



Background:

Many of the commonly used refrigerants are mixtures of several pure fluids. For example, R-410A, a widely used refrigerant in air-conditioning applications is a mixture of HFC-32 and HFC-125. The Kigali Amendment controls the use of HFCs, including those used in refrigerant mixtures. This Fact Sheet provides details about the GWP of refrigerant mixtures.

Calculating the GWP of a refrigerant mixture:

See [Kigali Fact Sheet 3](#) for details about the definition of GWP and for GWP values used in the Montreal Protocol.

The GWP of a blend is the weighted average of the GWPs of the blend components. See Box 1 for an example calculation of a blend GWP.

Box 1: Calculating the GWP of a Blend

A widely-used blend is R-404A. It consists of three HFCs:

52% HFC-143a + 44% HFC-125 + 4% HFC-134a

GWPs: HFC-143a: 4470 HFC-125: 3500 HFC-134a: 1430

Blend GWP = 52% * 4470 + 44% * 3500 + 4% * 1430 = 3922

Types of refrigerant mixture affected by the Kigali Amendment:

There are three different types of refrigerant mixture that will be controlled under the Kigali Amendment:

- 1) Mixtures of HFCs
- 2) Mixtures of HFCs and HCFCs
- 3) Mixtures of HFCs and uncontrolled substances (e.g. HFOs or HCs).

Details about substances controlled by the Montreal Protocol are given in [Kigali Fact Sheet 15](#).

When understanding and reporting the use of refrigerant mixtures, it is important to recognise that the Kigali Amendment only controls the use of HFCs. The “GWP-contribution” of non-HFCs does not count towards the GWP of a refrigerant mixture. Hence a refrigerant blend can be understood to have two different GWPs:

- a) The Actual GWP, which is calculated using the actual GWP of **all** components
- b) The ‘Kigali Amendment GWP’, which is calculated by treating non-HFCs as if they have a zero GWP.

The actual GWP and the ‘Kigali Amendment GWP’ for R-404A (see Box 1) is the same, as all the components are HFCs. However, the Kigali Amendment GWP for mixtures containing HCFCs or containing uncontrolled substances is always lower than the actual GWP. Box 2 shows two examples.

Box 2: Actual and ‘Kigali Amendment GWPs’

Example 1: A mixture of HFCs and HCFCs

R-408A composition: **46% HFC-143a + 7% HFC-125 + 47% HCFC-22**

Actual Blend GWP = 46% * 4470 + 7% * 3500 + 47% * 1810 = 3152

‘Kigali Amendment GWP’ = 46% * 4470 + 7% * 3500 + 47% * 0 = 2301

Example 2: A mixture of HFCs, HFOs and R-744 (CO₂)

R-455A composition: **21.5% HFC-32 + 75.5% HFO-1234yf + 3% R-744**

Actual Blend GWP = 21.5% * 675 + 75.5% * 4 + 3% * 1 = 148

‘Kigali Amendment GWP’ = 21.5% * 675 + 75.5% * 0 + 3% * 0 = 145

It is worth noting that in Example 1, the 'Kigali Amendment GWP' is considerably lower than the actual GWP, as the HCFC-22 in the blend has a relatively high GWP. In Example 2, there is only a small difference between the actual and the 'Kigali Amendment GWPs', because the non-HFC components both have ultra-low GWP and only make a small contribution to the actual GWP.

The table below provides GWP data for a wide range of different refrigerant blends.

GWPs of Refrigerant Blends								
Blend	Actual GWP	KA* GWP	Blend	Actual GWP	KA* GWP	Blend	Actual GWP	KA* GWP
R-401A	1 182	16	R-424A	2 440	2 440	R-450A	605	601
R-401B	1 288	14	R-425A	1 505	1 505	R-451A	149	146
R-402B	2 416	1 330	R-426A	1 508	1 508	R-451B	164	160
R-403A	3 124	0	R-427A	2 138	2 138	R-452A	2 140	2 139
R-403B	4 457	0	R-428A	3 607	3 607	R-452B	698	697
R-404A	3 922	3 922	R-429A	14	12	R-453A	1 765	1 765
R-407A	2 107	2 107	R-430A	95	94	R-454A	239	236
R-407C	1 774	1 774	R-431A	38	36	R-454B	466	465
R-407F	1 825	1 825	R-432A	2	0	R-454C	148	145
R-408A	3 152	2 301	R-433A	3	0	R-455A	148	145
R-409A	1 585	0	R-433B	3	0	R-456A	687	684
R-409B	1 560	0	R-433C	3	0	R-457A	139	136
R-410A	2 088	2 088	R-434A	3 245	3 245	R-458A	1 650	1 650
R-411A	1 597	14	R-435A	26	25	R-459A	460	459
R-412A	2 826	0	R-436A	3	0	R-459B	145	142
R-413A	2 053	1 258	R-436B	3	0	R-460A	2 103	2 101
R-415A	1 507	22	R-437A	1 805	1 805	R-461A	2 767	2 767
R-415B	546	93	R-438A	2 265	2 264	R-462A	2 250	2 249
R-416A	1 084	844	R-439A	1 983	1 983	R-502	4 657	0
R-417A	2 346	2 346	R-440A	144	144	R-507A	3 985	3 985
R-418A	1 741	3	R-441A	3	0	R-508A	13 214	5 772
R-419A	2 967	2 967	R-442A	1 888	1 888	R-508B	13 396	6 808
R-420A	1 536	1 258	R-444A	93	87	R-510A	1	0
R-421A	2 631	2 631	R-444B	296	293	R-511A	9	0
R-421B	3 190	3 190	R-445A	135	129	R-512A	189	189
R-422A	3 143	3 143	R-446A	461	459	R-513A	631	629
R-422B	2 526	2 526	R-447A	583	582	R-513B	596	593
R-422C	3 085	3 085	R-448A	1 387	1 386	R-514A	7	0
R-422D	2 729	2 729	R-449A	1 397	1 396	R-515A	393	386
R-423A	2 280	2 280	R-449B	1 412	1 411	R-516A	142	139

* the KA GWP is the "Kigali Amendment GWP" which excludes the GWP contributions from components that are not controlled under the Kigali Amendment (including HCFCs, HFOs, non-controlled HFCs, PFCs and non-fluorocarbons such as hydrocarbons).