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No Time For Complacency

Proposed Measures to Limit Further Damage from CFCs, HCFCs and HFCs

The international community has several options to reduce further damage to the ozone layer and the climate from fluorinated gases.

Among them are:

- Accelerate the HCFC Phase Out under the Montreal Protocol, without converting to potent global warming HFCs.
- Recapture and safely destroy all of banked CFCs and HCFCs.
- Establish a global cap on HFC emissions and phase out their use.

The Montreal Protocol bridges the dual atmospheric crises of ozone layer depletion and global warming. As such it needs to take responsibility not only for all the ozone depleting substances, but also for the global warming substitutes, such as HFCs, that the Protocol has promoted globally.

Taking into account projected growth rates (in a 100 year time horizon) the atmospheric concentration of all fluorinated gases (Montreal and Kyoto gases combined) in ratio to all greenhouse gases is 4% today and will be 6.2 % in 2050. In a 20 year time horizon it is 5% today and will be 8.6% in 2050. In comparison, 8.6% is the total contribution of all car-traffic worldwide today.

Accelerated HCFC phase out

Failure to act in the past can be rectified in the present.

The Parties to the Montreal Protocol have known for nearly twenty years that accelerating the phase-out of HCFCs in both industrialized and developing countries was one of the most effective measures at their disposal to significantly reduce near term atmospheric chlorine loading. Still they have repeatedly failed to reach consensus on needed action, and have thus shortchanged the ozone layer and the climate.

While Article 2F/Paragraph 7, of the Montreal Protocol stipulates "… that each Party shall endeavor to ensure that HCFCs use is limited to those applications where other environmentally suitable alternative substances or technologies are not available", for the most part the Parties and the Multilateral Fund elected to ignore this decision.

The WMO Scientific Assessment in 1991 noted: "The HCFCs have relatively short lifetimes, and generally display small ODPs over long time horizons, but exhibit ODPs over short time scales that can be as much as 3 to 10 times greater than their steady-state ODPs....[i][and] While the ODPs for some short-lived compounds, including the HCFCs, may suggest only a modest impact on the chronic response by ozone, the acute response over the next several years will be more substantial." [ii]

It is therefore prudent to focus on ODPs of HCFCs measured over the period of time when depletion will be worst: i.e.. the next 15-20 years. For example, the short term ozone depleting potential HCFC-141b is 40 to 50 percent that of CFC-11 for the first five years after reaching the atmosphere. Consequently, one kilo of HCFC-141b reaching the stratosphere this month will have destroyed half as much ozone as one kilo of CFC-11, the substance it is to replace, when measured one year from now.

The Executive Director of UNEP noted at the 11th meeting of the OEWG: "For Article 2 Parties reductions in the use of methyl bromide and further controls on HCFCs are the two remaining options for additional action which are both technically and economically feasible and would significantly lower stratospheric chlorine and bromine abundances" [iii]

The 1995 Supplemental Report of the Scientific Assessment calculated that growing use of HCFCs at 7% per annum until 2040, would increase future ozone losses by 6%, that is it would increase the integrated Equivalent Effective Stratospheric Chlorine/Bromine loading by 5.94%. [iv]

And the 1995 TEAP Report noted: "In many cases developing countries can avoid investments in HCFC technology that was at one time considered to be the best choice but has now been rendered unnecessary by newer and more environmentally acceptable technology". [v]

For example there are HCFC and HFC free alternatives for most applications of HCFCs, including for the replacement of HCFC-22 in air-conditioning equipment. HCFC-22 is the most ubiquitous HCFC. It is estimated that without mitigation, by 2015 the annual global production of HCFC-22 will be 700,000 tons. The GWP of HCFC-22 is 4300 and 1700 over a 20 year and 100 year time frame respectively.

The 2007 TEAP Task Force Report on HCFCs documents that an accelerated HCFC phase-out would hold massive benefits to the ozone layer and to the climate. According to the report, acceleration of the HCFC phase-out by 15 years would prevent the emission to the atmosphere of nearly 500,000 ODP tons, and potential reductions in up to 25 billion tons of CO2 equivalent, which equals three times the total projected greenhouse gas emissions of the USA in 2010.

Having failed to act in the past, the Parties must act now to reduce the damage that unmitigated HCFC emissions pose to the ozone layer and the climate. However, as the Parties move forward with an accelerated HCFC phase-out regime, it is essential that they avoid moving from the frying pan into the fire, by switching to high GWP HFCs.

Greenpeace supports the immediate acceleration of the HCFC phase-out regime. Specifically, Greenpeace supports the establishment of a 2005 baseline, coupled with a global freeze by no later than 2010-2012. Of course developing countries will need a second round of funding support from the Multilateral Fund to accomplish earlier phase-outs. Furthermore, such measures need to be coupled with a vigorous program to financially encourage the further development and deployment of HFC-free replacement technologies.

Low Lying Fruit: Recapture and safely destroy banked CFCs and HCFCs

Two measures that are readily available to the international community to limit unnecessary CFC and HCFC emissions are:

- To mandate or otherwise facilitate the recapturing of banked CFCs and HCFCs in old commercial and domestic refrigeration equipment and wherever possible, from insulation foam installations; and

- To facilitate, through the Multilateral Fund of the Montreal Protocol, the establishment of a global network for the recapturing and safe destruction of CFCs and HCFCs in domestic and commercial refrigeration equipment.

The 2006 TEAP/IPCC special report notes, that currently there are no mandatory obligations under the Montreal or the Kyoto Protocols for the recapturing and destruction of CFCs or HCFCs, even though a significant amount of HCFC/CFC emissions come from their respective banks.

Such measures could potentially prevent the emissions of hundreds of thousands of metric tons of ODs and potent global warming gases. The Multilateral Fund, with adequate funding, could be the facilitator for the establishment of such a global network.

Banked CFCs and HCFCs

Chemical	**Application**	**Bank in 2002 (metric tons)**	**CO2 equivalent emissions (metric tons)**	**Bank in 2015 (metric tons)**	**CO2 equivalent emissions (metric tons)**
CFC-11	Refrigerant	45,444	1.81×10^8	8700	3.48×10^7
	Foam	1,683,296	6.73×10^9	1,110,226	4.44×10^9
CFC-12	Refrigerant	486,533	4.13×10^9	93075	7.91×10^8
	Foam	168,273	1.43×10^9	117,973	1.00×10^9
HCFC-22	Refrigerant	1,397,057	2.1×10^9	-	-
	Foam	67,691	1.02×10^8	87,703	1.32×10^8
HCFC-141b	Foam	830,560	5.23×10^8	1,069,281	6.73×10^8
HCFC-142b	Foam	206,311	4.12×10^8	259,841	5.2×10^8

- In 2002 the total banked CFC-11 & 12 refrigerants in refrigeration equipment (i.e. domestic, commercial and mobile) was nearly 540,000 metric tons. That equals 4.3 billion tons of CO2 emissions, which is equivalent to half of the USA's projected greenhouse gas emissions in 2010. (UNFCCC Inventory).

- Global projections for 2015 indicate that the bank of refrigerants of CFC-11 and CFC-12 combined will still be 100,000 metric tons. 33% in domestic appliances, 6% in commercial equipment, 26% in industry and 11% in MACs.

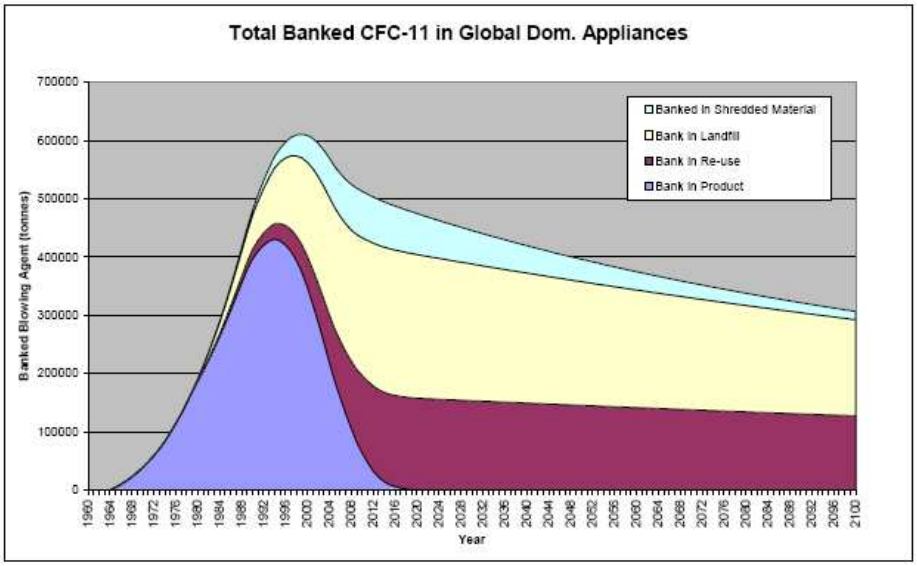
- In 2002, the banked CFCs in foams in refrigeration and building applications combined was approximately 1, 800,000 metric tons. That equals 8.16 billion tons of CO2 emissions, which equals the total projected greenhouse gas emissions of the USA in 2010.

- In 2002, the total bank of HCFCs in all forms of refrigeration as refrigerants was 1,500,000 metric tons. In 2015, under a business as usual scenario, the banked HCFCs as refrigerants are expected to grow to 1,800,000 metric tons.

- HCFC-22 contribution to this bank (representing 93% of the total) equals 2.1 billion metric tons (not including the global warming contribution of the HFC 23 byproduct from the production of R22). This equals the total annual emission of 420,000,000 cars, or more than double Germany's greenhouse gas emissions for 2010 (UNFCCC).

- In 2002, the global HCFC foam bank had the equivalent of 1.04 billion metric tons in CO_2 emissions, more than the projected greenhouse gas emissions of Germany in 2010. This figure will grow to 1.32 billion metric tons in 2015.

CFC-11 is almost exclusively used in foams. The graph below charts the total banked CFC-11 in domestic appliances up to 2100:



- The total bank of CFC-11 foam in domestic appliances globally in 2002 was 600,000 metric tons. Of this 200,000 was in landfill, but 400,000 was available for recapturing. In 2015 the total is projected to be 480,000 tons, of which 250,000 tons is expected to be in landfill, and the rest, 230,00 tons available for recapture and safe destruction.

- In 2015, the total banked CFCs in domestic equipment, foams and refrigerants, is expected to be 335,000 metric tons.

Recapturing CFCs from old Refrigerators

- An average European fridge contains 115 grams of CFCs in the circuit and 280 grams in the insulation, or approximately 312 grams of CFCs in total, which has the GWP equivalent of 2.8 tons of CO2.

- According to one estimate, the 200 million European CFC fridges still in use today, contain the GWP equivalent of 560 million tons of CO2. Put in context, the CO2 emissions from all traffic in Germany is 167 million tons per years (2004 source: DIW Berlin)

- Even though the European Union has the most number of refrigerator disposal facilities, of the 18 million CFC fridges that are discarded in EU (figures based on 25 state membership) each year, only 2.5 million CFC fridges are collected for recycling. This is a clear illustration that poorly administered regulation is the worst of all options.

- In the EU there are 40 to 50 recycling plants, while in the United States there are two and in many regions of the world there are none. In many countries old equipment is either incinerated, or shredded and placed in land fills. It is estimated that any CFC that ends in a landfill will seep out in to the atmosphere in 40 years. Efficient technology for recapturing CFCs from old refrigerators (from refrigerant cycle and foam) is readily available.

Headed for Catastrophes (HFCs)

The world is facing the daunting challenge of rapidly reducing greenhouse gas emissions. While most of the world's attention is on reducing CO2 emissions, the large scale emissions of hydrofluorocarbons (HFCs) pose to undermine the intent of the Kyoto Protocol.

The Montreal Protocol bridges the dual atmospheric crises of ozone layer depletion and global warming. The Protocol embraced the wide scale utilization of HFCs as replacements for CFCs. But just like HCFCs, HFCs can only be viewed as transitional substances. They are potent global warming substances.

Since the Montreal Protocol promoted the uptake of HFCs, it needs to take some responsibility in their phase-out.

A 2005 review by Greenpeace of all the HCFC/HFC projects funded by the Multilateral Fund indicated that many of these projects were funded even when environmentally safer and technologically proven alternatives were available. One glaring example was in domestic refrigeration sector. The 'Greenfreeze' fluorocarbon free technology has been available since

1993. By 2005 there were over 150 million Greenfreeze refrigerators in the world. And still, the preponderance of domestic refrigerator projects funded by the MLF continued to be with HCFC/HFC technology.

HFC Containment a Failure

In the 1990's HFCs were sold to the world with the promise of 'containment'. According to a 2004 study by Atlantic Consulting of the UK, containment of HFCs has failed.[vi] … [and] that leak rates of HFC-134a over the period of 1990-2000 are the same as they were for its predecessor, CFC-12, in the mid-1980's. In other words, containment of HFCs has failed.

It is estimated that over 50% of all HFCs produced to date have already been emitted into the atmosphere. Greenpeace calculates that just the production and emission of HFC-134a, the most commonly used HFCs, poses a significant danger to the climate.

HFC-134a in Banks, Emissions and Production (metric tons)

Chemical	Bank in 2002	CO2 equivalent emissions	Emissions in 2020	Production in 2020	Emissions in 2070 BAU	Production in 2070 BAU	Emissions in 2070 Best-case	Production in 2070 Best-case
HFC-134a	380,249	4.94×10^8	324,456	577,306	1,078,130	1,803,372	550,000	978,904

Banks

- In 2002, HFC-134a represented 78% of the total HFC refrigerant bank (380,000 metric tons) or the equivalent of 494 million tons of CO2. That is three times the projected 2010 greenhouse gas emissions of Greece, or the annual emissions from 99 million cars.

- The total HFC refrigerant bank for 2002 was 488,000 metric tons. Over 50% of this total was in MACs. Domestic refrigeration represented 10% or approximately 50,000 tons.

- Under a business as usual scenario, the projection for the global HFC bank in 2015 is projected to be 2,300,000 metric tons. This breaks down into 8% in domestic refrigeration, 41% in stationary AC, 28% in MACs, 18% in commercial cooling equipment.

Emissions

- In 2000 total HFC emissions were 93,000 metric tons. Under BAU scenario in 2015 total HFC emissions will be 366,000 tons. HFC-134a emissions are projected to grow from 80,000 metric tons in 2000 to 175,700 in 2010 (equivalent to the total annual emissions of 45,600,000 cars).

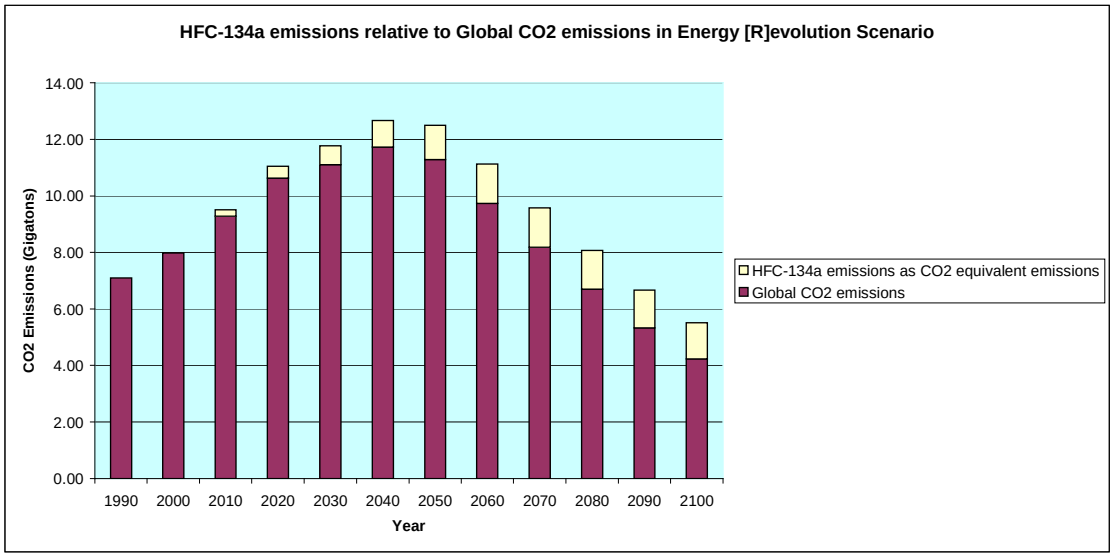
- In 2020, under BAU scenario, HFC-134a emission are expected to be 325,000 metric tons, in 2050, 931,000 metric tons, and in 2070, 1,078,000 metric tons. This would be equivalent to 1.4 billion CO2, which equals the annual emissions of 280 million cars, or more than double the greenhouse gas emissions of the UK in 2010.

Production

- In a business as usual scenario, HFC-134a production will reach a peak in 2070 at 1,803,372 tons per year. This is equivalent to 2.34 billion tons of CO2 emissions or 4 times the projected CO2 emissions of Australia in 2010:
- In a best case scenario, HFC-134a production will reach a peak in 2060 at 978,904 tons per year. This is equivalent to 1.27 billion tons of CO2 emissions (Double the projected CO2 emissions of the UK in 2010):

- The difference in equivalent CO_2 emissions between the BAU scenario and the best-case scenario is 1.07 billion metric tons. This figure is more than the projected greenhouse emissions of Germany in 2010.

- If both CO2 emissions and HFC 134a emission follow the BAU (A1 scenario of SRES data), 134a will make up 8.9 % of total greenhouse gas emissions in 2070.



If we do everything to try to curb annual CO2 emissions to 11 gigatons of CO2 emissions by 2050 (that is, increased energy efficiency and conservation, mass introduction of renewable energy systems, reduction in reliance on fossil fuels, moving energy production closer to the consumer,) but we continue as business as usual with HFC-134a then 134a will make up 17.1% of all greenhouse gas emissions in 2070.

Curb HFC emissions Now

Now is the time for the international community and industry to begin phasing out high GWP HFCs.

- The Montreal Protocol, in cooperation with the Kyoto Protocol, should work towards the establishment of a global cap on HFC emissions.

- Governments should bring in progressive restrictions on the use of high GWP HFCs to encourage the uptake of low GWP technologies.

- The Parties should direct the Multilateral Fund to immediately stop funding HFC projects when environmentally safer and technologically proven alternatives are available.

Positive Developments

Some governments and corporations are already taking steps to reduce HFC consumption.

- **German carmakers select CO2 refrigerants to replace HFC-134a in MACs**: In response to the European Union's decision to phase out high GWP, HFC-134a in mobile air-conditioning by 2011, in August of 2007 the German car manufacturers decided to use carbon dioxide as the replacement refrigerant. CO2 was selected over the new low GWP fluorocarbon refrigerants developed by DuPont and Honeywell companies.

- **UK Supermarkets convert to natural refrigerants**: In March 2006, several major UK supermarket chains announced their decision to phase-out their use of HFCs in cooling equipment and to convert to natural refrigerants such as carbon dioxide. ASDA, Marks & Spencer, Sainsbury's, Somerfield, Tesco and Waitrose emphasized that a further use of hydrofluorocarbons (HFCs) in commercial refrigeration was incompatible with increasing concerns over climate change.

- **Refrigerants Naturally:** Refrigerants Naturally Initiative, was established in 2004 by CocaCola, Unilever and McDonald's, in cooperation with UNEP and Greenpeace, with the explicit aim of phasing out the use of HFCs in their extensive fleet of point of sales cooling equipment. In 2006 Refrigerants Naturally welcomed three new partners, Pepsi Cola, Carlsberg Beer and IKEA. Other large corporations are currently deliberating joining the initiative in the near future.

  On September 17, 2007 Coca Cola announced that the company will be using HFC-free, climate-friendly coolers and vending machines in all official venues of the Beijing 2008 Olympic Games, to be held in Beijing and six co-host cities throughout China. This is the first time 100% of the Coca-Cola coolers and vending machines for the Games will feature hydrofluorocarbon (HFC)-free insulation, HFC-free natural refrigerant, and a proprietary technology called Energy Management System (EMS) that improves energy-efficiency by up to 35%.

Sources

- 'Determination of Comparative HCFC and HFC Emissions Profiles for the Foam and Refrigeration Sectors until 2015' (prepared with support from US EPA and ADEME) Submitted by Caleb Management Services Ltd. in April 2004
- TEAP: Report of the Task Force on Foam End-of Life Issues, May 2005
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- SRES report prepared by the Intergovernmental Panel on Climate Change (IPCC) for the Third Assessment Report, on future emission scenarios. Also used in Fourth Assessment Report (www.sres.ciesin.org)
- Globalis: An interactive world atlas of various UN Statistics (where I found past, present, and future total GHG emissions of various UN member countries), http://globalis.gvu.unu.edu/
- Global Warming Potential info: www.afeas.org/greenhouse_gases.html

[i] WMO 1991, p.6.17
[ii] Ibid. p.6.16
[iii] UNEP/Ozl.Pro/WGI/l 1/8, para.6
[iv] UNEP, 1995 Supplemental Report of the Scientific Assessment, Table 1

[v] Article 5(1) Party Scenarios, p.30
[vi] Atlantic Consulting: "HFC containment has already failed": February, 2004

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