-123, HCFC-124, HCFC-141b, HCFC-142b
Hydrofluorocarbons (HFCs)	HFC-134a, HFC-125, HFC-143a, HFC-23, HFC-32, HFC-152a, HFC-227ea, HFC-245fa, HFC-365mfc

Substances not controlled under the Montreal Protocol:

There are a small number of ODS and HFCs that are not controlled under the Montreal Protocol. These are therefore not listed in the Protocol's Annexes. These chemicals can be identified as two main categories illustrated with some examples below:

1. Annual use is negligible and/or the ozone depletion potential (ODP) or global warming potential (GWP) is extremely low

Hydrofluoroolefins (HFOs): HFOs are unsaturated fluorocarbons (i.e. molecules with a double bond between two carbon atoms). The presence of the double bond makes the molecule have a very short atmospheric life and a very low GWP. The majority of HFOs are unsaturated HFCs and have GWPs in the range of 4 to 9 and are not controlled under the Protocol. For example, HFO-1234yf, increasingly used in mobile air-conditioning has a GWP of 4.

Some HFOs are unsaturated HCFCs, with similar very low GWPs and a very low ODP. For example, one of the non-controlled low GWP alternatives to HFCs, HFO-1233zd, is an unsaturated HCFC with an ODP of 0.0003 which is around 100 times lower than the ODP of HCFC-22 and 3000 times lower than CFC-12.

Other low GWP HFCs: Not all HFCs are covered by the Kigali Amendment, only those listed in the relevant Annex are controlled. For example, HFC-161 (GWP=12) is not listed in Annex F and is therefore not under the control of the Montreal Protocol.

Dichloromethane (DCM): While previously thought to have little impact on ozone depletion, dichloromethane (DCM) is very rapidly growing in use. Levels in the atmosphere have increased by 60% over the past decade. DCM is a chemical which is a component of some paint stripper solvents and has an ODP of 0.4% of that of CFC-11.

1,2-Dichloroethane: 1,2-Dichloroethane (with an ODP of less than 0.001) is used in the manufacture of vinyl chloride (principally for PVC pipe) and also as an additive in motor vehicles fuels.

2. The families of chemical are very different in terms of source and usage to those controlled by the Montreal Protocol

Nitrous oxide (N₂O): The most significant ozone depleting chemical not covered by the Montreal Protocol is N₂O. The major anthropogenic source of N₂O is agriculture as well as from industry and the burning of fossil fuels and biomass.

GWPs of mixtures with controlled and uncontrolled substances:

When a refrigerant mixture contains different categories of substance, the Montreal Protocol reporting process makes use of adjusted values for GWPs. This includes:

- Mixtures of HCFCs and HFCs. Under Kigali Amendment reporting, the GWP of the HCFCs in a mixture are ignored, because HCFCs are already subject to phase-out controls under the Protocol.
- Mixtures of HFCs and uncontrolled substances (including high GWP substances such as PFCs and low GWP substances such as HCs). Under Kigali Amendment reporting, the GWP of the non-HFCs in a mixture are ignored, because they are not controlled under the Protocol.

See [Kigali Fact Sheet 16](#) for further details about the GWP of mixtures.