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29 The Siren No 35 Dec '87 interview

The ozone layer, CFCs, and the oceans

an interview with

Peter Usher

Peter Usher was born in Wales and is a graduate of University College of Wales, Swansea. After post-graduate training in meteorology in 1962 he moved to Kenya to assist in the operation of the East African Meteorological Services during the period of transition leading up to the independence of the countries of the region. Following independence, he continued working for the East African and later the Kenya Meteorological Services as part of the British Technical Aid Programme. In 1977, Mr. Usher became involved with the ozone layer issue as a consultant to UNEP. In 1980, he was appointed Programme Officer responsible for UNEP's programmes on problems of the atmosphere.

THE SIREN: How much ozone is there in the atmosphere?

PETER USHER: Very little. Ozone is found mainly in the high stratosphere between 25 and 50 kilometres above the earth's surface and, even at its highest concentration, there is usually less than 10 parts per million by volume. Ozone is being continually created and destroyed by sunlight and there is normally a dynamic balance between its production and its destruction. It is the advent in the stratosphere of man-made chemicals that is upsetting this balance and causing concern. To get a graphic interpretation of how much ozone there is in the atmosphere, if it was brought down

the surface, it would only constitute a er of about three centimetres.

How is ozone destroyed by chlorofluorbons (CFCs)?

Ozone is destroyed by several chemis but the most important are the Cs. CFCs are very stable compounds the lower atmosphere and that is at makes them so useful in many inustrial applications. But in the stratohere they are dissociated by sunlight leasing active chlorine. Chlorine comes with ozone to form oxygen and chlorine monoxide, which in turn also aks up to produce more oxygen and ease the chlorine again to continue catalytic destruction of ozone. One lecule of CFC can destroy several usand molecules of ozone.

When did CFC production start and w much is produced industrially every ar?

CFCs are man-made chemicals. They ot exist in nature and they were first leased in the early 1930s. The mand for these chemicals has steadily

grown over the years. In 1974, the time of peak production, about 800,000 tonnes of CFCs 11 and 12 were produced. At that time, we had the first indications of ozone depletion caused by CFCs, and that resulted in an initial large cut-back in production. Since then although use for non-essential purposes such as in spray cans has considerably decreased, their use in other manufacturing processes has substantially increased, so that we are now close to maximum production (not only of CFCs 11 and 12 but of other CFCs) once again. About a million tonnes of CFCs are currently being produced each year, all of which are emitted to the atmosphere eventually. Current growth rates are in excess of eight per cent a year.

Q. Isn't it very alarming that CFCs production is increasing, while the ozone content in the atmosphere seems to remain more or less the same?

A. Yes, of course. We at UNEP are particularly alarmed, and most environmentally concerned people are worried at the extent to which CFCs are being emitted to the atmosphere. It has been estimated that if CFC production increased by only three per cent a year over the present annual production, the corresponding ozone depletion could exceed ten per cent. The importance of this is that for every one per cent decrease in ozone there could be as much as four to six per cent increase in skin cancer occurence. This, and further occurences of biological damage will result in enormous environmental stress should ozone deplete by a significant amount.

Q What is UNEP doing about this?

A: UNEP is concerned with limiting the damage. It is probably impossible to avoid the ozone depletion that is likely to occur from the CFCs already emitted to the atmosphere because CFCs have long atmospheric life times - in excess of a hundred years - and they will continue to deplete ozone for the next

century or more. It was UNEP's concern that this damage should be at least contained by reducing the amount of CFCs being emitted into the atmosphere.

UNEP has been involved with the ozone layer issue for more than 10 years. Its initial concern was with obtaining a better understanding of the processes which control ozone distribution in the atmosphere. UNEP co-ordinated the assessment programme that led to our current understanding of the atmosphere and the basis of concern that is felt by science for the ozone layer. A concensus was reached that the ozone layer was in danger from CFC emissions and although the understanding of the atmosphere is still incomplete, there is good agreement among scientists that even under current production rates of CFC 11 and 12, ozone depletion would reach three to five per cent annually.

Q: When did scientists reach this conclusion?

A: For the last 10 years an annual assessment of ozone depletion has been published by UNEP. In the early days, because of our very limited understanding of the atmosphere, some fairly wild estimations of ozone depletion were made. At one stage we were talking about ten or twenty per cent depletion even on current emission rates. What we had not fully understood was the number and nature of related chemical reactions within the atmosphere. It is only in this decade that our understanding has refined to the extent where one can be more confident of the amount of ozone depletion that would occur under different release rates of CFCs. As I say it is currently understood that depletion of three to five per cent a year would result under present release rates of CFCs. However, the atmosphere models which provide us with this information did not indicate the large depletions that occurred over the Antarctic over the last 10 years. These depletions, which exceed fifty per cent of normal ozone levels, are a further cause for concern and it is not entirely understood why such large depletion should occur there.

Q Is this the famous hole?

A. This is the famous or rather infamous hole over the Antarctic. It is probably related to special meteorological conditions that exist in that area but recent scientific investigations indicate that it is almost certainly chemically generated. This heightens our concern because we could have seriously underestimated the amount of future ozone depletion. It has hastened the need for action to limit chemical emissions to the atmosphere, and the Ozone Convention and the Protocol to Control Ozone Depleting Substances which was recently signed in Montreal, is the major step that can be taken in this direction.

Q Was it a major task persuading all the Governments to agree to the Protocol?

A. It was a major task because it took time to convince everybody of the necessity for drastic action at an early stage. It had been comparatively easy to agree upon the Convention to protect the ozone layer. The Convention did not indicate how this protection could be achieved - it was an agreement amongst States to co-operate in scientific research, monitoring and information exchange. As it gave no provision for any action that States might take together to limit the amount of CFC production, an additional treaty was needed which would lay down specific requirements for the limitation of the manufacture and emission to the atmosphere of ozone-depleting substances. Because of the specific nature of the regulations that were to be applied and their binding legal nature, some difficult negotiations were required.

There were different opinions amongst states over how stringent the regulations should be. Our concern in UNEP was to get regulations that were environmentally satisfying. That is to

say, satisfactory for maintaining the ozone layer in more or less its present state. We were particularly supported by Canada, the Scandinavian countries and the USA, which called for stringent regulations requiring as much as 85 per cent reduction in CFCs production while other countries, such as the European Community States and Japan, felt that a production freeze might be sufficient to limit ozone depletion. But as scientific evidence gathered, most countries came to the conclusion that only by the application of fairly stringent regulations would a solution emerge.

I believe that in the two-year period of negotiation to develop the Protocol, we actually strengthened the regulations rather than weakened them by compromise. I say this because the initial calls were for reductions on CFCs 11 and 12 alone. It was only after concern was expressed by scientists following meetings organized by UNEP, that a call for limitations on the whole range of ozone-depleting substances was made. Not only are CFCs 11 and 12 to be controlled but also CFC 113, which is used as a solvent in the electronics industry, as well as CFCs 114 and 115 and the halons. The halons are bromine containing compounds, which have a present use as fire extinguishers. They have an ozone-depleting potential 10 times greater than the CFCs and, therefore, UNEP was very concerned about any additional growth in the production of these compounds.

So, in the two-year period between the signing of the Convention and the signing of the Protocol we were able not only to increase the range of substances to be regulated, but we also went well beyond the production freeze. The freeze is only the first step in the regulatory process. It will be followed by a twenty per cent reduction and after scientific review, a further thirty per cent reduction in emissions which will be enacted by all States. We have reserved the right to call upon the contracting parties to make even more rigorous cuts, should science indicate that it is necessary.

The final agreement came only after extremely hard bargaining and a lot of midnight oil burning, but it was signed by more than 20 States including the major CFC producers. The Protocol can only come into effect if the countries representing two-thirds of production capacity are party to the Protocol. CFC production of those countries that have signed the protocol already exceed this figure. So, if all the countries that signed the Protocol go on to ratify - it can come into force. It is an extremely strong Protocol, although it must disappoint some environmental groups who would like to see larger reductions. I think the Protocol is satisfactory not only from the environmental perspective, but in the way it resolves many of the immediate economic problems it would have caused developing countries. It also allows time for a rationalisation of industry so that they can absorb the losses which are consequential by this agreement and gives them time to find acceptable substitutes.

Q If the oceans cover almost 70 per cent of the earth's surface, how much CFCs are actually getting into the ocean?

A. Very little. CFCs are extremely stable compounds. They do not dissolve in water much, but of course there is some transfer to the ocean. Probably no more than one per cent of CFCs ever gets into the ocean. Recent studies show that scientists can detect very minute amounts of CFCs 11 and 12 down to 1000 metres deep in the Pacific Ocean. Nevertheless, it is a major problem of the atmosphere rather than that of the ocean.

Q What are the adverse effects of increased ultra violet light on plankton in particular, and marine life in general?

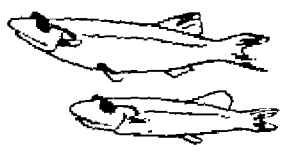
A. It has been demonstrated that UV-radiation causes damage to fish eggs, larvae, shrimp, crabs and plants essential to the aquatic food web. For example, studies have shown that a 20 per cent increase in biologically damaging UV-B would directly kill eight per cent of the annual larval population of anchovy. This incidence of UV-B would occur if the total column of ozone was depleted by nine per cent.

The main effect of UV-B stress would probably manifest itself as loss in overall productivity and reduction in species diversity, particularly the latter. Solar UV-B radiation can induce biological effects in clear water to depths of more than twenty metres and a large proportion of phytoplankton, zooplankton and fish species in their juvenile stage exist in these shallow depths. If there were changes in the abundance of zooplankton species this the impact would be considerable due to the critical role of zooplankton in the marine ecosystems.

In addition to occurrences of mass mortalities of the egg and early larval stages of fish, UV-B stress could cause alterations in the time of onset of larval feeding on zooplankton to the extent where it might not coincide with the period of spring phytoplankton bloom, thus affecting the size and densities of that year's fish species.

Q What about the effects on marine flora, such as seaweed, seagrasses and mangroves?

A. Research into the effects of UV on plants has only been carried out for about 15 years. There are very few field studies, most of the research has been carried out in laboratories. What they do show is that many important food crops are affected by UV-radiation, but as far as I am aware, no studies have yet been carried out on marine plants. One would assume from studies that have been carried out on terrestrial plants that increased ultra violet radiation on marine plants - which are after all



critical habitats for other marine organisms - would also cause adverse effects.

If CFCs continue to increase in the atmosphere, UV would automatically increase and the effects on man and environment are far too horrific for us to contemplate. We are already facing large increases in skin cancer, eye damage and other human health problems as well as damage to plant life and terrestrial and acquatic ecosystems. If CFCs are allowed to increase the effects on aquatic life would be even more serious than I stated earlier, and there would be little hope for a suitable environment for our children and grandchildren.

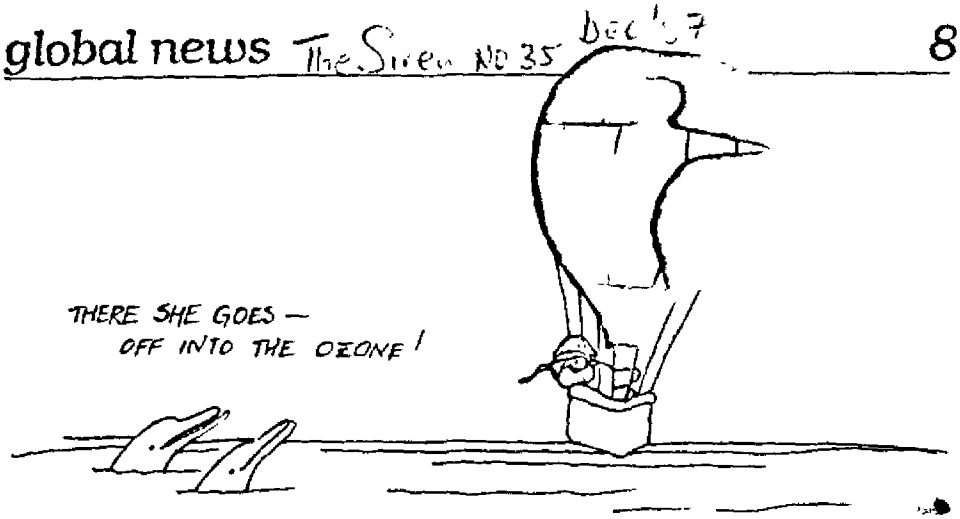
Q Then the Montreal Protocol is really very significant in that we are now taking definite steps to protect our environment from CFC-induced ozone depletion?

A: The Protocol is more than very significant. It is crucial to environmental protection and it is the major milestone in global atmospheric protection. It is also important as a precursor of other agreements and other actions that will address environmental problems of equal or even greater significance. I particularly refer here to the problem of greenhouse gases affecting our climate which has enormous consequences for both the human and animal environment, particularly for the seas and for the people who inhabit coastlines and delta areas. We are not sure how this can be satisfactorily dealt with, but we are addressing it in a similar way to the ozone layer problem. That is through the intensive scientific investigation to understand the nature and the scale of the problem and to determine the appropriate steps that might be taken to prevent, mitigate or delay the advent of climate change and to adapt to the effects that will eventually occur. This is a very long-term programme and so urgent that we must again arrive at a global agreement on actions. Particularly where they concern global energy use and the transmission of greenhouse gases to the atmosphere. We have a little time before we have to take specific action but such are the major economic and environmental consequences of climate change that the cost of inaction may be more than the world could bear.

Q So tackling the greenhouse gas problem will be your next goal?

PETER USHER: It is occupying the major part of my thinking at this time, yes.

THE SIREN: Thank you Peter, and good luck.



Historic ozone layer agreement

An unprecedented international agreement to protect the ozone layer from man-made chemical destruction was signed 16 September 1987, in Montreal, Canada. the Protocol to Control Ozone Depleting Substances, which is expected to enter into force on 1 January 1989, will freeze the production of chlorofluorocarbons (CFCs) one year later at their 1986 level.

CFCs - which are commonly used as cooling agents in refrigerators and air conditioners, to propel aerosols (spray cans), clean computer components and in the manufacture of plastic foams - deplete the ozone layers. Ozone filters out excessive amounts of ultraviolet light which can and does cause skin cancer and eye damage, and harm plants and animal life.

The landmark Montreal agreement also calls for reducing production and consumption of CFCs by 50 per cent by mid-1998. It allows limited production increases to meet very specific situations. This reduction would be achieved in two stages: a 20 per cent cut by mid 1993, and a further 30 per cent reduction by mid-1998.

The new Protocol also asserts that "special provision is required to meet the needs of developing countries for these substances (CFCs)." It was agreed that developing countries would have ten years to comply with the treaty's provisions concerning freezes and reductions. They could increase their consumption of CFCs during this period to 0.3 kilograms per capita. Concern that countries not signing the Protocol would take commercial advantage of it was satisfied by two paragraphs in the accord. One bans the import of the CFCs from any state not complying with the agreement within one year of its entry into force. The other forbids, under specific conditions, countries that have ratified the Protocol to export these substances to a non-party state, as from 1 January 1993.

Of the 62 countries and the European Economic Community present at the September Montreal conference, 24 countries and the EEC signed the Montreal Protocol on the spot. Others are expected to follow suit soon.

"This is the first truly global treaty that offers protection to every single human being on this planet," said Dr M.K. Tolba, UNEP's Executive Director. "UNEP considers this accord unique because it seeks to anticipate and manage a world problem before it becomes an irreversible crisis."

For further information see Interview, pp 29 - 34 of this issue. ∝

The Montreal protocol on the ozone layer does more to protect economic interests than it does the environment.

TWILIGHT ON THE OZONE

The year of 1987 witnessed the culmination of major proceedings that indicate a growing environmental cognizance in the higher political circles. But the brou-ha-ha surrounding such events as the World Commission On Environment and Development, The National Task Force on Environment and Economy, and The Montreal Protocol on Substances That Deplete the Ozone Layer has masked the real question: Is the environment any better off as a result of these initiatives? When considering the situation of the ozone layer, the answer is a resounding no.

Not too long ago we awoke to front-page news of a huge "hole" in the ozone layer above the Antarctic. In October 1984, the British Antarctic Survey discovered that springtime ozone concentrations had been dropping (by up to 40 percent) over the Antarctic since 1977. During this period, the "hole," occurring in the 12 to 24 kilometre altitude range, grew to an area larger than the size of the Antarctic continent itself. The sudden depletion was cause for great concern as it pointed to a ➤

rapid decrease in the atmosphere's ability to block out harmful ultraviolet radiation. Meanwhile, the news created a fervor in the scientific community, where it blew apart all existing mathematical models predicting the future of the ozone layer.

In the international political arena, our leaders sped up efforts to protect the ozone layer. Historically, international action dates back to 1981 when the United Nations Environment Programme (UNEP) initiated negotiations that led to the Vienna Convention for the Protection of the Ozone Layer. (The convention, in calling for cooperation in research, monitoring and information exchange, was the forerunner to a protocol that would enforce effective control measures.)

Now, it seems that the gaping stratospheric Antarctic sore has been joined by a smaller, though equally disconcerting, springtime depletion over the Arctic. And as if to allay any sense of security that this is only a polar phenomenon, recent controversial reports point to a small thinning of the ozone layer globally. What a nightmare!

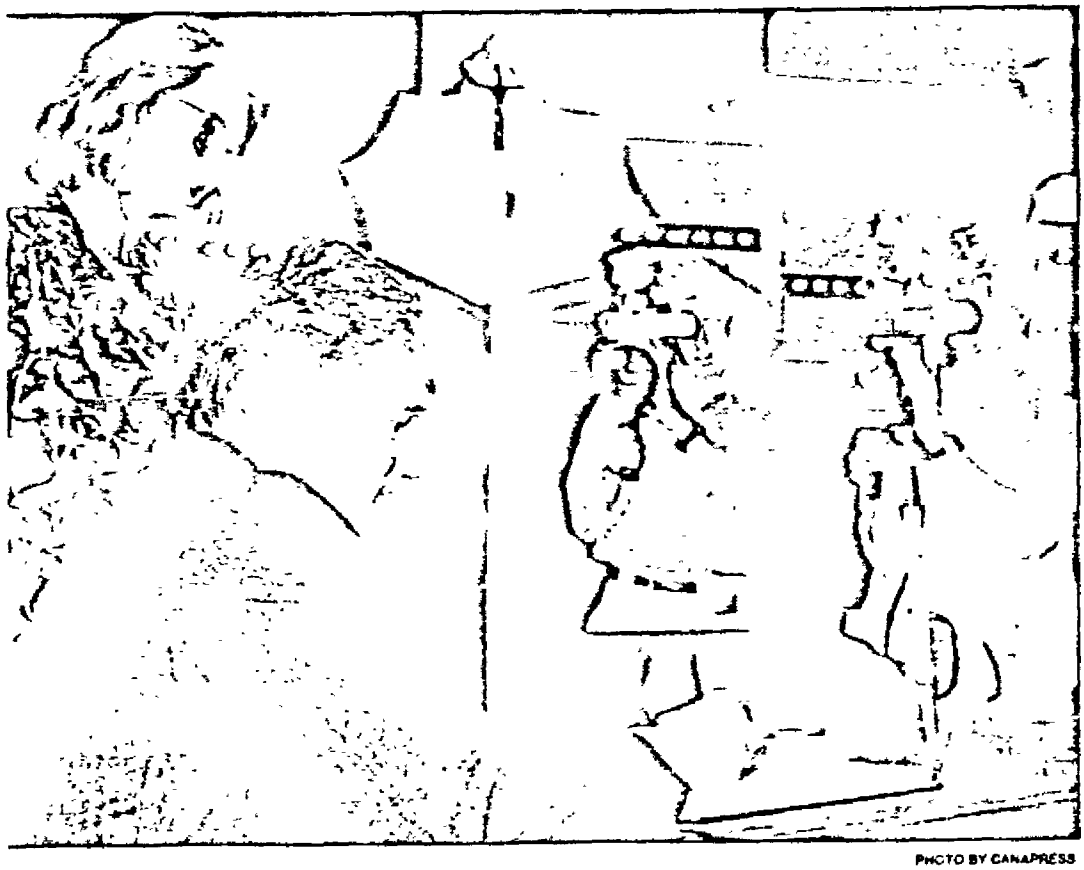
As is all too often the case, the large scale of the problem, the scientific uncertainties as to its cause and the intangible immediacy of the danger add up to make it a very difficult issue to grasp. It is truly one massive global problem requiring concerted global effort to find a solution. And while individuals may see solutions, collectively it becomes a very complicated task.

Thus it was with great relief that many people greeted the arrival of the first global treaty intended to protect the ozone layer – The Montreal Protocol on Substances That Deplete the Ozone Layer. The protocol, completed on September 16, 1987, was hailed by Dr. Mostafa Tolba, the executive director of UNEP (whose personal efforts to attain the protocol date back to 1977), as "the first truly global treaty that offers protection to every single human being on this planet." In fact, it appears to offer only Band-Aid protection at best.

The Montreal protocol began to truly take shape after the Vienna convention was completed in early 1985. Over the course of the protocol's development some very disturbing information started turning up about the ozone layer. Some atmospheric scientists, so deeply shocked by the "hole," began exploring its roots. Evidence suggested that a synergistic effect emanating from factors including the solar cycle, polar stratospheric meteorology and a growing presence of manmade chemicals in the stratosphere was responsible for the sudden depletions. A heated scientific debate ensued over the role of natural and/or manmade factors in the Antarctic phenomenon.

Attention began to refocus on manmade chemicals that were first created in the 1930s and had been singled out back in 1974 as being capable of destroying ozone. Specifically, scientists were looking at two groups of chemicals – chlorofluorocarbons (CFCs), which contain chlorine, and halons, which contain bromine – and their ability to disturb the delicate conditions in the stratosphere that limit the amount of ultraviolet radiation reaching the earth's surface. While these chemicals were long known to destroy ozone in the lab, their involvement in the process that creates the sudden depletions remained uncertain, and the controversy raged on with this new focus.

Meanwhile, these ozone-depleting substances were, and still are, being used in phenomenally huge amounts as propellants and refrigerants, with a slew of lesser uses ranging from bubble gum remover to fire extinguish-



Federal Environment Minister Tom McMillan signing the Montreal protocol: more hype than substance.

PHOTO BY CANAPRESS

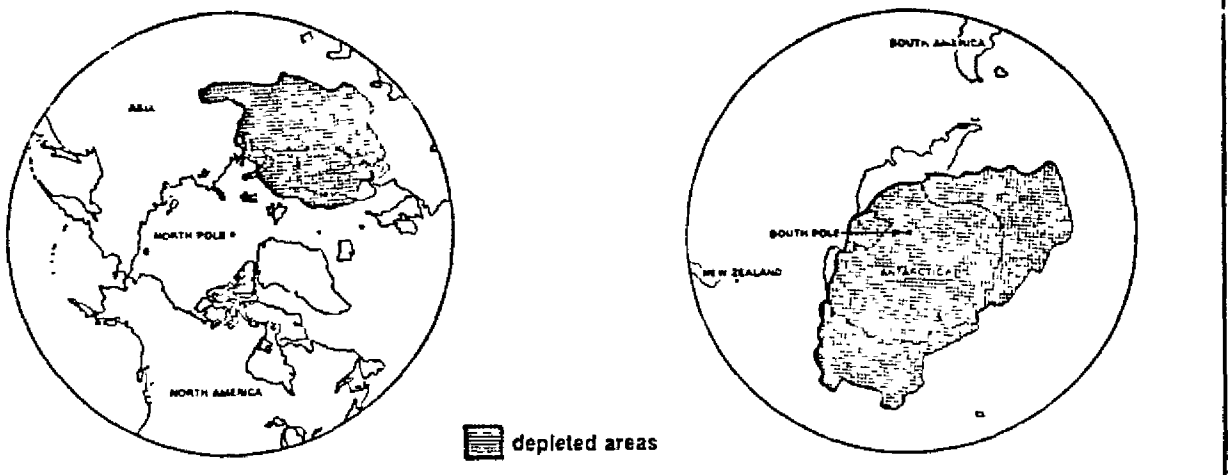
THINNING OF THE POLAR OZONE LAYER

ARCTIC

(From satellite image of March 1986)

ANTARCTIC

(From satellite image of October 1986)



ATMOSPHERIC ENVIRONMENT SERVICE

ing substances .The total global use in 1986 alone was 800 kilotonnes, and it is rapidly approaching the 1,000 kilotonnes a year level Little though is known about the resiliency of the stratosphere to deal with these chemicals. Nevertheless, it is estimated that the natural removal process can, for example, remove an estimated 15 percent of the total 1986 global CFC consumption level. The remaining 85 percent will continue to thin out the ozone layer.

Much more is known about the ozone-destroying chemicals. They have life spans of around 100-plus years. They are inert until they rise to the stratosphere. And they are capable of wiping out more than 10,000 molecules of ozone per atom of chlorine and 100,000 molecules per atom of bromine released. In effect, they are endowed with the ability to produce a huge cumulative effect that is certain to continue growing. In addition, they add to global warming. (In fact, on a molecule for molecule basis these chemicals possess six times the "greenhouse effect" of carbon dioxide.) It was because of this information that the scientific community rallied together and called for at least an 85 percent reduction in the use of CFCs from the estimated levels of 1986.

Regardless of this plethora of numbers, the cumulative nature of these chemicals indicates that even if we went cold turkey and cut to zero today, our dependence on these substances over the past decades will ensure that ozone depletion will continue unabated for an estimated 20 years. Only at that point will the stratosphere's inherent capacity to cope with the chemical stress balance out the remaining chemicals fuelling the destruction process As federal Environment Minister Tom McMillan said in his address to the delegates in Montreal, we are dealing with "a planetary time-bomb... and the pace is accelerating "

While things look bleak enough, possibly the most ominous information about the ozone "hole" is that: its discovery was a total shock; it's huge; and it shows an incomplete return to prespring ozone levels. All this suggests that the atmosphere has a threshold to what it can handle before it becomes critically altered This precipitous response provides evidence that the atmosphere is not a black hole that can endlessly suck away what a rapidly changing planet throws at it. So, as the pressures mount we are increasingly taxed to answer a paramount question: Can we react quickly and effectively? The proceedings that led up to and culminated in The Montreal Protocol on Substances That Deplete the Ozone Layer were to address just this sort of question.

During the months of intense lobbying immediately preceding the presentation of the final document in Montreal, nations, guided under the aegis of UNEP, tried to hammer out an effective document. The Canadian delegates often found themselves playing the role of mediator while calling for significant cuts along the 85 percent line. European delegates wanted much lower reductions and were reluctant to include the halons on the list The first sacrifice ensured that these chemicals made the list, but all cuts would amount to only 50 percent of 1986 levels. Achieving this became more complicated when Soviet delegates wanted assurance that exemptions would be provided for manufacturing plants (which would produce or use CFCs) that are already in the planning stages. In order to assure the Soviets' presence in the agreement, it was agreed that all cuts would not be initiated until 1990. At that time there is to be an initial cut to return production and consumption to the 1986 levels. In 1994, there is to be a 20 percent reduction from these levels, with a further 20 percent reduction occurring in 1999.

Developing countries were brought into the fold by delaying for 10 years their compliance with the control measures stated in the protocol. In addition, a multitude of clauses, exemptions and exclusions allow developed countries to reduce the extent of their cuts by as much as 15 percent to meet the import demands of countries whose industries are affected by actions within the protocol. As such, by 1999 the cuts may add up to only 35 percent of the 1986 levels, not 50 percent.

In addition, the protocol's "start button," known as the "entry into force provision,"

states that at least 11 ratifications from states representing two-thirds of the 1986 global consumption are required to bring the document into effect Lacking this, no nation is obliged to take any steps unilaterally. Nor are there any measures cited to deal with nations, who upon ratifying the protocol, fail to fulfill the requirements within the document.

So rather than heeding the scientists' call to create enforceable and effective cuts to the production and use of the harmful chemicals, and thereby ensure the protection of the ozone layer, the delegates concentrated more on economic issues.

True, bringing together 56 countries with diverse interests reflected in their developed/developing biases was no easy task. But the final document is an extremely complicated scheme that, instead of protecting the ozone layer, protects trade and guarantees corporate interests. It provides for little more than superficial cuts in the production and consumption of these chemicals

So while we hear great lip service paid to a "precedent-setting" global treaty that offers a panacea through its "dynamic" (meaning flexible) approach, it is clear that the cuts attained are nowhere near the 85 percent reduction needed. According to Dr. Joe Farman, the British scientist who first discovered the Antarctic "hole," "the cuts in consumption of CFCs... are hopelessly inadequate to stop the build-up." And while accurate numbers are hard to come by because of the complexities of atmospheric science, one model predicts that a fully ratified protocol means that we are still going to have a global depletion of two percent over the next century. The effect of this depletion is not quantifiable, but aquatic and terrestial food chains will certainly be qualitatively damaged, human immune systems impaired, and increases in skin cancers will abound.

During all the proceedings leading up to and including the events in Montreal there had remained uncertainty about the role ozone-depleting substances play in the "hole" phenomenon. This absence of clear facts surely weakened the scientific basis for the negotiations. In the temporal sense of a dramatic tragedy, just two weeks after the proceedings were completed new evidence surfaced from aircraft-borne experiments over the Antarctic, undertaken by a consortium of scientists headed up by NASA. Initial results showed conclusively that these synthetic substances are directly, and in proportion to their abundance, responsible for the destruction of ozone. Without a doubt, these chemicals, in conjunction with natural events, cause the "hole." Worse still, these latest results from 1987 confirm that not only is the duration and size of the depletion phenomenon increasing, so is the amount of ozone actually being destroyed At some altitudes aircraft-borne monitors recorded a 99 percent reduction in springtime ozone levels.

The question surfaces: Would the Montreal protocol have been stronger had this information been available? Difficult to tell, though not entirely pointless to ask, since surely with this new information the need for tougher control measures is even stronger. But, to date, only 24 countries and the European Economic Community have signed the protocol, thereby agreeing to its terms; none have yet gone that extra step of ratifying it.

Our Canadian environment minister has used the need to ratify the Montreal protocol as political fodder to speed up passage of the new Canadian Environmental Protection Act. While he maintained that existing legislation was insufficient to enforce the requirements in the protocol, others contended that with the Environmental Contaminants Act and the Clean Air Act it was possible to immediately ratify the document and initiate control measures Meanwhile, the move to alternative chemicals, products and technologies is only hindered by the capital expenditures required to transfer to new technologies, since such alternatives already exist for most cases where ozone-depleting substances are needed.

Regardless of the posturing, lip service and bombastic statements from politicians, the Montreal protocol has not done what it was intended to do. It does not protect the environment. The document took years to get set in ink, and it will take years before it has any impact; still more time will pass before any review process is undertaken. The upshot is that the gaping Antarctic sore will most likely continue to deepen and spread...while an even larger question remains as to the fate of the entire ozone layer itself. ⊖

David Way works in science television and is currently at TVOntario, a public educational television network

Governments take first small step to ozone protection

Julia Langer

A[illegible] the ozone layer over A[illegible] has grown deeper [illegible] than ever before according to [illegible] atmospheric survey [illegible] dings of up to 8% percent [illegible] raised concerns for the health of the [illegible] teams

Interaction [illegible] tion climatic patterns interest [illegible] not the ozone layer at [illegible] Watson, chief scientist [illegible] project but there is no [illegible] chlorofluorocarbons [illegible] other synthetic chlorinated chemicals responsible for the destruction

An international treaty to protect the ozone layer was signed in Montreal in Mid-September, just [illegible] days before the survey was completed. The negotiated protocol calls for a 35 percent cut in production of five CFCs within approximately 12 years and a freeze in the production of halons.

"The pact shows a global recognition of the problem but does not even come close to providing the necessary level of protection," says Friends of the Earth, an environmental organization represented at the proceedings. The group says an immediate 85 percent cut in the emission of damaging chemicals is needed simply to stabilize ozone concentrations at present (depleted) levels taking into account the CFCs already stockpiled in the atmosphere and the balance between ozone depletion and production.

Scientists agree. "The global community cannot afford to wait for another dozen years before applying stringent controls on CFC emissions," says Sherwood Rowland, the California chemist who first postulated the chemical destruction of the ozone layer.

Stratospheric ozone filters out most of the harmful ultraviolet (UV) radiation from the sun's rays. A depleted ozone layer has serious health and environmental implications. Doctors predict an increase in skin cancer, eye damage, and immune system diseases as a result of increased exposure to UV, and point to the near epidemic incidence of skin cancer which has increased by 83 percent in the past few years.

The current extent of depletion, since measurements began in 1974, is four to six percent world-wide, and approximately ten percent over Canada. As a rule-of-thumb, a one percent decrease in ozone concentration means a two percent increase in UV and a four percent increase in the potential for skin cancer.

Other adverse effects include drops in the yield of important crops such as corn, wheat and soya, and reduced productivity of planktonic organisms in the upper layers of the oceans. In addition, CFCs are excellent heat absorbers and contribute to general atmospheric warming or the "greenhouse effect".

Aerosol spray cans were the earliest target of CFC controls in the mid-1970s. Fearful of holes in the earth's natural sunscreen, the North American public successfully pressured their governments to introduce aerosol bans. Production dipped temporarily but use in other areas such as refrigeration, air conditioning, foam production and solvents has boosted production beyond any previous levels.

Ozone depletion is a global problem but essentially a consumer issue. Refrigerators, air conditioners, insulation, mattresses and cushions, furniture frames, food packaging, stereos and computers are all made with or contain these odourless, relatively non-toxic, superbly heat absorptive gases.

According to Friends of the Earth, "There are numerous opportunities for effective industry, government and consumer action. For starters, there are some products which should simply be banned." The group is pushing for government regulations to ban CFC-based aerosols, fast food containers and grocery packaging, and to impose strict controls on the use and production of CFCs. Pressure from consumers, including product boycotts, will also be necessary, the group says.

Industries are already starting to react to the international condemnation-in-principle of CFCs and other ozone depleting substances.

A draft 3500 page report on from the US Environmental Protection Agency details alternatives to CFC-blown foams, new cooling systems and coolants, insulation options including fiberglass, cellulose, and vacuum panels, and electronic assembly without CFC solvents. Many of these options are already in use.

The Montreal protocol has been hailed as a precedent-setting, proactive response to a global environmental problem, but in the words of Mostafa Tolba, Director of UNEP, "people solve problems, not protocols". ❑

Julia Langer is executive director of Friends of the Earth Canada.

Friends of the Earth ozone recommendations

What the Canadian government should do now

At the time of the signing of the Montreal protocol on protection of the ozone layer, federal environment minister Tom McMillan gave a strong commitment to implementing controls in Canada.

Friends of the Earth recommend immediate action on the following specific steps:

- **Food packaging** The use of styrofoam food packaging and [illegible] should be banned by regulation.
- **Refrigerators and air conditioners** Regulations should be promulgated requiring [illegible] and refrigeration systems to be drained before disposal and the coolant collected and destroyed. No new institutional systems should be built using CFCs and existing systems must install rupture recovery systems. Air conditioning and refrigeration servicing operations should be stringently regulated and inspected.
- **Rigid and flexible foams** Alternative materials should be promoted. Foam blowing operations should be regulated under the Clean Air Act by setting strict emission limits for CFCs.
- **Aerosols** Regulation SOR/81-365 under the Environmental Contaminants Act banning the use of CFC propellants in some aerosols should be extended to all aerosols except for medicinal uses.
- **Solvents** Strict emission limits under the Clean Air Act should be imposed on operations which use CFC solvents. Recapture and reuse systems should be mandatory.
- **Restricting imports** Declining quotas on the import of products made with and containing CFCs should be developed and enforced. Canada's indirect production of CFCs as a result of imports should be publicly reviewed.
- **Product labelling** A warning label should be developed and affixed to all products made with or containing CFCs and halons.
- **Living within a budget** Canada should adopt a target of an 85 percent cut in the production of ozone depleting substances within five years.

Climate change from CO_2 not to be feared

By Robert C. Cowen

Humanity need not be at the mercy of the climate-changing effect of carbon dioxide (CO_2) gas released by burning fossil fuels — coal, natural gas, and oil. Earth's climatic destiny in this respect remains somewhat within people's control.

That is the upshot of the latest expert analyses of this long-running issue. These offer a positive alternative to recent hand-wringing about the climatic outlook or a tendency to study the problem while taking no action at all.

Climatologists generally agree that CO_2, accumulating in the air, will eventually raise the lower atmosphere's average temperature by a few degrees. This could make deserts of some now fertile croplands, such as the North American wheat belt. It could melt the Antarctic icecap and raise sea level enough to flood out many cities. But both the timing and the degree of any such effects are speculative and uncertain.

RESEARCH NOTEBOOK

Thus the US Environmental Protection Agency (EPA) was widely criticized as being needlessly alarmist last October, when it warned of climatic change in the near future. It suggested that drastic action to curb the use of fossil fuels may be needed within this century The EPA statement was immediately followed by a National Academy of Sciences (NAS) report urging "caution, not alarm." The NAS advised postponing any action on the problem until further research clarified the question.

By emphasizing energy efficiency and such fossil fuel alternatives as nuclear and solar power, CO_2 warming can be stretched over centuries instead of coming on within less than 100 years. A new study recommends this 'CO_2-benign' energy strategy.

This was too much for Prof. David J. Rose of the Massachusetts Institute of Technology. He told the Monitor that he considered both panic and procrastination to be ill-advised. He believes it is time to begin coping with the problem even while trying to understand it better "You can't go around crying . . . [climate threat] without doing something about it," he said. He added that a study he then was finishing for the National Science Foundation would soon put the issue in different perspective.

Now the NSF has released that study. Its central point is that "a significant global CO_2 warmup in the next century cannot be avoided, but the extent and timing of it are to a considerable degree under our control. . . ." By emphasizing energy efficiency and such fossil fuel alternatives as nuclear and solar power, CO_2 warming can be stretched over centuries instead of coming on within less than 100 years. The NSF study calls this a "CO_2-benign" energy strategy.

The report also notes that the degree of threat of climatic change depends partly on humanity's own lifestyles. It explains, ". . . civilizations tend to organize and optimize their activities with respect to their current environment; thus, changes are on that account more likely to be harmful than beneficial." By following a "CO_2-benign" energy strategy, people should be able to adapt gradually to any climate changes.

Rose was principal investigator for this study. He worked with Marvin M. Miller of the Massachusetts Institute of Technology and Carson Agnew of Stanford University as co-principal investigators They acknowledge that the problem still is poorly understood. Yet they insist that the US and other nations can begin now to build an effective energy strategy for coping with the CO_2 effect. They say it is time to start worldwide discussion of possible energy development, just as nations already

Please see CO_2 next page

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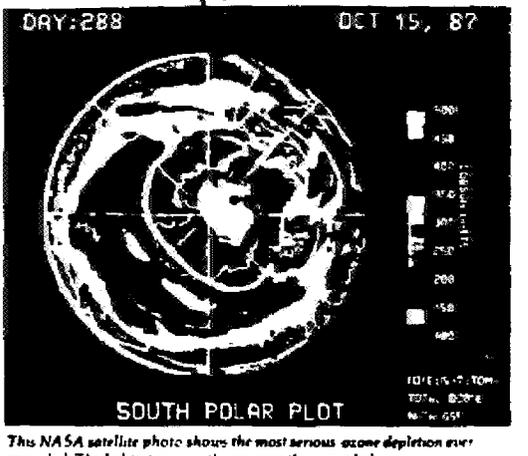
NRDC Newsline

Ozone Depletion Worsens, NRDC Leads Drive for Total CFC Phase-out

Stratospheric ozone depletion is dramatically worse than we thought, according to a new report just issued by an international panel of more than one hundred scientists. The report, prepared under the auspices of the National Aeronautics and Space Administration (NASA) documents an unexpectedly rapid thinning of the stratospheric ozone shield all over the globe, with chlorofluorocarbons (CFCs) the likely cause. The alarming findings add new urgency to NRDC's drive for a total phase-out of CFCs and other ozone-depleting chemicals.

According to the scientists' report, even after natural factors are accounted for, satellite and ground-based monitors show ozone losses since 1969 as high as 3 percent over the heavily populated regions of North America and Europe and 5 percent over parts of the southern hemisphere. What's more, depletion is occurring at two to three times the rate predicted by computer models scientists have previously relied on.

"We are facing a global emergency," NRDC senior attorney David Doniger testified before the Senate Environment and Public Works Committee on March 30. Doniger called for immediate steps to strengthen the international agreement reached last September in Montreal – which the Senate ratified by a vote of 83-0 just one day before the new scientific report was issued – as well as Environmental Protection Agency regulations proposed last December under a court-ordered deadline won by NRDC. "The Montreal accord and the proposed EPA rules will cut CFCs by less than 50 percent over ten years. The world has *already* suffered more ozone depletion than EPA predicted would occur under that level of cuts *by the year 2050*. Safeguarding the ozone layer requires a rapid and total CFC phase-out, not just a ten-year halfway measure."



This NASA satellite photo shows the most serious ozone depletion ever recorded. The lightest area in the center is the ozone hole.

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Ozone Depletion Worsens, NRDC Leads Drive for Total CFC Phase-out

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The findings of global ozone losses follow on the heels of proof, gathered by NASA last year, that CFCs are the cause of the massive Antarctic ozone "hole" that opens each year when spring returns to the southern hemisphere. Ozone levels over Antarctica plummeted by more than 50 percent last September and October.

Ozone depletion will allow more ultraviolet radiation to penetrate to the earth's surface, causing tens of thousands of extra skin cancers, cataracts, and immunological diseases in the U.S. over the coming decades. More ultraviolet radiation also damages crops and other vegetation and endangers the marine food web. Even the earth's climate may be changed.

The new scientific report prompted a surprise announcement from du Pont, the world's largest CFC producer which had led industry opposition to controls on these chemicals for more than a decade. Du Pont stated a "goal" of totally phasing out its CFC production and called for immediately reassessing the Montreal agreement once it takes effect next year. "While du Pont's new position is welcome, its conversion is far from complete," said NRDC's Doniger. "Du Pont has set no schedule for its own actions, and it still opposes any move to phase-out U.S. production and use prior to reaching a new international agreement. In addition, du Pont and other CFC producers stand to make billions of dollars in windfall profits as these chemicals are phased out." Nonetheless, the du Pont switch offers an opportunity for positive private sector movement. In letters sent this month to top officials of each producer and major user of CFCs, NRDC is asking for concrete commitments to end use of these chemicals.

Governmental action remains a must, however. In 1986 NRDC was the first to call for a total phase-out of CFCs, as well as related chemicals known as halons. Final EPA regulations are due on August 1 under a court-ordered deadline obtained by NRDC. "Unless EPA orders a complete phase-out of U.S. CFC production and use, we'll go back to court," Doniger vowed.

Internationally, NRDC is urging the State Department to make ratification and reassessment of the Montreal agreement a top priority in dealings with our European allies and Japan, who with the U.S. account for the bulk of world production of CFCs. NRDC is also pressing for passage of legislation now pending before Congress which would phase out CFCs over six to eight years and tax away the producers' windfall profits.

What can NRDC members do?

- Write EPA Administrator Lee Thomas – press him for regulations that will totally phase out CFCs and halons and recoup chemical company windfall profits for the American people.
- Contact your Senators and Congressional representatives – urge them to pass phase-out and windfall profit legislation. Bill numbers and chief sponsors are: S. 571 (Chaffee) and S. 570 (Baucus) in the Senate, H.R. 2036 (Bates) and H.R. 2854 (Stark) in the House.
- Write CFC and halon producing and using corporations – demand, as consumers and shareholders, a specific timetable for CFC and halon reductions. (Contact NRDC's Washington office for a list of producers and major users.)

David Doniger's article, "Politics of the Ozone Layer," in the current issue of *Issues in Science and Technology Policy* (published by the National Academy of Sciences) gives a detailed critique of the Montreal agreement and the EPA regulations. Reprints are available from the New York office for $2.00.