House of Commons
Canada

THE STANDING COMMITTEE ON ENVIRONMENT

DEADLY RELEASES
CFCs

Part I of "Our Changing Atmosphere" Series

"Even if all use of CFCs was halted immediately, the atmospheric concentration of the ozone would not return to normal for more than a century."

June 1990

The Honourable David MacDonald, P.C., M.P.
Chairperson

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Third Report of the Standing Committee on Environment

The Honorable David MacDonald, P.C., M.P.
Chairman

June 1990

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HOUSE OF COMMONS

Issue No. 50

Tuesday, May 29, 1990
Thursday, June 7, 1990

Chairperson: David MacDonald

CHAMBRE DES COMMUNES

Fascicule nº 50

Le mardi 29 mai 1990
Le jeudi 7 juin 1990

Président: David MacDonald

Minutes of Proceedings and Evidence of the Standing Committee on

Environment

Procès-verbaux et témoignages du Comité permanent du

L'Environnement

RESPECTING:

In accordance with its mandate under Standing Order 108(2), a study of global warming.

INCLUDING:

Third Report to the House

CONCERNANT:

Conformément au mandat que lui accorde l'article 108(2) du Règlement, une étude du réchauffement de la planète.

Y COMPRIS:

Troisième rapport à la Chambre

Second Session of the Thirty-fourth Parliament, 1989-90

Deuxième session de la trente-quatrième législature, 1989-1990

Printed on recycled paper

Imprimé sur papier recyclé.

35112-1

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Published under authority of the Speaker of the House of Commons by the Queen's Printer for Canada
Available from the Canadian Government Publishing Center, Supply and Services Canada, Ottawa, Canada K1A 0S9

REPORT TO THE HOUSE

The Standing Committee on Environment has the honour to present its

THIRD REPORT

Pursuant to Standing Order 108(2) the Standing Committee on Environment undertook a study on CFCs. After hearing evidence, the Committee has agreed to report to the House as follows.

FOREWORD TO OUR CHANGING ATMOSPHERE SERIES

Human activities are having an increasing effect on our climate. Industrial development, the burning of fossil fuels, deforestation, and even agricultural practices are changing the composition of the earth's atmosphere. (Environment Canada, Atmospheric Environment Service, The Impact of Global Warming, Fact Sheet, 1989, p. 1)

As the Standing Committee on Environment of the House of Commons, we join the international community in recommending strategies to address the atmospheric problems that are affecting our country and our planet. As we began our study it soon became clear that, just as the air we breathe is a mixture of different gases with the potential for complex chemical reactions, so are the various atmospheric problems interwoven.

The Committee has focused on those atmospheric problems which the 1988 Toronto Conference on the Changing Atmosphere identified as the most urgent. Global warming is certainly one of the most compelling. It concerns our use of energy and other resources at the most fundamental level; patterns of use that have become entrenched in our socio-economic system and that are not easy to change, but patterns that must change. Ozone depletion may be relatively simple in theory to prevent compared to global warming, but still requires national action and concerted international cooperation, demonstrated by the Montreal Protocol. Yet even this agreement must be strengthened if the effort is to be successful. Canada has been struggling to reduce acid gas emissions and, after having established domestic control programs, it appears that we may be on the verge of implementing an American-Canadian control program. However, it remains to be seen if these steps will be enough to save our lakes and forests, and reduce the adverse health effects from acidic aerosols. Sadly, acid aerosols are only one component of the myriad of chemical contaminants found in the air that we breathe.

The Committee intends to produce other reports dealing with atmospheric change. We have been conducting extensive hearings on global warming and will table a report recommending policies for reducing Canada's contribution to the problem. The Committee also is alarmed at the potential harm to the environment in general, and to human health in particular, from airborne toxic chemicals. We expect to address the problem of toxic air pollution after completing our major study of global warming.

This first report on "Our Changing Atmosphere" addresses options for controlling the man–made chemicals that are both depleting the Earth's protective ozone layer and contributing to global warming. Society must phase out the use of CFCs (chlorofluorocarbons), halons and related chlorinated solvents, and ensure that they are replaced by the least harmful substitutes possible. There also is a need to ensure that these ozone depleting/global warming substances are recovered, recycled and ultimately destroyed. It has been suggested that if all the CFCs now in use were to be released, the ozone layer would likely be destroyed. The impact on the Earth's life forms could be devastating.

The need to recover these substances from existing uses in refrigeration equipment has given rise to the term "vampire unit", referring to the equipment used in recovering CFCs and halons in a gaseous state. The analogy is simple but effective. A vampire unit connects to the compressor system in a refrigerator, for example, sucking out the life–blood of the system—the CFCs. At this point, however, the analogy ends, since the vampire unit is protecting life on our planet.

There are three main thrusts to the Committee's recommendations: an accelerated phaseout in the production of CFCs and related ozone depleting substances, beyond that prescribed in the Montreal Protocol; the development of a domestic recovery and recycling system and the call to action of the international community to act decisively in combatting ozone depletion and to assist developing countries to prosper without replicating the harm the industrialized world has done to the Earth's atmosphere. By following our recommendations, we believe that the Government of Canada can set an example for other countries to follow and enhance its credibility as a leader in environmental protection.

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A CALL TO ACTION

We, the Members of this Committee, have reached one overpowering conclusion—not just a consensus, but a unanimous opinion—that ozone depletion is a threat to the continuation of life on Earth.

In our view, the governments of the world must immediately declare themselves at war with all of those elements which are responsible for depletion of Earth's ozone, which at the same time contribute to global warming. These are:

—CFCs

—halons

—methyl chloroform and carbon tetrachloride

—HCFCs and HFCs.

Two major public policies will be essential to the world's future:

1. all ozone depleting substances must be eliminated from further use, worldwide; and
2. all such substances must be recovered and destroyed.

We realize that these policies cannot be completely implemented immediately but time is of the essence. In the interest of human survival, we call on governments, industries, labour movements, universities and scientific organizations around the world to initiate action at once which will fulfill these policies while time is still available to defeat this common threat.

In our recommendations we attempt to provide a framework for such action which seems reasonable and realistic in the circumstances of our world today.

These recommendations should be reviewed annually to determine if schedules and timetables can be advanced.

We dedicate these pages to concerned citizens, including teachers, students, scientists, policy-makers, business and labour people.

We, the Members of this Committee, invite their comments and suggestions on the content of this report.

SUMMARY AND PRINCIPAL RECOMMENDATIONS

Life on Earth is shielded from damaging ultraviolet radiation by the ozone layer, yet we are threatening that layer's very existence. If all CFCs dispersed in refrigeration systems throughout the world were released, the ozone layer would probably be destroyed. Moreover, CFCs contribute to global warming, each molecule having up to 20,000 times the greenhouse effect of carbon dioxide. The time to remove the threat that CFCs pose to our atmosphere is now. This report recommends a strategy for eliminating these substances from our environment.

Three issues need to be resolved. First, we must phase out the production and use of CFCs and related substances that are damaging the atmosphere. Second, we must develop and market the least harmful substitutes. Third, we must ensure that those chemicals now in use are recovered, recycled and eventually destroyed—they must not be allowed to escape into the atmosphere. This must be accomplished globally.

Control and Elimination

Provisions for controlling certain CFCs and halons are contained in the Montreal Protocol of 1987. Although this international agreement would result in a 50% reduction in the production[1] and consumption[2] of CFCs in the signatory countries by 1998, it has become clear that this is not sufficient to stop depletion of the ozone layer. The Protocol must be strengthened at the June 1990 meeting in London by accelerating the phaseout of those CFCs and halons already covered, by including other ozone-depleting substances and by bringing other countries, particularly developing countries, into the Protocol.

Our first two recommendations call on the federal government to take a strong stand, both at home and at the international negotiating table, for more rapid phaseout of CFCs (used predominantly in refrigeration), halons (used in fire extinguishers) and the chlorinated solvents carbon tetrachloride and methyl chloroform (used primarily as cleaning agents).

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1. As defined in the Protocol, "production" means the amount of controlled substances produced minus the amount destroyed by technologies to be approved by the Parties.

2. As defined in the Protocol, "consumption" means production plus imports minus exports of controlled substances.

(1) **We recommend that the following be adopted as the basis for regulations under the *Canadian Environmental Protection Act* (CEPA) and be promoted prior to amending the Montreal Protocol:**

a) **a minimum 85% reduction in the production and consumption of all CFCs by 1995, with a complete phaseout by 1997; and**

b) **a complete phaseout in the production and consumption of carbon tetrachloride and methyl chloroform by 1995, except for their use as a feedstock for CFC or halon substitutes and as organic laboratory solvents.**

(2) **We recommend that regulations be invoked under CEPA requiring a 95% reduction in halon production and consumption by 1993, and a complete elimination by the year 2000, except for those "essential uses" where no reasonably performing substitute is available.**

CFCs became widely used in a variety of industrial processes, given their non-toxic and non-flammable nature. Problems arise in substituting other chemicals for these applications. Substitutes already developed can be classified as HCFCs (hydrochloro-fluorocarbons), chemicals that contribute less to global warming and ozone depletion, and HFCs (hydrofluorocarbons), chemicals that contribute to global warming but not to ozone depletion. HCFCs are projected by industry to capture up to 30% of the CFC market by 2000, with HFCs capturing another 9% by that time. Neither group is totally harmless, but using them as temporary bridging chemicals could reduce the continuing damage to the atmosphere by 80 to 90%. We cannot afford to wait for the perfect substitute, but we must choose substitutes carefully. We must assess their benefits in reducing both ozone depletion and global warming, and ensure that the least harmful substitute is used in a particular application.

(4) **We recommend that:**

a) **neither HCFCs nor HFCs be used in any aerosols;**

b) **HCFCs and HFCs only be used in other products as replacements for CFCs where safe alternatives are not available;**

c) **only those HCFCs and HFCs with the least ozone depletion and global warming potential be used in products or processes requiring such substances;**

d) **in future, HCFCs and HFCs not be substituted for CFCs at any time in amounts greater than 30% and 9%, respectively, of present CFC use, and by 2010 the production and consumption of HCFCs and HFCs be discontinued.**

The use of CFCs in automobile air conditioning has been the cause of some introspection by the Committee. Like most people, we would prefer to drive in comfort on a hot summer day. But we cannot accept current technology that allows CFCs to escape from automobile air conditioners because they lack leak-proof systems. The Committee has been advised that an HFC substitute should be available by 1993 or 1994 but that substitute itself will not be totally harmless. In the interim, CFC release will continue to damage the ozone layer and contribute to global warming. Therefore:

(6) We recommend that air conditioning units for the passenger compartments of all motor vehicles be leak-proof, beginning with the 1992 model year.

Those members of the public who want to take a stronger position and who own automobiles with air conditioning now, could have the CFCs in the system properly removed. The air conditioner could then be left uncharged until a leak-proof unit could be retrofitted to the automobile or until a harmless substitute becomes available.

Government Cooperation and Resources

Many initiatives for managing the phaseout of CFCs, halons and their substitutes that are not completely harmless will involve many or all jurisdictions to be found in Canada. We believe there is a need for leadership to accelerate initiatives. The Canadian Council of Ministers of the Environment is the most appropriate body dealing with multijurisdictional environmental concerns. Therefore:

(5) We recommend that the Canadian Council of Ministers of the Environment take the lead when multijurisdictional participation would accelerate initiatives for the reduction, recovery, recycling and eventual safe destruction of CFCs and halons.

The recovery/recycling industry for CFCs, halons and their substitutes is in its infancy. The necessary technology is being developed, but the service industry faces many hurdles in its application. For example, most major automobile manufacturers will soon require their dealerships to recover and recycle CFCs from automobile air conditioners using specialized equipment. Small, independent garages may not be able to afford this equipment, and may lose business. A similar problem will arise in the appliance service industry. Equipment costs will make it difficult for small companies to compete, especially if recovery and recycling are made mandatory, as is proposed in recommendation (8).

(8) We recommend that Environment Canada be provided the necessary funds to assist the relevant authorities in developing programs for the recovery and

recycling of CFCs from commercial, household and mobile refrigeration systems that are to be scrapped or that have been previously abandoned. Once destruction technologies and less harmful substitutes are available, then the recovered, more harmful substances must be destroyed.

Although the Committee would prefer to see market forces act alone in removing these substances from circulation, we recognize that the accelerated timetable which we propose for the phasing out of CFCs requires federal action. The Committee proposes therefore that a tax be levied on the production of new CFCs and halons. It is hoped that this tax will provide incentive for producing industries to become directly involved in recycling as has reportedly happened in the United States since their tax was implemented. Recycling CFCs should be less costly than producing new CFCs. Recycling should also accelerate the phaseout of their production. Revenues from the tax could be used to support other CFC and halon weaning initiatives at home and abroad.

(17) **We recommend that a tax be levied on CFCs and halons at least equivalent to that to be implemented in the United States. Funds equal to those derived from the tax should be used to support initiatives arising from recommendations of this report.**

International Responsibility

Assistance to developing countries both financially and in the form of technology transfer will be necessary to ensure that all potential producers of CFCs become members of the "global bargain" to protect the ozone layer, known as the Montreal Protocol.

Although developing countries have 80% of the world's population they have been responsible for only 15% of the world's production of CFCs. But they also have a growing demand for refrigerators, freezers and other refrigeration systems. With their increasing debt they cannot afford the additional, marginal costs of converting to less harmful substitutes. The international community must help. Canada must indicate its whole hearted effort to keep this global bargain alive. Therefore:

(20) **We recommend that the federal government contribute to all funding mechanisms developed under the Montreal Protocol. We also recommend that a roundtable be established in Canada consisting of all government departments, industry, non-government organizations and other stakeholders who would be involved in funding and facilitating technology transfer to developing countries.**

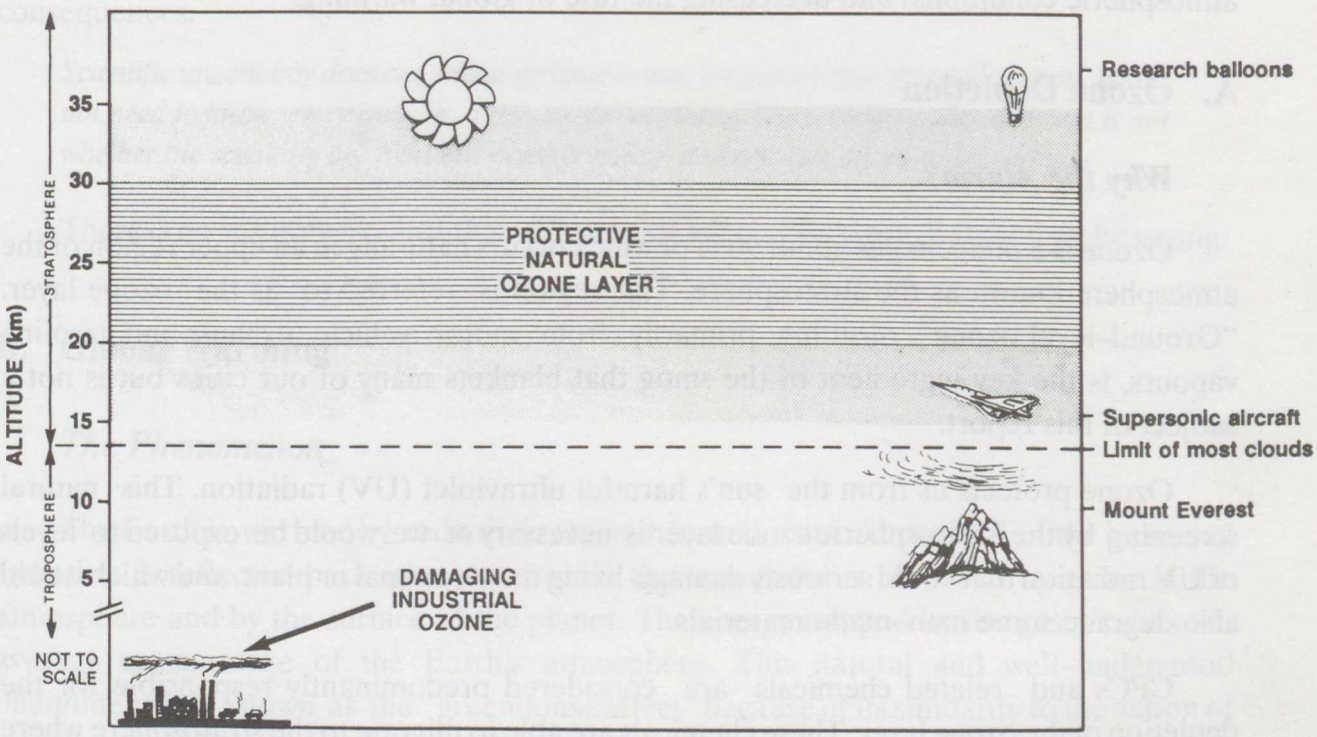
We must also ensure that Canada's policies and actions are consistent with the international goals of global bargains. Therefore:

(22) We recommend that a review be undertaken of trade development programs and subsidies, and of foreign aid policies, programs and projects to ensure they are consistent with the preventive aims of this report.

INTRODUCTION

Although life on Earth is shielded from damaging ultraviolet radiation by the ozone layer, we are threatening that layer's very existence. Since the 1930s, we have emitted millions of kilograms of chlorofluorocarbons (CFCs) and related chemicals that have slowly migrated to the upper atmosphere. There, through a series of chemical reactions, the ozone has progressively been depleted. This has resulted in a worldwide erosion of the protective layer and a pronounced seasonal reduction in ozone concentration over a large area of the southern polar region, known as the Antarctic "ozone hole". If all the CFCs throughout the world were to be released, the Earth's ozone layer would probably be destroyed.

Figure 1 : Ozone in the Atmosphere



In the upper atmosphere, a protective layer of ozone shields us from the sun's damaging rays, while at ground level this same gas is a serious air pollutant. (Most of the ozone in the upper atmosphere occurs between 15 and 35 km, with the heaviest concentration between 20 and 30 km.)

Source: Environment Canada, Atmospheric Environment Service, *The Ozone Layer*, Fact Sheet, Supply and Services Canada, 1987, p. 2.

CFCs, like DDT and PCBs, were considered valuable and beneficial chemicals before their environmental costs were recognized. They are used as coolants in refrigerators and freezers, and in air conditioners for automobiles and large buildings. In some countries, CFCs continue to be employed as propellants in aerosol cans for such products as hair sprays and deodorants. In recent years they have been increasingly used in manufacturing soft foam for cushions, solid foam for packaging and insulation and as a cleaning solvent for micro-electronic circuitry.

CFCs are not the only chemicals responsible for depleting the ozone layer. We now realize that related chemicals such as halons used in some fire extinguishers and certain industrial solvents have similar destructive properties. Only recently, however, have we discovered these same chemicals act as greenhouse gases and that their past release to the atmosphere will cause an estimated 20 to 25% of future global warming.

Controlling the use of these substances will therefore have two benefits: allowing the ozone layer to replenish itself slowly (since ozone molecules do form under normal atmospheric conditions) and decreasing the rate of global warming.

A. Ozone Depletion

Why the Alarm?

Ozone is a pungent gas about 90% of which occurs naturally in an upper region of the atmosphere known as the stratosphere. This region is referred to as the ozone layer. "Ground-level ozone", resulting primarily from motor vehicle exhaust and gasoline vapours, is the key ingredient of the smog that blankets many of our cities but is not a subject of this report.

Ozone protects us from the sun's harmful ultraviolet (UV) radiation. This natural screening by the stratospheric ozone layer is necessary or we would be exposed to levels of UV radiation that could seriously damage living tissue, animal or plant, and which would also degrade some man-made materials.

CFCs and related chemicals are considered predominantly responsible for the depletion of the ozone layer. These chemicals are able to migrate to the stratosphere where the sun's radiant energy causes them to decompose and release chlorine and bromine. These molecules act as catalysts for chemical reactions leading to the breakdown of ozone. A single molecule of chlorine can destroy tens of thousands of molecules of ozone before being removed from the atmosphere. The problem is compounded in that, once released, many ozone depleting substances remain in the atmosphere for long periods of time, typically 75 to 100 years.

Skin Cancer and Other UV–Related Hazards

Depletion of the ozone layer has already increased the risk of skin cancer to Canadians by over 15%. Each 1% loss of ozone leads to a 3–4% increase in non–melanoma skin cancer, a 0.6% increase in cataracts, and a 1% reduction in the yield of UV–sensitive crops such as wheat, rice, corn and soybeans. There are other problems such as suppression of the immune system, suspected increases in malignant melanoma, degradation of industrial materials such as plastics and paints, and a threat to the aquatic food chain given the susceptibility of phytoplankton to UV radiation.

Assessing the Risk

The catastrophic consequences of ozone depletion and the failure of atmospheric models even to predict the ozone hole over the Antarctic are a strong driving force for international cooperation. Inaction in the face of scientific uncertainty can have profound consequences.

> *Scientific uncertainty does not mean we have to wait for more research to take action. We do not need to know everything in order to do anything. The relevant policy question is not whether the scientists are right but whether policy–makers can afford to be wrong...*

There is no insurance policy that will provide adequate coverage should we be wrong.

B. Global Warming

The Phenomenon

The Earth is warmed by radiation received from the sun. About 30% of the incoming radiation is reflected back into space while the remainder is absorbed by gases in the atmosphere and by the surface of the planet. The energy trapped by the gases raises the average temperature of the Earth's atmosphere. This natural and well–understood phenomenon is known as the "greenhouse effect" because of its similarity to the action of a greenhouse. The gases which exhibit this behaviour are often referred to as "greenhouse gases".

The principal natural greenhouse gases are water vapour (H_2O) and carbon dioxide (CO_2). Without them, the average air temperature at ground level would be approximately $-18^{\circ}C$, not the $+15^{\circ}C$ we experience. This natural greenhouse effect is vital to the presence of life on the Earth.

Since the onset of the Industrial Revolution, the human race has been adding to the natural occurrence of greenhouse gases in the atmosphere, at first slowly but now at an alarming rate. Although CO_2 created in burning fossil fuels such as coal, oil and gas has been the principal concern, we now know that other gases from industrial and agricultural activities (notably methane, CFCs and nitrous oxide) contribute to the greenhouse effect. Ozone depleting substances such as CFCs, the subject of this report, are considered responsible for as much as one-quarter of the extra greenhouse effect.

Although these additional greenhouse gases are increasing the potential to elevate the average temperature of the atmosphere that is, to cause "man-made global warming"—scientists cannot yet predict with certainty at what point society's activities will cause an identifiable warming, nor can they accurately determine the rate of this induced warming. Climate and weather patterns change naturally and it is difficult to separate normal shifts from human induced changes.

It is only a question of time, however, until human induced effects become distinguishable from natural effects. Given the immensity of climatic systems, we can anticipate that once these changes are precipitated, there will be little that humanity can do but watch them unfold and try to adapt to them.

There is debate regarding how quickly society should respond to this threat and how far-reaching public policy initiatives should be at this time. There is little disagreement, however, that we are conducting a global experiment in atmospheric chemistry with little understanding of how it will turn out. Testifying before our Committee on the extent of scientific agreement about the reality of global warming, James Bruce, a leading Canadian authority on climate change, remarked:

> *. . . I think on any scientific topic you care to name you can probably find a few scientists who will dissent from the general view of the subject. I have chaired and participated in many meetings with the leading scientists of the world on this topic and I would say I have rarely seen such a consensus on what will happen with increased greenhouse gases in the world's atmosphere.*
> *(*House of Commons, Standing Committee on Environment, *Minutes of Proceedings and Evidence,* Issue No. 30, 25 January 1990, p. 45*)*

Society's emissions of greenhouse gases are changing the chemical composition of the atmosphere at a rate unparalleled in human history. We understand that altering the Earth's climate will have far-reaching impacts on the social, economic and natural systems of our world. The current scientific consensus is that we are already committed to an increase in average global temperature ranging from 1.5°C to 4.5°C in the first half of the 21st century. Warming is expected to be more pronounced at higher latitudes and

temperature increases will be accompanied by changes in climatic conditions that are not readily predictable. Patterns of agriculture and water resources will be affected.

Sea Level Rise

Sea level is projected to rise roughly one metre by 2050, flooding coastal lowlands and islands and reducing freshwater supplies as saltwater intrudes into the groundwater regime. Higher temperatures will cause some permafrost, mountain glaciers and polar ice to melt. The upper layers of the oceans will expand through warming, adding to the rise in sea level. Canada could experience a substantial loss of land on Prince Edward Island, the Hudson Bay coastline, and in river deltas such as the lower Fraser and the Mackenzie. A rise in sea level could be catastrophic for low–lying countries and island states. Millions of people could be forced to relocate from the delta regions of Bangladesh and Egypt alone. The Republic of Maldives in the Indian Ocean, with a population of 200,000, has been described by its President as an "endangered nation".

Climate Instability

Populations in many regions of the world could be subjected to increasingly severe and unpredictable cyclonic storms, and more erratic weather patterns. Regional changes in precipitation patterns will occur, concomitant with regional variability in temperature increases. Altered climates would affect world food security by changing agricultural productivity, and would affect the productivity and biological diversity of natural ecosystems, particularly forests.

THE MONTREAL PROTOCOL

Canada and 46 other countries have signed the Montreal Protocol on Substances that Deplete the Ozone Layer, which came into force on 1 January 1989. The Protocol establishes a schedule to reduce the global consumption of five CFCs and three halons. The schedule for their reduction is:

- a freeze in consumption (defined as production plus imports minus exports of bulk chemicals) at 1986 levels of

  CFCs starting on 1 July 1989
  halons starting on 1 January 1992, and

- a reduction in consumption of CFCs of

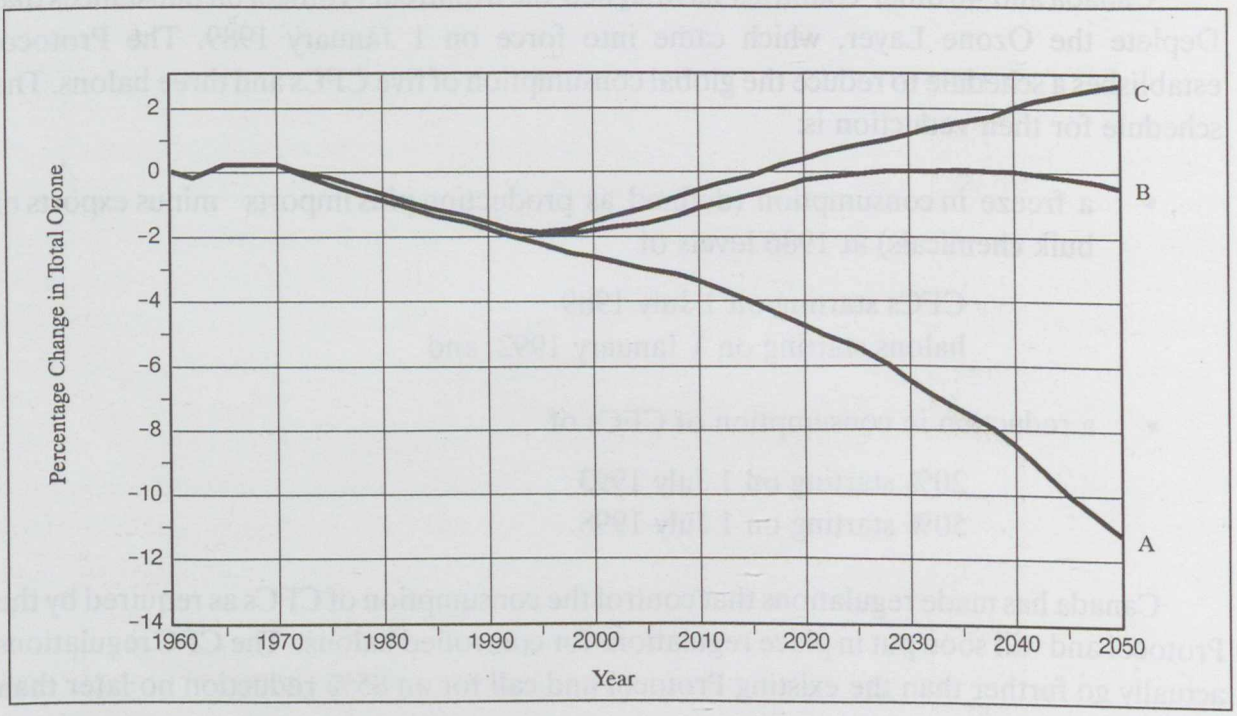
  20% starting on 1 July 1993
  50% starting on 1 July 1998.

Canada has made regulations that control the consumption of CFCs as required by the Protocol and will soon put in place regulations for controlled halons. The CFC regulations actually go further than the existing Protocol and call for an 85% reduction no later than 1999.

Despite these controls, the total quantity of CFCs in Canada and globally continues to grow. In Canada we are adding some 20,000 to 25,000 tonnes per year to the existing stock. This annual addition is not required to be reduced until 1993 and then only by 20%.

The Protocol provides for adjusting control measures as more environmental, technical and economic information becomes available. As illustrated in Figure 2, compliance with the Protocol as it stands will not allow the ozone layer to recover its natural level of concentration. The only solution is to expand the range of substances covered and advance the target dates for their control. It is hoped this will be achieved at the meetings in London, in June 1990. Advancing the elimination of ozone depleting chemicals would also retard the accumulation of greenhouse gases in the atmosphere.

Figure 2 : Predicted Changes in Ozone Concentration for Different Phasedown Scenarios



A – Montreal Protocol unamended, maximum 50% reduction by signatory countries and increase in CFC and halon use by developing countries

B – CFC and halon phaseout by 2000

C – CFC and halon phaseout by 2000, and methyl chloroform, carbon tetrachloride and HCFC-22 constant at 1986 levels.

Source : Adapted from: *Protecting the Earth's Atmosphere : An International Challenge,* Report of the Study Commission of the 11th German Bundestag "Preventive Measures to Protect the Earth's Atmosphere". German Bundestag, Publ. Sect., Bonn, 1989, p. 305.

TECHNICAL INFORMATION

A. Background

The discovery of the refrigerant properties of CFCs in 1928 was followed in the 1940s by their application as a blowing agent in rigid insulating foam; as a propellant in aerosol cans (originally in those containing pesticides to control malaria) during the Second World War; and as flexible polyurethane foams for furniture in the 1950s. More recently, CFCs have been used as a cleaning solvent, particularly for electronic equipment. A breakdown of global and Canadian use of the five CFCs controlled by the Montreal Protocol is given in Figure 3. This illustration does not include the three halons (fire extinguisher agents) that are also controlled by the Protocol.

Canada's contribution to global ozone depletion is less than 2%, an amount comparable to our contribution to global warming. However, Canada's per capita contribution to CFC emissions, at approximately 0.8 kilogram per year, is the second highest in the world after the United States. The use of CFCs in Canada is substantially different from the global pattern, chiefly because of their virtual elimination from aerosol cans used in the homes of Canadian consumers.

Even if all use of CFCs was halted immediately, the atmospheric concentration of ozone would not return to normal for more than a century. This is due to the long life span of CFCs in the atmosphere—in some cases estimated to be longer than 100 years—and because products made from CFCs, such as foams, continue to release CFCs as they slowly decompose.

There are dozens of end uses for the different CFCs, each of which must be evaluated to ensure that restricting their use is not too disruptive. Using less harmful substitutes and modifying the way some products are made or applied should result in reduced environmental degradation with little disruption to society. More limited use of CFCs alone could displace 29% of their present global use by the year 2000 (UNEP, 1989, p. 11).

The chemicals of concern are not only the fully halogenated[1] chlorofluorocarbons (CFCs), but also:

- hydrochlorofluorocarbons (HCFCs) that are not fully halogenated;
- halons, which are fully halogenated hydrocarbons generally containing bromine;

1. A carbon-based molecule is "fully halogenated" when all the other atoms attached to it are halogens. Halogens are a group of elements including fluorine, chlorine, bromine and iodine.

- carbon tetrachloride and
- methyl chloroform.

All these chemicals have some degree of ozone depleting potential (ODP) and global warming potential (GWP). Another group of chemicals viewed as substitutes for the CFCs and HCFCs are hydrocarbons that do not contain chlorine or bromine, the molecules that cause the destruction of the ozone. These hydrofluorocarbons (HFCs) are not ozone depleting but may act as greenhouse gases.

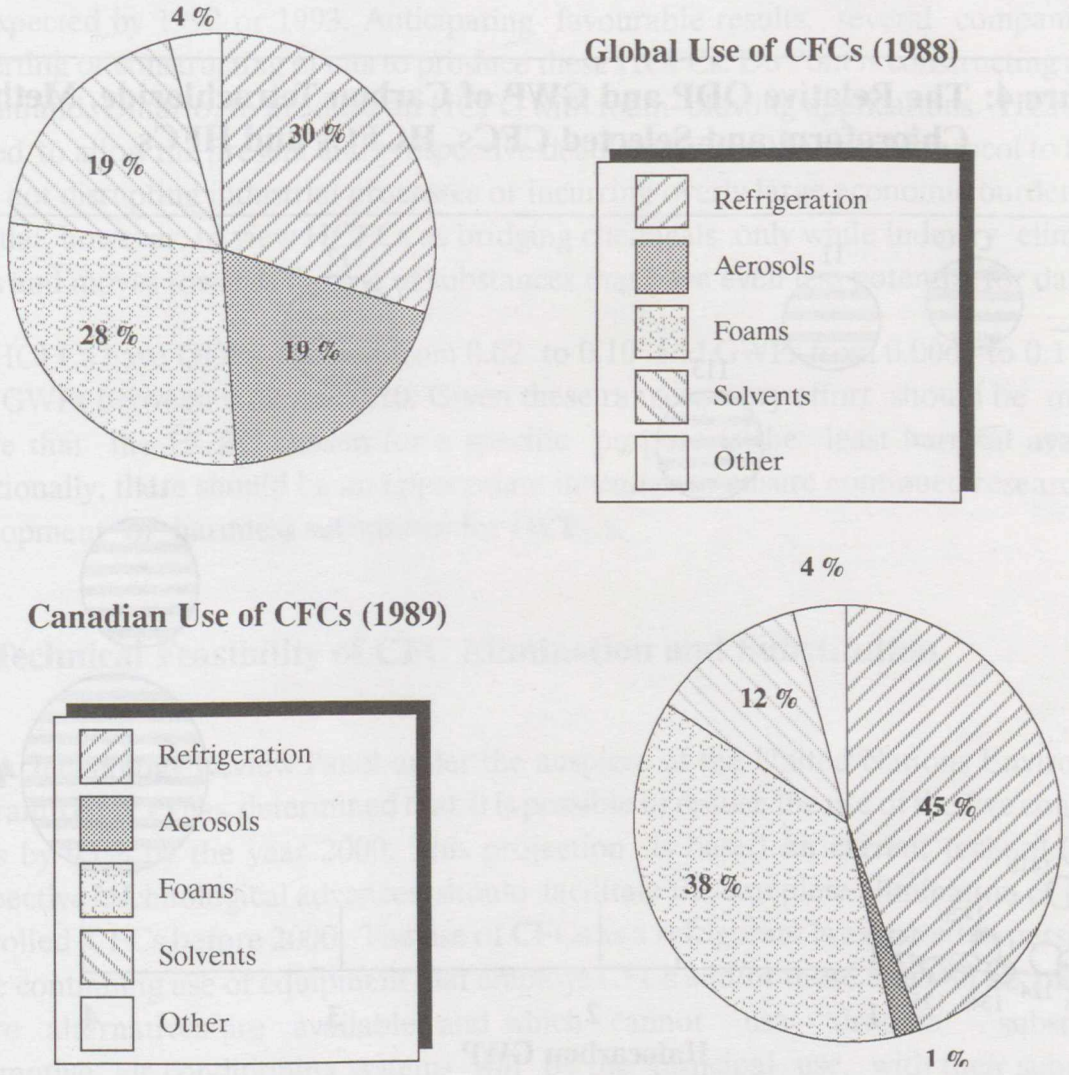
ODP and GWP values have been calculated for most of the 50 or so chemicals that fall into these categories. In assessing their environmental acceptability, both indices need to be taken into account. Using these values, it is possible to estimate the changes in ozone depletion and global warming that could be expected should different practices and combinations of chemicals be selected to replace those now in use.

Figure 4 shows the relative ODP and GWP of selected substances that require control and some of their substitutes. It is evident from Figure 4 that use of the HCFC and HFC substitutes would substantially reduce damage to the atmosphere. It has been estimated that completely substituting HCFCs and HFCs for CFCs would result in a 90% reduction in the overall ODP. Figure 4 also illustrates the pronounced differences in ODP and GWP of the selected HCFCs and HFCs. These differences must be incorporated into government policy.

Halons were developed at the end of the Second World War and have grown in popularity as fire extinguishing agents, particularly for use on sophisticated electronic equipment because they are essentially inert and do not leave a residue. The largest release of halons, however, is from testing extinguishers rather than their use in actual fire fighting. There should, therefore, be substantial opportunity for their control even if their use continues. Halons have extremely high ODP (3–10). The GWP is known only for one of the halons, and its value is 0.8.

Carbon tetrachloride is used primarily as a feedstock in producing CFCs. At the time of signing the Montreal Protocol it was believed that controlling the major CFCs would result in the control of carbon tetrachloride as well. Rising levels in the atmosphere indicate, however, that this assumption was incorrect and that the non-feedstock uses of this toxic substance—such as a constituent in pesticides, as a dry cleaning agent, as a solvent in synthetic rubber and dyes, and as a grain fumigant—are substantial. The ODP of carbon tetrachloride is high (1.0–1.2) but the GWP is moderate (0.12).

Figure 3 : Global and Canadian Use of Controlled CFCs

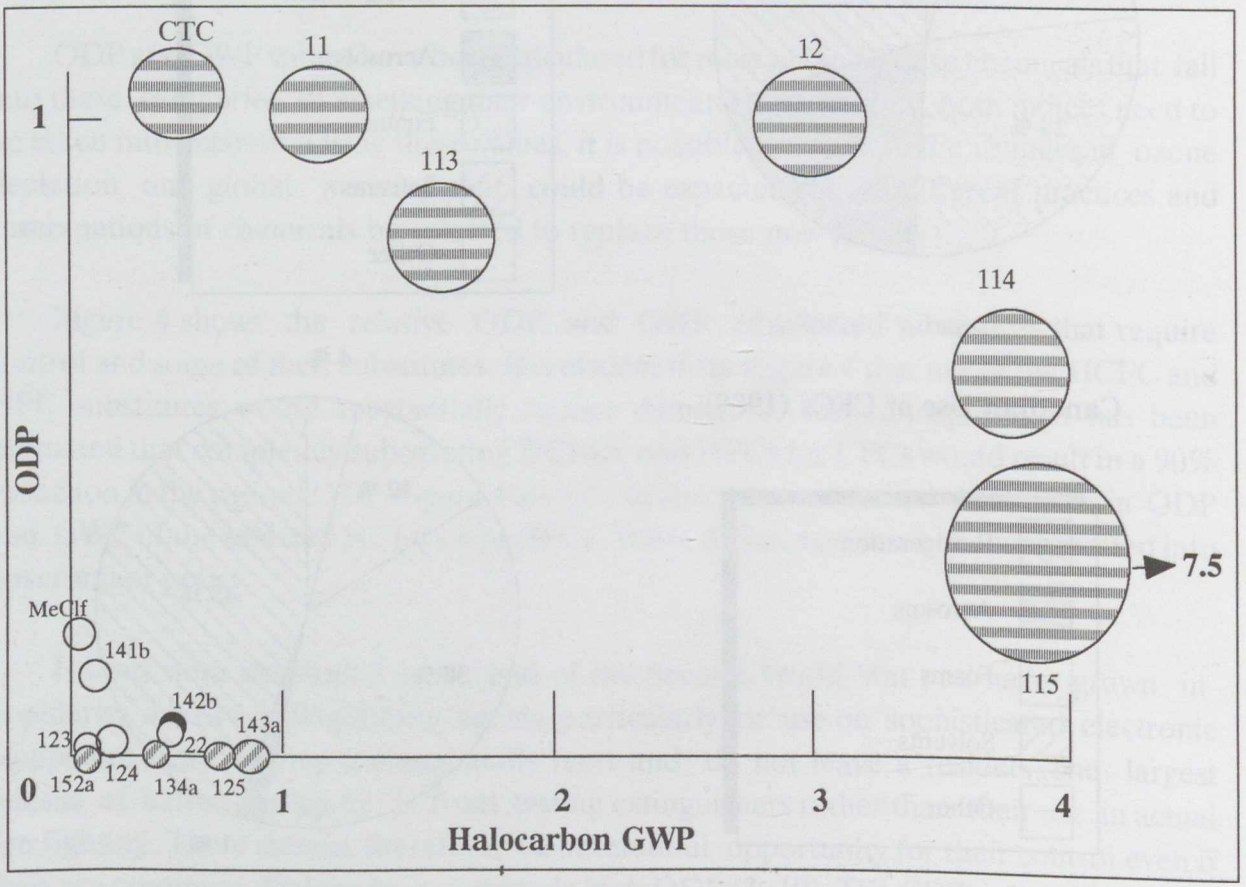


Sources : Dupont Canada Inc., Estimates received by Environment Canada, 27 April 1990 (for the global data).
V. Buxton, Environment Canada, *Minutes of Proceedings and Evidence of the Standing Committee on Environment*, Issue 20, 7 November 1989, p. 34.

Methyl chloroform was introduced in the mid–1950s as a cold cleaning solvent substitute for carbon tetrachloride. Today it is primarily used for vapour degreasing and cold cleaning of fabricated metal parts and other materials, but may have some application as a feedstock for CFC substitutes. Little information is available on the global uses of methyl chloroform, but the large quantities known to be consumed

(700 kilotonnes/year) make it a substance of concern for ozone depletion even though its ODP is relatively low (0.11). Its GWP is very low (0.0074). The lifetime of the product in the atmosphere is short (6.3 years), unlike many other chemicals of concern; once the use of methyl chloroform is stopped, its atmospheric effects will soon cease.

Figure 4: The Relative ODP and GWP of Carbon Tetrachloride, Methyl Chloroform and Selected CFCs, HCFCs and HFCs



HCFCs and HFCs provide large improvements in terms of both ozone depletion potential (ODP) and halocarbon global warming potential (GWP). The area of the circle is proportional to the lifetime of the compound it represents. The centre of the circle marks the ODP and halocarbon GWP. The compounds shown in the illustration are: CFCS-11, -12, -113, -114, -115; carbon tetrachloride (CTC); HCFCs-22, -142b, -124, -123, -141b; methyl chloroform (MeClf); and HFCs-152a, -134a, -125, -143a. The ODPs are calculated from the results of computer model simulations.

Source : United Nations Environment Program/World Meteorological Organization, "Scientific Assessment of Stratospheric Ozone", quoted in Du Pont's *Fluorocarbon/Ozone Update*, August 1989, p. 5.

HCFCs are viewed by industry and by most policy-makers as valuable in an orderly transition from CFCs to a time when non-halogenated substances would dominate most end uses. A few HCFCs are already in use (as in producing rigid foams) and several HCFCs are undergoing accelerated toxicity testing. Results of the long-term toxicity tests are expected by 1992 or 1993. Anticipating favourable results, several companies are converting or constructing plants to produce these HCFCs. Du Pont is constructing a plant in Maitland, Ontario, to produce an HCFC with foam-blowing applications. HCFCs are needed to allow the present and prospective deadlines of the Montreal Protocol to be met while not disrupting industrial processes or incurring overly large economic burdens. It is essential, however, to view HCFCs as bridging chemicals only while industry eliminates CFCs and moves towards the use of substances that have even less potential for damage.

HCFCs have ODPs ranging from 0.02 to 0.10 and GWPs from 0.0064 to 0.11, with most GWPs between 0.02 and 0.10. Given these ranges, every effort should be made to ensure that the HCFC chosen for a specific purpose is the least harmful available. Additionally, there should be an appropriate incentive to ensure continued research and development of harmless substitutes for HCFCs.

B. Technical Feasibility of CFC Elimination and Substitution

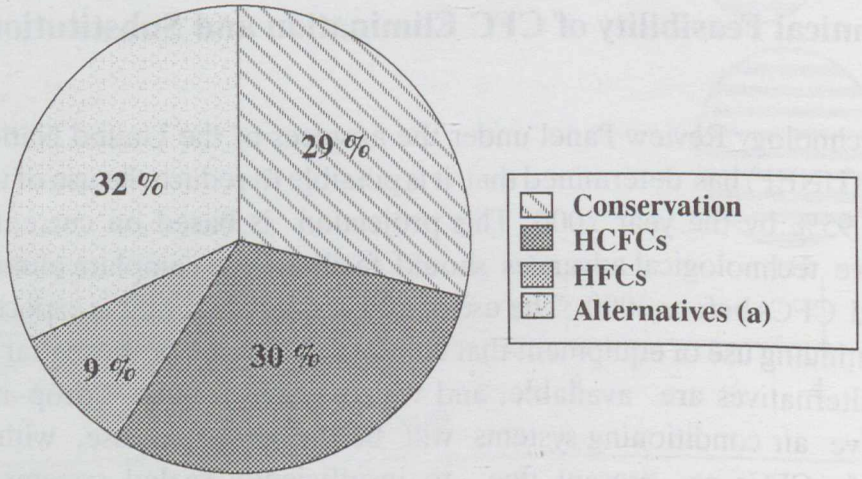
A Technology Review Panel under the auspices of the United Nations Environment Program (UNEP) has determined that it is possible to reduce the use of the five controlled CFCs by 95% by the year 2000. This projection is based on current technology, but prospective technological advances should facilitate the complete elimination of the five controlled CFCs before 2000. The use of CFCs as a refrigerant is expected to persist, due to the continuing use of equipment that employs CFCs and/or those that will be produced before alternatives are available, and which cannot use "drop-in" substitutes. Automotive air conditioning systems will be the principal use, with their substantial release of CFCs at present due to insufficiently sealed systems and inadequate recovery/recycle technologies for maintenance.

Changes in products and practices, such as using hot water instead of CFCs to wash microchips, will account for a large reduction in CFC use. HCFCs are projected to account for 30% of CFC demand by 2000, and HFCs for another 9% (Figure 5), resulting in an anticipated overall reduction in ODP of 90%. There is potential for further reduction in ODP and GWP by carefully selecting which HCFC or HFC should replace a CFC for a specific use. According to the Technology Review Panel, which relies on data from industry, the World Meteorological Organization (WMO) and the United States Environmental

Protection Agency (EPA), HCFCs will contribute between 2% and 10% to global warming at least until 2030.

Substitutes for CFCs, most importantly HCFCs, can affect global warming in more than one way. They may have their own radiative properties or GWP. Moreover, their use may change the efficiency of equipment and products, which could result in changes in fossil fuel demand and emissions of carbon dioxide. Use of an HCFC in high-quality insulation, for example, may increase energy efficiency sufficient to offset the GWP produced by the HCFC acting as a greenhouse gas. It is thus important to ensure that choices minimize the overall ODP and the GWP. At times, more than one CFC substitute or HCFC may be usable in a given application. The decision to use a particular HCFC must be made on environmental grounds, considering both ODP and GWP.

Figure 5: Projected Displacement of Current CFC Demand by 2000



Note (a) : "Alternatives" are substitutes for CFCs other than HCFCs and HFCs.

Source : United Nations Environment Program, Technology Review Panel, *Technical Progress on Protecting the Ozone Layer*, 30 June 1989, p. viii, Figure 5.

The Office of Air and Radiation of the U.S. EPA has examined four scenarios for HCFC/HFC substitution, assuming a phasing out of CFCs by the year 2000. One scenario, called "Minimize Greenhouse/Energy Impact," projected that a mix of HCFCs

and HFCs would result in an increase in chlorine concentration in the stratosphere of only 0.1 parts per billion (EPA, 1989, p. 3–69). Although there would be a minor increase in chlorine concentration, the CFC replacements in this scenario would decrease global warming by 1% in 2075. Avoiding extensive use of HCFCs with higher ODP, for example HCFC–141b, would preclude significant increases in stratospheric chlorine.

It is important to compare the effectiveness of such policies for CFC replacement. For example, in the EPA's limiting or "worst case" scenario, where "Maximum Use of HCFCs with Maximum Chlorine Content" is considered, the estimated rate of warming would actually increase by 4.3%, indicating the inherent GWP of these substitutes (EPA, 1989, p. 3–59). Comparing this increase to the 1% reduction in GWP that is possible indicates how proper management could make a difference of over 5% in the rate of global warming. In comparison, doubling fuel efficiency of the global automobile fleet would only reduce the global warming effect 7% in 2075 (EPA, 1989, p. 3–59).

Implementing the "Minimize Greenhouse/Energy Impact" scenario is projected to result in a large net global saving in energy costs. Such savings are generated in this scenario with energy consumption being minimized through, for example, the use of ammonia as a refrigerant and energy–efficient vacuum panels instead of conventional foam insulation. The potential global savings in energy costs were estimated by the EPA to total as much as $US 270 billion and could substantially offset the overall costs of reducing the present use of CFCs (EPA, 1989, pp. 3–47, 3–48 and 3–57).

C. Reducing the Use of Other Ozone Depleting Substances

Methyl chloroform and carbon tetrachloride are expected to be the principal sources of chlorine in the stratosphere once CFCs are phased out of production. Their potential contributions to global warming have not been calculated, perhaps because their GWP collectively is relatively low. Considering the recent, unexpected increase in carbon tetrachloride levels from uses that are not yet fully documented, and because of its GWP, there should be more concern about trends in the use of this solvent. There already is concern regarding methyl chloroform because of its ODP. Since alternates exist for both substances, there should not be any reason why policy and regulation cannot eliminate them by 2000. According to the Technology Review Panel, substitutes exist for 90–95% of methyl chloroform uses. Substitutors also exist for most uses of carbon tetrachloride except in their feedstock application for HCFC's. The UNEP working group in a draft report suggests that it is technically feasible to end the production and consumption of carbon tetrachloride by 2000 (UNEP, 1989a, p. 11).

The feasibility of ending halon use appears to have been the most contentious topic of discussion for the Technology Review Panel. Although much less used than CFCs, halons have an extremely high ODP and a relatively high GWP. Alternatives do exist for halons used in fire extinguishers and fire control systems, but in the minds of some there is a question of the cost:benefit ratio should these alternatives be used on sensitive electronic equipment. They argue that the failure of computerized functions could threaten the environment and human life, health or security.

Apparently economic analyses weighing the costs and benefits of using halons have not been performed. Recent developments by chemical manufacturers suggest that less harmful non–halon and non–CFC alternatives may be available sooner than previously anticipated. Phasing out the use of halons may be less of a technical problem than envisioned.

CONTROL MEASURES

A. Targets and Timetables

There is general agreement that it is technically feasible to phase out use of the five CFCs controlled by the Montreal Protocol. What remains is determining the targets and timetables for their elimination and providing assistance to developing countries to encourage them to join the Protocol. Canada can contribute to this process by controlling CFCs in this country, by helping to develop and implement amendments to strengthen the Protocol, and by indicating its intention to ensure additional resources are available to developing countries. Time, however, is of the essence; the Protocol will be renegotiated in June 1990.

This Committee recommended that Canada take a strong position on amending the control provisions of the Montreal Protocol at the November 1989 international meetings. We stand by, and in some cases strengthen our former position, which was stronger than Canada brought to the negotiating table at that time. Other countries subsequently proposed controls as strong as those of this Committee. We hope that more countries including Canada will have the courage at the June 1990 negotiations to adopt a timetable for eliminating CFCs.

Our recommendations for the control of CFCs and related substances are now more comprehensive than those the Committee made in November 1989. This is primarily the result of two factors. First, more information regarding the technical potentials for controls has been made available since that time, and second, the urgency of the problem has also become clearer to the international community. Targets and timetables as outlined below are necessary to reduce the threat to the ozone layer and to reduce global warming.

(1) We recommend that the following be adopted as the basis for regulations under the *Canadian Environmental Protection Act* (CEPA) and be promoted prior to amending the Montreal Protocol:

a) a minimum 85% reduction in the production and consumption of all CFCs by 1995, with a complete phaseout by 1997; and

b) a complete phaseout in the production and consumption of carbon tetrachloride and methyl chloroform by 1995, except for their use as a feedstock for CFC or halon substitutes and as organic laboratory solvents.

Problems in phasing out halons, whose use may be deemed essential because of safety or security applications, have led to disagreement about technically attainable targets. There is also reluctance to further limit the use of halons because of perceived economic costs, should benign and inexpensive substitutes not be found. There does seem to be agreement, however, that improved management of the present stock of halons in fire extinguishing systems and the prohibition of non-essential uses could reduce the demand for halons by 95%.

That said, there maybe an even more compelling reason for eliminating their use.

> *Unlike CFCs, which release chlorine into the stratosphere, halons release bromine, a much more effective ozone depleter. It is now estimated that the two most common halons, Halon 1211 and Halon 1301, have ozone depletion potentials 15 and 30 times higher than the most damaging CFCs. (Friends of the Earth, Friends of the Earth's Proposals for Amending the Montreal Protocol on Substances that Deplete the Ozone Layer, Submission to the Standing Committee on Environment, 26 January 1990, p. 5)*

Therefore:

(2) We recommend that regulations be invoked under CEPA requiring a 95% reduction in halon production and consumption by 1993, and a complete elimination by the year 2000, except for those "essential uses" where no reasonably performing substitute is available.

Beyond regulating the production and consumption of CFCs, it is necessary to control certain end uses. Banning CFCs in 1980 as a propellant in three types of aerosols (hair sprays, anti-perspirants and deodorants) reduced this use of CFCs in Canada by 85% at the time. Their application in new aerosol products, however, grew so much that by 1986 it accounted for 12% of total Canadian use. As public concern increased, aerosol manufacturers voluntarily removed CFCs from their products. This has been so effective that now aerosols account for only 1% of CFC use in Canada. Manufacturers of foam packaging are similarly removing CFCs from their products.

Regulations have been proposed under CEPA to control both non-essential uses of CFCs and of halons in small, hand-held fire extinguishers. We are concerned that these regulations have not yet been adopted.

(3) We recommend that the proposed regulations governing non-essential uses of CFCs and of halons in hand-held fire extinguishers (Ozone-depleting Substances Regulations No. 2 and No. 3) be implemented as soon as possible and that any portions of the regulations to which there has been no legal objection be adopted immediately.

Assessing the relative harm of chemicals which contribute to ozone depletion and global warming indicates that, in the short term, use of HCFCs and HFCs as substitutes for CFCs may be necessary since harmless substitutes are not yet available, and HCFCs and HFCs are much less harmful than CFCs. In order not to rely too heavily or too long on HCFCs and HFCs, however:

(4) We recommend that:

a) neither HCFCs nor HFCs be used in any aerosols;

b) HCFCs and HFCs only be used in other products as replacements for CFCs where safe alternatives are not available;

c) only those HCFCs and HFCs with the least ozone depletion and global warming potential be used in products or processes requiring such substances;

d) in future, HCFCs and HFCs not be substituted for CFCs at any time in amounts greater than 30% and 9%, respectively, of present CFC use, and by 2010 the production and consumption of HCFCs and HFCs be discontinued.

B. The Need for Coordinated Actions

It is clear that phasing out the use of CFCs, halons and their substitutes which still have ozone depletion and global warming potential will require a concerted effort at all levels of governments. Many jurisdictions will be involved in recovery, recycling, transporting and the eventual destruction of these substances. In particular there is a need to accelerate recovery and recycling activities since they are the key to removing our dependence on new molecules of these substances. Recycling will allow us to accelerate the phasing out of production.

There is a need for leadership in this regard. Presently the Canadian Council of Ministers of the Environment is the most appropriate body available to deal with multijurisdictional activities relating to environmental concerns. They should be active in all aspects of managing the phaseout of these substances when more than one jurisdiction is involved.

(5) We recommend that the Canadian Council of Ministers of the Environment take the lead when multijurisdictional participation would accelerate initiatives for the reduction, recovery, recycling and eventual safe destruction of CFCs and halons.

RECOVERY, RECYCLING AND DESTRUCTION

A. Recovery and Recycling of CFCs, HCFCs and HFCs

In recent years there has been increased interest in developing appropriate technologies (affectionately referred to as "vampire units") for the recovery and recycling of CFCs in industrial processes and from refrigeration and air conditioning equipment. Pressure brought to bear on the industry through public debate, such as that conducted by this Committee, and through local and regional legislation has played an important part in this progress. The State of Vermont, for example, passed a bill restricting the use of CFCs in automobile air conditioners. Subsequently, some of the large automobile manufacturers have indicated that their service depots would soon acquire recovery and recycling equipment. The Greater Regional District of Vancouver and Metropolitan Toronto are implementing bylaws that require the recovery and recycling of CFCs, while Montreal is planning to invoke as regulations the proposed "Code of Practice for the Reduction of CFC Emissions in Refrigeration and Air Conditioning Systems", developed by Environment Canada.

Recovery and recycling of CFCs can be done in several ways. For example, if a refrigeration unit needs repairs the CFCs can be withdrawn into a sealed container and then reinjected into the same unit upon completion of the repairs. Although the CFCs would contain oils and other substances, they are replaced into the same refrigeration unit from which the contamination was derived and they will not need to be repurified. When a refrigeration unit is decommissioned, however, the CFCs are often contaminated by substances that may be incompatible with other refrigeration units, or there may only be limited uses for the contaminated CFCs until they have been repurified. Since units for on site repurification are not available for most situations, recycling will often involve transporting the substance to a place where it can be repurified. Liquid CFCs that are used as solvents or cleaning agents, however, are often contaminated by more dangerous chemicals and must be handled as a hazardous waste until they are purified.

The Committee encourages initiatives being taken by manufacturers such as Inglis, which soon will recover CFCs from refrigerators during repair at its service centres. CAMCO and other companies are investigating technologies for portable CFC recovery and recycling equipment to be used in the home during maintenance procedures. The Committee applauds service organizations, such as the Heating, Refrigerating and Air

Conditioning Institute (HRAI), which have helped develop a Code of Practice as well as education and training programs for technicians who design and service refrigeration equipment. CFCs have been voluntarily removed from use by the foam packaging industry and from 95% of the aerosol uses in Canada, those of a medical nature being the main exception.

Automobile Air Conditioners

Not all uses of CFCs in Canada are being reduced, however. The Committee condemns the automobile industry's failure to develop air conditioning units that are leak-proof. An estimated 60% of new cars sold in Canada are equipped with air conditioning units, as are 90% of the cars exported to the United States (representing 75% of Canadian auto production). We have concluded that all non-commercial vehicles equipped with air conditioning beginning with the 1992 model year should have leak-proof systems, both to prevent the escape of CFCs and to contain the subsequent HFC substitute, which will not be entirely harmless.

(6) We recommend that air conditioning units for the passenger compartments of all motor vehicles be leak-proof, beginning with the 1992 model year.

"Code of Practice" for Recycling

The quantity of CFCs contained in appliances, air conditioners and refrigeration units is believed to be sufficiently large that, if released, would so deplete the ozone layer as to threaten life processes. In Canada alone, there are tens of millions of refrigeration units in use, all containing some quantity of CFCs. Each year, the refrigeration and air conditioning industry uses an estimated 7,500 tonnes of the five controlled CFCs. Approximately half of this is in commercial systems, one-quarter in home refrigerators and freezers, and one-quarter in mobile air conditioners. Home air conditioning, both central and window units, heat pumps and commercial unitary air conditioning systems used in malls and buildings up to 10 stories already use an HCFC (HRAI, 1990, p. 6).

Unknown amounts of CFCs are inadvertently being lost to the atmosphere during servicing of these systems. It is essential that these CFCs be recovered and recycled until substitutes are available, at which time they should be recovered and destroyed.

The proposed Code of Practice should provide a guide for recovery and recycling, at least in commercial and industrial applications. The Committee believes, however, that the Code should be upgraded to a regulation. Therefore:

(7) **We recommend that the proposed "Code of Practice for the Reduction of CFC Emissions in Refrigeration and Air Conditioning Systems" developed by Environment Canada for commercial refrigeration units be made a regulation under CEPA. The Committee further recommends that this Code be applied to the management of HCFC and HFCs. These regulations should come into effect by 30 June 1991.**

It is our understanding that Environment Canada is looking at initiatives to ensure that recovery and recycling technologies are available and that education and training programs in their use are developed. Compliance and enforcement capabilities must also be established.

Abandoned Refrigeration Equipment

Previously abandoned refrigeration equipment contains possibly large quantities of CFCs. Canada may even be receiving used refrigerators from scrap dealers in the United States. Although the actual percentage of compressor systems which contain CFCs and are still intact after being dumped is not known, it would be prudent to recover the CFCs from this potential source of emissions. As well, CFCs should be recovered when refrigeration units are removed from service and before they are dumped. We understand that the City of Toronto may soon introduce special equipment to be towed behind garbage trucks to pick up this type of waste and recover their CFCs. Such municipal initiatives should be encouraged. In this regard:

(8) **We recommend that Environment Canada be provided the necessary funds to assist the relevant authorities in developing programs for the recovery and recycling of CFCs from commercial, household and mobile refrigeration systems that are to be scrapped or that have been previously abandoned. Once destruction technologies and less harmful substitutes are available, then the recovered, more harmful substances must be destroyed.**

Recycling of CFC Solvents

Some CFCs are in liquid form at room temperature and are used as solvents. Those should also be recycled until phased out. Industry is optimistic that replacements can be found for most solvent uses and should be encouraged to make these substitutions as rapidly as feasible. Until then, industry should be required to recycle CFCs employed as solvents, since the technology to do this is becoming available.

(9) We recommend that the Canadian Council of Ministers of the Environment coordinate appropriate jurisdictions in the making of regulations for the recycling of CFCs used as solvents. When alternatives to solvent CFCs and destruction technologies are available, the CFCs must be recovered and destroyed.

Technologies for Destruction

Ultimately, technologies will be required to destroy CFCs, halons, HCFCs, HFCs and related substances. The Committee is concerned that sufficient progress be made for their incineration or other means of destruction. We do not want to see problems of storage arise, as is the case for PCBs, particularly considering the volatility of some of these substances. Therefore:

(10) We recommend that funding be provided by the federal government to assist the provinces and producing industries in developing the appropriate destruction technologies for CFCs, halons, HCFCs, HFCs and related substances. Once developed, the appropriate jurisdiction should make regulations for the destruction of these substances.

Life Cycle Management

Proper management of the recovery, recycling and destruction of those substances presently in refrigeration units is essential, as is the complete "cradle-to-grave" management of new CFC production and of HCFC and HFC substitutes as they become commercially available. "Life-cycle" management of CFCs and their replacements need not involve overly cumbersome manifest systems for tracking these substances. In fact, only those substances used as solvents should be classified as hazardous wastes, not CFCs used as refrigerants. This point of clarification recently was made by the EPA in the U.S. (Federal Register Vol. 54, No. 144, 28 July 1989, pp. 3135-3137). The classification of CFCs and related substances in different jurisdictions should be the same to allow for national uniformity. There may be occasions when a province or a municipality will

invoke regulations regarding these substances under their own legislation. In such cases consultation with the federal authorities hopefully would occur. Efforts would be made to coordinate the regulatory agendas. To this effect:

(11) We recommend that national standards and guidelines be developed for classifying CFCs and related substances to ensure that regulations concerning their handling and transportation are uniform across the country.

To ensure life-cycle management of CFCs, HCFCs and HFCs that are not used as solvents:

(12) We recommend that "cradle-to-grave" management be applied to new CFCs, HCFCs and HFCs used for refrigeration purposes, ensuring that the producing and importing industries are responsible for tracking these chemicals to their final end use. Regulations with respect to the recovery, recycling and destruction of these substances should govern the remainder of their life cycle.

B. Recovery of Halons

We are concerned about the continued production and consumption of halons and have recommended their accelerated phaseout. Environment Canada has proposed regulations to remove halons from hand-held fire extinguishers. Formal objections to these proposed regulations, however, have been filed by several parties, including trade associations in the United States. The Committee has acknowledged these legal objections in Recommendation (3), but would like to see them resolved as soon as possible in order that these regulations can proceed.

The largest quantity of halons and source of emissions, however, is not found in hand-held fire extinguishers but large flooding systems, similar to the familiar overhead water sprinkler systems. Most emissions from these flooding systems occur during installation when the system is tested, or during periodic tests to ensure that the system is functional. There are alternative testing methods available that use less harmful gases and we believe that those methods should be mandatory.

We also believe that halons should not be used in flooding systems except in cases where such use is deemed essential. Some high technology industries with halon flooding systems are planning to remove them. We hope that others will follow such leads, independent of any regulations or amendments to the fire code. Careful management of the existing quantity of halons using recovery and recycling technology should readily supply all the halons required for the few uses deemed essential. Once appropriate

substitutes become available, however, halons should be removed from use even if the stock of halons (often referred to as a bank) is not depleted.

(13) We recommend that the National Fire Code and the National Building Code be amended immediately and as necessary to prohibit the testing of flooding systems with halons and to prohibit the construction of "non-essential" halon flooding systems. They must also be amended to require the removal of all non-essential halon flooding systems as early as possible but no later than 1 January 1993. Halons will be supplied for essential uses from the existing stock of halons before new halons are consumed. Once substitutes and destruction facilities are available, the remaining stock of halons must be destroyed.

It has been brought to our attention that the federal government is one of the larger users of halons in both flooding and hand-held systems. The Department of National Defence makes extensive use of halons in both essential and non-essential situations. They and other departments must stop using halons except in approved, essential use situations. It is imperative that the government get its own house in order.

(14) We recommend that the federal government immediately develop a coordinated plan for the removal of "non-essential" halon systems used by any federal government department or agency, and that it provide justification for the retention of any system it identifies as essential.

C. Managing Ozone Depleting Substances and Their Substitutes

Implementing all these regulations for CFCs, halons and their substitutes could be an onerous task in view of requirements for enforcement and compliance, and the need for education and training programs. The Committee suggests that the provinces accept responsibility for these initiatives under CEPA, or other legislation such as the *Transportation of Dangerous Goods Act*, where there may be provision for federal-provincial cooperation. There will be numerous occasions, some indicated in this report, where the responsibility will rest solely with the provincial or municipal governments. Various provinces and municipalities are already actively instituting programs for recovery and recycling or regulating the phaseout of some uses of these ozone depleting/global warming substances. There is a dire need for cooperation at all government levels. Recommendation (5) addresses the multijurisdictional aspects of managing these substances.

Implementing changes to relevant codes will affect officials in all jurisdictions.

(15) We recommend that the federal government and the provinces collaborate in developing a national education program for municipal and other officials responsible for activities that involve CFCs, halons and related substances.

We also recognize that there will be times when the responsibility for enforcement of and compliance with regulations will rest with the federal government. To handle this additional responsibility, Environment Canada requires a sufficient number of properly trained personnel.

(16) We recommend that Environment Canada's budget be increased to ensure the enforcement of and compliance with new regulations where the federal government retains responsibility.

This is in addition to any new resources that might be required in administering the regulations, and for implementing new education and training programs.

Implementing these regulations should not be allowed to create an uneven playing field adversely affecting small service industries. It should be possible using the appropriate instruments to promote a new industry for the recovery, recycling and destruction of these regulated substances.

MARKET SIGNALS

Industry has shown initiative in dealing with the issue of reducing CFC use, including research into the development of substitutes. To a lesser degree, industry has shown similar initiative with respect to halons. The signing of the Montreal Protocol, of course, has prompted this development. In fact, since the Protocol was adopted, it has become in the best economic interests of a company to develop alternatives because of the marketing advantage that can be gained by the first company out with a preferred substitute.

Although we would prefer to see minimal disruption of the industries and businesses using these substances, we have concluded that halting ozone depletion is so important that CFCs, halons and related substances must be controlled without delay. Considering the present low cost of CFCs and the predicted costs of their substitutes, it is doubtful that a recycling industry can develop. Intervention in the market appears necessary to compel the recovery and recycling of these substances and to ensure that small business are not excluded from this enterprise, particularly from the recovery aspect where a large number of personnel will be needed.

One incentive for the development of such an industry is the requirement that substitutes—HCFCs and HFCs—also be recycled and eventually destroyed, as we have recommended. The HCFC and HFC substitutes will in turn be replaced as less harmful chemicals are developed. There should, therefore, be a relatively profitable market for recovery and recycling enterprises.

Smaller businesses may have the most difficulty with recycling requirements. Will the small independent garage, for example, be able to afford the equipment to recover and recycle CFCs from automobile air conditioners? Will the independent appliance repair business be at a similar disadvantage?

Although the price of CFCs is currently increasing, it is still too low to force consideration of alternatives or to make their recycling commercially viable. A law passed by the U.S. Congress 1 January 1990 placed a tax on CFCs and halons at the production end. The tax raises the price of CFCs from about $US 0.60 per pound in increments to approximately US $3.25 by the year 1994. This tax has reportedly been successful in stimulating the producing industries to become involved with recycling. It is less expensive to recycle old CFCs than to produce new CFCs given the rate of taxation. Stimulating recycling in addition to the development of substitutes is necessary if reductions in production and importation are to be achieved.

Revenues derived from a tax on ozone depleting substances in Canada could be used to provide assistance to help small service businesses cope with the anticipated regulatory changes. Revenues could be used for programs such as Environment Canada's Development and Demonstration of Resource and Energy Conservation Technologies (DDRECT) to fund grants and loans for developing recycling technologies and service industries. Perhaps most important of all, the revenues could provide the additional funds that will be needed to assist developing countries in converting to the new technologies and substitutes so that they can also become signatory to the Montreal Protocol.

(17) We recommend that a tax be levied on CFCs and halons at least equivalent to that to be implemented in the United States. Funds equal to those derived from the tax should be used to support initiatives arising from recommendations of this report.

This recommendation was adopted by a narrow majority of the Committee (See Minutes of Proceedings).

Changing the Technology of Production and Use

As substitutes for CFCs and halons become available, there will at times be a choice for a particular end use. The prices of these substitutes will vary, as will their ODP and GWP. We have already emphasized that the less harmful substance should be used, taking indirect effects into consideration when applicable. As an example, the insulating value of foams produced with these substitutes would be a consideration.

To minimize longer-term costs, producers and users should adopt, as they become available, those substitutes which offer large environmental gains. This is not necessarily happening. Although less harmful substitutes for halons appear imminent, some companies are developing products that use halons or are substituting CFCs for halons. Although CFCs could be useful in replacing halons temporarily from essential uses, we would not like to see them used in non-essential situations or as replacements for less harmful alternatives such as dry chemical, fire extinguishing agents.

Because of such developments, which indicate that environmental awareness will not necessarily prevail, market forces need augmenting to ensure use of less harmful substitutes.

(18) We recommend that when there is a substantial difference in the environmental impacts of two or more substitutes for a given end use, an equalizing tax be placed on the substitute(s) that is (are) more harmful but less costly. The tax should be revised every six years to allow time for the market to regulate itself.

This recommendation was adopted by a narrow majority of the Committee (See Minutes of Proceedings).

RESEARCH NEEDS

Our understanding of the process of ozone depletion is incomplete. For example, ozone depletion in the Arctic is of particular interest to Canada but we do not know the extent of the depletion or whether the development of an Arctic "ozone hole" is likely. It appears that the atmospheric conditions conducive to the formation of the Antarctic ozone hole are not duplicated in the Arctic but the same conditions may not be necessary. Monitoring indicated an overall reduction of 8% in ozone concentration in the spring of 1989 in the Arctic with larger reductions in some layers of its stratosphere. However, similar depletion was not recorded in 1990. We do not know how to explain the irregularities and do not know for certain whether we are monitoring the appropriate geographic locations.

In the temperate latitudes, such as over southern Canada, we now experience a 2–4% overall annual reduction relative to ten years ago. Seasonally, the reduction is 7–8% for a four to five month period in the spring. Yet we are uncertain of the linkages between the polar regions and the temperate latitudes. Monitoring and research to date have been insufficient to answer these and related questions. Therefore:

(19) We recommend that adequate funding be made available to the Atmospheric Environment Service of Environment Canada to conduct monitoring of and research into ozone depletion.

INTERNATIONAL MEASURES

Assistance to and participation by developing countries will be necessary to implement and expand the control measures of the Montreal Protocol. Provision for such an initiative was included in Article 5 of the Protocol. Developing countries cannot afford the increased marginal costs of converting to CFC substitutes. For example, the cost of converting a CFC–producing plant to HCFC or HFC production would be prohibitive for them. These are the major costs currently being considered and are estimated to be $US 100–250 million over the first three years.

Developed countries are responsible for more than 85% of the production of CFCs, but have only 20% of the world's population. It seems only fair that the main economic benefactors, such as Canada, assist developing countries with the transition to less harmful substitutes. In fact, the success of the Protocol will probably require such a commitment.

There are various formulas that could be used to calculate the contributions of different countries to an assistance fund. It could be based on a percentage of CFC consumption in a given year, or perhaps on the regular United Nations contributions scale, linked mainly to GNP. Whatever the basis and the amount selected, it is essential that Canada contribute its share, which would probably fall within the range of about 2–3.5% of the total.

In addition to funding mechanisms, the Protocol contains provision for the transfer of information and technology. There are still stumbling blocks with respect to intellectual property rights that must be overcome. Canada must demonstrate that it is making a whole–hearted effort to bring the complete global community into the Protocol. We cannot afford to let the withholding of additional funds and selfishness with technology transfer jeopardize the attempt to control CFCs globally. If countries do not sign the Protocol and begin to produce CFCs and related substances, the Protocol would be undermined and life on Earth further threatened. Therefore:

(20) We recommend that the federal government contribute to all funding mechanisms developed under the Montreal Protocol. We also recommend that a roundtable be established in Canada consisting of all government departments, industry, non–government organizations and other stakeholders who would be involved in funding and facilitating technology transfer to developing countries.

Industrialized nations and multinational companies should take the lead in negotiating international agreements known as "global bargains". Such bargains will often entail providing financial assistance and technology transfer to developing countries. Given the extremely harmful nature of CFCs to the atmosphere, we should ensure that potential large-scale producers, in particular China, India and Brazil are included in this global bargain, known as the Montreal Protocol.

(21) We recommend that Canada take the lead in negotiating "global bargains". In the CFC global bargain, substitutes for CFCs could be offered in exchange for full participation in the Montreal Protocol, with appropriate conditions for monitoring and inspection. The intention of this bargain is to assist developing countries eliminate their consumption of CFCs.

The Committee is also concerned that Canada's trade and international aid policies be conducive to assisting developing countries in a sustained manner. Environmental impacts must be accounted for when economic policies are set or projects undertaken. It is important that Canadian foreign policy be consistent with the intent of the Montreal Protocol and all other global bargains that may be established in the future.

(22) We recommend that a review be undertaken of trade development programs and subsidies, and of foreign aid policies, programs and projects to ensure they are consistent with the preventive aims of this report.

We view these recommendations as fundamental in protecting the global atmosphere.

PUBLIC EDUCATION AND RESPONSIBILITY

Public pressure has been an effective force in accelerating the removal of CFCs from some products. The two most notable examples are the recent removal of CFCs from most aerosol products, and the substitution of an HCFC and pentane for CFCs in some cups and packaging materials made from rigid foam. The public can do even more, for example, by choosing non-pressurized dispensers, or products packaged in non-petroleum-based material, or products with substantially reduced packaging.

Automobile air conditioners are a substantial source of emissions of CFCs to the atmosphere. A CFC substitute should be available in 1994 or 1995. Until that time, consumers should question the need to purchase an air conditioner in an automobile, unless leak-proof systems become available in the interim. Owners of vehicles with air conditioners should have them serviced only by persons trained and equipped to recover CFCs. It is likely that the "do-it-yourself" canisters of CFCs now available to "top up" leaking systems will soon disappear from the market. Individuals can assist this process by refusing to buy products containing CFCs.

Homeowners will also be required to act responsibly as equipment for recovering CFCs from home refrigeration systems such as refrigerators and freezers becomes available. As regulations for recovery and recycling come into force, consumer cooperation will be needed to ensure that CFCs are properly recovered by authorized personnel. The public must demand access to facilities for the recovery, recycling and ultimate destruction of CFCs.

Just as consumers have been a driving force for industrial responsibility in the use of CFCs in the past, they can be a potent lobby for future initiatives to ban ozone-depleting substances and to control use of their substitutes. Public involvement is essential. That involvement in turn depends on a well informed public.

(23) We recommend that all levels of government, producers of these chemicals, and manufacturers of CFC-containing equipment, develop and implement a coordinated, nationwide public education program for the recovery, recycling, handling, storage and ultimate destruction of CFCs and related substances.

RECOMMENDATIONS

(1) We recommend that the following be adopted as the basis for regulations under the *Canadian Environmental Protection Act* (CEPA) and be promoted prior to amending the Montreal Protocol:

a) a minimum 85% reduction in the production and consumption of all CFCs by 1995, with a complete phaseout by 1997; and

b) a complete phaseout in the production and consumption of carbon tetrachloride and methyl chloroform by 1995, except for their use as a feedstock for CFC or halon substitutes and as organic laboratory solvents.

(2) We recommend that regulations be invoked under CEPA requiring a 95% reduction in halon production and consumption by 1993, and a complete elimination by the year 2000, except for those "essential uses" where no reasonably performing substitute is available.

(3) We recommend that the proposed regulations governing non–essential uses of CFCs and of halons in hand–held fire extinguishers (Ozone depleting Substances Regulations No. 2 and No. 3) be implemented as soon as possible and that any portions of the regulations to which there has been no legal objection be adopted immediately.

(4) We recommend that:

a) neither HCFCs nor HFCs be used in any aerosols;

b) HCFCs and HFCs only be used in other products as replacements for CFCs where safe alternatives are not available;

c) only those HCFCs and HFCs with the least ozone depletion and global warming potential be used in products or processes requiring such substances;

d) in future, HCFCs and HFCs not be substituted for CFCs at any time in amounts greater than 30% and 9%, respectively, of present CFC use, and by 2010 the production and consumption of HCFCs and HFCs be discontinued.

(5) We recommend that the Canadian Council of Ministers of the Environment take the lead when multijurisdictional participation would accelerate initiatives for

the reduction, recovery, recycling and eventual safe destruction of CFCs and halons.

(6) We recommend that air conditioning units for the passenger compartments of all motor vehicles be leak-proof, beginning with the 1992 model year.

(7) We recommend that the proposed "Code of Practice for the Reduction of CFC Emissions in Refrigeration and Air Conditioning Systems" developed by Environment Canada for commercial refrigeration units be made a regulation under CEPA. The Committee further recommends that this Code be applied to the management of HCFC and HFCs. These regulations should come into effect by 30 June 1991.

(8) We recommend that Environment Canada be provided the necessary funds to assist the relevant authorities in developing programs for the recovery and recycling of CFCs from commercial, household and mobile refrigeration systems that are to be scrapped or that have been previously abandoned. Once destruction technologies and less harmful substitutes are available then the recovered, more harmful substances must be destroyed.

(9) We recommend that the Canadian Council of Ministers of the Environment coordinate appropriate jurisdictions in the making of regulations for the recycling of CFCs used as solvents. When alternatives to solvent CFCs and destruction technologies are available, the CFCs must be recovered and destroyed.

(10) We recommend that funding be provided by the federal government to assist the provinces and producing industries in developing the appropriate destruction technologies for CFCs, halons, HCFCs, HFCs and related substances. Once developed, the appropriate jurisdiction should make regulations for the destruction of these substances.

(11) We recommend that national standards and guidelines be developed for classifying CFCs and related substances to ensure that regulations concerning their handling and transportation are uniform across the country.

(12) We recommend that "cradle-to-grave" management be applied to new CFCs, HCFCs and HFCs used for refrigeration purposes, ensuring that the producing and importing industries are responsible for tracking these chemicals to their final end use. Regulations with respect to the recovery, recycling and destruction of these substances should govern the remainder of their life cycle.

(13) We recommend that the National Fire Code and the National Building Code be amended immediately and as necessary to prohibit the testing of flooding systems with halons and to prohibit the construction of "non-essential" halon flooding systems. They must also be amended to require the removal of all non-essential halon flooding systems as early as possible but no later than 1 January 1993. Halons will be supplied for essential uses from the existing stock of halons before new halons are consumed. Once substitutes and destruction facilities are available, the remaining stock of halons must be destroyed.

(14) We recommend that the federal government immediately develop a coordinated plan for the removal of "non-essential" halon systems used by any federal government department or agency, and that it provide justification for the retention of any system it identifies as essential.

(15) We recommend that the federal government and the provinces collaborate in the developing a national education program for municipal and other officials responsible for activities that involve CFCs, halons and related substances.

(16) We recommend that Environment Canada's budget be increased to ensure the enforcement of and compliance with new regulations where the federal government retains responsibility.

(17) We recommend that a tax be levied on CFCs and halons at least equivalent to that to be implemented in the United States. Funds equal to those derived from the tax should be used to support initiatives arising from recommendations of this report.

(18) We recommend that when there is a substantial difference in the environmental impacts of two or more substitutes for a given end use, an equalizing tax be placed on the substitute(s) that is (are) more harmful but less costly. The tax should be revised every six years to allow time for the market to regulate itself.

(19) We recommend that adequate funding be made available to the Atmospheric Environment Service of Environment Canada to conduct monitoring of and research into ozone depletion.

(20) We recommend that the federal government contribute to all funding mechanisms developed under the Montreal Protocol. We also recommend that a roundtable be established in Canada consisting of all government departments, industry, non-government organizations and other stakeholders who would be involved in funding and facilitating technology transfer to developing countries.

(21) We recommend that Canada take the lead in negotiating "global bargains". In the CFC global bargain, substitutes for CFCs could be offered in exchange for full participation in the Montreal Protocol, with appropriate conditions for monitoring and inspection. The intention of this bargain is to assist developing countries eliminate their consumption of CFCs.

(22) We recommend that a review be undertaken of trade development programs and subsidies, and of foreign aid policies, programs and projects to ensure they are consistent with the preventive aims of this report.

(23) We recommend that all levels of government, producers of these chemicals, and manufacturers of CFC–containing equipment, develop and implement a coordinated, nationwide public education program for the recovery, recycling, handling, storage, and ultimate destruction of CFCs and related substances.

APPENDIX I

Glossary of Abbreviations and Acronyms

CAMCO	Canadian Appliance Manufacturing Company
CEPA	*Canadian Environmental Protection Act*
CFCs	chlorofluorocarbons
EPA	Environmental Protection Agency (United States)
GNP	Gross National Product
GWP	global warming potential
HCFCs	hydrochlorofluorocarbons
HFCs	hydrofluorocarbons
ODP	ozone depleting potential
UNEP	United Nations Environment Program
UV	ultraviolet (as in ultraviolet radiation)
WMO	World Meteorological Organization

APPENDIX II

Ozone Depleting Potential and Global Warming Potential

Chlorine and bromine containing compounds that are sufficiently stable migrate to the stratosphere (that zone of the atmosphere located 15 to 45 kilometres above the Earth's surface) where, over time (5 to 100 years or more), high-energy radiation from the sun causes these compounds to decompose, releasing chlorine or bromine. The chlorine and/or bromine then reacts with other gases in the atmosphere, the net result of which is a reduction in the concentration of ozone while the chlorine or bromine remains. Chlorine and bromine act as catalysts for this destructive process, each atom participating in as many as 100,000 ozone-destroying reactions before being washed out of the atmosphere.

Factors governing the relative efficiency of these compounds in destroying ozone are recognized to be:

(1) the rate of release of the compound into the atmosphere;

(2) the rate of removal of the compound in the troposphere and its persistence in the stratosphere; and

(3) the efficiency of the compound in destroying ozone in the stratosphere.

ODP is defined as the model-calculated ozone depletions under steady state conditions. More specifically, it is defined as the ratio of calculated ozone column change for each mass unit of a gas emitted into the atmosphere relative to the calculated depletion for the reference destruction potential of various chemicals.

The ability of a compound to absorb infrared radiation characterizes global warming potential (GWP). GWP is defined as the ratio of calculated warming for each unit mass of a gas emitted into the atmosphere relative to the calculated warming for a mass unit of reference gas CFC-11 or CFC-12. The estimated global warming potential of CFCs ranges up to 20,000 times that of carbon dioxide, on a molecule-for-molecule basis.

Sources: (1) United Nations Environment Program, Technology Review Panel, *Technical Progress on Protecting the Ozone Layer*, 30 June 1989, pp. 4-5.

(2) United States, Environmental Protection Agency, *Policy Options for Stabilizing Global Climate*, Draft Report to the Congress — Executive Summary, February 1989, p. 16.

APPENDIX III

Witnesses and Submissions Specific to Ozone Depleting Substances

WITNESSES	ISSUE NO.	DATE
Greenpeace John Bennett, Atmosphere Campaigner	13	22 June 1989
CAMCO Inc. Ray Thompson, Vice–President, Marketing Bill Bender, Manager, Advance Technology Bill Smithers, Manager, Consumer Services	13	26 June 1989
Environment Canada Honourable Lucien Bouchard, Minister of the Environment Lee Clark, Parliamentary Secretary to the Minister of the Environment Michael Owens, Legal Counsel Glenn Allard, Director, Commercial Chemicals Branch, Conservation and Protection Peter Higgins, Director General, Environmental Protection, Conservation and Protection	13	26 June 1989
Environment Canada Glenn Allard, Director, Commercial Chemicals Branch, Conservation and Protection Alex Chisholm, Science Advisor Vic Buxton, Chief, Chemicals Control Branch, Conservation and Protection	20	7 November 1989
Friends of the Earth Robert Hornung, Ozone Campaign Coordinator	20	7 November 1989

WITNESSES	ISSUE NO.	DATE
Royal Netherlands Embassy Bert Metz, Counsellor for Health and Environment Mieke Bos, Third Secretary	29	23 January 1990
INCENDEX International Inc. Esmat Macramalla, President George Ferris, Vice–President, Research and Development	32	20 February 1990
Heating, Refrigerating and Air Conditioning Institute of Canada Warren Heeley, President Garry Stroud, Secretary–Treasurer and President, Copeland Refrigeration of Canada Limited	34	8 March 1990

SUBMISSIONS

Kevin Doyle, Chairman
Canadian Aerosol Information Bureau

David E. Todd, Staff Vice–President
Via Rail Canada Inc.

Dow Chemical Canada Inc.

J.B. Fogg, Marketing Manager
Cornwall Chemicals Limited.

SELECTED REFERENCES

Buxton, V., Environment Canada. House of Commons Standing Committee on Environment, *Minutes of Proceedings and Evidence*, Issue 20, 7 November 1989.

Forester A.J., J.C. McConnell and W.F.J. Evans, *An Assessment of the Effect of Halons on the Environment*, Environment Canada, Atmospheric Research Directorate, ARD 89–007, December 1989, 103 pp.

Heeley, W., Heating, Refrigerating and Air Conditioning Institute of Canada. House of Commons Standing Committee on Environment, *Minutes of Proceedings*, Issue 34, 8 March 1990.

Proffitt, M.H., D.W. Fahey, K.K. Kelly and A.F. Tuck. "High Latitude Ozone Loss Outside the Antarctic Ozone Hole", *Nature*, Vol. 342, No. 6247, 16 November 1989, pp. 233–237.

United Nations Environment Program, Open Ended Working Group of the Parties to the Montreal Protocol, *2nd Draft Synthesis Report Annex 1.1.* September 1989, 17 pp.

United Nations Environment Program, Technology Review Panel, *Technical Progress on Protecting the Ozone Layer*, 30 June 1989, 103 pp.

United Nations Environment Program/World Meteorological Organization, "Scientific Assessment of Stratospheric Ozone", quoted in Du Pont's *Fluorocarbon/Ozone Update*, August 1989, 9 pp.

United States, Environmental Protection Agency, *Federal Register*, Vol. 54, No. 144, 28 July 1989, pp. 3135–3137.

United States, Environmental Protection Agency, Office of Air and Radiation, *Analysis of the Environmental Implications of the Future Growth in Demand for Partially–Halogenated Chlorinated Compounds*, Peer Review Draft, 24 July 1989, 131 pp.

United States, Environmental Protection Agency, *Policy Options for Stabilizing Global Climate*, Draft Report to the Congress: Executive Summary and Volume 1, February 1989, 90 pp.

REQUEST FOR GOVERMENT RESPONSE

Pursuant to Standing Order 109, your Committee requests that the Government table a comprehensive response to the Report within 150 days.

A copy of relevant Minutes of Proceedings and Evidence of the Standing Committee on Environment (*Issues Nos. 13, 20, 29, 32, 34 and 50 which includes this Report*) is tabled.

Respectfully submitted,

David MacDonald,
Chairperson

MINUTES OF PROCEEDINGS

TUESDAY, MAY 29, 1990
(77)

[*Text*]

The Standing Committee on Environment met *in camera* at 9:10 o'clock a.m. this day, in Room 701, 151 Sparks Street, the Chairperson, David MacDonald, presiding.

Members of the Committee present: Bud Bird, Charles Caccia, Marlene Catterall, Rex Crawford, Stan Darling, Jim Fulton, André Harvey, Lynn Hunter, David MacDonald and Robert Wenman.

In attendance: From the Library of Parliament: Robert Milko, Research Officer.

The Committee discussed its future business.

In accordance with its mandate under Standing Order 108(2), the Committee resumed its consideration of global warming and discussed its draft report on CFCs.

It was agreed,—That the Chairperson report to the House requesting permission to release the Global Warming Report if the House is not sitting and if the Committee so decides.

At 12:08 o'clock p.m. the Committee adjourned to the call of the Chair.

AFTERNOON SITTING
(78)

The Standing Committee on Environment met *in camera* at 4:26 o'clock p.m. this day, in Room 701, 151 Sparks, the Chairperson, David MacDonald, presiding.

Members of the Committee present: Terry Clifford, Stan Darling, Charles Caccia, Marlene Catterall, Jim Fulton, Lynn Hunter, David MacDonald, Brian O'Kurley and Robert Wenman.

Other Member present: Jim Jordan.

In attendance: From the Library of Parliament: Robert Milko, Research Officer.

In accordance with its mandate under Standing Order 108(2), the Committee resumed its consideration of global warming and discussed its draft report on CFCs.

It was agreed, —That the draft Report on CFCs be adopted as the third Report of the Committee subject to final review by a meeting of members, with representation from each political party, at 9:00 o'clock a.m., Thursday, May 31.

It was agreed,—That the report be printed in the *Issue of Minutes and Proceedings.*

It was agreed,—That the Chairperson present the report to the House.

It was agreed,—That, pursuant to Standing Order 109, the Committee request the Government to table a comprehensive response to the report.

At 6:00 o'clock p.m. the Committee adjourned to the call of the Chair.

THURSDAY, JUNE 7, 1990
(81)

The Standing Committee on Environment met *in camera* at 10:48 o'clock a.m. this day, in Room 371 West Block, the Chairperson, David MacDonald, presiding.

Members of the Committee present: Bud Bird, Charles Caccia, Marlene Catterall, Terry Clifford, Rex Crawford, Stan Darling, Lynn Hunter, David MacDonald and Brian O'Kurley.

Acting Members present: Geoff Wilson for Robert Wenman and Charles DeBlois for Louis Plamondon.

In attendance: From the Library of Parliament: Robert Milko, Research Officer. *From the Parliamentary Centre for Foreign Affairs and Foreign Trade:* Dean Clay, Research Officer.

The Committee discussed its report on CFCs.

After debate it was agreed,—That the recorded vote held during the *in camera* meeting of the afternoon of May 29 be printed in this day's Minutes of Proceedings as follows:

"Jim Fulton moved,—That draft recommendations 17 and 18 be included in the Report.

After debate the question being put on the motion and the result of the recorded vote having been announced:

Yeas	*Nays*
Charles Caccia	Marlene Catterall
Stan Darling	Terry Clifford
Jim Fulton	Brian O'Kurley
Lynn Hunter—4	Robert Wenman—4

Whereupon the Chairperson voted in the affirmative."

After debate it was agreed,—That Bud Bird's dissent on Recommendations 17 and 18 be also recorded in this days Minutes of Proceedings.

It was agreed,—That 500 additional copies of the Third Report be printed.

At 11:55 o'clock a.m., the Committee adjourned to the call of the Chair.

Stephen Knowles,

Clerk of the Committee.