1. CFC Replacement & Climate Change

CFCs (Chlorofluorocarbons) were developed in the 1930s as safe, non-flammable and non-toxic refrigerants. Since then, CFCs used as refrigerants, foam blowing agents, solvents and propellants, have played a vital role in industries such as manufacturing, medicine, food (production, supply and retail) refrigeration, air-conditioning, insulating foam and electronics.

Since the late 1980s however, the effect of CFCs on the stratospheric ozone layer has become the focus of much attention. In 1987 governments around the world signed the 'Montreal Protocol', the first international agreement to protect the global environment. It set in motion a phase-out timetable for these products, which were implicated in the depletion of the ozone layer. Society required a non-flammable, non-toxic alternative to replace CFCs. Industry responded with the development of an alternative group of products - known as HFCs (Hydrofluorocarbons) - to replace CFCs, and also stepped up production of HCFCs (Hydrochlorofluorocarbons) - substances having a much lower impact on the ozone layer and used therefore as transitional products. Subjected to the most extensive and rigorous tests of any industrial chemicals, HFCs have since been proven to offer all the benefits of CFCs - they are safe, they don't create smog, they are non-flammable and non-corrosive - but with zero ozone depletion potential.

Consequently, HFCs and HCFCs have become the CFC replacement of choice for the majority of industry, and their introduction has been supported through investments totalling over $2.5 billion by producers and an estimated $25 billion by user industries. In short, they have ensured that the Montreal Protocol objective to phase out CFCs in the developed world has been met.
However, debate surrounds the use of HFCs as a result of their potential to contribute to global warming. Environmental pressure groups in particular have argued for the use of toxic or flammable products such as ammonia and hydrocarbons as CFC alternatives instead of HFCs.

The fluorocarbon industry has always been aware of the global warming potential of HFCs, but research has shown that their total global warming impact will always be negligible because of three important factors

- The limited quantities of HFCs that will be used
- The efforts of industry to prevent emissions from occurring
- HFCs have excellent energy efficiency characteristics

In practice, the actual contribution of HFCs to global warming will only ever be 1-2% - and this is assuming all the HFCs produced are emitted. To put this into perspective, annual emissions of HFCs will never amount to more than 0.002% of the emissions of the main global warming gas, carbon dioxide (which is emitted at the rate of 26 billion tonnes every year and growing).

Furthermore, both producer and user industries are continually reducing HFC emissions by working to improve efficient usage, containment, recovery and recycling, e.g. through training programmes.

Finally, the energy efficiency of HFCs must also be stressed. By using the concept of Total Equivalent Warming Impact (TEWI), the lifetime impact of HFC systems can be proven to have a lower global warming impact than most alternatives. This is because TEWI takes account of both the direct impact of any global warming gas leakages from a system and the indirect impact of the carbon dioxide emissions resulting from the energy consumption of the system. As such, TEWI demonstrates that the GWP (Global Warming Potential) of any chemical does not properly represent its total warming impact as it fails to account for energy saving and the resulting carbon dioxide emission reduction. This is valid both for refrigeration and rigid insulation foams.

Judged in light of these facts, HFCs can be seen, in many cases, to offer the best alternative to CFCs.

Fair assessment of the properties of fluorocarbons is crucial for all political efforts to transform the requirements of the Kyoto Protocol (result of the UNFCCC (United

Nations Framework Convention on Climate Change) meeting at Kyoto in December 1997) into national regulations. This conference has seen international agreement on actions to reduce emissions of man made gases that have potential to alter climate.

Together with carbon dioxide, nitrous oxide, methane, PFCs (Perfluorocarbons) and SF6 (Sulphurhexafluoride), HFCs are part of the 'basket' of the six man made gases, for which emission reduction targets have been set in the Kyoto Protocol. By encouraging government-industry partnerships and existing voluntary efforts towards the better use, containment, recovery and recycling of HFCs, the potential global warming impact of the uses of these products can be minimised, whilst ensuring that the process of CFC phase-out can progress smoothly. This in turn will allow to focus on tackling the real ways to limit global warming.

Global Warming and Ozone Depletion Data

	Industrial/ Human Output (Emissions) Mln Tonnes (1995)	Predicted Contribution to Manmade Global Warming	Atmospheric Life/Years	ODP	GWP 100 Yr (CO_2)	GWP 500 Yr (CO_2)
Carbon Dioxide	26,030	71%	500	0	1	1
Methane	375	21%	14.5 (+/- 2.5)	0	21	6.5
Nitrous Oxide	9	7.5%	120	0	310	170
HFC 134a	0.020*	<<.05%	14	0	1300	420
HCFC 22	0.224*	<<.5%	13.3	0.055	1700	520
CFC 12	0.189*	<.5%	102	1	8500	4200

Source: Climate Change 1995: contribution of Working Group 1 to the Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), 1996
*Source: AFEAS report on production, sales and atmospheric release of Fluorocarbons through 1995.

Relative Contributions of Greenhouse Gases

(Source: IPCC1994, IS 92a Scenario)