EXPERIENCE WITH THE USE OF TRADE MEASURES IN THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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This paper is also available in French.

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PREFACE

The Joint Session of Trade and Environment Experts began a work programme analysing the use of trade measures in multilateral environmental agreements in June 1996. The first paper, "Experience with the Use of Trade Measures in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)", has been published as OCDE/GD(97)106. This paper constitutes the second paper in this series to be published. A third paper dealing with the use of trade measures in the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal is in progress.

1. INTRODUCTION

Ozone was first discovered in 1840. It was first detected in the earth's stratosphere around 1880. Chlorofluorocarbons (CFCs) were first produced in Belgium in 1892, and discovered by General Motors in the US in 1929 to be an effective heat transfer fluid (Brack, 1996, p.5). In 1974 the theory was advanced that chlorofluorocarbons (CFCs) may destroy significant amounts of stratospheric ozone. CFCs were banned as propellants in non-essential aerosols in the US in 1978. Shortly after the Vienna Convention for the Protection of the Ozone Layer was opened for signature in 1985, the British Antarctic Survey presented evidence of the "hole" in the ozone layer over Antarctica. The Montreal Protocol entered into force in 1989, providing for the phase out of substances that deplete the ozone layer. Subsequent amendments and adjustments added more substances and sped up the phase-out schedules. By the Ninth meeting of the Parties of the Montreal Protocol in September 1997, one headline read "Phew, the ozone layer may be saved"[1].

In the space of a decade, the world has substantially reduced its use of chemicals previously considered indispensable for a multitude of uses. Recent scientific evidence indicates that there is a slowing in the rate of ozone depleting substances entering the atmosphere. Assuming that all countries continue to meet the Protocol phase out timetable, it is expected that upper atmosphere ozone depletion will stabilise by about 2000, and recover by about 2040[2]. This has led many commentators to describe the Vienna Convention and its Montreal Protocol as one of the most successful environmental protection agreements in the world.

The ozone layer is one of the few examples of a truly global environmental resource. The ozone layer protects all life on earth. It is the classic example of a public good: no-one can be denied access to its benefits; and its use by one does not diminish its availability for use by others. The tragedy of the commons therefore applies - in the absence of international co-operation there will be inadequate market incentives to protect the resource which is however essential to the common good. Moreover, emissions of ozone depleting substances cause the same amount of damage to the ozone layer wherever on earth they are released. A global response was therefore required, and the Montreal Protocol has now been ratified by 163 countries.

The Montreal Protocol has introduced several very important innovations into international environmental law. Four main ones are its financing mechanism, its close formal integration of scientific, economic and technological factors; its procedure for progressive tightening of controls, and its compliance procedures. In addition, its use of trade restrictions was novel. While trade measures have long been used in various forms of environmental and other agreements, the Montreal Protocol is the first that uses trade measures as part of such a comprehensive and integrated policy package addressing a truly global problem. Indeed as the Protocol is being implemented and ODS are being phased out, new kinds of trade measures are still being proposed to help deal with residual problems such as illegal trade.

This paper concentrates on the trade measures and their effectiveness. It is not possible to treat them in isolation however from the whole system. So Section 2 surveys the environmental and industrial context. Section 3 describes the main features of the Montreal Protocol, including the trade measures. Section 4 concentrates on the purposes and effectiveness of the trade measures, while Section 5 looks at compliance issues. Developing country aspects are briefly discussed in Section 6, before some concluding remarks.

2. ENVIRONMENTAL AND INDUSTRIAL CONTEXT[3]

The thin layer of ozone in the stratosphere, located between 10 and 50 kilometres above the Earth, absorbs all but a small fraction of the harmful ultraviolet radiation (UV-B) emanating from the sun and protects all life on earth (Ozone Secretariat 1997). In the early 1970s, scientists suspected that the presence of chlorine in the atmosphere, caused by the release of CFCs, might cause damage to the ozone layer. The seminal research of Mario Molina and Sherwood Rowland of the University of California, Irvine, in 1974 showed that when certain chemicals, particularly chlorofluorocarbons (CFCs), were released into the atmosphere, they were not chemically broken down or rained out in the biosphere or troposphere, but because of their stable chemical structure, they persist and migrate up to the stratosphere[4]. There they decompose by a chemical interaction catalysed by ultra-violet radiation which causes a release of large quantities of chlorine followed by a chain of chemical reactions which destroy the ozone (Twum-Barima and Campbell 1994, p.7).

Observations of the atmosphere since then have proved that ozone was being depleted at the rate of about 5 per cent every decade over middle and higher latitudes of the Earth, and that an "ozone hole" appeared annually over the Antarctic (Ozone Secretariat 1997, p.1). In 1995 for example, the ozone hole covered an area of 22 million square kilometres, roughly twice the surface area of Europe. In 1996 the ozone hole over the Antarctica was the longest lasting on record, beating the previous record of 77 days duration in 1995. A 1 per cent decrease in stratospheric ozone results in a 1-2 per cent increase in UV-B radiation. This is equivalent to 100 000-150 000 additional cases of cataracts world-wide each year, or a 2 per cent increase in some forms of skin cancer (Brack, 1996, p.9).

Increased UV-B radiation would increase the incidence of human skin cancer and eye diseases and cataracts, adversely affect immune systems in living organisms, inhibit plant growth and crop yields, kill aquatic organisms that are important part of the marine food chain (some 30 per cent of the world's animal protein comes from the sea), and cause many materials used outdoors, such as plastics, paints and wood, to degrade more rapidly. In addition, changes in ozone levels in other altitudes could influence temperature structures and circulation patterns of the stratosphere, with major implications for the global climate (Twum-Barima and Campbell 1994, p.7).

The Montreal Protocol provides for significant reductions in the production and consumption of certain chemicals, namely chlorofluorocarbons (CFCs), halons, carbon tetrachloride, methyl chloroform, hydrochlorofluorocarbons (HCFCs), hydrobromofluorocarbons (HBFCs) and methyl bromide.

CFCs are used as aerosol propellants, blowing agents for foams, coolant in refrigerators and air conditioners, solvents in electronics production, for dry cleaning and metal degreasing. Halons are used mainly in commercial and military fire protection systems; methyl chloroform as a solvent; carbon tetrachloride as a chemical feedstock for CFC production; methyl bromide as a pesticide and a fumigant for soil and agricultural products; and HCFCs and HBFCs as substitutes for CFCs. CFCs are extremely useful chemicals: they are cheap to produce, non-toxic, non-flammable and chemically stable.

Consequently, the scientific findings were not welcome from the industrial and economic perspective. There was also initial scepticism and anxiety from politicians and fellow scientists concerning the science of ozone depletion. While in retrospect it may seem that phasing out ozone depleting chemicals was fairly straightforward, that was not the view at the time. A series of case studies performed in the US concluded that many US industries were able to eliminate the use of CFCs more quickly, at lower cost, or with greater environmental benefits than had been predicted.

In 1987, US industries used one-third of all CFCs produced world-wide--and US companies sold more than $500 million worth of the chemicals every year. Goods and services involving CFCs were worth $28 billion annually, and more than $128 billion of installed equipment relied on CFCs. The inexpensive, non-toxic, non-flammable compounds had become integral to everything from refrigeration to electronics manufacturing. Industries uniformly argued that no acceptable, economically viable alternatives existed, that adopting any substitutes would be costly and slow-going, and that product performance would suffer. But the worst never happened and a different picture emerges as we look back on efforts to meet the Montreal Protocol's phase-out requirement. (Cook, 1996a, p.1)

Reflecting the scientific uncertainty and the economic costs of adjustment of abatement policies, international efforts initially focused on intensifying research and information exchange. The UNEP sponsored "World Plan of Action on the Ozone Layer" was agreed in 1977, focusing on further research. Negotiations for an international agreement to curb CFC use started in 1981, but proceeded quite slowly. The US, having banned the use of CFCs as aerosol propellants in non-essential applications in 1978, proposed international controls on CFC use in various sectors, starting with aerosols. Canada, Sweden and Norway had also taken similar measures domestically. The EC preferred to limit CFC production capacity more generally. No agreement on phase-out strategies was reached by the time the Vienna Convention for the Protection of the Ozone Layer was agreed in March 1985.

Through the Vienna Convention, governments committed themselves to protect the ozone layer and to co-operate with each other in scientific research and information exchange to improve understanding of atmospheric processes, and technical and economic aspects. Importantly, it also established the procedural rules for future protocols to be developed under the framework of the Vienna Convention. The Vienna Convention is a framework convention -- it did not itself establish controls on ozone depleting substances. Working Group negotiations began immediately after the Vienna Convention was agreed to continue the search for agreement on binding controls.

Many commentators have pointed to the strong impetus given to "ozone diplomacy" by the scientific discovery of the hole in the ozone layer over the Antarctica, just two months after the Vienna Convention was agreed. This dramatic event helped mobilise public opinion, and industry began to accept the inevitability of controls on ozone depleting substances. Dupont, the major US CFC producer announced in October 1986 that alternatives to the main CFCs could be on the market in volume within five years, given appropriate incentives. By September 1987 the Montreal Protocol had been agreed under the general framework of the Vienna Convention, providing for substantial cuts in CFC production and consumption.

3. OUTLINE OF THE MONTREAL PROTOCOL

The various policy instruments used in the Montreal Protocol as amended at successive Meetings of the Parties constitute an integrated approach designed to contract, then close down the industries producing ozone depleting substances world-wide while minimising adjustment costs, particularly for developing countries. While the policy instruments are interrelated, they are described here under the categories of production and consumption controls; trade measures; and financial assistance.

3.1 Production and Consumption Controls

The core control mechanism of the Protocol is the phase-out schedules for production and consumption of ozone depleting substances. There was a strong debate leading up to the Protocol as to whether consumption or production capacity should have been regulated. In order to avoid commercial advantage flowing disproportionately to any particular region, it was concluded that the most equitable method was to control both.

The original Montreal Protocol provided for controls on eight chemicals - five CFCs and three halons. Both production and consumption of the CFCs were to be cut by 50 per cent from 1986 levels by 1998, while production and consumption of the three main halons were frozen at 1986 levels from 1993. Interim reductions on the way to the end-point were also specified. In subsequent agreements, new chemicals have been added and the phase-out schedules have been progressively tightened, in some cases dramatically. Meetings of the Parties at London in 1990, Copenhagen in 1992, Vienna in 1995 and Montreal in 1997 have each brought forward deadlines and broadened the coverage to other ozone depleting substances (ODS). Since the Vienna Convention the ozone regime has explicitly committed itself to continued review of the evidence with a view to accelerating the phase-out of ozone depleting substances.

The following table provides an outline of the phase-outs as first agreed, and the current phase-out agreements following the most recent Meeting of the Parties in Montreal, September 1997.

The category of “developing countries” in the context of the Montreal Protocol refers more precisely to countries operating under Article 5 of the Protocol, that is a Party that is a developing country and whose annual calculated level of consumption of the controlled substances is less than 0.3 kilograms per capita. (The terms developed and developing countries or Parties are used synonymously with non-Article 5 and Article 5 countries or Parties, respectively, in this paper.)

An important procedural innovation introduced into the Montreal Protocol has facilitated the acceleration of the phase-out schedules. Changes to the control schedules are defined as “adjustments”, and once they are agreed by the Meeting of the Parties (in theory by majority voting, but in practice by consensus) they are binding on all parties to the Protocol six months after their adoption. Adding new chemicals to the control regime, or changes to an Article or addition of a new Article, requires an “amendment” to the Protocol. Under Article 9 of the Vienna Convention a two-thirds majority of the parties must ratify amendments before they enter into force, except as may be otherwise provided in such an amendment (e.g. amendments so far have specified a threshold of 20 ratifications before entry into force). Only parties to the particular amendment are bound by it.

Production is defined as total production minus the amount destroyed by approved technologies minus the amount used as feedstock (in chemical processes which transform the chemical nature of the controlled substance). Consumption is defined as production plus imports minus exports. The formula applies to the basket of like chemicals grouped together in the Annexes to the Protocol, weighted according to their ozone depleting potential. For example, the five main CFCs are listed in Group I of Annex A, and the phase out of production and of consumption is applied to the five chemicals in aggregate. This means that within the group, during the transition period, the chemicals most easily replaced by substitutes could be phased out first, reducing the overall cost of the phase-out.

Table 1. SUMMARY OF MONTREAL PROTOCOL MEASURES

SUBSTANCES (BASE LINE)	**DEVELOPED COUNTRIES**		**DEVELOPING COUNTRIES**
	Initial Schedule	***Current Schedule****	***Current Situation***
CFCs 11,12,113,114,115 (1986) Annex A, Group I	50% cut by 1998 (Montreal)	Phased out end of 1995[a] (Copenhagen)	Total phase out by 2010
Halons 1211,1301,2402 (1986) Annex A, Group II	Freeze from 1993 (Montreal)	Phased out end of 1993 (Copenhagen)	Total phase out by 2010
10 other CFCs (1989) Annex B, Group I	-20% by 1993 (London)	Phased out end of 1995 (Copenhagen)	Total phase out by 2010
Carbon tetrachloride (1989) Annex B, Group II	-85% by 1995 (London)	Phased out end of 1995[a] (Copenhagen)	Total phase out by 2010
Methyl chloroform (1989) Annex B, Group III	Freeze in 1993 (London)	Phased out end of 1995[a] (Copenhagen)	Total phase out by 2015
HCFCs - 40 substances (1989 plus 2.8% of 1989 CFC consumption) Annex C, Group I	Freeze from beginning of 1996 (Copenhagen)	Cut by 99.5% in 2020[b] and phase out by 2030 (Vienna)	Freeze in 2016 at 2015 base level Total phase out by 2040
HBFCs Annex C, Group II		Phased out end of 1995 (Copenhagen)	Phase out in 1996 (no identified uses) (Vienna)
Methyl bromide (1991) Annex E	Phase out by 2010 (Copenhagen)	Phase out by 2005[C] (Montreal II)	Freeze by 2002 at 1995-98 base level and phase out by 2015 (Montreal II)

* Only final phase-out dates are listed here for simplicity but interim reductions also applied.

[a] With the exception of a very small number of internationally agreed essential uses that are considered critical to human health and/or laboratory and analytical procedures, and use in solid rocket motors.

[b] .0.5% consumption is allowed between 2020 and 2030 for the servicing of refrigeration equipment and air-conditioning equipment.

[c] Exemptions for “critical uses”. Interim reductions for developed countries of 25% by 1999, 50% by 2001 and 70% by 2003.

Montreal = agreed at 1987 Conference
Copenhagen = agreed at 1992 Meeting of Parties
Vienna = agreed at 1995 Meeting of Parties
Montreal II = agreed at 1997 Meeting of Parties

There are several important nuances to these controls. First, developing countries were given a ten year transition period beyond the commitments made by the developed countries in Article 5. While the developing countries did not participate very much in the early negotiations of the Protocol, the view was taken that this grace period would cushion the economic impact of moving to higher cost substitutes, and would not have a substantial additional adverse impact on the ozone layer as Article 5 countries are, by definition, low consumers of ODS. Second, "essential uses" were exempt, subject to periodic review. Third, in order to assure supplies for developing countries without encouraging the establishment of new production facilities, developed countries were allowed to produce fifteen per cent above their scheduled limits to meet the basic domestic needs of developing countries. This provision means that exports from developed to developing countries to meet basic domestic needs is still legal, up to specified limits.

Fourth, recognising the problems that would arise as production was reduced and individual plants fell below viable economies of scale, there is provision for a transfer of production between parties, so long as the combined total production does not exceed that permitted by the control schedules. This is known as "industrial rationalisation". Up to fifteen per cent extra production above the control schedules is permitted for the basic domestic needs of developing countries and/or the industrial rationalisation provisions. Fifth, recycled and re-used amounts are not considered as production, obviously designed to encourage recycling and re-use. Lastly, from 1993, exports to non-Parties could no longer be deducted and would be included in a country's calculated level of consumption. This was designed to encourage exporting countries to persuade their customer countries to join the Protocol.

Beyond specifying the formula, its exceptions and the phase-out schedule, the Protocol does not specify the precise policy measures that each country should implement to achieve the agreed outcomes. It lays down the required end results, but not the means of reaching them. Consequently a wide range of policy measures have been used in different countries to meet the obligations of the Protocol. These include taxes on ODS, tax breaks for substitutes, production quotas, import quotas (sometimes tradable), import bans, import, export and manufacture licensing, product labelling requirements, technical product standards, consumption bans, voluntary agreements with industry, and promotion of substitutes. Trade measures have been included in the mix of policy instruments used, as controlling domestic production and consumption also entails controlling exports and imports to some degree. At the very least, there is a requirement to monitor and collect data on imports and exports to meet the reporting requirements of Article 7 of the Protocol.

The continuing scientific, economic and technological assessments built into the working processes of the Montreal Protocol have underpinned the progressive broadening and deepening of the ozone regime. At the First Meeting of the Parties in Helsinki in 1989, the establishment of four panels of experts was endorsed. They were the Scientific Assessment Panel, the Technological Assessment Panel, the Economic Assessment Panel[5] and the Environmental Effects Assessment Panel. Reports from these panels are used as the basis for reaching decisions on necessary and feasible control actions. They generate the information on the environmental impacts of ozone depletion, the state of the ozone layer, and the availability and economics of alternative technologies for replacing the controlled substances. The evolution of these findings, and the resulting changes in the Protocol, have been documented elsewhere [see Benedick (1991), Brack (1996) and Twum-Barima and Campbell (1994)]. The unprecedented integration of scientific, technological and economic expertise in an environmental regime has also been subject to discussion in the literature [see Benedick (1991), Parson and Greene (1995) Ulfstein (1996) and Szèll (1991)]. This underpinning has contributed to the effectiveness and the legitimacy of the Protocol.

3.2 Trade Measures

The only explicit restrictions on trade contained in the Montreal Protocol concern trade with non-Parties; a recently-agreed commitment to institute a licensing system for trade between Parties; and a recently agreed export ban on used and recycled substances applying to Parties in non-compliance with phase-out schedules. The Party/non-Party trade measures were designed to deal comprehensively with party/non-party trade in all manifestations of ODS--the chemicals; and potentially products containing them, products made with them, and technologies to produce or use them. A summary of the trade measures with respect to the various categories of ODS is given in Box 1 below, and further elaborated in the text following.

a) Controlled substances

The first category of trade restrictions in Article 4 of the Protocol, "Control of Trade with Non-Parties" is a ban on imports (Article 4.1) and exports (Article 4.2) of the controlled substances between Parties and non-Parties, unless non-Parties are determined by the Parties to be in full compliance and have submitted data to that effect (Article 4.8). The importation of Annex A substances, the main CFCs and halons, from non-Parties was banned from 1990, one year after the Protocol entered into force. Importation from non-Parties of Annex B substances (carbon tetrachloride, methyl chloroform and other CFCs) was banned as of August 1993, being one year after the London Amendment came into effect. Imports of Annex C Group II substances (HBFCs) were banned from June 1995, one year after the Copenhagen agreement came into effect. Imports of Annex E substances (methyl bromide) from non-Parties shall be banned within one year of the date of entry into force of the amendment agreed at the 1997 Meeting of the Parties.

Exports to non-Parties were initially banned only from Article 5 (developing) countries, but this distinction was removed in the London and Copenhagen Amendments, which adopted outright export bans to non-Parties for all Parties.

The text of Article 4 has become rather complicated as it reflects the amendments adding new substances to the control schedules each with different dates of effect. Each amendment adding new substances to be controlled needs to be ratified separately by the Parties. A party to the Protocol that has not ratified a subsequent amendment is treated as a non-Party for the purposes of trade in the relevant substances controlled by that particular amendment. The current situation with respect to ratifications is the following: 166 countries have ratified the Vienna Convention; 163 have ratified the Montreal Protocol; 116 its London Amendment and 72 the Copenhagen Amendment.

b) Products containing controlled substances

As well as the ban on trade with non-Parties in the controlled substances themselves, Article 4 also deals with products **containing** the controlled substances. Article 4.3 of the original Montreal Protocol required the Parties, within 3 years of entry into force, to elaborate in an annex a list of products containing controlled substances in Annex A, i.e. CFCs and halons. Parties not objecting to the annex were to ban the import of these listed products from non-Parties to the Protocol within one year of the annex having become effective. Analogous sub-paragraphs were added to Article 4.3 to require the same procedure for products containing ozone depleting substances that were subsequently added to the Protocol's control system. An important exception is the recent decision on methyl bromide, which did

not include a provision for banning trade with non-Parties in products containing methyl bromide. This was in recognition of the fact that the TEAP was unable to identify any such products **containing** methyl bromide in the full sense. Methyl bromide is widely used as a pesticide and a fumigant. Trace residuals may occur in some agricultural products, arising from the use of methyl bromide as a fumigant in storage or transport vessels, but this would be very difficult to verify. It is practically impossible to verify if

Box 1. Summary of Trade Measures Taken to Date under the Montreal Protocol

(a) Control of trade in ODS with non-Parties

(i) Annex A substances (main CFCs and halons):

- Import from non-Parties banned from January 1990.
- Export banned from January 1993.

(ii) Annex B substances (carbon tetrachloride, methyl chloroform and other CFCs):

- Import and export banned from August 1993 for non-Parties to the London Amendment.

(iii) Annex C - Group II (HBFCs):

- Import and export banned from June 1995 for non-Parties to the Copenhagen Amendment.

(iv) Annex E (methyl bromide)
Ninth Meeting of parties in 1997 bans import from and export to non-Parties within one year of entry into force of amendment.

(b) Control of Trade in Products Containing ODS with non-Parties

- Import of products (listed in Annex D) containing Annex A substances banned from May 1992.

- List of products containing Annex B and Annex C, Group II, substances not drawn up

(c) Products made with but not containing ODS

- Fifth Meeting of the parties decided that it was not feasible to ban or restrict trade in products made with but not containing Annex A substances.

(d) Licensing Systems to be established for trade between Parties by 2000.

(e) Parties in a situation of non-compliance for a particular substance required to ban export of used, recycled and reclaimed quantities of that substance.

methyl bromide has been used **during** the production process. Trade measures on these bases were therefore not pursued. Trade with non-Parties of cylinders and cans which contain methyl bromide is banned however.

A list of products containing Annex A Group I CFCs and halons was indeed drawn up as Annex D to the Protocol. It listed six categories of products: automobile and truck air-conditioning units; domestic and commercial refrigeration and air conditioning/heat pump equipment; aerosol products (except medical aerosols); portable fire extinguishers; insulation boards, panels and pipe covers; and pre-polymers. The Annex entered into force in May 1992, and within one year, Parties who had not objected to the list were required to ban the import of these listed products containing Annex A substances from non-Parties.

Lists of products containing Annex B and Annex C ozone depleting substances were not however drawn up. In the event, the substances themselves were due to be phased out before the product import bans would have come into effect. Furthermore, by then the main producers had joined the Protocol, so an import ban on products containing these ODS from non-Parties was decided to be more cost and effort than it was worth in terms of benefit to the ozone layer.

At the most recent meeting of the Parties in September 1997, the question of controlling **exports** of products containing ODS was revived. A proposal was put by the African group of countries who saw imports of products containing CFCs such as used refrigerators as prolonging their dependence on outdated technologies, with future adjustment costs outweighing immediate benefits of the use of the products. No binding commitments were entered into, but the Parties agreed in Decision IX/9:

> "1. To recommend that each Party adopt legislative and administrative measures, including labelling of products and equipment, to regulate the export and import, as appropriate, of products, equipment, components and technology whose continuing functioning relies on supply of substances listed in Annexes A and B of the Montreal protocol, in order to avert any adverse impact associated with the export of such products and equipment using technologies that are or will soon be obsolete because of their reliance on Annex A and Annex B substances, and which would be inconsistent with the spirit of the Protocol .
>
> 2. To recommend to non-Article 5 Parties to adopt appropriate measures to control, in co-operation with the importing Article 5 Parties, the export of used products and equipment, ...whose continuing functioning relies on supply of substances listed in Annexes A and B of the Montreal Protocol."

These concerns about dependence on obsolete technologies demonstrate that the strategy of two-track phase-out schedules for developed and developing countries does have some disadvantages as well as advantages for developing countries. The long grace period induces a division in the world market between those using primarily old, and those using primarily new, substances and technologies. Trade between the two groups can then give rise to some tensions. Concerns about being a market for products based on obsolete technologies is one form of tension, another is the fear of losing industrial competitiveness by not adopting leading edge products and production methods.

c) Products made with, but not containing, controlled substances

The third category of trade restrictions foreseen by the Protocol covers products **made with, but not actually containing**, ozone depleting substances. Article 4.4 required the parties to determine the feasibility of banning or restricting imports from non-Parties of products produced with but not containing controlled substances, within five years of the entry into force of the Protocol. This approach was in recognition of the fact that a huge range of products were then produced using CFCs in some way, from electronics to flash frozen food. If determined feasible, a list of these products was to be put in an annex to the Protocol, and Parties not objecting to the list were to ban their import within one year of the annex coming into effect. As new ozone depleting substances were added to the Protocol, corresponding provisions were also added to Article 4.4 requiring determinations of feasibility for controlling trade in products made with but not containing those respective categories of substances. No provision was made for determining the feasibility of restricting trade in products made with but not containing methyl bromide with non-Parties.

The feasibility of restricting trade in products made with but not containing ODS was examined by the Technology and Economic Assessment Panel (TEAP) in 1993. Their report noted that in some cases of ODS being used in manufacturing processes it would be technically possible, although highly expensive to detect trace residues of the ODS. In other cases, such as where CFCs had been used as solvents in electronics production, ODS would be undetectable. The range of products potentially produced with the controlled ODS was still huge. The conclusion reached was that the costs of detecting the very small amounts of ODS used to make each product greatly outweighed the benefit to the ozone layer, and therefore the TEAP did not recommend consideration of trade measures along these lines. The Parties accepted this recommendation not to proceed at the Bangkok 1993 Meeting, while requesting the TEAP to review the issue at regular intervals.

The hypothetical but unlikely situation remains therefore that this category of trade measures could be activated in future.

d) Technology for producing and using controlled substances

The original Montreal Protocol addressed the issue of technology by discouraging the export to non-Parties of technology for producing and for using ODS (Article 4.5). Parties also agreed to refrain from providing new subsidies, aid credits, guarantees or insurance programmes for exports to non-Parties of products, equipment and technology that would facilitate the production of ODS (Article 4.6). Equipment for recycling, recovery, destruction or containment of ODS, or for development of alternatives, was explicitly excluded from both these provisions (Article 4.7). These provisions have also been applied with respect to methyl bromide.

e) Licensing Systems

As illegal trade in ODS, especially CFCs, has emerged as a serious problem undermining the Protocol's controls, proposals were put to the 1997 Montreal Meeting of the Parties to tackle this problem. A proposal to require Parties to license each import and export of controlled substances was adopted. This requirement is to become binding at the start of the year 2000 or within three months of the date of entry into force of the Montreal amendment, whichever is the later. However in relation to export and import of HCFCs and methyl bromide, developing countries may delay the introduction of a licensing system until

2005 and 2002 respectively. Many Parties already have licensing systems in place as a method of complying with the controls on consumption and production of ODS. Making such systems mandatory is aimed at improving the integrity of global information on trade in ODS. Trade is still legal between Parties under several situations, e.g. in recycled substances and to meet the basic domestic needs of developing countries, which provides opportunities for fraudulent trade to occur under cover of a legitimate reason (see Section 5.3 below).

A related proposal that trade in controlled substances be banned with Parties which do not comply with the requirement to implement a licensing system, (as an enforcement mechanism) was not accepted by the Parties in Montreal.

f) Export of used, reclaimed and recycled ozone-depleting substances

Another trade restriction adopted by the Parties at Montreal in September 1997 prohibits a Party that is continuing to produce a controlled substance after its phase-out date from exporting used, recycled or reclaimed substances of that same substance. This measure is also aimed at better controlling illegal trade, specifically that emanating from Parties not in compliance with the relevant control schedules. It is intended to help prevent the export of new substances under the guise of recycled substances, trade in which is exempt from the Protocol's controls on production and consumption. This measure is also intended to ensure that those countries which continue to produce a substance while in non-compliance with the phase-out schedules for that substance, use their existing supplies of recycled, reclaimed or used substances for their domestic market needs rather than trading these supplies internationally.

3.3 Financial and Technical Assistance

The Montreal Protocol has produced the outstanding example of integrating financial and technical assistance for developing countries into an international environmental protection regime. Article 5.5 states that "developing the capacity to fulfil and implement the obligations of Article 5 Parties "will depend upon the effective implementation of the financial co-operation as provided by Article 10 and transfer of technology as provided by Article 10A".

The Second Meeting of the Parties in 1990 in London agreed to create an Interim Multilateral Fund to pay "the agreed incremental costs" of adherence to the Protocol for Article 5 developing countries. The Fund was formally established in December 1992. The assistance funded includes country programme preparation to identify the needs of Article 5 countries, the facilitation of technical co-operation to meet those needs, the dissemination of information and training, the facilitation and monitoring of opportunities for bilateral and regional co-operation and the financing of investment projects.

Initially funding of $160 million was set for the Multilateral Fund for 1991-93, and an extra $80 million was assessed to cover the accession of India and China. A further $510 million was agreed for 1994-96; and a further replenishment of $540 million for 1997-99. Non-Article 5 countries contribute to the Fund according to the UN assessment scale. Only high ODS-consuming Article 5 countries make contributions to the Fund. Non-Article 5 Parties have the option of making up to 20 per cent of their contributions available in the form of direct bilateral assistance to Article 5 countries.

The Fund's Executive Committee approves the country programmes and the specific projects proposed to reduce use of ODS. The Executive Committee consists of fourteen members, seven

representatives each from Article 5 and non-Article 5 countries. The chairmanship and vice-chairmanship rotate between developed and developing countries. The goal is to reach decisions by consensus, but there is also a voting procedure requiring a two thirds majority from each group.

Four agencies assist in the implementation of the Fund: UNEP, UNDP, UNIDO and the World Bank. Article 5 countries use one of these agencies to prepare a study of their sources and uses of ODS, and reduction strategies. At the 1997 Ninth Meeting of the Parties, the following information was provided by the implementing agencies:

- The World Bank's current project portfolio amounted to $US250 million, approximately half of the Fund resources allocated to date. That sum would be used to phase out over 50 000 ODP tonnes (Ozone Depletion Potential weighted) out of around 200 000 tonnes remaining in use in Article 5 countries.
- UNDP had a portfolio under the Fund amounting to $US158 million, which would eliminate 20 130 ODP tonnes per annum of ODS. As of the end of June 1997, UNDP had disbursed $62 million, in 225 projects. UNDP had 21 ongoing institutional strengthening projects to assist recipient Governments in their efforts to formulate national policies, to accelerate ODS phase-out and to monitor implementation of their country programmes.
- The UNIDO programme to date consisted of nearly 260 projects in 58 countries with a total value of $111 million. When concluded these projects would phase out more than 15 356 metric tonnes of ODS. UNIDO was exploring the development of new initiatives in areas that included alternatives to methyl bromide.
- UNEP's Industry and Environment Centre had assisted 75 countries with the development of their country programmes and was providing institutional support to 49 of them. The Industry and Environment Centre also runs the clearing-house programme funded by the Multilateral fund called OzonAction (see below). (Report of the Ninth Meeting of the Parties)

Separately and in addition to the Multilateral Fund, the Global Environmental Facility includes activities to reduce ozone layer depletion as one of its four focal areas. It is available for countries with economies in transition (which are not eligible for assistance from the Fund, being non-Article 5 Parties). Approved GEF projects totalling nearly $US120 million were helping to eliminate annual consumption of up to 45 000 tonnes of ODS in 11 countries. Six additional ozone projects are in the final stages of preparation, and more would follow as soon as remaining eligible countries had joined the Protocol. (Report of the Ninth Meeting of the Parties)

Given the unprecedented nature of this multilateral effort to provide financial assistance in support of an environmental policy, it is not surprising that there have been problems in implementation. The main issue has been the pace with which funds have been disbursed, particularly in the initial years. Efforts to streamline the procedures and reduce delays are still being made[6].

As concerns technology, non-Article 5 Parties have pledged to ensure that appropriate technology should be made available on 'fair and most favourable conditions'. This formulation is less forthcoming than the developing countries' desire for technology transfer on 'preferential and non-commercial terms'. The debate on the terms and conditions of technology diffusion for implementing the commitments of the Montreal Protocol is an ongoing one.

In practice, technology diffusion and related technical assistance have been delivered through the investment projects approved by the Multilateral Fund, through bilateral assistance programs, and the OzonAction program implemented by UNEP. Box 2 below describes the technology clearing house,

training and information services provided by UNEP's Industry and Environment Office. (For further discussion of lessons in technology transfer under the Montreal Protocol see Shende and Gorman 1997).

Box 2: OzonAction

Since 1991, the UNEP IE Ozon Action Programme in Paris has been strengthening the capacity of governments (especially National Ozone Units) and industry in developing countries to make informed decisions on technology and policy options that will result in cost-effective ODS phase-out activities with minimal external intervention. The Programme accomplishes this by delivering a range of need-based services, including:

Information Exchange

to enable decision makers to take informed decisions on policies and investments. Information and management tools already provided for developing countries include the OzonAction Information Clearinghouse (OAIC) diskette and the World Wide Web site, a quarterly newsletter, sector-specific technical publications for identifying and selecting alternative technologies, policy guidelines and a query response service.

Training and Networking

that provide platforms for exchanging experiences, developing skills, and tapping the expertise of peers and other experts in the global ozone protection community. Training and network workshops build skills for implementing and managing phase-out activities, and are conducted at the regional level (support is also extended to national activities). The Programme currently operates seven regional and sub-regional Networks of ODS Officers comprising more than 80 countries, which have resulted in member countries' taking early steps to implement the Montreal Protocol.

Country Programmes and Institutional Strengthening

that support the development of national ODS phase-out strategies and programmes, especially for low-volume ODS-consuming countries. The Programme currently assists 74 countries in the development of their Country Programmes and implements Institutional-Strengthening projects for 50 countries.

SOURCE: OzonAction Website: http://www.unepie.org/ozonaction.html

4. PURPOSE AND EFFECTIVENESS OF THE TRADE MEASURES

As the purpose of the Vienna Convention and the Montreal Protocol is quite clear-cut, it is relatively straight forward to measure the effectiveness of the Convention in achieving its environmental objectives. Separating out the contribution made by the trade measures to achieving the overall environmental outcomes is however not at all straightforward. Some specific purposes or objectives of the trade measures can be identified, namely promoting universal participation and avoiding industrial relocation. However even here the situation is not one where a single policy instrument is targeted at a single objective: multiple policy instruments are targeted at even these narrower objectives of the trade measures.

The approach taken here is to summarise the evidence so far available on the environmental achievements of the Montreal Protocol. Then the narrower objectives of the trade measures are examined, as are the contributions of the relevant policy instruments to achieving these. Finally, some other aspects of effectiveness are examined.

4.1 Environmental Effectiveness of the Montreal Protocol

The objective of the Montreal Protocol and the Vienna Convention is "to take appropriate measures to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer". To this end, the Parties are "Determined to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the **ultimate objective of their elimination** on the basis of developments in scientific knowledge, taking into account technical and economic considerations and bearing in mind the developmental needs of developing countries" (Preamble to the Montreal Protocol: emphasis added).

Working from cause to effect, at least four indicators of environmental effectiveness could be examined: levels of production and consumption of ODS; the chlorine loading in the atmosphere; the state of the ozone layer; and the reduction in harmful effects of increased radiation.

a) Production and Consumption of ozone depleting substances

Detailed information by country and by controlled substance is required to be reported to the Ozone Secretariat. As of August 1997, 113 out of 161 countries had reported data for 1995, and only 43 had reported data for 1996. This data has not yet been published in aggregate form, although individual country data for each group of substances is available on the Internet up to 1994[7]. Aggregate data for 1993 show approximately a 70 per cent reduction in production and consumption of CFCs and halons in developed countries from the base year, but increases in developing countries. Globally there had been a reduction of about 60 per cent in CFC and halon production and consumption by 1993. (Brack 1996, p.28) That figure should now be lower, but official statistics are unavailable.

Table 2 below shows changes in the consumption of ODS for selected countries from 1986 to 1994.

As can be seen, production and consumption of ODS while greatly reduced has not been eliminated. Some essential uses remain even for CFCs and halons. Production is still allowed in developed countries (up to 15 per cent of relevant production base-lines) for supplying developing countries' basic domestic needs. Phase-out deadlines are well in the future still for developing countries, and for some ODS overall.

The situation of HCFCs and methyl bromide is especially complicated. HCFCs have been subject to controls since the Copenhagen Amendment, but are not scheduled to be phased out until 2020 (2040 in developing countries) in recognition of the fact that they have been used as substitutes to the more damaging CFCs. While the ozone depleting potential of CFC-11 is 1.0, that of HCFCs is 0.11 or less. This is because most of the HCFCs released at ground level are destroyed in the lower atmosphere before they reach the stratospheric ozone layer. HCFCs are used in particular as CFC substitutes for

Table 2. Consumption of Chlorofluorocarbons and Halons in Selected Countries, 1986 and 1994[1]

Country of Region	Use		Change
	1986	1994	
	(tons weighted by substance's ozone-depleting potential[2])		(per cent[3])
China	46 600	90 900	+ 95
European Comm./Union	343 000	39 700	- 88
Russia[4]	129 000	32 600	- 75
Japan	135 000	19 700	- 85
South Korea	11 500	13 100	+ 15
Mexico	8 930	10 800	+ 21
Brazil	11 300	7 780	- 31
Thailand	4 660	7 230	+ 55
India	2 390	7 000	+193
Argentina	5 500	4 950	- 10
Canada	23 200	4 850	- 79
Malaysia	3 840	4 760	+ 24
Philippines	1 920	4 010	+ 109
Australia	18 600	3 890	- 79
Venezuela	4 590	3 130	- 32
Indonesia	1 710	2 880	+ 69
South Africa	18 700	2 420	- 87
Poland	10 600	1 680	- 84
Ukraine	1 850	1 530	-17
United States	364 000	-91	- 100

Source: French (1997, p.166), taken initially from "The Reporting of Data by the Parties to the Montreal Protocol on Substances That Deplete the Ozone Layer," UNEP, Nairobi, 12 September 1996.

1 "Consumption" is production (the amount of a substance produced in a year plus stock at the end of the year minus stock at the beginning of the year) plus imports minus exports minus feedstock use. Thus, if a lot of stockpiled material is used as feedstock to make other chemicals, the consumption number can be negative, as it is for the United States.

2 Compounds vary in their ability to deplete ozone. These numbers relect the tonnage of the various CFCs and halons listed in Annex A of the Montreal Protocol (CFC-11, CFC-12, CFC-113, CFC-114, CFC-115, Halon-1211, Halon-1301, and Halon-2402) multiplied by their respective ozone-depleting potentials (ODPs). The ODP value is the ratio of a given compound's ability to deplete ozone compared with the ability of a similar mass of CFC-11.

3 Percentages may differ from the data due to rounding.

4 Data are for 1993.

refrigeration. So in recognition of this interdependency, only consumption not production controls were established for HCFCs. A proposal at the most recent meeting of the Parties to accelerate the phase-out schedule of HCFCs was not accepted, on the grounds that HCFCs were still preferable to CFCs, and made a positive contribution overall. Some countries however have already stopped production of HCFCs. HFCs and PFCs are potent greenhouse gases, and hence there is a complex relationship between the Montreal Protocol and the Climate Change Convention concerning these substances.

Leading up to the September 1997 Meeting of the Parties, the Executive Secretary of the Ozone Secretariat, Mr K. Madhava Sarma, noted that the most important issue before the Parties was probably that of control measures on methyl bromide. This pesticide and fumigant was the most important ozone-depleting substance that had not been subject to a definite phase-out timetable by all Parties. This issue was very strongly debated in Montreal, with different views being held on the feasibility of phasing out the chemical. The TEAP Report had concluded that there was no significant technical or economic obstacles to prevent the establishment of more stringent controls on methyl bromide for both Article 5 and non-Article 5 Parties, and indeed the same controls for each group.

Ultimately, the phase-out by developed countries, previously set at 2010, has been moved up to 2005 with exemptions for critical uses, and interim reductions of 25 per cent by 1999, 50 per cent by 2001, and 70 per cent by 2003. Developing countries, previously committed only to a freeze by 2002, have agreed to a 20 per cent reduction by 2005 and a phase out by 2015. They will use a four-year average of 1995-1998 as the base year for calculating the phase-out, and the interim reduction schedule will be reviewed in 2003.

So while dramatic reductions in production and consumption of the main ODS can be seen to have occurred in the developed countries, the 10 year delay allowed for compliance in developing countries means that the situation there is more mixed. For CFCs for example, it is not until 1999 that developing countries are required to freeze consumption, and not until 2010 when it is due to be phased out entirely. Many developing countries however have made stronger commitments than this unilaterally. UNEP state that of the 60 Article 5 countries with approved country programs in 1995, 46 are committed to complete phase-outs of ODS ahead of the 2010 deadline. Nevertheless, as shown in Table 2, China and Russia are very large producers of ODS, significantly slowing global reductions.

These results however are way in excess of what was initially considered achievable, and so far ODS have been phased out before deadlines became binding in many cases.

A significant factor behind the ability to accelerate the phase-outs has been the faster and cheaper development of substitutes than initially envisaged for each category of ODS. The following table summarises substitutes for ODS.

Table 3: Substitutes for Ozone-Depletion Substances

Compounds	Applications	"In-Kind" Substitutes[1]	Examples of "Not-In-Kind" Substitutes[2]
CFCs	refrigerants	HCFCs, HFCs	Hydrocarbon refrigerants (propane and butane) were introduced in "Greenfreeze" domestic refrigerators by Foron of Germany. The Calor company now makes hydrocarbon refrigerants for commercial refrigeration and air conditioning; these are used in some U.K. offices and stores
	foam insulation	HCFCs, HFCs	The largest foam manufacturer in Canada, Demilec, recently unveiled "Sealection 500," a flexible urethane foam building insulation that is blown with water and is cheaper than its competitors. Some European companies use rigid foam blown with cyclopentane, a hydrocarbon, to insulate refrigerators.
	aerosol propellants	HCFCs, HFCs	Airspray International in the Netherlands makes air-powered spray devices. Systems sold by Blagden Spray in Scandinavia use compressed nitrogen or air. In the United States, hydrocarbon propellants prevail; these low-cost alternatives save U.S. consumers an estimated $165 million each year.
CFCs/Methyl Chloroform	electronics, cleaners/ degreasing solvents	HCFCs, HFCs, PFCs	Design changes in the production processes for electronic goods reduced hazardous lead waste and the need to clean circuit boards at Texas Instruments; this saved the company over $300 000 in annual cleaning costs. Water is used for some electronics cleaning. Citric acid solvents are effective degreasers.
Halons	fire extinguishers	HCFs, PCFs	The Norwegian Fire Research Laboratory, after five years of research, concluded that water is as effective as halons for certain uses. "Inergen," a mixture of argon, nitrogen, and carbon dioxide, is widely used in Europe.
Methyl Bromide	multiuse pesticide (fumigation of soil, commodities, storage areas)	chlorinated pesticides, such as "Telone" and "DD" mixtures	Integrated pest management (IPM), a range of chemical and nonchemical tactics, has replaced methyl bromide in some countries. An IPM strategy based on composting replaced methyl bromide for flower production in Colombia and saves growers there about $1 900 per hectare. Carbon dioxide is used to treat stored grain in Indonesia, the Philippines, and Vietnam. In Missouri, Quaker Oats operates a production plant that uses heat to kill pests in the building.

Source: French (1997, p 160-161)

[1] HCFCs are scheduled for eventual phaseout under the Montreal Protocol. HFCs and perfluorocarbons (PFCs) are not scheduled for phaseout, but are potent greenhouse gases. Likewise, the pesticides listed are not scheduled for phaseout, but they are carcinogens.

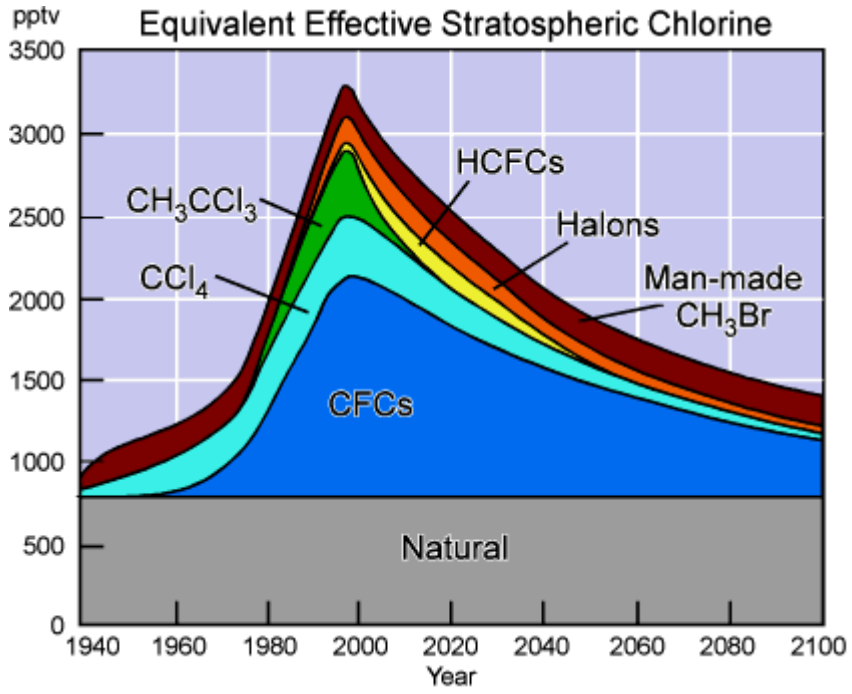
[2] This broad category includes simpler, naturally occurring chemicals as well as design changes that eliminate the need for any chemicals.

The extent of the technology switch away from fluorocarbon-based substances that would be achieved was also underestimated. For example, in 1989 DuPont estimated that by the year 2000, CFCs would be replaced by HCFCs (30 per cent), HFCs (9 per cent), conservation and reuse (25 per cent) and not-in-kind i.e. non-fluorocarbon alternatives (32 per cent). Four years later the respective estimates were 11 per cent for HCFCs, 15 per cent for HFCs, 29 per cent for conservation and 49 per cent for not-in-kind technologies (Brack 1996 p.31). Innovation in the electronics industry is perhaps the best example of how alternative cleaning methods proved often to be both less expensive and less environmentally damaging.

b) Chlorine Loading

Scientific expeditions to the Antarctic and the Arctic in the late 1980s showed that pre-existing models used to predict ozone levels were inadequate and had underestimated the extent of ozone depletion - in fact greater depletion than estimated had already occurred. This led scientists and policy makers to use an alternative concept to measure the total ozone-destroying potential of chemicals in the atmosphere, called the chlorine loading (Twum-Barima and Campbell, 1994, p.21).

The following graph illustrates the profile of the chlorine loading expected over the next century, and the contribution made by various ozone depleting substances. It is based on the assumption that countries comply with the Montreal Protocol and its London and Copenhagen amendments.



Source: Alternative Fluorocarbon Environmental Acceptability Study (AFEAS) (http://www.afeas.org/atm_cl.html), taken initially from the Scientific Assessment of Ozone Depletion, 1994, World Meteorological Organisation, Global Research and Monitoring Project Report No. 37, pp 13.11-13.12. The natural contribution covers methyl chloride and that part of the methyl bromide flux that is not man-made. Bromine from all sources (Halons and methyl bromide) is shown as its equivalent in chlorine.

c) Ozone Layer

Current estimations, assuming compliance with the Protocol's requirements, predict that the ozone layer will start to heal slowly from around the year 2000, and will reach pre-ozone hole levels by the year 2050. This is reflected in the chlorine loading graph above.

d) Reduction in Harmful Effects of Ozone Depletion

As noted by UNEP's Deputy Executive Director, Mr Reuben Olembo, the actual costs of ozone depletion in general are not completely known. Skin cancer cases are the most easily quantified. "Research had indicated that, even with the 1992 Copenhagen amendment, the depletion of the ozone layer was expected, in the year 2050, to result in 33 000 additional skin cancer cases in the United States (10 per cent above the current level) and 14 000 in north-west Europe. The number was expected to reach its peak in 2060 and then to decrease."[8]

Collaborative research conducted by Dutch and American research institutes (Slaper *et al*, 1996) has attempted to estimate the differences in expected skin cancer rates under three scenarios: no restrictions, the original Montreal Protocol restrictions, and the Copenhagen Amendment restrictions. With no restrictions on ODS, they estimate a **quadrupling** of skin cancer incidence by the year 2100; under the terms of the initial Montreal Protocol, a **doubling** by that year; whereas under the Copenhagen amendments, the peak relative increase in incidence of skin cancer of about **10 per cent** occurs around 2060. For illustration, the controls of the Protocol as amended at Copenhagen were estimated to have avoided an increased incidence of 6 494 cases per million people in the US in 2100 relative to no restrictions, and 3 445 in Europe. Current incidence is about 2 000 per million in the US and 1 100 per million in Europe. This research was referred to the Ninth Meeting of the parties by the Panel on Environmental effects of Ozone Depletion.

(See also Section 4.3 below and the Canadian study referenced in Footnote 11).

4.2 Purpose and Effectiveness of Trade Measures

At one level, various trade measures are implemented by Parties as a means of meeting their obligations on consumption and production targets and data reporting. In this case the purpose is to complete the comprehensive regulation of domestic ODS using and producing industries which are operating in an integrated world economy. In economic terms, trade is a 'leakage' from the domestic economy. In open economies, total consumption and production includes exports and imports.

Of more interest in terms of the trade and environment debate are the trade measures incorporated explicitly into the Protocol, especially the Party/non-Party trade measures contained in Article 4. Similarly to the situation in domestic policy, the overall purpose is to close the system of controls on ODS producing and consuming industries. This overall goal of making the regime robust in terms of both economic and environmental leakage can be divided into two more specific (but related) objectives. First, as a way of encouraging universal participation in the Protocol; and second, to the extent the first objective is not fully met, discouraging relocation to, and expansion of use and production in, non-Parties of the industrial activity which was being phased out.

Universal participation

Effective protection of the ozone layer is the quintessential case of a global resource requiring concerted action. Emissions of ozone depleting substances cause the same damage regardless of where on earth they occur. This environmental fact is one reason why universal participation in the Protocol came to be considered as essential. Although the original Montreal Protocol focused primarily on the need for developed countries to take action as the main producers and consumers of ODS, the Party/non-Party trade measures already sent a very strong signal that the intent of the Protocol was to regulate these industries worldwide. A non-Party (unless acting in conformance with the control measures) would be in the situation of losing access to the controlled substances entirely, rather than phasing them out in a staged manner. Moreover, the provisions for potentially restricting trade with non-Parties in products containing ODS (refrigerators), or made with but not containing ODS (electronic goods) sent a very strong economic signal to the effect that export-based industries using ODS could not survive in a country not adhering to the Montreal Protocol.

The trade restrictions thus acted as a disincentive, or a penalty even, for staying outside the regime (or more accurately, not complying with the regime's controls). Many commentators have pointed to the clear impact this had on inducing accession to the Protocol by several countries[9]. The Republic of Korea is perhaps the most important example. Domestic ODS production was growing, from 36 per cent of consumption in 1989 to 52 per cent in 1990, and self-sufficiency could probably have been attained. Also, initial estimates of the adaptation costs were much higher than the amount of funds expected to be made available under the Multilateral Fund[10]. However, Korea had a large and growing export-oriented electronics industry, producing exports valued at $13.5 billion in 1989 (O'Connor 1991). Access to the main markets of the US and Europe were threatened by the trade provisions of the Protocol. Korea ultimately acceded to the Protocol in 1992 (Brack 1996, p.57).

Korea, as did all other countries, of course had more reasons to join the Protocol than just the avoidance of the potential restrictions on its exports of products containing ODS. First, there was the common need to protect the ozone layer, and public awareness of this issue had soared. Second, there was the prospect of gaining access to financial assistance with adaptation costs. Third, there was technical co-operation on substitute technologies. Fourth, the ten year grace period was a form of preferential treatment for developing countries. Fifth, the fact that after 1993 exports of ODS were to be counted as domestic production provided an incentive for exporters to encourage their customer countries to join the Protocol. Sixth, major multinational companies producing and using ODS had given unambiguous signals that ODS would be phased out, and that new leading-edge technologies would replace them. Each of these factors contributed to the overall decisions of particular countries to join.

As noted earlier, the initial negotiations on the Montreal Protocol focused on the main (OECD) producers and consumers of CFCs. The developing countries used only a small amount of CFCs, but this level was expected to grow rapidly in the near future as economic growth made refrigerators and air conditioners accessible to many millions more people. India and China alone accounted for nearly 40 per cent of the world population. As the large developing countries expanded their consumption of CFCs, the reductions made in the developed countries would be insignificant in overall terms. Developing countries were understandably reluctant to accept apparent constraints on their economic development for a problem not of their own making (French 1997). How to attain global participation therefore became the main issue for the 1990 London meeting.

While the ten year grace period for compliance by developing countries was aimed at reducing the adjustment burden and therefore encouraging participation, it was clearly insufficient to attract

widespread participation, even in conjunction with the trade restrictions against non-Parties. Apart from Mexico, very few developing countries joined the Protocol until after the 1990 London Meeting. Some countries, notably India and China, made it clear that their participation was contingent on adequate financial assistance being forthcoming. Hard negotiations ensued, and the Multilateral Fund was the result. Participation increased rapidly after that, and is now effectively universal.

While it is impossible to disaggregate the relative importance of the various factors, the combination of the trade restrictions and the financial assistance created a strong incentive to join. The trade measures build in an accelerator factor, that is the more countries become parties, the bigger the incentive to join, as the aggregate size of the non-Party markets diminish. The Fund was critical to achieving critical mass in terms of India's and China's accession, and then the trade restrictions meant it was in the best interests of practically all other countries to also become Parties. Once membership becomes near universal, the non-Party trade restrictions have done their job and are of no operational importance. Participation in the most recent amendments to the Protocol however is not yet universal.

Industrial Relocation

If ODS producers simply moved their production capacity to non-Party territory, this would exacerbate the problem of environmental leakage arising from less than universal participation. The efforts of Parties would be undermined in terms of slowing ozone depletion. In addition, non-Parties would reap economic advantages, at least in the short term. They would be free riding by enjoying the benefits of others' actions to protect the ozone layer, and simultaneously enjoying the economic benefits of expanding their own ODS producing industries.

The series of trade restrictions against non-Parties were also aimed at these economic or competitiveness arguments. Companies could not simply move offshore to non-Parties and export substances and products back. In fact industrial relocation for this purpose can only be attractive if there is less than universal participation, so the two objectives are closely related. To the extent that other policy instruments such as the Multilateral Fund were significant contributors to encouraging broad membership, they have also therefore discouraged industrial relocation.

Consequently very few examples of relocation of ODS facilities to escape the controls of the regime have been documented. This demonstrates the success of the various efforts to encourage wide membership, including but not exclusively, the series of trade restrictions.

4.3 Other Effectiveness Indicators

There are various ways to examine the effectiveness of multilateral environmental agreements and the trade measures they use. Apart from looking at the environmental achievements, it would also be of interest to look at the overall cost-benefit. While environmental benefits are always extremely hard to quantify, some attempts have been made in the case of protecting the ozone layer. The Economic Assessment Panel in 1989 identified, but could not quantify, "enormous beneficial impacts on human health and the environment" from reducing ODS. It concluded that "the monetary value of the benefits of safeguarding the ozone layer is undoubtedly much greater than the costs of CFC and halon reductions" (Twum-Barima and Campbell 1994 p.27). Similarly, a recent Canadian study[11] which provides quantitative assessments of some costs and benefits concluded that "the benefits of the actions taken to restore the ozone layer far outweighed the costs and had resulted in real benefits, not only for human health and natural resources, but also for business and industries as well".[12]

Indeed a particular strength of the Montreal Protocol is that decisions on phase-outs have been made in the context of economic costs and benefits as well as scientific information. This expertise undoubtedly gives added credibility to decisions once reached by the Parties, thereby encouraging compliance and hence environmental effectiveness.

Compliance with the obligations of the Protocol could be another measure of effectiveness, and this issue is examined in the following Section.

5. COMPLIANCE ISSUES

The Montreal Protocol has made advances in the way that international legal regimes deal with the problem of non-compliance and enforcement. The Implementation Committee is often discussed as a model for future MEAs (Lang, 1996), and its functioning is still being refined. It is briefly described below.

In addition to the legal aspects of implementation and compliance, it is important to consider actual experiences with non-compliance and enforcement of obligations. The Montreal Protocol is progressively closing down production of ozone depleting substances. As the size of the industries diminish overall, pressure increases on the remaining escape clauses and loopholes in the overall regulatory system. They also assume a more prominent role in the policy debate. This is the case with illegal trade, trade in recycled substances and the effects of differential treatment for developing countries.

5.1 Data Reporting

A system which imposes binding targets, but not uniform measures to meet them, relies critically on data reporting to monitor implementation. The Executive Secretary of the Ozone Secretariat Mr K. Sarma noted just prior to the Ninth Meeting of the Parties that as of August 1997, 113 countries had reported data for 1995, and 38 had not yet submitted their reports. Only 43 had reported data for 1996, so timeliness of reporting needed to improve[13].

The Meeting of the Parties (Decision IX/28) agreed on new streamlined reporting requirements and the simplification of reporting forms. It also requested the UNEP Industry and Environment Centre to prepare a handbook on data reporting, including information on data collection techniques, trade names, custom codes, and advice on what sectors may be using controlled substances.

5.2 The Non-Compliance Procedure

As one of the participants in the creation of the innovative non-compliance procedure has commented, the challenge was to design a mechanism for monitoring and enforcing compliance that would ‘have teeth’, but also be in the best interests of protecting the ozone layer overall (Szèll 1996, p.46).

> From the outset, one thought was paramount in the minds of the drafters. The purpose of Montreal -- many would say its only real purpose -- was to promote protection of the ozone layer. In pursuit of this goal, the traditional control strategies were either too weak to have real impact or too strong to be appropriate. What was needed was a new approach, somewhere between the two: a regime that was non-confrontational, conciliatory and co-operative, that

> would cajole, encourage or otherwise help Parties that were in breach of their obligations to achieve full compliance. There was a strong feeling that if Parties felt they were being subjected to some kind of judicial process they would become defensive and turn in on themselves, with the result the ozone layer would be the loser. With a more constructive approach based on a recognition that non-compliance is frequently the consequence ... of technical, administrative or economic problems, a regime that worked with, rather than against, Parties in difficulty was sought.
>
> The pattern of the regime devised was as follows. Where a Party or the Secretariat has reservations regarding another Party's performance under the Protocol it can make a submission to an Implementation Committee whose task it is to consider such submissions, request and gather further information as appropriate and, where necessary, seek to "secure an amicable solution" on the basis of respect for the Protocol. The regime also contains provision for a Party to make submissions to the Committee in respect of itself -- a feature that demonstrates very well the essentially co-operative character of the process. The Implementation Committee, which is composed, not of individuals appointed in their own right, but of the representatives of ten Parties elected on the basis of equitable geographical distribution for two year periods, has no decision-making powers. Those who drew up the regime were concerned it should not have such authority given that it was not fully representative of all the Parties. The Committee is, however, required to report regularly to the Meeting of the Parties which, as a sovereign body, does possess the power to take certain actions in consequence of recommendations made by the Implementation Committee. (Such actions include encouraging a Party to seek financial assistance from the Global Environmental Facility or to seek guidance from Montreal's Technical and Economic Assessment Panel, issuing a caution to a Party it considers to be in default and, arguably, even imposing a suspension). (Szèll 1996, p. 46-47)

So far the particular cases of non-compliance have concerned several countries with economies in transition. They have triggered the non-compliance procedure themselves. The Implementation Committee has sought additional information, and formulated recommendations to the Meeting of the Parties on the necessary steps to bring about compliance. The 1997 Meeting of the Parties dealt with non-compliance by Latvia, Lithuania, the Russian Federation, (and the Czech Republic with respect to methyl bromide). The main conclusion concerning the three countries in a situation of general non-compliance was that international assistance, particularly the Global Environmental Facility, should be considered favourably to help the phase out of ODS.

The Russian Federation is of particular concern because of the size of its production sector. It was in a situation of non-compliance in 1996, and is expected to be in 1997. The Parties took note of the fact that the Russian Federation had started controlling exports of ODS from July 1996 by not exporting any ODS including used, new, recycled or reclaimed substances except to Article 5 Parties and members of the Commonwealth of Independent States. This measure was designed to help reduce markets for ODS and hence improve the Federation's compliance, but also to help tackle problems of illegal trade globally. An export restriction along similar lines (see below) has been formally adopted as an amendment to the Protocol.

At the 9th Meeting of the Parties, an Ad Hoc Working Group of Legal and Technical Experts was established to pursue further work on the revision of the non-compliance procedure of the Montreal Protocol. The work of this group will include a review of the non-compliance procedure in order to consider any proposals for strengthening the procedure and for improving the effectiveness of the

functioning of the Implementation Committee. The Ad Hoc Working Group will consist of representatives from 7 developed and 7 developing countries and will report to the 10th Meeting of the Parties to be held in Cairo, Egypt in November 1998.

5.3 Illegal Trade

While the control schedules of the Montreal Protocol have progressively reduced the range of production and trade of ODS that can legally occur, illegal trade has correspondingly emerged as a significant weakness in the overall regulation of ODS worldwide. Illegal trade occurs because there is still demand for CFCs in non-Article 5 Parties, there is still supply, and because there are still various forms of legally valid transactions. Demand exists in large part for servicing old CFC-dependent equipment, such as air conditioners and refrigerators. Alternatives exist, but are more expensive than CFCs, especially black market CFCs. Supply still exists both illegally (i.e. in non-compliance situations), and legally in the form of stockpiles of new and recycled CFCs, and in new production capacity in non-Article 5 countries.

Consumption and production in developing countries of CFCs and other ODS is of course allowed, with the freeze due to come into effect in 1999. Developed countries can still export up to 15 per cent of their production in the baseline year to meet the basic domestic needs of developing countries. Even in developed countries there are still essential use exemptions and use of ODS for chemical feedstock is allowed. And recycled substances are not subject to the controls, apart from a requirement to report the quantities traded. All of these circumstances mean that there is ample opportunity and means for illegal trade to be hidden in amongst various legal trade flows. New CFCs can be disguised as recycled, transhipments may not actually be transhipped, and other mislabelling and fraud can occur.

The Parties, both collectively and individually, have certainly recognised illegal trade as a serious threat to compliance with the Protocol and hence to the ozone layer. Illegal trade is estimated to amount to 20,000 tonnes per year: it has been said also that “in Miami for a time, only cocaine had more street value than CFCs” (*The Economist*, 19 September 1997). The Ninth meeting of the Parties took several measures attempting to improve the Parties’ ability to reduce illegal trade.

First, an Amendment to the Protocol was adopted requiring all Parties to implement an import and export licensing system. In Decision IX/8, (Report of the Ninth Meeting of the Parties), Parties stated that export and import licensing systems would:

> “(a) Assist collection of sufficient information to facilitate Parties’ compliance with relevant reporting requirements...; and
>
> (b) Assist Parties in the prevention of illegal traffic of controlled substances, including, as appropriate, through notification and/or regular reporting by exporting countries to importing countries and/or by allowing cross-checking of information between exporting and importing countries.”

Contact officers are to be established for the licensing systems, and Article 5 Parties are eligible for assistance in the development, establishment and operation of licensing systems. The licensing system has stopped short of a prior notification and consent system. Neither does it deem trade occurring outside a licensing system illegal.

Second, an Amendment was agreed whereby a Party still producing ODS in non-compliance with the control schedules, shall ban the export of used, recycled and reclaimed quantities of that substance, other than for destruction. This new Article 4A is designed to reduce the amount of ODS exported from countries with economies in transition mislabelled as recycled substances, given that production of new ODS is still occurring in some parties in violation of the Montreal Protocol control schedules.

Third, "in order to facilitate co-operation between customs authorities and authorities in charge of ODS control and ensure compliance with licensing requirements", UNEP and the World Customs Organisation will co-operate to improve the use of customs codes for tracking movements of ODS. Separate customs codes for each kind of HCFC will be introduced, and a list of customs codes for ODS commonly marketed as mixtures will be developed. (Decision IX/22, Report of the Ninth Meeting of the Parties).

Each of these new measures are trade measures, as they are designed to help deal with the problem of illegal trade. They could probably be described as necessary but not sufficient in themselves, to deal with the problem overall. Stringent enforcement of national laws is of course also necessary. As long as there are differential phase-out periods, with some trade occurring legally, the problem of controlling illegal trade will be even more difficult than it is in cases of total bans. Even total consumption or trade bans provoke illegal trade, as has been discussed elsewhere with respect to CITES and the Basel Convention. This means that MEAs that ban the use or trade of harmful but still valuable substances also need to construct mechanisms to deal with the inevitable problems of illegal trade.

6. RELATIONSHIP BETWEEN THE MONTREAL PROTOCOL AND THE MULTILATERAL TRADING SYSTEM

The purpose of this Section is to raise some of the issues associated with the relationship between the rights and obligations of the Montreal Protocol and those of the WTO. As the Protocol uses various trade measures to attain its environmental objectives, the issue of the relationship with the international legal system governing trade is an important one within the trade and environment debate. However, no attempt will be made in this paper to come to conclusions on how any hypothetical legal dispute would be argued or decided.

It should be recalled at the outset that so far there have been no cases of conflict between the obligations with respect to trade provisions in a multilateral environmental agreement and rights under the WTO which have led to formal dispute settlement in any forum, including the WTO dispute settlement system. There are clear political reasons explaining that situation, not least of which is the undesirability of calling into question a multilateral treaty signed by many Governments. As the Montreal Protocol enjoys near-universal membership, with participation in subsequent amendments smaller but still high, this signifies widespread international acceptance of the Protocol and further reduces the likelihood of a conflict arising.

6.1 Membership of the Montreal Protocol and the WTO

The Montreal Protocol has 163 Parties, more complete coverage than the WTO. Non-Parties to the Protocol number only 24, with a combined population of around 120 million people, compared with a world population of more than five billion. There are no significant producing or consuming countries among them, most of them being newly formed countries or countries suffering war conditions. As noted

above, Parties are only bound by amendments to the Protocol if they have ratified that amendment. The subsequent amendments have less universal membership than the Protocol itself, and so there are more non-Parties for the purposes of substances added later (the Annex B, C and E substances) than for Annex A CFCs and halons. The Copenhagen amendment for example only has 72 Parties. While legally this means there are many non-Parties that could hypothetically feel aggrieved by the Party/non-Party trade restrictions introduced in subsequent amendments, in political terms their participation in the Protocol overall would constrain any potential disputation.

The most important of the trade measures in the Protocol are the Party/non-Party measures of Article 4. In theory, a non-Party (not demonstrating compliance) that is a member of the WTO may be in a position to argue that another WTO member is in breach of its WTO obligations when that country, party to the Montreal Protocol, implemented Article 4. The actual likelihood of this happening is, of course, another matter. Apart from the consideration mentioned above, it is clear that the fewer the number of non-Parties, the less likely the prospect of such a situation arising. Moreover, non-Parties which are complying with the Protocol obligations and have submitted data to the Secretariat to demonstrate as much, are exempt from the Article 4 trade restrictions.

No disputes between Montreal Protocol Parties have arisen with respect to trade issues.

6.2 Where Could any Dispute be Heard?

In the event that any dispute arose, the preliminary issue of where it would be heard has potentially significant implications for which legal regime is applied to settle it.

Article 11 of the Vienna Convention on the Protection of the Ozone Layer provides the mechanism for the settlement of disputes between Parties to the Convention and the Montreal Protocol concerning interpretation or application. In the first instance, "the parties concerned shall seek solutions by negotiation". Then "if they cannot reach agreement through negotiation, they may jointly seek the good offices of, or request mediation by, a third party". Disputes can also be submitted to arbitration and to the International Court of Justice, if the parties to a dispute agree. A dispute before the ICJ would be settled according to the rules and principles of international law.

The dispute settlement procedures of the Convention and the Protocol can only be invoked when the issues raised concern the interpretation or implementation of the agreements. Despite the fact that neither the Vienna Convention nor the Montreal Protocol require binding trade restrictions between parties, a dispute concerning a trade measure could presumably still fall under the regime's dispute settlement procedures.

It may be noted in this context that in the section on Conclusions and Recommendations of the December 1996 Report of the WTO Committee on Trade and Environment, WTO Members stated their view that "if a dispute arises between WTO members, parties to an MEA, over the use of trade measures they are applying between themselves pursuant to the MEA, they should consider trying to resolve it through the dispute settlement mechanisms available under the MEA"[14].

In the event that a WTO dispute settlement procedure were initiated, the Dispute Settlement Panel would be charged with examining the matter pursuant to the relevant WTO provisions, in accordance with "customary rules of interpretation of public international law" (Article 3(2) of the Dispute Settlement Understanding).

6.3 Some Relevant WTO Principles

(a) Article I - General Most Favored Nation Treatment.

Article I of GATT 1994 requires that with respect to (*inter alia*) all rules and formalities in connection with importation and exportation, any advantage, favour, privilege or immunity granted by any WTO member to any product originating in or destined for any other country shall be accorded immediately and unconditionally to the like product originating in or destined for the territories of all other WTO members.

The question may arise as to whether a country, in implementing its obligations under the Montreal Protocol, could find itself denying another WTO member Most Favored Nation treatment. The restriction on trade with non-Parties could theoretically give rise to this situation.

For example, country A, a party to the Montreal Protocol Copenhagen Amendment and a member of the WTO, would be obliged to implement an import ban on methyl chloroform from country B, not a party to the Copenhagen Amendment, but a WTO member. In the context of Article I of the GATT, country B could claim that country A is conferring an advantage or privilege on the product coming from other countries which are party to the Amendment. The nature of the advantage would be the right to be imported into country A.

If a measure taken under the Protocol was considered to be inconsistent with the MFN principle, the question would then arise as to whether the trade restriction would nevertheless be justified in the WTO under a relevant exception (see discussion of Article XX below).

Like products and process and production methods

The category of trade measures contained in Article 4 which required the Parties to consider the feasibility of restricting products made with but not containing controlled substances may raise the issue of trade measures being based on process and production methods (PPMs). To date the Parties to the Montreal Protocol have in fact decided that for the substances so far considered, it would not be cost-effective to attempt to discriminate between products according to whether ODS were used in their production. The PPM issue is not, therefore, relevant.

(b) Article III - National Treatment

Once imported products have crossed the border, Article III of the GATT requires imported and domestic ‘like products’ to be treated the same with respect to internal regulations and taxes. Various forms of regulations and taxes on ODS have been used by Parties to help meet the consumption and production phase-out commitments. If they applied differently to imported than to domestic products, there could be a violation of Article III. There is no evidence that this has been the case so far. Again, as with Article I, even if this was the case, Article XX would then need to be considered (see below).

(c) Article XI - General Elimination of Quantitative Restrictions

GATT Article XI states that no prohibitions or restrictions other than duties, taxes or other charges shall be applied to imported or exported products (with some exceptions not relevant here, such as agricultural products). In effect, export and import bans are prohibited.

Therefore, the question could arise as to whether the Montreal Protocol Article 4 import and export bans, or import or export bans instituted by national Governments as part of their policy measures to meet the consumption and production limits, would be consistent with GATT Article XI. It is essential that this Article, as others, be considered taking into account the general exceptions (see below).

(d) Article XIII - Non-discriminatory Administration of Quantitative Restrictions

This Article concerns import and export licensing, prohibitions and quotas, and requires that like products coming from, or going to, all countries be treated in the same way. Similar issues concerning discriminatory import prohibitions could arise under this Article as arise under Article I with respect to the distinctions made between Parties and non-Parties.

The new decision to require export and import licences for trade between Parties may also fall under the scope of this Article. As licensing is to apply between all Parties, it would not seem that any additional discrimination will occur beyond that required by the Party/non-Party trade restrictions.

(e) Technical Barriers to Trade Agreement

One of the WTO Agreements, the Technical Barriers to Trade Agreement may also apply to technical regulations used by national governments to implement the Montreal Protocol obligations, (e.g. technical regulations setting specifications for ODS use in fire extinguishers). Paragraph 2.2 of the Agreement requires that technical regulations shall not be more trade restrictive than necessary to fulfil a legitimate objective. Environmental protection is listed in this paragraph as a legitimate objective.

(f) Article XX - General Exceptions

The GATT provisions accommodate trade restrictions in the pursuit of environmental protection under certain circumstances. Article XX states (in part) that:

> *Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures:*
> *...*
> *(b) necessary to protect human, animal or plant life or health;*
> *...*
> *(d) necessary to secure compliance with laws or regulations which are not inconsistent with the provisions of this Agreement,....*
> *...*

(g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption;...

To fall under Article XX, an action taken needs to satisfy the conditions laid down in the chapeau and one of the paragraphs of Article XX. Paragraphs (b), (d) and (g) above would seem to be the most relevant.

Given that the Montreal Protocol is also a reflection of the views of the international community, it is not clear how far a WTO Panel would inquire into the specific requirements of Article XX in the case of a trade measure taken under the Protocol. It is possible, for example, that a (rebuttable) presumption would be made that an international consensus exists on the validity and necessity of the instruments chosen to meet a Montreal Protocol objective. It could also, for example, decide to solicit the views of the Protocol or its expert panels on the specific matters raised by Article XX.

In interpreting a WTO provision, or interpreting the relationship between a WTO provision and the provision of another international agreement, the WTO dispute settlement system provides for recourse to customary rules of interpretation of public international law, including the Vienna Convention on Treaty Law. To date, the WTO dispute settlement system has made reference only to some of the rules of interpretation of the Vienna Convention in clarifying WTO provisions. Article 31(3)(c) of the Vienna Convention on the Law of Treaties provides that when interpreting a Treaty provision, one may take into account "any relevant rules of international law in the relations between the parties". Nevertheless, the role of WTO dispute settlement is to determine existing rights and obligations under the WTO Agreements.

If the Protocol were examined when applying the "arbitrary and unjustifiable discrimination", and the "disguised restriction on trade" tests of the chapeau of Article XX, the "necessity" test in Article XX(b) and (d), and the specific requirements of Article XX(g), the following aspects may, *inter alia*, be relevant:

- the ozone layer is an exhaustible natural resource, and its depletion adversely affects human, animal and plant life and health;
- an international consensus on the need to act has emerged;
- the Protocol has been based on international scientific, economic and technology assessments of what is necessary to protect the ozone layer;
- Article 4 exempts non-Parties from the trade restrictions if they are complying with the Protocol and have submitted data to that effect. This means that any discrimination is not based on membership of a treaty *per se*;
- the trade measures are only one part of an integrated set of policy instruments used in the Protocol.

In terms of the application of Article XX(b), previous WTO panels, none of which have concerned trade measures taken pursuant to multilateral environmental agreements, have not considered trade measures as "necessary" if "alternative measures either consistent or less inconsistent with the *General Agreement* were reasonably available to (a member) for achieving its aim of protecting human, animal or plant life."[15]

No further attempt is made here to explore these hypothetical scenarios.

7. DEVELOPING COUNTRY ASPECTS

One of the special features of the Montreal Protocol is the extent to which it has put into practice the principle of 'common but differential responsibilities'. All countries need to contribute for protection of the ozone layer to be effective, but they can do so in different ways.

Initially, ozone depletion was seen as a problem caused by developed countries, of concern primarily to them, and therefore for them to fix. As environmental issues gained more prominence, as the Montreal Protocol was signed, and as it became evident that industrial processes were indeed going to be changed, the question became one of deciding the terms on which developing countries would participate in the ozone regime. Three main areas of 'differential responsibilities' have been discussed above: the ten year grace period, financial assistance for incremental costs of implementing the Protocol, and technical assistance.

Many studies have been undertaken to assess the effects on particular developing countries of the Montreal Protocol. UNCTAD studies for example, have shown that developing countries have been more affected by trade and competitiveness effects than developed countries, though outcomes vary substantially depending on particular circumstances. Case studies demonstrate that the philosophy of the ten year grace period as providing a benefit to developing countries has some flaws. In China for example, while refrigerator exports declined by 58 per cent between 1988 and 1991 overall, those firms that switched to CFC-free technology increased their exports (Brack, 1996, p.88). This helped to persuade China to bring forward by 5 years (to 2005) the total phase out CFCs and halons. Other export-oriented developing countries have similarly advanced their phase-out deadlines above the Protocol's requirements. Reduced pressure to adapt to new market realities can be a mixed blessing. The assumptions at the time of course were that substitutes would be more expensive, and in some cases this has proven to be true. In some cases it has not. Consumer preferences in major markets have also affected market dynamics.

Developing countries were also concerned about the availability and price of ODS as they were phased out in the developed countries (the major producers). Dividing the world market into two in this way could cause problems of scarcity and high prices. The formula that was adopted to ease risks of shortages and monopoly power was to allow the developed countries to continue producing to meet the basic domestic needs of developing countries. So far the problem seems to be an excess, rather than a world shortage, of CFCs.

Despite declarations to the contrary, the Multilateral Fund has set a precedent for future environmental treaties that compensation should be paid to developing countries for adaptation costs. While improving the equity of international environmental agreements -- a critical factor -- this also means that each adjustment becomes a financial negotiation. The financial mechanisms have also caused some perverse incentives, such as a rapid acquisition of ODS production capacity in order to increase compensation eligibility. By and large, however, the financial mechanism has made adaptation less costly for developing countries. Greater financial assistance however would have allowed for faster phase-outs, reducing the problems caused by segmenting the world market according to two-track phase-out schedules.

The degree of technical co-operation, assistance and transfer seems impressive relative to other international environmental issues, yet is often described as inadequate by developing countries. The debate on the terms of transfer of proprietary technology in the context of MEAs is ongoing.

8. CONCLUDING REMARKS

The international community has just celebrated the tenth anniversary of the signing of the Montreal Protocol. Naturally this milestone provided cause for reflection on the progress made and the remaining challenges. The general tone of assessments seem to recall how difficult the task appeared ten years ago, and how much faster than expected countries were able to reduce their dependency on ozone depleting substances. At the same time, ozone depletion has not yet peaked, and ODS are far from disappearing entirely. Illegal trade in ODS and non-compliance in countries with economies in transition are serious current problems, and compliance in many Article 5 countries may prove to be a difficulty when the first controls become effective in 1999.

The Montreal Protocol set out to construct a comprehensive set of regulations to reduce the size of industries producing ODS, and ultimately to eliminate them. This required policy measures that were based on the economic structure of the industry worldwide. The basic form of the regulation was to limit and reduce the quantities of ODS consumed and produced at the national level. As ODS were traded commodities, there was obviously also a flow-on effect to trade in ODS.

Most attention in the trade and environment debate has however focused on the stipulation of the Protocol that Parties should not trade with non-Parties. These trade restrictions would potentially have covered substances themselves, products containing the substances, and products made with but not containing the substances. The inclusion of these provisions made it very clear that countries not complying with the Protocol would not be able to base export industries on ozone depleting substances. This provided a reason, particularly for countries with export sectors using ODS, to join the ozone regime. They also strengthened the signal to industry that ODS had a limited commercial future. As industry started to announce intentions to move to alternatives, the regime's credibility increased, which also would have encouraged participation

It was not however sufficient reason for some countries, particularly those with large domestic economies who could become self sufficient in ODS. The provision of financial assistance to meet the agreed incremental costs of adherence was crucial in securing the agreement of some countries to join. Once a significant part of the world was inside the ozone regime, the trade measures meant that the cost of staying outside was high, because of the very limited size of the aggregate non-Party market for supply of ODS and as a destination for ODS-related products. Consequently, participation in the ozone regime is practically universal.

Universality of participation was particularly important for the success of the ozone regime given the rather special nature of the ozone layer. It is a public good, protecting all forms of life, and harmed by the release of ODS wherever that occurs. Effectiveness of the Protocol depended on minimising scope for leakage of the damaging activity to non-participating countries. To the extent that the trade measures forced the pace of participation, they have increased the overall effectiveness of the regime.

Once universal participation is achieved, the Party/non-Party trade restrictions are largely hypothetical. While this is the case for the original Protocol, it is less so for the subsequent amendments to the Protocol. The Copenhagen amendment for example has been ratified by only 72 States. For the purposes of the amendment, non-Parties means countries not having ratified the amendment.

So far no trade disputes have arisen from measures taken to implement the Montreal Protocol and its amendments. The likelihood of a trade dispute arising would have been higher in the early years of the Protocol when there were fewer Parties compared to now, but even then this did not occur. A hypothetical situation may still arise where a Party to an amendment is considered by another WTO member to be unable to meet both its commitments under the Protocol and the WTO. There is however a further question as to whether (a) this would in fact ever become a matter of dispute in light of the very broad international consensus on the Protocol, and (b) if so, whether it would be addressed under the WTO dispute settlement provisions in any case.

It is interesting to note that new forms of trade controls have been adopted as responses to the problems that are arising as ODS production contracts, namely smuggling. Licensing arrangements and tailored export bans for countries in positions of non-compliance are the main examples. These responses reflect the need for actions that impact on international trade when it is those flows themselves that are the problem. It should also be noted that at least part of the underlying cause of the extent of the illegal trade problem arises because of the two-speed phase-out process which has been adopted. Greater financial assistance would have allowed for faster phase-out schedules in developing countries, thus reducing the problems such as continued dependence on condemned technologies, and a two-track system of trade controls providing easy cover for smugglers.

NOTES

1. *The Economist*, 19 September 1997.

2. Fact sheet from Environment Australia, "The Montreal Protocol on Substances that Deplete the Ozone Layer".

3. This Section is taken directly, and in large parts verbatim, from Ozone Secretariat 1997, and Twum-Barima and Campbell, 1994.

4. In 1995 Molina and Rowland, along with Paul Crutzen of the Max Planck Institute, Germany, received the Nobel Prize in Chemistry for this work.

5. The Economics and Technology panels were later merged into one Technology and Economic Assessment Panel (TEAP).

6. See "Actions Taken to Improve the Financial mechanism for the Implementation of the Montreal Protocol", Report of the Executive Committee of the Multilateral Fund for the Implementation of the Montreal Protocol to the ninth Meeting of the Parties, UNEP/OzL.Pro/WG.1/15/4.

7. http://www.unep.org/unep/secretar/ozone/home.htm

8. Opening remarks made by Mr Reuben Olembo, Deputy Executive Director of UNEP, at the Fifteenth Meeting of the Open-Ended Working Group of the Parties to the Montreal Protocol, UNEP/OzL.Pro/WG.1/15/5, 12 June 1997.

9. For further examples see Van Dyke (1997) and Brack (1996).

10. The Republic of Korea had been classified as a developing country at the time of its accession to the Protocol, but subsequently became reclassified as a non-Article 5 Party because its per capita consumption of ODS exceeded the specified limit of 0.3 kg. When per capita consumption later fell below the threshold again, Korea was reclassified as an Article 5 Party (in 1994). Korea accepted the resolution of the Sixth Meeting of the Parties which called on Parties re-classified as Article 5 Parties to refrain from drawing on the Multilateral Fund.

11. The full study is called "The Global Benefits and Costs of the Montreal Protocol on Substances that Deplete the Ozone Layer". Both the summary report, "The Right Choice at the Right Time", and the full study are available through the Global Air Issues Branch of Environment Canada. Further details on quantitative estimates are not included here because the report was received after this paper had been approved for derestriction by the Joint Session.

12. Minister of the Environment for Canada, Ms Christine Stewart, speaking at the Ninth Meeting of the Parties in Montreal, September 1997.

13. UNEP/OzL.Pro/WG.1/16/2, Report of the Sixteenth meeting of the Open-Ended Working Group of the Parties to the Montreal Protocol, p.2.

14. Paragraph 178 of the December 1996 CTE Report [WT/CTE/1]. It has to be noted that at the meeting where the Report was adopted the Chairman of the CTE stated that this Report did not modify the rights and obligations of any WTO Member under the WTO Agreements. Several delegations expressed concerns and reservations on certain paragraphs of the Report. On paragraph 178 Mexico stated that

"... no element in the Report could be used as a basis for action under the Dispute Settlement Understanding (DSU). As such, Mexico would have preferred not to have included paragraph 178. The DSU as well as other WTO Agreements provided for the right to invoke the DSU which could not be changed in any other fora than the WTO. Matters which were WTO-related should be dealt with in the WTO; those which were not within the WTO's competence should be dealt with outside the WTO. In case where there was a possibility to resort to one or another fora, there shall be freedom of choice, there was a possibility to resort to one or another fora, there shall be freedom of choice; there was no relationship in terms of *lex-specialis* or *lex posterior* concerning which fora prevailed". [WT/CTE/M/13].

NAFTA parties explicitly addressed this issue, stating in Article 104 that insofar as specified environmental agreements, including the Montreal Protocol, contain their own dispute settlement processes, they will take precedence over the applicable dispute settlement processes of the NAFTA.

15. United States - Standards for Reformulated and Conventional Gasoline, Report of the Appellate Body, WTO document WT/DS2/AB/R, p. 16.

BIBLIOGRAPHY

BENEDICK, Richard Elliot (1991), *Ozone Diplomacy: New Directions in Safeguarding the Planet,* Harvard University Press: Cambridge MA. and London.

BRACK, Duncan (1996), *International Trade and the Montreal Protocol,* Royal Institute of International Affairs, Earthscan Publications Ltd.: London.

COOK, Elizabeth (Ed.) (1996a), *Marking a Milestone in Ozone Protection: Learning from the CFC Phase-Out,* WRI Issues and Ideas, January 1996, World Resources Institute: Washington DC.

COOK, Elizabeth (Ed.) (1996b), *Ozone Protection in the United States: Elements of Success,* World Resources Institute: Washington.

DOWNIE, David Leonard (1995), "Road Map or False Trail: Evaluating the 'Precedence' of the Ozone Regime as a Model and Strategy for Global Climate Change", in *International Environmental Affairs,* Vol.7 No.1.

FRENCH, Hilary F. (1997), "Learning from the Ozone Experience", in *State of the World 1997,* Worldwatch Institute, Earthscan Publications Ltd: London.

GOLDBERG, Donald M. (1995), "The Montreal Protocol", in *The Use of Trade Measures in Select Multilateral Environmental Agreements,* Environment and Trade Report No. 10, UNEP: Geneva.

LANG, Winfried (Ed.) (1996), *The Ozone Treaties and their Influence on the Building of International Environmental Regimes,* Austrian Federal Ministry of Foreign Affairs: Vienna.

NORDIC RESEARCH COUNCIL (1996), *The Effectiveness of Multilateral Environmental Agreements,* Nordic Council of Ministers: Copenhagen.

O'CONNOR, David C. (1991), "Policy and Entrepreneurial Responses to the Montreal Protocol: Some Evidence from the Dynamic Asian Economies", OECD Development Centre Technical Paper No. 51, OECD: Paris.

OECD (1995), "Trade Restrictions in International Environmental Agreements: The Case of the Montreal Protocol", COM/ENV/TD(95)15.

OZONE SECRETARIAT (1997) ,"The Montreal Protocol and Trade Measures", Communication to the WTO Committee on Trade and Environment from the Secretariat for the Vienna Convention for the protection of the Ozone Layer and the Montreal Protocol on Substances that Deplete the Ozone Layer, WT/CTE/W/57, 28 August 1997.

PARSON, Edward A. and Owen GREENE (1995), "The Complex Chemistry of the International Ozone Agreements" in *Environment*, 37:2 March 1995.

SHENDE, R. and S. GORMAN (1997), "Lessons in Technology Transfer Under the Montreal Protocol", paper prepared for the OECD Environment Directorate (Climate Change Programme) by the OzonAction Programme, United Nations Environment Programme, Industry and Environment Office (OECD, forthcoming).

SLAPER, Harry *et al.* (1996), "Estimates of Ozone Depletion and Skin Cancer Incidence to Examine the Vienna Convention Achievements" in *Nature*, Vol.384, 21 November 1996.

SZELL, Patrick (1991), "Ozone Layer and Climate Change", in H.P Newhold, W. Lang and K. Zemanek (Eds.) *Environmental Protection and International Law*, Graham and Trotman: London.

SZELL, Patrick (1996), "Implementation Control: Non-compliance Procedure and Dispute Settlement in the Ozone Regime" in Lang (1996) *infra.*

TWUM-BARIMA, Rosalind and Laura B. CAMPBELL (1994), *Protecting the Ozone Layer through Trade Measures: Reconciling the Trade Provisions of the Montreal Protocol and the Rules of the GATT*, Environment and Trade Report No. 6, UNEP: Geneva.

ULFSTEIN, Geir (1996),"The Vienna Convention for the Protection of the Ozone Layer and the Montreal Protocol" in Nordic Research Council (1996) *infra.*

VAN DYKE, Brennan (1997), "Effectiveness of Trade and Positive Measures in Multilateral Environmental Agreements: Lessons from the Montreal Protocol" draft in progress for UNEP.