THE MONTREAL PROTOCOL IN 2012

ENDING THE REIGN OF FLUOROCARBONS, ANSWERING THE CALL ON CLIMATE

32nd MEETING OF THE OPEN-ENDED WORKING GROUP OF THE PARTIES TO THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

JULY 23RD – 27TH
BANGKOK, THAILAND



ENVIRONMENTAL INVESTIGATION AGENCY
WASHINGTON, DC, U.S.A. • LONDON, U.K.

Montreal Protocol on Substances that Deplete the Ozone Layer

32nd MEETING OF THE OPEN-ENDED WORKING GROUP OF THE PARTIES

2012 is on pace to become the hottest year on record. The Arctic icecap is currently at its lowest level for this date in history, and excess atmospheric heat is spawning record temperatures, droughts and the onset of progressively earlier, stronger and more frequent storms worldwide. This continues an ominous trend indicating that "acute climate change" is already arriving and these events are just the beginning of the massive and escalating disruptions to the planetary ecosystem predicted by world renowned climate scientists.

Despite the possibility of losing the slim chance that remains to arrest climate change before significant "tipping points" are reached, Parties to last year's UNFCCC conference in Durban failed to act. The decision to defer agreement on a global climate treaty until 2015, and its implementation until at least 2020, is an enormous gamble; the nations of Earth simply cannot afford to take an eight-year hiatus from efforts to combat global warming.

While it appears that an agreement to control emissions from fossil fuel use must wait, there are huge opportunities for action involving the 30-40% of global warming caused by non-CO_2 or short-lived climate forcers. Reductions in HFCs, black carbon, methane and tropospheric ozone could halve the rate of global warming between now and 2050 and buy the world much needed time for anticipated action on CO_2 to take effect.

Among the strategies for controlling short-lived climate forcers, HFCs represent the only mature and comprehensive global option for immediate action. Under the Vienna Convention, the Montreal Protocol has been tasked with responsibility for controlling ozone-depleting substances (ODS) and dealing with any "adverse effects" arising from their elimination. Without question, the negative impact and contribution to global warming arising from using HFCs as alternatives to ODS qualifies as an "adverse effect" that is a direct result of the ODS phase-outs, and as such it is time for the Montreal Protocol to fully embrace its obligations and act decisively to regulate HFCs.

There are several key measures that Parties should undertake at this year's 32nd Meeting of the Open-Ended Working Group. A formal contact group should be convened to discuss the HFC amendment proposals, the TEAP should be given additional time and clearer guidelines to complete and re-issue its report on alternatives, and Parties should act to ensure the venting of HFC-23 is addressed in any financial agreements between the Executive Committee of the Multilateral Fund and countries with HCFC-22 production facilities as part of the accelerated HCFC phase-out.

At the Rio+20 Conference earlier this year, the nations of the world agreed on a final document that states: *"We recognize that the phase-out of ozone depleting substances is resulting in a rapid increase in the use and release of high global warming potential hydrofluorocarbons to the environment. We support a gradual phase-down in the consumption and production of hydrofluorocarbons."*

The time for action on HFCs has arrived. The Montreal Protocol is the only international body with the experience and expertise to initiate and effectively achieve a timely "HFC phase-down". In the true spirit of multilateralism that this body has helped so much to define, it is time to translate support for an HFC phase-out into the concrete action that has become the hallmark of the Montreal Protocol.

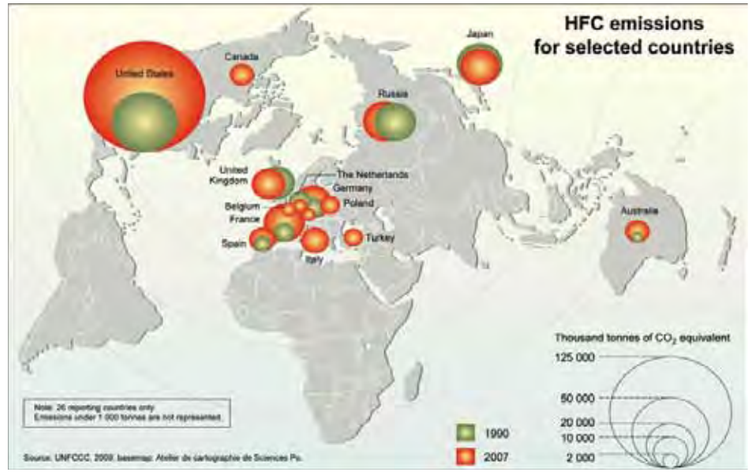


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A2 LEADERSHIP ON LOW-GWP ALTERNATIVES TO HCFCs

Article 5 charges developed nations with responsibility to provide financial and technological assistance to developing nations in the implementation of technologies and processes with lower ozone depleting effects. Under Article 10A, Article 2 (A2) nations are required to transfer "best available, environmentally safe substitutes and related technologies" to Article 5 (A5) nations at "fair and most favorable trade conditions." This commitment to facilitate access to relevant scientific information, data, training, and technology was reasserted in the Helsinki Declaration adopted at the First Meeting of the Parties in 1989. Consequently, Parties are required to adhere to all aspects of these terms during ODS phase-outs including the accelerated 2007 HCFC Phase-out pursuant to Decision XIX/6 that was adopted in order to prevent the release of additional ODS, but equally to prevent some 15-20 GtsCO_2e emissions. Under the Montreal Protocol doctrine of common but differentiated responsibilities, A2 countries led the phase-out of HCFCs in 1996, but unfortunately started their phase-out of HCFCs before the focus on the massive climate impact of HFCs. As a result, there was a massive A2 shift from HCFCs to high-GWP HFCs, and as of 2010, 77% of all conversions were to HFCs as shown in the chart below.



If this same replacement pattern is replicated in A5 countries, HFCs will be 9-19% of anticipated CO_2 emissions by 2050 under a BAU scenario. HFC emissions could negate all reductions of GHG emissions now pledged and/or anticipated under the UNFCCC process up until 2050 and effectively sabotage global efforts to avert the onset of acute climate change.

Decision XIX/6(9) encouraged all Parties to promote the selection of alternatives to HCFCs that minimize environmental impacts, particularly on climate. Decisions XIX/6 and XXI/9 instructed the ExCom of the MLF to consider and incentivize climate benefits in the selection of alternatives for HCFCs in the phase-out by A5 countries, by promoting the selection of low-GWP alternatives and bypassing HFCs. The HCFC phase-out in A2 countries will achieve a 90% reduction by 2015, but since climate co-benefits were not a condition or aspiration of the phase-out, transitions did not favor low-GWP alternatives, even where they were developed and commercialized.

This contrasts with the ExCom's approach to A5 nations' HPMPs, that has been to promote dramatic conversions to low-GWP substitutes, and which has led to the commercialization of some refrigerants and technologies for the first time (e.g. methyl formate). Astonishingly, many of the low-GWP alternatives being pioneered by A5 nations cannot yet be legally sold in many A2 countries. This is precisely the opposite of how the concept of common but differentiated responsibilities is supposed to work.

A2 countries must revisit their HCFC phase-outs and apply the same standards as the ExCom for their remaining transitions, and take immediate steps to remedy the impact of past transitions that have resulted in widespread adoption of HFCs.

To comply with their obligations, A2 countries must act now to lead the transition that will bypass HFCs. The development of viable alternatives will ensure effective technology transfer to A5 countries, which will enable developing countries and the world to achieve the greatest climate benefits possible from the HCFC phase-out.

Compound	Consumption	R-404A	R-410A	HFC-134a	HFC-245fa	Not-in-kind [1]
HCFC-22	66.50%	35%	55%			10%
HCFC-141b	30.00%	-	-		50%	50%
HCFC-142b	3.50%	-	-	50%		50%
Total HFC consumption		23%	37%	2%	15%	23%

[1] "Not-in-kind" includes both conversions to low-GWP alternatives and to technologies that eliminate the need for the HCFCs such as pumps and roll-ons instead of aerosols.

EU F-GAS REGULATION REVISION

The European Union (EU) has almost completed the phase-out of HCFCs. Since January 2010 it has been illegal to use virgin HCFCs to service RAC equipment, and from 1st January 2015, this ban will apply also to recycled and reclaimed HCFCs.

Unlike many other A2 countries, the EU also has legislation to control the use of HFCs and other F-gases. Adopted in 2006, the EU F-Gas Regulation's main objective is "to reduce the emissions of the fluorinated greenhouse gases covered by the Kyoto Protocol," particularly those from HFCs. However, HFC emissions have since risen by 28% in the EU, a figure that is predicted to rise to 82% by 2050 even with full implementation of the Regulation. It is now abundantly clear that in its present form, the F-Gas Regulation is insufficient to address HFC emissions.

"HFCs and HFC-based equipment could be effectively eliminated by 2030"

The original sin of the F-Gas Regulation was a lack of ambition. In the years leading up to its adoption, a powerful HFC lobby pressured decision-makers to adopt an approach premised on containment and recovery that allowed industry to place new HFC equipment on the market without limitation, and force end-users and taxpayers to comply with burdensome and largely ineffective measures for limiting leaks and recovering discarded equipment. The HFC industry, with its decades of international ODS lobbying experience, simply ran circles around EU policymakers and the alternatives industry.

The EU F-Gas Regulation is now undergoing a review, with an option to revise. In the intervening years, several things have happened: studies have



shown that the Regulation was costly and ineffective; certain Member States, such as Denmark, have taken aggressive action to ban HFCs; and the alternatives industry has developed a broad range of energy efficient and commercially viable technologies. As a result, supermarkets and other end-users have begun switching to alternatives voluntarily in order to reduce their carbon footprint.

The HFC industry, for its part, has also changed its tune. Content until recently to claim containment and recovery a success, it now acknowledges that other measures are needed while continuing to lobby against any bans or clear restrictions. Instead, the HFC industry is pushing for a gradual phase-down approach that will allow almost unfettered access to the European market for decades. However, according to recent Commission-funded and independent analyses, safe, climate-friendly and energy-efficient alternatives can fully satisfy market demand for new equipment in 20 of the 29 primary subsectors by 2015 or 2020, depending on the subsector, and the remaining subsectors no later than 2030.

In truth, there is no need for new HFC-based equipment in most subsectors and banning them could abate over 2.1 Gt CO_2e tonnes of emissions by 2050 while spurring a much-needed global transition. There is ample scientific and technical justification for policy action to move away from reliance on HFCs in these sectors, a move that would complement existing and future European policies, including the Roadmap for Moving to a Competitive Low-Carbon Economy in 2050 and the Energy Efficiency Plan.

The EU must now make a choice. It can lead on this critical climate issue by ensuring that any proposal to revise the F-Gas Regulation includes subsector-specific bans, with the phase-down (quantitative limits) and other measures adopted to complement the bans. Or it can allow the F-Gas Regulation to once again fall victim to a lack of ambition by focusing measures on a gradual phase-down which will ultimately allow continued placing on the market of HFC equipment when it is no longer necessary.

Irrespective of the EU's handling of the F-gas Regulation, it is clear that within the EU, HFCs and HFC-based equipment are by and large no longer necessary or desirable, and could be effectively eliminated ahead of the step-down schedules in the proposed HFC Amendments.





Much of Europe's alpine regions are on schedule to lose most of their glaciers in the next 20 to 30 years and become "ice-free".

LOW-GWP ALTERNATIVES PAVE THE WAY FOR HFC PHASE-OUT

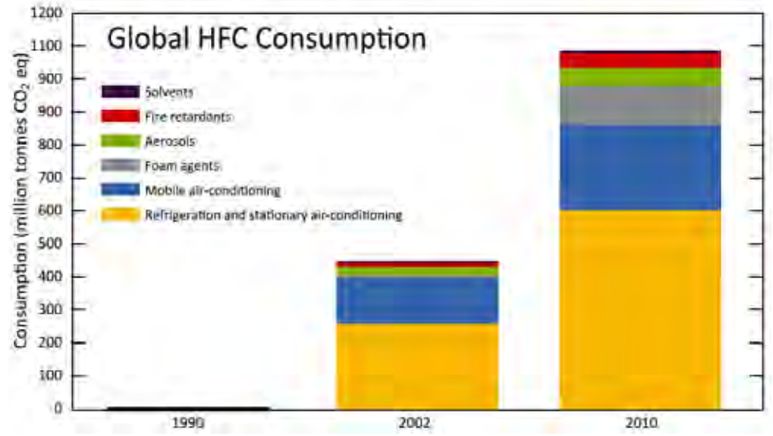
Fluorinated greenhouse gases, including CFCs, HCFCs and HFCs, have a significant impact on climate change with recent estimates indicating that they account for about 12% of all radiative forcing caused by increased greenhouse gas (GHG) levels since the beginning of the industrial revolution.[1] Thanks to the phase-out of CFCs under the Montreal Protocol, atmospheric concentrations of these gases are declining, while those of the HCFCs and HFCs used as replacements are rising rapidly.[2]

While they do not deplete the ozone layer, many HFCs are potent greenhouse gases. HFC emissions (excluding HFC-23 by-product) currently account for around one percent of global greenhouse gas emissions but as much three percent in many developed countries which have already phased-out a majority of their HCFC consumption.

HFC consumption has increased from almost zero in 1990 to 400 million tonnes CO_2e in 2002, to 1100 million tonnes CO_2e in 2010, and continues to rise. Consequently, atmospheric HFC emissions are increasing dramatically, paralleling the growth in production and consumption. The atmospheric abundances of the major HFCs used have increased 10-15% per year in recent years.[3]

There are two long-term technical options for eliminating the contribution of HFCs to climate change:

1. *Using fluorine-free substances with low or zero-GWP.* Commercially available examples include:
- Ammonia
- Hydrocarbons such as propane and iso-butane
- Dimethyl ether
- Water
- CO_2
- Other substances used in aerosols, foams, refrigeration, air conditioning and fire protection systems



UNEP Synthesis Report, 2011, "HFCs: A Critical Link in Protecting the Climate and Ozone Layer", Figure 1.4. Estimated global consumption of HFCs by various sectors, expressed in CO_2 equivalent, for 1990, 2002, and 2010.

2. *Alternative methods and processes* (termed 'not-in-kind' alternatives): Commercially used examples include fiber insulation materials, dry-powder asthma inhalers, and building designs that avoid the need for air-conditioners. [4]

Low-GWP alternatives to HFCs have already won significant market share in some sectors, with over 90% of new domestic refrigerators/freezers and approximately 25% of new industrial air conditioners in the EU using alternatives. In other sectors however, low-GWP technologies remain minor players, although their share of the market could increase dramatically, and is poised to do so in a number of sectors.

As well as offering lower direct emissions from the refrigerants used, many alternative technologies also provide additional indirect emissions savings through increased energy efficiency as compared to traditional HCFC and HFC technologies. Low-GWP alternatives have been used for more than 150 years in some applications and comprise significant portions of the refrigerant mix in many sectors.
The proposed HFC Amendments to the Montreal Protocol, the proposed revisions to the EU F-gas regulations, and the growing recognition that both HCFCs and HFCs must be phased out, have led to the rapid increase in proven and commercialized low-GWP alternatives in new applications and sectors, prompting rapid market growth and creating a multi-billion dollar business opportunity.

At the 2010 UNFCCC meeting in Cancun, the Consumer Goods Forum (CGF) made a commitment to begin phasing out HFCs by 2015. With over 650 members from retail, manufacturing and service providers across 70 countries a commitment of this scale will have a global effect on the proliferation of HFC-free technology. A variety of climate-friendly alternatives are already available in retail food applications, including hydrocarbons such as propane (R-290), as well as ammonia (R-717), and carbon dioxide (R-744) that should allow the CGF members to meet their pledge.

Barriers to the adoption of alternative technologies exist in some sub-sectors, for example, regulations and standards that inhibit the use of flammable and/or toxic alternatives, insufficient supply of components, increased investment costs, and lack of relevant skills among technicians.[5] However, the current use of alternatives demonstrates that these barriers can be overcome, through revised technical standards, training and technical assistance, infrastructure developments and financial subsidies. Perhaps most important is the political will to move away from HFCs through legislation, as demonstrated by Denmark, which has banned the use of HFCs in some sectors and imposed a tax on HFC refrigerants.



Manufacturers in the EU and India are already producing energy efficient AC systems that run on hydrocarbons.

In addition to its progress report, the TEAP has produced a report on additional information on alternatives to ODS in response to Decision XXIII/9. Given the unclear mandate and unrealistically short timeframe, much of the current report is lifted verbatim from the TEAP's last comprehensive assessment of alternatives that was produced in 2010. Unfortunately, this process did not allow the TEAP to review and evaluate all of the dramatic changes that have occurred in low-GWP alternatives in just two short years.

Among the noteworthy omissions are:

- HFC-free refrigeration is available for all commercial refrigeration applications, with major retailers such as AEON, the largest supermarket chain in Japan, undertaking the building of new HFC-free supermarkets immediately. CO_2 systems have been installed in approximately 1,500 supermarkets across Europe.[6]
- The US EPA Significant New Alternatives Program (SNAP) Program has been overwhelmed by applications for approval of low-GWP-alternatives and has issued rules in the last two years, including, but not limited to: (1) expanding the use of CO_2 in commercial refrigeration; (2) allowing hydrocarbons to be used in domestic refrigerators and freezers and in stand alone retail coolers; (3) approving CO_2 and HFC-1234yf for use in mobile air conditioners; and (4) issuing acceptability determinations for low-GWP alternatives in refrigeration, air conditioning, solvent cleaning and fire suppression sectors.
- Major advances have been made to reduce charge sizes of ammonia systems allowing them to be piloted in supermarkets and on ships.
- Cascade systems have been designed attain and maximize the cooling efficiency of ammonia while ensuring that no ammonia enters occupied space.
- Super-transcritical CO_2 systems have been developed that work effectively and efficiently at higher ambient temperatures than traditional CO_2 systems.
- Hydrocarbon air conditioners have been proven in China and India, have already been commercialized in India, and are approved for sale in the EU.

Sector	Examples of Alternatives	Use of Alternatives in Sector		
		Industrialized Countries	Developing Countries	Global Total
Industrial refrigeration systems (a)	Ammonia, CO2, HC	92%	40%	65%
Industrial air conditioning systems (a)	Ammonia, CO2, HC	40%	15%	~ 25%
Domestic refrigerators (vapor compression cycle) (b)	HC	51%	22%	36%
Foam in domestic refrigerators (c)	HC	66%	68%	67%
Foam in other appliances (c)	HC	38%	< 1%	28%
Polyurethane foam boards and panels (c)	HC	82%	21%	76%
Fire protection systems (d)	Water, foams, dry chemicals, inert gases	-	-	75%
Asthma medication (e)	Dry powder inhalers	-	-	~ 33%
Solvents (f)	Aqueous, no-clean, alcohols, others	>90%	>80%	>80%

Sources: FTOC 2010; RTOC 2010; TEAP 2009ab; TEAP 2010a. The percentages in this table refer to: (a) refrigerants used in new installations annually; (b) annual production of new equipment; (c) annual consumption of blowing agents; (d) usage or market; (e) annual medical doses; (f) market penetration in solvent applications.

Additionally, massive advances have been made in the energy efficiency of technologies using low-GWP alternatives allowing them to reduce both direct and indirect emissions of GHGs.

- **Domestic refrigeration:** The isobutane standard for refrigerators and freezers in EU has a 10-30% higher efficiency than HFC-134a and also reduces noise level.
- **Retail Stand-alone units:** HC-290 has shown 10-25% higher energy efficiency than HFC units.
- **Industrial refrigeration:** Ammonia systems have proven to generally be at least 15% more efficient than their HFC counterparts. For example, a replacement of a 3.2 MW HCFC-22 system for ammonia resulted in a 40% reduction in energy consumption, and the new plant involved also utilized heat recovery and water heating through a heat pump that resulted in 1.4 million British pounds (€1.75 million) in annual energy cost savings.
- **Chillers:** Ammonia and hydrocarbon chillers on the market in the EU have shown increased energy efficiency of 10% in small hydrocarbon chillers and up to 20% for small ammonia chillers. For example, GEA Grasso has an ammonia chiller with a smaller carbon footprint, less noise and lower energy consumption than a similar capacity HFC chiller. At 25% capacity, the energy consumption is less than half of a normal HFC chiller.



Chiller cabinets using low-GWP refrigerants are proliferating worldwide

EIA urges the Parties to allow the TEAP additional time to truly assess and report on the advances being made and the technologies now being developed, piloted and successfully commercialized Additionally, the TEAP's mandate should be expanded to consider energy efficiency as, depending on the sector, indirect emissions from energy production generally exceed direct impacts of RAC emissions by a factor of four, i.e., refrigerant/AC emissions account for some 20% of lifetime appliance/systems emissions compared to 80% for lifetime energy usage.

Article 5 countries need to understand options as they start to consider their stage 2 HPMPs, and Article 2 countries need to consider what steps should be taken to reverse the 77% conversion from HCFCs to HFCs that occurred during the first 15 years of the HCFC phase-out. There is no reason to implement and finance a global "phase-in" of HFCs, and a very long and compelling list of reasons for donor and developing nations alike to invest in low-GWP alternatives.

HFOs and Mid-Level GWP Alternatives/Blends

Just as HFC-free refrigerants are being tested and evaluated for use in new applications and sectors, the fluorinated gas industry is offering HFOs, new fluorinated compounds to replace HCFCs and HFCs, including HFC-1234yf and HFC-1234ze. Proving and commercializing these chemicals has met many hurdles: their expected cost will be as much as ten times higher than HFCs; the current supply is unable to meet even the minimal requirements of European car manufacturers; and obstacles to expanding production have been substantial.

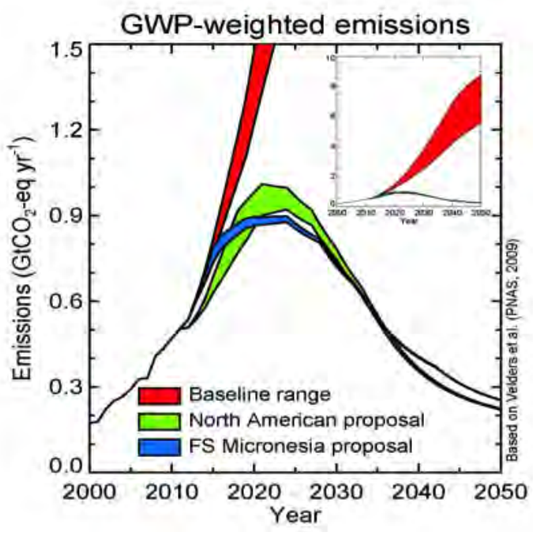
The current method for production of HFC-1234yf uses HCFC-22, which produces HFC-23. Additionally, HFC-1234yf has been unable to shed the potential environmental impacts of its chemical breakdown that produces TFA (trifluoroacetic acid), which accumulates in freshwater systems where it has phytotoxic effects.[7]

Mid-range alternatives such as HFC-32 and some HFO/HFC blends are being marketed with GWPs ranging from 400 to 1,000. While these compounds may be marginally superior to high-GWP chemicals now in use, they do not offer a solution to rapidly growing emissions in RAC sectors and will ultimately have to be phased-out. Therefore, to avoid additional costs and multiple disruptions to industries and users, transitioning to medium-GWP HFCs in new equipment should be avoided.

HFC AMENDMENT PROPOSALS – FINISHING THE JOB

Proposals to amend the Montreal Protocol to regulate production and use of HFCs have been tabled every year since 2009 by Micronesia, and by Canada, Mexico and the United States. Since that time, and despite the formal support by over half the Parties for action to regulate HFCs, formation of a formal contact group to discuss the Amendment Proposals has been repeatedly blocked.

This ongoing failure by the world's most successful environmental treaty to convene real discussions about what is by far the most significant, immediate and cost-effective prospect available for combating climate change must not be allowed to continue. The UNFCCC's deferral of agreement on an international climate treaty makes it imperative that Parties agree to the formation of a formal contact group to discuss the HFC Amendment Proposals.



Research and analysis predicts that HFC emissions will reach between 5.5 and 8.8 GtsCO_2e by 2050 under business as usual scenarios.[8] Recent data supports these figures and indicates that global HFC consumption will reach over 3 GtsCO_2e annually by 2030.[9] The Velders analysis also indicates that global HFC emissions will significantly exceed previous estimates after 2025, with developing country emissions as much as 800% greater than developed countries emissions by 2050.[10]

Projected global HFC emissions in 2050 are equivalent to 9–19% of CO_2 emissions in business-as-usual scenarios and contribute a radiative forcing equivalent to 6–13 years of CO_2 emissions near 2050. This percentage increases to 28–45% compared with projected CO_2 emissions in a 450 ppm CO_2 stabilization scenario. Consequently, if left unchecked HFC use will prove fatal to efforts to arrest and reverse climate change by largely negating anticipated reductions in CO_2 and other GHG emissions.

With the potential to avoid 88 to 140 GtsCO_2e emissions by 2050 at a cost of approximately 5-11 billion[11], there simply is no other near-term strategy for mitigation that could be implemented to achieve a comparable level of GHG mitigation. With anticipated gains in energy efficiency factored in to reflect technological improvements historically associated with the ODS phase-outs, the potential mitigation could increase significantly through improvements in energy efficiency. As the CFC phase-out showed an overall net improvement in energy efficiency of approximately 30%, a corresponding rise in efficiency associated with an HFC phase-out could.effcetively double the amount of total mitigation.

Despite strong support for action on the part of 108 nations, China, India and Brazil have consistently blocked discussion based upon questions regarding the legality of action on HFCs by the Montreal Protocol, lack of information on alternatives, and concerns about costs. Repeated attempts to address these concerns are themselves hampered by assertions that the Montreal Protocol cannot act on HFCs because they belong in the UNFCCC.

As every nation is a member of the Montreal Protocol, and given that production and use of HFCs are not regulated under the UNFCCC or any other international accord, there is simply no reason for the Montreal Protocol not to engage in formal discussion of the proposals. On the contrary, this need has been internationally recognized and effectively sanctioned as evidenced by the recent *Rio+20* declaration which stated *"We recognize that the phase-out of ozone-depleting substances is resulting in a rapid increase in the use and release of high global-warming potential hydrofluorocarbons to the environment. We support a gradual phase-down in the consumption and production of hydrofluorocarbons."* Moreover, the enormous contribution that an HFC phase-out would make toward climate mitigation has become generally accepted within the UNFCCC with the exception of resistance offered by the same Parties that are blocking discussion of HFCs in the Montreal Protocol.

Rio+20 final document text, adopted by Parties June, 2012:

"We recognize that the phase-out of ozone-depleting substances is resulting in a rapid increase in the use and release of high global-warming potential hydrofluorocarbons to the environment. We support a gradual phase-down in the consumption and production of hydrofluorocarbons."

Since it is now clear that there is no chance of a global climate agreement until at least 2015, and implementation before 2020, the insistence that HFCs must be regulated under the UNFCCC is a specious argument that is delaying critical action on climate change. If the world is to have any real chance of avoiding the enormous projected growth in HFC emissions, all Parties to the Montreal Protocol must recall their long-standing obligations under this treaty and commit to engaging this issue constructively.

The Amendment Proposals have slightly different timelines for phasing-down HFCs, but both achieve essentially the same level and quantity of emissions reductions by 2050 (see graph preceding page). Both proposals also call for a combined HCFC and HFC baseline in recognition of their similar and largely interchangeable nature, and as a means of allowing Parties more flexibility in meeting reduction levels.

The increasing availability of low-GWP alternatives has made it feasible to now convert entire sectors (e.g., foams, mobile air conditioning, domestic, commercial and industrial refrigeration) to low-GWP compounds and technologies. There are no longer any technical reasons for Parties to delay action to control HFCs, as evidenced by numerous studies, low-GWP transitions agreed through HPMPs, and significant voluntary commitments by end-users (e.g. the Consumer Goods Forum) to undertake their own transitions to low-GWP alternatives.

The need for early action to curtail HFC emissions is critical, particularly in Article 5 countries where soaring demand for refrigeration and air-conditioning is triggering a corresponding rise in HFC consumption. Setting a clear schedule HFC phase-out schedule now will help ensure that developing nations do not invest in an HFC cul-de-sac, requiring far more costly and difficult mitigation efforts in the future.

- **All Parties should insist on the formation of a formal HFC contact group and advance discussions on the amendment proposals to a point where they can be adopted in 2013.**



Fluorite-ore-concentrating-equipment in China. Global demand for fluorine-containing chemicals is forecast to rise 3.9 percent per year to 3.5 million metric tons in 2016, valued at $19.7 billion.

PHANTOM ODS EMISSIONS – FEEDSTOCKS

The Montreal Protocol only controls production and consumption of ODS for "emissive" uses, such as for refrigerants, solvents, and aerosols. Where used as "feedstock" ingredients in manufacturing chemicals like PTFE (Teflon), pharmaceuticals or agricultural products, ODS remain unregulated. Production of these powerful ODS and high-GWP compounds will continue unabated "until either the products derived from feedstock are no longer needed or when alternative economically attractive synthetic technologies are commercialized." [12]

Since it was represented that feedstocks are consumed in manufacturing processes and therefore "non-emissive", they are not subject to Montreal Protocol control. However, it is now recognized that considerable[13] fugitive emissions occur during production, storage, transport, and transfer. [14] Additionally, there is no independent oversight to ensure that ODS feedstocks are not used illegally for emissive purposes.

Although Parties are required to report all ODS production under Article 7, feedstock emissions are not reported [15], and attempts at estimates suffer from inadequate and unreliable data.[16] As feedstock production and use increases, emissions are becoming a greater concern, and if the lack of MLF funding is resolved by swinging plants from emissive to feedstock production, this becomes an even larger issue. HCFC-22 feedstock production has exceeded emissive production, and Miller & Kuijpers project that global HCFC-22 feedstock production will reach one million tonnes by 2035,[17]mostly from Article 5 countries (see chart).
Demand for emissive HCFCs in developing countries has risen about 15% annually since 2002. Production of HCFC feedstocks could severely compromise the HCFC phase-out, as it heightens the risk of illegal diversion for emissive use as has already occurred in A2 countries. There is simply no means of preventing manufacturers, distributors and end-users from selling feedstocks for emissive use at huge profits.

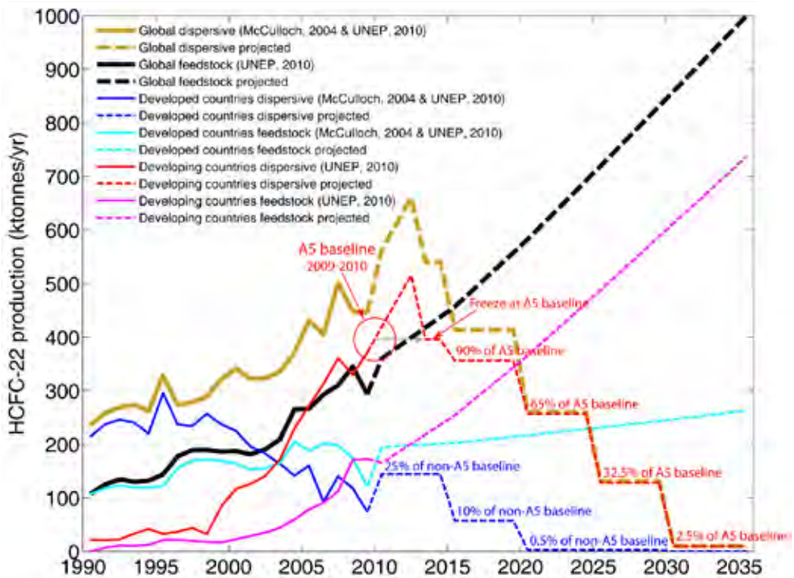
The 2010 TEAP Assessment Report states, "[k]nowledge of ODS feedstock use and emissions is incomplete"[18] (owing to a lack of reporting), notes that the majority of production is not reported to a public data bank, and recommends institutionalized reporting of feedstock use.[19] Also of concern is HCFC-22 that represents the vast majority of HCFC feedstock, and its HFC-23 byproduct, much of which is vented into the atmosphere.[20] HFC-23 production from feedstock in Article 5 countries will reach 10.76 kilotonnes in 2020, and 21.68 kilotonnes (320.8 million CO2e tonnes) in 2035. [21]

Discussion of production HPMPs is not public, making it impossible for observers to see or comment on production sector proposals, or to know how many plants the ExCom is recommending be "swung" to feedstock. Document UNEP/OzL./ExCom/67/36* "Distribution of Confidential Documents" addresses the need for Parties to access information submitted to the ExCom even if it is confidential, but does not address observer need for the same information. The ExCom should analyze these documents and provide summaries that exclude only information that is truly confidential. Observers have the need to know how the production phase-outs might be accomplished as these decisions have huge implications for future production and illegal trade.

Parties Should:

- **Require reporting of all ODS feedstock production, consumption and trade;**
- **Include feedstock trade in ODS licensing systems;**
- **Direct the TEAP to identify substitutes and not-in-kind alternatives to ODS feedstocks.**

Projected HCFC-22 production - Miller & Kuijpers[17]



MAINTAINING AND EXPANDING HFC-23 DESTRUCTION

Since 2005, the world has spent several billion dollars on carbon credits generated under the UN Clean Development Mechanism (CDM) program for HFC-23 destruction. Despite this enormous financial outlay, atmospheric concentrations of HFC-23 (14,800 GWP, atmospheric lifetime 270 years[22]) have continued to rise. Scientific data indicates that over 90% of annual HFC-23 emissions (approximately 8.6 Gg –127 million tonnes CO_2e) are originating from non-CDM HCFC-22 production facilities within China.[23]

China is the biggest beneficiary of the CDM HFC-23 methodology and home to 11 of the 19 HFC-23 destruction projects that have accounted for almost half of all certified emissions reductions (CERs) issued by the CDM to date.[24] Despite being paid some two billion dollars for HFC-23 offsets since the beginning of the program, 65% of which is collected by the Chinese government as tax,[25] China has made no effort to use any part of these windfall profits to address HFC-23 emissions at non-CDM HCFC-22 plants, all seven of which are located within China (*see chart*). These seven HCFC-22 plants are venting HFC-23 directly into the atmosphere despite the extremely low cost of capturing and incinerating the HFC-23 waste stream.

COMMISSION REGULATION (EU) No 550/2011 of 7 June 2011

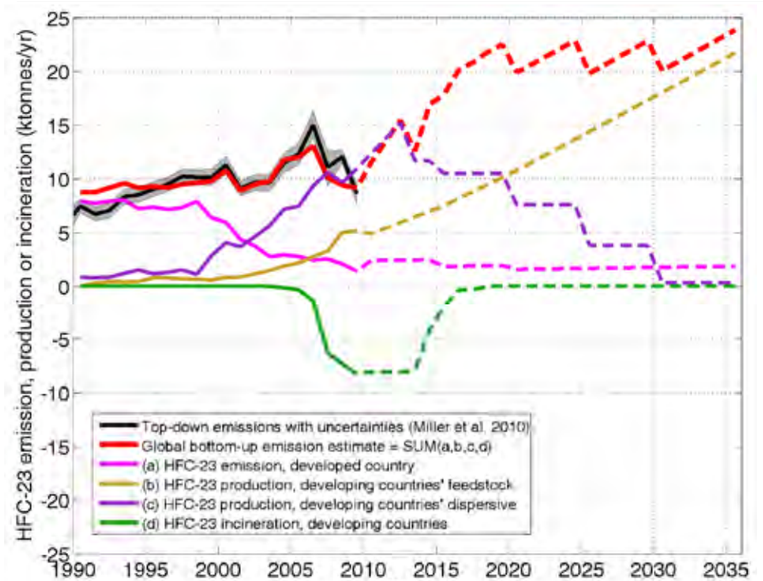
THE EUROPEAN COMMISSION…HAS ADOPTED THIS REGULATION:

Article 1

From 1 January 2013, the use of international credits from projects involving the destruction of trifluoromethane (HFC-23) and nitrous oxide (N_2O) from adipic acid production for the purposes of Article 11a of Directive 2003/87/EC is prohibited, except for the use of credits in respect of emission reductions before 2013 from existing projects of these types for use in respect of emissions from EU ETS installations that took place during 2012 which shall be allowed until 30 April 2013 inclusive.

The actual cost of HFC-23 destruction is less than US $0.20 or €0.17/$CO_2e$ tonne,[26] meaning that the estimated floor price of €6/$8 paid for Chinese credits produces up to a 4000% profit for HCFC-22 manufacturers. One Indian manufacturer reported that in 2007 nearly 90% of annual profits were generated from the sale of carbon credits.[27]

Projected HFC-23 emissions (in red), note rise caused by non-renewal of CDM projects – Miller & Kuijpers[17]



The exceedingly lucrative nature of HFC-23 destruction enterprises and the vast sums accrued from the sale of carbon credits makes China's indifference and inaction on HFC-23 venting extremely irresponsible. While China has made no secret of its desire to obtain similar crediting for its non-CDM HCFC-22 plants, there is clearly no support for any such action within the UNFCCC and the recent steps taken by the EU to ban the use of industrial gas offsets within its Emissions Trading Scheme (ETS) in 2013[28] has effectively eliminated the viability of such efforts.

The EU decision to end acceptance of industrial gas offsets for use in the ETS, and the Danish Proposal that is expected to achieve agreement among EU member States to similarly forswear the use of these offsets as part of national emission reduction obligations for non-traded sectors (agriculture, transport, etc.), effectively ends viable international crediting for HFC-23 destruction. The only other major market for HFC-23 offsets will also be closed in 2013 when Japan pursues its own domestic compliance scheme, the Bilateral Offset Control Mechanism (BOCM), without recourse to existing CDM projects/offsets. Australia and New Zealand have already taken steps to preclude the use of HFC-23 offsets in their own national emissions trading schemes, while Canada has never, nor does it intend to utilize HFC-23 offsets. Voluntary markets, even if they were inclined to do so, are simply not sufficiently large or mature

LIST OF NON-CDM HCFC-22 PRODUCERS IN DEVELOPING (A5) NATIONS					
Name	Country	Location Province	City	Number of production lines	Estimated annual production capacity
Shangdong Jinan 3F	China	Shandong	Jinan	??	??
Zhejiang Pengyou	China	Zhejiang	Jinhua	1	10,000
Zhejiang Sanmei	China	Zhejiang	Wuyi	1	18,000
Zhejiang Yonghe (Xingteng)	China	Zhejiang	Jinhua	1	12,000
Zhejiang Lanxi Juhua	China	Zhejiang	Lanxi	1	15,000
Jiangxi Sanmei	China	Jiangxi	Xingguo	1	30,000
Sichuan Zhonghao	China	Sichuan	Chenguang	2	38,000
Facilities venting and/or selling HFC-23 from uncovered/uncredited production lines.					

enough to absorb the vast quantity and costs of HFC-23 credits that will become available in 2013 when the historic market for these offsets shuts down.

This long-overdue change within international carbon markets will eliminate a multi-billion dollar annual subsidy to the international HCFC industry, de-incentivize the runaway production of HCFC-22 and HFC-23, and end a program that has been undermining and operating at cross-purposes to efforts by the Montreal Protocol to phase-out HCFCs. While these are welcome developments, clearly the issue now is to maintain current HFC-23 destruction and address venting at those plants where HFC-23 continues to be released into the atmosphere.



Juhua GroupsHCFC production plant, Quzhou City, Zhejiang Province, China is a CDM HFC-23 Project operated in conjunction with the UK-based Climate Change Capital of Bunge Ltd.

The logical solution would be for China to utilize a fraction of the approximately US $2 billion collected from taxing HFC-23 destruction credits to finance installation of incinerators at non-CDM plants and cover operational costs until such time as these plants are retired or repurposed under the terms of the 2007 accelerated HCFC phase-out.

Beyond the non-CDM HCFC-22 plants and production lines in China, virtually all other non-CDM HCFC-22 facilities in the world voluntarily absorb the costs for destroying HFC-23. There is no reason why China and other nations should not implement this standard international industry practice by requiring producers to assume responsibility for HFC-23 destruction when their current CDM crediting periods expire. This is entirely reasonable given the vast sums already paid and the minimal cost of preventing HFC-23 emissions.

The MLF Secretariat's Report for the 55th ExCom Meeting raises concern that CDM HFC-23 credits "*... are more valuable than the resulting HCFC production thereby making it difficult to provide an incentive for closure of production facilities.*" While the profitability of HFC-23 crediting is coming to an end in 2013, and since unilateral action by China and India to address HFC-23 emissions seems unlikely, the MLF should consider assuming responsibility for paying the incremental costs to all HCFC-22 producers in developing countries for the capture and destruction of HFC-23.

With respect to plants currently operating under the CDM HFC-23 Methodology for destruction, MLF funding for incremental payments should be made available after their CDM contracts have expired. With respect to non-CDM plants, which exist only in China, MLF funding to equip China's seven non-CDM plants with incinerators (estimated at $50-100 million[29]) should be a condition of fnding for China's HCFC production phase-out. The additional cost to the MLF of paying incremental costs for all HFC-23 destruction worldwide would be on the order of $30 million annually[30].

The creation of HFC-23 is a direct by-product of the production of HCFC-22. The General Obligations contained in Article 2 of the Vienna Convention for the Protection of the Ozone Layer ("Ozone Convention") are sufficiently broad in scope to allow, and indeed practically compel Parties to control by-products from the production of ODS such as HFC-23.

Article 2(2)(b) of the Ozone Convention sets forth the following obligation:
To this end the Parties shall … [a]dopt appropriate legislative or administrative measures and co-operate in harmonizing appropriate policies to control, limit, reduce or prevent human activities under their jurisdiction or control should it be found that these activities have or are likely to have adverse effects resulting from modification or likely modification of the ozone layer …"[31]

While HFC-23 is not an ODS, it is a powerful GHG with a GWP of 14,800 and is a contributing cause of climate change that explicitly qualifies as an "adverse effect" as defined under the Ozone Convention:

"Adverse effects" means changes in the physical environment or biota, including changes in climate, which have significant deleterious effects on human health or on the composition, resilience and productivity of natural and managed ecosystems, or on materials useful to mankind."3[2]

Activities to aid the recovery of the ozone layer through regulation of ODS constitute a modification of the ozone layer. These activities, and others, are resulting in the proliferation of HFC-23 that is causing adverse effects because of its role as a super GHG that contributes to climate change. Therefore, harmonizing policies under the Montreal Protocol to ensure an environmentally sound transition away from ODS by mandating the destruction of HFC-23 falls squarely within the scope of Article 2(2)(b). This interpretation of Article 2 of the Ozone Convention is also supported by subsequent agreements among the Parties relating to the Ozone Convention.[32] The text of the Montreal Protocol makes clear that the phase-out of ODS are not supposed to occur in a vacuum but rather, all relevant scientific information and environmental impacts, including the climatic effects, as specifically noted in the Preamble[34], must be considered. Article 2F(7)(c), for example, specifically provides that:
"each Party shall endeavor to ensure that … [HCFCs] are selected for use in a manner that minimizes ozone depletion in addition to meeting other environmental, safety and economic considerations."[35]

The Parties supported this concept by adopting Decision V/8 in 1993, requiring Parties to consider ODS substitutes in light of their environmental impacts.[36] The following year, the Parties further expanded their mandate to consider environmental impacts other than ozone depletion by adopting Decision VI/13 that required the TEAP to "*consider how available alternatives compare with [HCFCs], with respect to such factors as energy efficiency [and] total global warming impact …*"[37]

Therefore, the ExCom should establish the guidelines related to the eligibility criteria mandated in Decision XIX/6[38] and require that Producing Countries agree to capture and destroy HFC-23 as a condition of receiving any funding for closure or transitions at any of their HCFC plants. EIA urges that the MLF be directed to implement these controls and accorded sufficient funding to achieve and verify such HFC-23 destruction.

- **Parties should instruct the MLF to establish the eligibility guidelines mandated in Decision XIX/6 to compel capture and destruction of all HFC-23 in order to qualify for closure or transition funding under the HCFC phase-out.**



FE-13TM (HFC-23) fire extinguishing agent is the product of Dupont. Dupont and other companies in the EU, US and China are selling HFC-23 for fire suppression systems rather than destroying it despite the availability of low/zero ODP/GWP alternatives.

CLIMATE FINANCING FOR LOW-GWP ALTERNATIVES

The total amount of funding available for new activities for the 2012-2014 triennium is US$169 million. The value of projects submitted to the 67th MLF Meeting exceeds the 2012 allocation by US$50 million, with US$48.9 million of this attributed to the production sector in China. Although the distribution of funding by tranche is not known, the total value of projects submitted including those to be considered at the 67th Meeting exceeds the funding expected to be available in the business plan for 2012 to beyond 2020 by US$222.6 million. Seventeen countries do not yet have approved HPMPs in addition to those pending at the 67th Meeting.

The funding shortfall becomes even more onerous when current growth in HCFCs is considered. The Updated Model Rolling 3-Year Phase-Out Plan: 2013–2015 reveals that the reductions achieved by non-Article 5 countries between 2000 and 2010 have been completely nullified by the growth in production and consumption of HCFCs in Article 5 countries. Total HCFC production increased from 37,749 ODP tonnes in 2000 to 38,283 ODPt in 2010, despite a reduction in Non-Article 5 countries during this time from 29,981 ODPt to 4513 ODPt. Total HCFC consumption rose from 38,255 ODPt to 40,880 ODPt between 2000 and 2010, despite a reduction in Non-Article 5 countries from 25,219 ODPt to 3,953 ODPt.

By comparison, the highest total consumption of CFCs ever reported was 178,144 metric tonnes in 1995, while the aggregated HCFC consumption baseline (i.e. the average of 2009 and 2010 consumption) is 500,459 metric tonnes, almost three times that of the highest ever CFC consumption. This dramatic increase in HCFC use is coming at a time when HFCs already comprise around one percent of global GHG emissions and are the fastest growing class of GHGs. Unless HCFCs and HFCs are addressed simultaneously, the impact on the global climate will be severe.

Given the global financial crisis, it is unlikely that there is going to be a supplemental replenishment. However, countries are providing billions of dollars for fast start climate finance. As suggested by several Parties at the last OEWG, there should be substantive discussion of incentives to attract climate financing and how transitions aided by climate finance could be operationalized.

The World Bank showed recently that additional climate funding could have avoided the transition to high-GWP HFCs in China's foam sector, which consists of thousands of small and medium sized enterprises (SMEs). Using a cost-effectiveness calculation based on ODP, only enterprises that used 50 mt or more of HFC-141b for foam blowing could be cost-effectively converted to hydrocarbon blowing agents.

Under an alternative scenario where the value of the reduction of CO2e is factored in, a dramatically lower cut-off volume could be justified. Conversion of 2.8 ODP tonnes (25 mt) of HCFC-141b foam to hydrocarbon technology would result in an estimated annual reduction of 19,000 tonnes CO2e emissions. The cost per CO2e tonne at the time was US $12.5. Therefore, if the value of the CO2e reductions were factored into the cost-effectiveness calculation, for an investment of US $900,000 in cyclopentane at 10% interest and a payback time of 5 years, the annual cost of approximately US $240,000 would be "cost-effective." Even down to a consumption of 2.2 ODP tonnes (20 mt) of HCFC-141b, investments in hydrocarbons are justified if the climate benefit is included. For conversions to hydrocarbon pre-blended polyols, the threshold could be as low as 1.1 ODP tonnes (10 mt) of HCFC-141b factoring for the climate value of these conversions. Rather than following this strategy, the MLF converted the SMEs en masse to HFC-245fa.

It should be possible to demonstrate the climate abatement opportunities of HPMPs to secure climate money. The MLF could pay for conversions based on ODP and countries could provide climate money to pay for the differential above the ODP cost-effectiveness threshold for a transition based upon cost-effectiveness using GWP. There are many ways this could be structured and incentives that could be offered for a program of cost-effective, quality mitigation options.

Numerous countries are investing in forest protection, alternative energy, black carbon control, methane capture and other efforts to mitigate emissions without burdensome crediting processes. Questions include: 1) what incentives can the Montreal Protocol offer with little burden for attracting climate money to pay for greater transitions to low-GWP alternatives; 2) under what terms of reference would the ExCom be authorized to spend any climate funds that are attracted; and 3) how could a separate climate fund be structured so that it would not compete with the need for a stable and sufficient replenishment?

EIA urges the Parties to explore how climate financing could be secured to help facilitate Article 5 transitions directly from HCFCs to low-GWP alternatives and how such funding could be used to shore up the substantial projected shortfall in the HCFC phase-out.



Kyetrack Glacier, Himalayas, Tibet, base of 8201m Cho Oyu - the "Turquoise Goddess" on the Nepal border.
Credits: 1921- Major E. O. Wheeler; 2009 - David Breashears

ENDNOTES

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12. TEAP Progress Report, 61 (May 2011) *available at* http://montreal-protocol.org/assessment_Panels/TEAP/Reports/TEAP_Reports/TEAP_Progress_Report_May_2011.pdf.

13. *Supra* note 10 at 22.

14. *Supra* note 12 at 62.

15. *Id.*

16. *Id.*

17. Miller & Kuijpers, *Supplement to: Projecting future HFC-23 emissions*, 5 *available at* http://www.atmos-chem-phys-discuss. net/11/23081/2011/acpd-11-23081-2011-supplement.pdf.

18. TEAP Assessment Report 2010, 2 (2010) *available at* http://ozone.unep.org/ Assessment_Panels/TEAP/Reports/TEAP_Reports/TEAP- Assessment-report-2010.pdf.

19. *Id.* at 17.

20. *Supra* note 10 at 23.

21. *Supra* note 17.

22. Forster, p., et al., *Changes in Atmospheric Constituents and in Radiative forcing, in Climate Change 2007: the Physical Science Basis,* Contribution of Working group to the Fourth Assessment Report of the IPCC, 129–234 (2007) Cambridge Univ. Press.

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24. UNEP Risoe CDM/JI Pipeline Analysias and Database *available at* www.unepriso e.org.

25. http://www.rsc.org/chemistryworld/Issues/2007/April/CleaningUpCarbonMarket.asp (this link does not work and I don't have a title)

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27. Gujarat Fluorochemicals Analysis, Dalal Street July 23-Aug 5, 07, *available at* www.gfl.co.in.

28. Commission Regulation (EU) No 550/2011 *available at* http:// eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2011:149:0001:0003:EN:PDF

29. Samuel LaBudde, personnel communications with Dupont and Honeywell engineers.

30. Based on current production levels times costs of $0.20/tonne for incineration.

31. See Vienna Convention for the Protection of the Ozone Layer, opened for signature Mar. 22, 1985, 1513.

32. *Id.* at Art. 1(2) (emphasis added).

33. Interpreting treaties based on subsequent agreements adheres to the international legal principles of treaty interpretation set forth in Article 31 of the Vienna Convention on the Law of Treaties. *See* Vienna Convention on the Law of Treaties, opened for signatures May 23, 1969, 1155 U.N.T.S. 331 [hereinafter Vienna Convention on the Law of Treaties] at Art. 31(2).

34. *See e.g.* Montreal Protocol on Substances That Deplete the Ozone Layer, opened for signature Sept. 16, 1987, 26 I.L.M. 1550, Art. 5. (1989) (as amended 32 I.L.M. 84) (1992), at Preamble.

35. Id. at Art. 2F(7)(c)

36. Fifth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, Bangkok, Thail., Nov. 17-19, 1993, Report of the Fifth Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer, Decision V/8, UNEP/OzL.Pro.5/12 (Nov. 19, 1993) *available at* http://www.unep.org/OZONE/Meeting_Documents/mop/05mop/MOP_5.asp [hereinafter Fifth Report].

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38. In XIX/6 Parties directed the ExCom to "make the necessary changes to the eligibility criteria related to the post-1995 facilities and second conversions." To date the ExCom has not established these eligibility criteria.

39. Table 5, UNEP/OzL.Pro./ExCom/67/7

The INOX Group's Gujarat Fluorochemicals Ltd. HCFC plant in Rajitnagar, India operates in partnership with the UK-based INEOS Limted Group as a CDM HFC-23 project and is subject to long-running accusations of poisoning residents of the surrounding community. At one point a GFL Director claimed that local contamination is caused by fluorite deposits 60 miles away despite direct evidence of the company's failure to properly dispose of chemical waste.





Greenland "ice" sheet at 1500 meters showing accumulation of particulates that absorb heat and accelerate melting. Diminishing albedo is contributing to a circumstance where "it is reasonable to expect 100% melt area over the ice sheet within another similar decade of warming" at which point the Greenland Ice sheet "will be tipped into a state of inevitable decline". Photo: Jason Box, OSU

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Front cover photo: Clint Spencer