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NEWS FROM

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FOR IMMEDIATE RELEASE
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GORE TO SERVE AS DELEGATE TO THATCHER ENVIRONMENT CONFERENCE
Weekend Meeting to Focus on Protecting Upper Ozone Shield

WASHINGTON -- U.S. Sen. Al Gore, D-TN, will be in London this weekend as part of a five-member U.S. delegation to an international conference, sponsored by British Prime Minister Margaret Thatcher, focusing on protecting the earth's upper ozone layer. Gore will be the only member of Congress in the delegation.

The conference, which opens Saturday, will bring together policy makers and scientists from the around the world to discuss recent scientific studies on stratospheric ozone, and policy options to protect the atmospheric shield that screens the sun's ultra-violet radiation.

Gore is the author of the World Environment Policy Act of 1989, introduced on the first day of the 101st Congress and one of the most comprehensive environmental bills now pending. During recent Congressional recesses he has visted Antarctica to study ozone depletion and Brazil, to survey damage to the Amazon rainforests.

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OUR FUTURE WORLD

Global Environmental Research

An abridged report to the Advisory Council on Science and Technology by the Natural Environment Research Council

March 1989

most conservative estimate indicates that the human population will reach 6.1 billion by 2000 with the lowest predicted stabilisation being 10.2 billion in 2100. Other extrapolations predict stabilisation at even higher figures up to a maximum of 14 billion. The pressure on the environment in order to sustain a population of this size will be immense.

Concern about the future trends of human economic and social development, its sustainability and its effect on the world's environment became more prominent publicly in the early 1960s and 1970s. In succeeding years this public concern about the environmental consequences of Man's activities has been manifest in the debates on issues such as nuclear, fossil and renewable energy, the 'greenhouse' effect, the 'ozone' hole, and on whale and seal conservation. Natural disasters such as floods, hurricanes and droughts and the incidents with toxic waste disposal have raised the public perception of the importance of environmental research.

In recent years, there have been numerous reports on the environment. In particular the Report of the World Commission on Environment and Development - Our Common Future (the Brundtland Report), published in 1987, on the effect of human population pressure and economic development is significant. The UK Government responded to the Brundtland Report in July 1988 by welcoming it and setting out ways in which the Government believes the UK is addressing the concerns identified in it. The Prime Minister, in a speech to the Royal Society on 27 September, expressed the UK Government's acceptance of the need to tackle problems of a changing global environment.

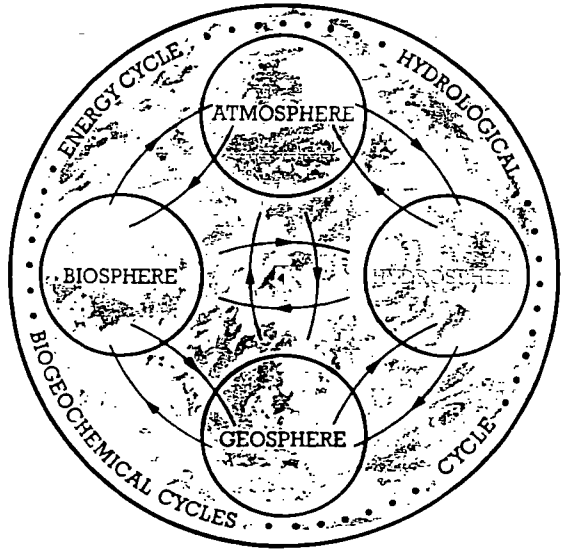
Concern for the global environment is now an issue which is high on the public and political agenda. Fortunately current technology provides the means to observe and measure the global processes. This, in turn, leads to the development of computer models of changes in the environment so that we may understand in order to predict the impact and timescales of Man's influence. Research into the global environment is crucial and urgent.

Environmental Processes

Global environmental research falls into two categories. The first concerns research on processes which are global in scale and implication: the plate tectonics of the solid Earth; oceanic and atmospheric circulation; the water cycle; and chemical fluxes in the atmosphere, oceans and terrestrial environment of which the fluxes for carbon, nitrogen, oxygen and sulphur are probably the most significant. Fluxes of phosphorus and cationic elements (eg aluminium, magnesium, iron etc) are important although their effect is mainly local. The second category is research on local or regional phenomena which are repeated worldwide so becoming an issue of global environmental concern. Examples are acid precipitation; contamination of aquifers; urbanisation; desertification and land use change; deforestation; pollution of regional seas; and soil infertility and erosion. This report, is concerned with the first type of research rather than with the local or regional issues.

Global environmental research is defined as the study of those global processes which are likely to have an effect on a timescale of a year to a century. These may be the product of several centuries of change. It is apparent that the study of one particular process commonly leads on to the appreciation that this is but one part of a more complex system embracing the whole planet. This emphasis on studies of the Earth as an integrated system is the important and new element in global environmental research. Man has now become a key, possibly the key, participant in planetary processes. The challenge is to be able to differentiate between the changes induced by Man's activities from the intrinsic 'natural' evolution of the complex global system. Most of the 'natural' systems are non-linear so that even a minor 'perturbation' by Man may produce cumulative, catastrophic and potentially irreversible consequences.

Because the subject area is so broad it is necessary to draw on a wide variety of disciplines in an endeavour to understand and predict the processes under investigation. For example, it is important to include geological research, with its long series of data, in order to distinguish



Components of the global environmental system.

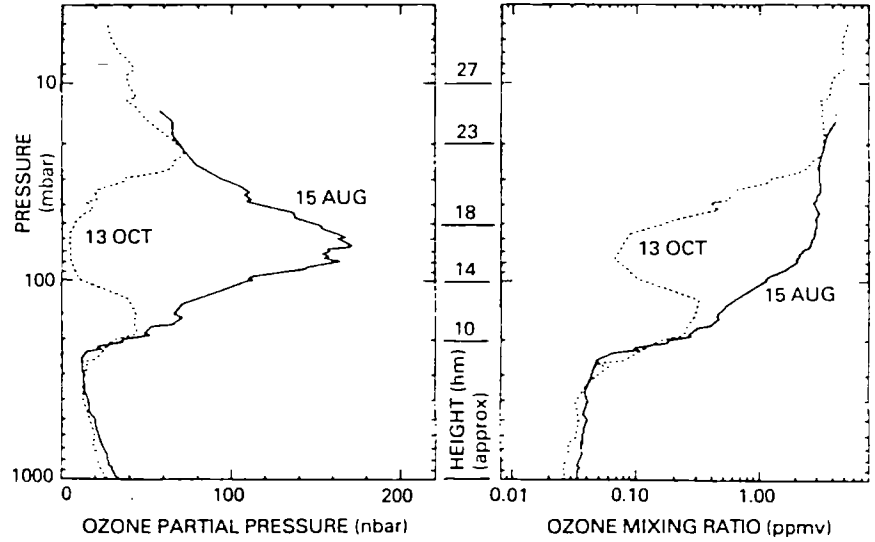
between shorter and longer term effects, and between natural and Man-induced changes.
Global environmental research must determine the long term availability of resources required to sustain economic and social development as well as to investigate the environmental and socio-economic consequences of whatever actions and policies are chosen. The objective of the research is to be able to predict with reasonable accuracy. The lead time involved in identifying a phenomenon or predicting a process to the point at which internationally agreed action can be taken is considerable. This emphasises the urgency of the research in order that decisions, which may have profound effects on the global system, can be taken with confidence as to their likely consequences.

The Global Environment

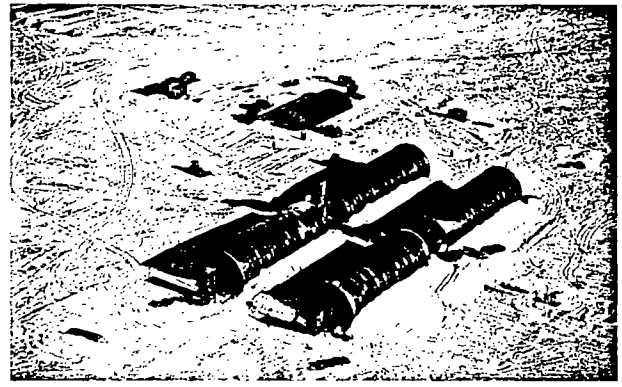
The global environment may be conveniently described as four linked subsystems:
the Atmosphere, the Geosphere, the Biosphere and the Hydrosphere. These may be considered as sources and sinks of elements and substances which circulate within and between the subsystems. The movement of elements and substances (the fluxes), driven by the Energy, Hydrological and Biogeochemical cycles, reveals that the global system is dynamic although it may remain in a stable equilibrium over long periods of time. Man's influence is to alter the balance of the elements and substances within and between the four subsystems and to change the fluxes between them. Man's activities have now reached the point where the alterations to the fluxes can change the global system perhaps irreversibly.

The Atmosphere

The Earth's atmosphere is a product of both physical, chemical and biological interactions on land and in the oceans over a very long timescale. The lower part of the atmosphere (below 18 kilometres), the troposphere, is a fluid medium that has complex dynamic and chemical behaviour. The troposphere interacts with the land,



Profiles of the ozone layer over Halley (76 S, 27 W) 15 August and 13 October, 1987. The depletion of ozone over Antarctica in September and October 1987 was the most severe yet seen. The profile on 15 August shows an undisturbed ozone layer, with a strong peak at about 18km altitude. By 13 October, this peak had disappeared. Between 14 and 18km, 97% of the ozone had been destroyed. The ozone column was 50% less than on 15 August. The observations were carried out by the British Antarctic Survey, with financial assistance from the Chemical Manufacturers Association, Washington, USA, and the Department of the Environment.



British Antarctic Survey's Halley Base

ocean, and their biota, as well as the stratosphere above, and serves as the principal link among them. These interactions centre on the ability of the troposphere readily to exchange heat, momentum, radiation, water, trace chemicals, and aerosols with the Earth's surface. These properties or materials are transported over regional and global scales as well as vertically across the tropopause. The Earth's atmosphere is unique in being rich in oxygen produced over geological time by plant photosynthesis. It is a source and a sink for many chemical species. It is the only sink for man-made chlorofluorocarbons (CFCs used in aerosols, as refrigerants and in manufacturing processes) and it is a sink for methane. Carbon dioxide, methane, the oxides of nitrogen and CFCs are the principal greenhouse gases giving concern and their effect is discussed in the section on the energy system. The role of the oxides of nitrogen and ammonia in atmospheric chemistry is clearly of significance in terms of the chemistry of acid precipitation, and their reactivity with ozone, both in the troposphere (where it is a pollutant) and in the stratosphere (where it is not). The stratosphere (between 18 and 55 kilometres altitude) is of crucial importance to life on Earth because this region of the atmosphere contains the layer of ozone that screens the Earth's surface from biologically harmful ultraviolet radiation. The stratosphere is also the zone within which global circulation predominates so that material entering the stratosphere is likely to be distributed globally and to have much longer residence times than in the troposphere.

The atmosphere is sensitive to perturbation both from natural and Man-induced events. The principal natural changes occur as a result of volcanic eruptions resulting both in the production of gases such as sulphur dioxide and carbon dioxide and in the generation of dust. Volcanic dusts can have a significant effect on insolation levels and on rainfall through the nucleation of water droplets and the production of aerosols. The rate of production of gases, from whatever source, and dust is variable and uncertainties obscure prediction. The Man-induced perturbation of most significance is the increase in greenhouse gases. The role of CFCs in the depletion of stratospheric ozone, identified by the British Antarctic Survey in the Antarctic and now suspected in the Arctic, as well as an overall drop in stratospheric ozone, has major implications for all life forms. This is expected to be a continuing problem owing to the long residence times (up to 100 years) of several of the CFC species.
The atmosphere, even more than the oceans, demonstrates the global and trans-national nature of the phenomena which need to be understood. The speed with which material may be dispersed by the atmosphere emphasises this point. Transfer of chemicals via the atmosphere across Europe occurs in days and around the globe in weeks. Large scale effects may be produced from small-scale or local processes. The Chernobyl incident forcibly demonstrated this fact with some economic consequences for the UK. While most common atmospheric pollutants have only local or regional effects due to their relatively rapid removal from the atmosphere by wet and dry deposition, stable and insoluble materials have much longer residence times and so can have global effects.

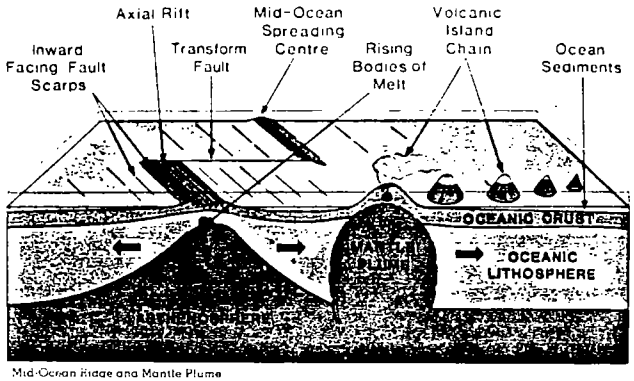
The Geosphere

The structure of the Earth is well known, comprising a core, a mantle and a crust, together with the dynamical effects of plate tectonics, in which rigid sections of the continental crust and upper mantle (the lithosphere) are in motion at maximum rates of a few centimetres per year. Despite this slow rate of movement plate boundaries provide the major geologically active zones of the World containing the bulk of seismicity and volcanism.

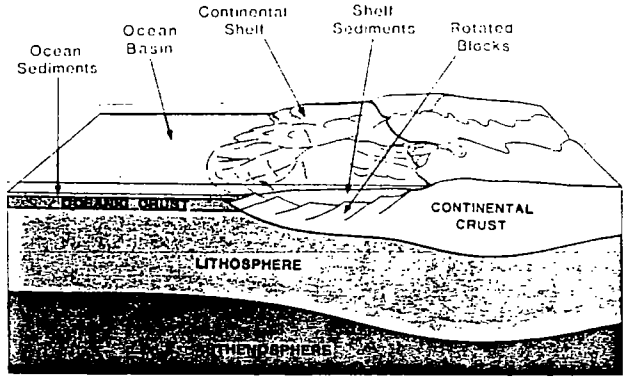
Geological aspects of global environmental research are local or regional in origin but have cumulative or interactive effects worldwide. Volcanic activity is confined to narrow and well known zones around the world, yet we are still not able to reliably predict eruptions which will cause damage. Prediction depends on continuously monitoring temperature, tilt and seismicity. Instruments to do this are in place in only a few locations. The precursors of eruptions do not give sufficiently clear warning of impending eruption for the development of acceptable policies on warning and evacuation. Major eruptions can lead to devastation and loss of life; they can cripple national economies for years. More rarely, they can produce dust clouds so massive that particles can be distributed worldwide, with sufficient density to affect world weather and climate, reducing the temperature on the Earth's surface globally and triggering increased rainfall regionally. Volcanic eruptions are also responsible for the emission of carbon dioxide and sulphur dioxide into the atmosphere; the latter will produce acid precipitation and aerosols. Proposals have been mooted for an international programme of hazard mitigation which would include deployment of groups of scientists to monitor volcanism at times of build-up of activity.

The natural source for atmospheric methane is from buried hydrocarbon source rocks which is being increasingly identified as a widespread phenomenon contributing to the accumulation of greenhouse gases.

The seismic zones of the Earth are as well-known as, and largely coincident with, the volcanic belts,



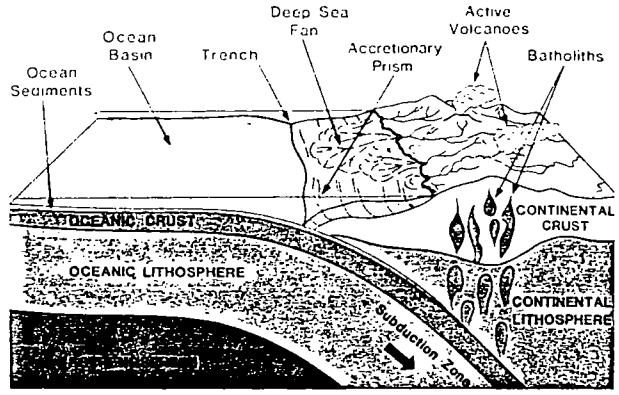
Mid-Ocean Ridge and Mantle Plume



Passive Margin

although large damaging earthquakes do occur outside these belts. There are also wide areas of land in which significant seismic activity occurs without volcanism. Effective earthquake prediction is still little more than a dream, and monitoring of precursors has not yet produced accurate forecasting, even though there are many examples of successful prediction. Worldwide, the cost of seismic damage to property and people is greater than that from volcanic eruptions, and the risk is more widespread by the triggering of tsunamis that can propagate waves across oceans, flooding low-lying regions to devastating effect. The damaging effect of earthquakes has been forcibly demonstrated by the recent earthquakes in the USSR and the devastation which they caused. Both earthquakes and volcanic eruptions can produce mud-slides (lahars) which have caused considerable localised damage and loss of life.

Environmental Processes



Subduction Zone

The Biosphere

This section deals with the relatively small zone within which life on the planet exists. It links the lower atmosphere (troposphere) with the geosphere and provides a mechanism for the transfer of chemicals (via the biogeochemical cycles) and of water (via the hydrological cycle). The biosphere also contributes to the planetary energy system. As life has evolved over some 3500 million years, biological processes have fundamentally modified the chemistry of the Earth. Early life forms created, through photosynthesis, an oxygen-rich atmosphere which enabled other life forms to evolve into a diverse and rich set of flora and fauna on land and in the sea. The evolution of terrestrial plant life has been of enormous significance in transforming the surface of the Earth. Plant life forms an integral part of biogeochemical pathways and interacts with the physical energy system. The significance of tropical rain forests in the carbon cycle and hence on climate warming is accepted. Not so apparent or understood but of enormous significance, is the role of the phyto- plankton in the oceans. The ecosystem of the oceans may be a major component of the climate system.

The World's ecosystems are finely balanced. Man has the ability to disturb this balance on a global scale, for example, by changing the structure of vegetation and soils, or by changing distributions of chemicals and favouring one set of organisms at the expense of another, as in agriculture. Examples include the over-exploitation of a particular species, the elimination of a 'pest' or the importation of a single species as in monoculture. Man's activities, through agriculture and the destruction of habitats, have tended to limit biodiversity and have thus reduced the gene pools in ways in which the effects may be difficult to predict. Agriculture now depends on only some 20 species for nearly all its production. Man's activities have led to an elimination of species from specific areas resulting in extinction. Such activity removes a major resource from mankind. The chemicals produced by living organisms, especially plants, have provided the source materials for many prescription drugs and it is estimated that plant-derived medicines account for some £15 billion p.a. on the international trade market. Man is also responsible for introducing exotic, including genetically engineered, organisms into new territories.

The Hydrosphere

Water dominates the global processes whether as a liquid, in the vapour phase, or as a solid. Its role in the atmosphere, of which it is an important constituent, is covered under the section on the energy cycle. The hydrosphere, and in particular oceanic circulation, provides worldwide connections which operate as widely but less rapidly than the equivalent atmospheric processes. Such circulation facilitates the transfer of energy, particulate matter (sediments) and chemicals. The oceans form important sources and sinks in the biogeochemical cycles.

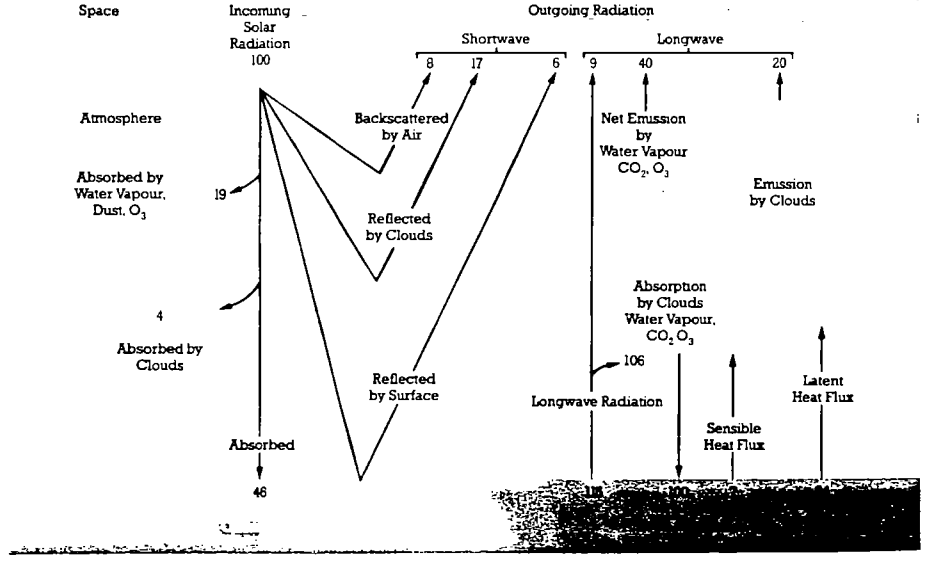
The oceans play a crucial role in the carbon, nitrogen, phosphorus and sulphur cycles. They absorb carbon dioxide, especially in the colder regions, and this water sinks, and circulates as bottom waters, eventually coming to the surface again after a period of approximately 1000 years. The level of this CO_2 absorption has still to be defined and yet is fundamental to the understanding of the carbon cycle. The oceans are a major source of sulphur and its compounds through submarine volcanicity and through the production of dimethyl sulphide (DMS) from plankton. The oceans also play a central role in the nitrogen cycle by the outgassing of ammonia, oxides of nitrogen and other compounds and act as a sink, again principally through plankton, for phosphorus. The ocean system is still relatively unexplored. Futher research is required to understand and quantify the natural perturbations in order to define the role of the oceans in the climate system. For example, studies of the equatorial Pacific phenomenon known as El Nino, which is associated with a reversal of equatorial wind pattern and changes in sea surface temperature and atmospheric pressure known as the Southern Oscillation, are of considerable importance. By some estimates, the cyclic El Nino climate event in 1983, associated with sea surface temperature changes of about 1 C, caused 1,000 deaths, as well as severe economic damage in Australia, Asia, North_

and South America and Africa. The significant heating of the eastern equatorial Pacific which occurs in such strong El Nino events is associated with significant climatic anomaliers over many regions around the World.
It is now suspected that such climatic tele- connections may well form a key part of the global climate system and it is important that the relationship of the UK and NW Europe to this system is well identified. It can be readily appreciated that the worldwide monitoring of sea surface temperature is important. To this end the European Space Agency's ERS -1 satellite will carry an instrument for measuring temperature changes, which can determine sea surface temperature to a accuracy of better than 1°C.

The Energy Cycle

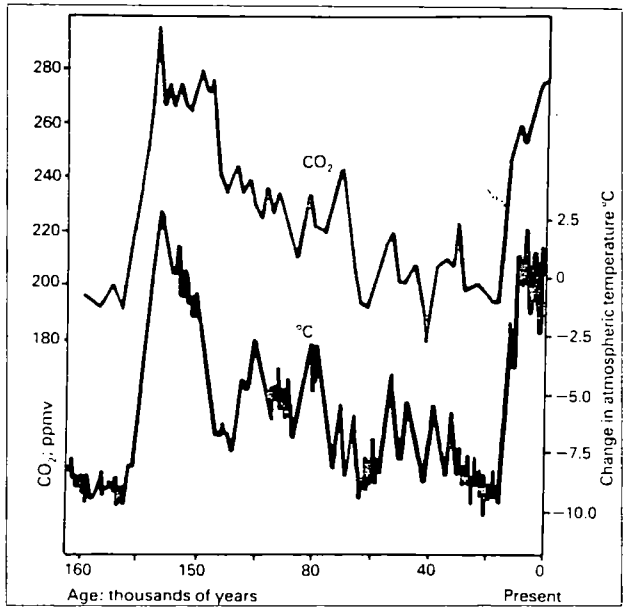
The most fundamental flux which links the various components of the planetary system is that of energy derived from solar insolation. Solar energy heats the atmosphere and the oceans, particularly in the equatorial regions. It is this flow of energy and the associated latitudinal imbalances which produce the global circulation of the atmosphere and the oceans. Within the energy cycle, there are many locations at which small changes can produce significant overall effects. The atmosphere's role in transmitting, absorbing and reflecting radiation is critical and is determined by its chemical composition and the presence of clouds, aerosols and particulate matter. The oceans provide the medium through which energy received at the Earth's surface from the Sun at the tropics is transported towards the colder polar regions. Certain trace gases (eg carbon dioxide, methane and water vapour) play a major role in absorbing short-wave infra-red energy reflected from the Earth's surface. Without this warming effect, the temperature at the surface of the Earth would be some 30°C colder than it is now. Of the trace gases, water vapour is the most significant. A temperature increase raises the capacity of the atmosphere to hold water vapour. Increased water vapour absorbs more energy and so could increase the temperature still further. The increased atmospheric water vapour may lead to increased cloudiness which, depending on the type of cloud formed, could have an effect on the energy balances. Rising temperature, from whatever cause, will affect the amount of atmospheric water vapour and cloudiness.

Radiation balance of the Earth (numbers refer to arbitrary units of radiation)

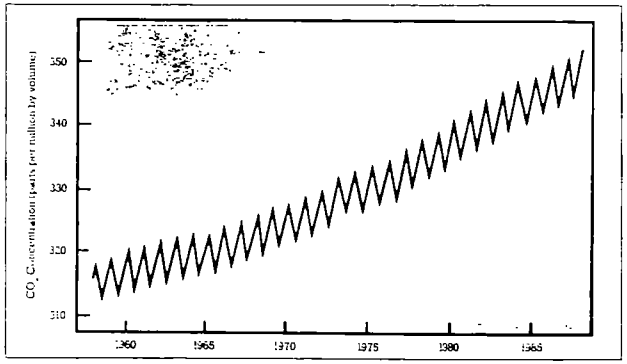


The energy cycle may be perturbed by external forcing from changes in the Earth's orbital characteristics such as the obliquity of the orbit and its eccentricity. These cyclical changes in orbit change the amount of solar insolation over geological timescales. Another external factor is the change in solar energy output itself. Internal forcing of the system includes changing albedo (the reflectivity of the Earth's surface) and cloudiness resulting from natural climatic variation.

Carbon dioxide (CO_2) from fossil fuel burning is the single largest waste product from modern society and has increased in atmospheric concentration by some 30% since the Industrial Revolution. Natural levels of CO_2, as determined from ice cores, show a variation with changing climatic conditions in that the level was 200 parts per million by volume (ppmv) during glacial periods rising to 280ppmv during interglacials. In 1958 the atmospheric concentration was 315ppmv and is now more than 350ppmv; and is predicted to increase still further at a rate of 0.4% per annum. Even if fossil fuel consumption were only to be doubled, and there is every likelihood of this being achieved with the growth of the developing countries economies, then the CO_2 concentration is expected to reach 600ppmv. The rise in atmospheric CO_2 is exacerbated by the destruction, by burning, of the rain forests. Other Man-induced causes of an increasing atmospheric CO_2 content come from the cultivation of soils and by the drainage and drying of wetlands, peats and tundra. The result of this increasing content of atmospheric CO_2 is predicted to be an increase in average global temperatures of between 1.5 C and 4.5 C. Regional variations may be much

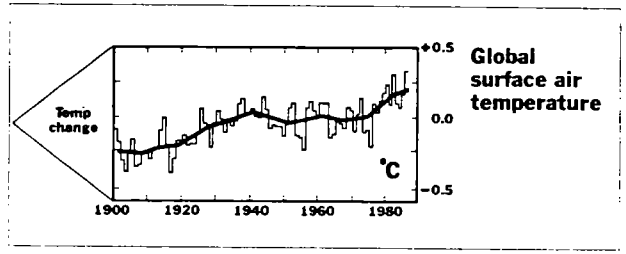


Long term records of the changes in temperature and carbon dioxide in the atmosphere are linked.



The rise in the atmospheric concentration of CO_2 since 1958 as measured at Mauna Loa, Hawaii

higher, especially in polar and near-polar regions. Man's ability to affect the energy cycle by changes in the chemical composition of the atmospheric gases is shown by the changes in atmospheric CO_2. We are now also witnessing increases in other gases such as methane,



CFCs and nitrous oxide with similar radiative properties. These gases may have a cumulative effect similar to that induced by carbon dioxide and are several orders of magnitude more effective infra-red absorbers, molecule for molecule, than CO_2. Methane, at its lowest atmospheric concentration of about 0.3ppmv at the peak of glaciation is now at a level of approximately 1.7ppmv; it may continue to rise at the current rate of 1 to 2 per cent per year. Recent calculations have shown that the effect of these other trace gases can double the warming resulting from CO_2. Such global warming could accelerate the present sea-level rise, probably giving a rise of between 30 centimetres and 60 centimetres, by the middle of the next century. The effects of this change in sea-level could include, erosion of beaches and coastal margins; land-use changes: wetland loss; increased frequency and severity of flooding; loss of water resources; damage to port facilities, coastal structures and water management systems.

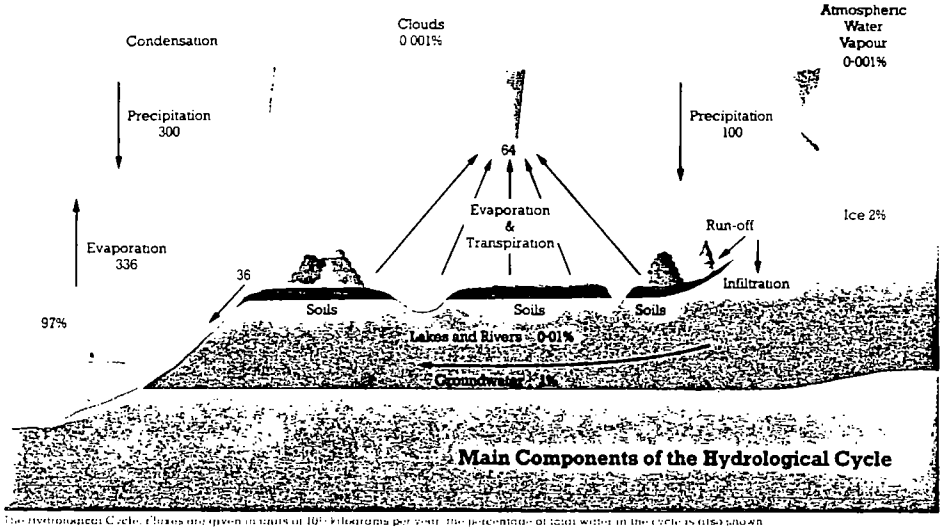
In addition to changes in the energy cycle from changing atmospheric chemistry, there are other physical effects which need to be taken into account. One is the effect of cloudiness discussed previously and here an increased warming may have a negative effect. Second, the level of aerosols and dust in the atmosphere is an important factor; increasing levels of dust will reduce incoming radiation substantially. The level of volcanism which, in turn, affects atmospheric dust loads has been shown to have major consequences. 1816 was the 'year without a summer' following the eruption of the Tambora volcano. The devastation of Krakatoa and more recently the El Chichon (Mexico) eruption have included significant increases in atmospheric dust. Similarly, a recent study on the likely environmental consequences of nuclear war has demonstrated the sensitivity of the World's climate system to extreme smoke and dust loading, no matter what the cause. Urbanisation, changing land use patterns, and desertification all effect the reflectivity of the Earth (albedo) as do the changes which would result from a melting or the extension of the polar ice caps and hence they can have a climatic effect.

Krakatoa

Adjustments to the energy cycle may result from changes in total solar radiation and in the Earth's orbital variations and such changes have been identified through both historical and geological time. The consequences of human activity are additional factors. It is important to disentangle the various changes from one another in order to predict future climate variation.

Hydrological Cycle

The hydrological cycle is perhaps the most basic of the global cycles influencing global circulation in the atmosphere and the oceans and as the routes for the biogeochemical cycles. The global hydrological cycle links the reservoirs of water (contained within the oceans, ice and snow, lakes, rivers, ground water, clouds and atmospheric water vapour) as well as the fluxes between them. The timescales involved in the various parts of the cycle differ widely. For example, atmospheric water vapour has an average residence time of 10 days while that of water in the oceans varies from 10 to 1500 years. A complete



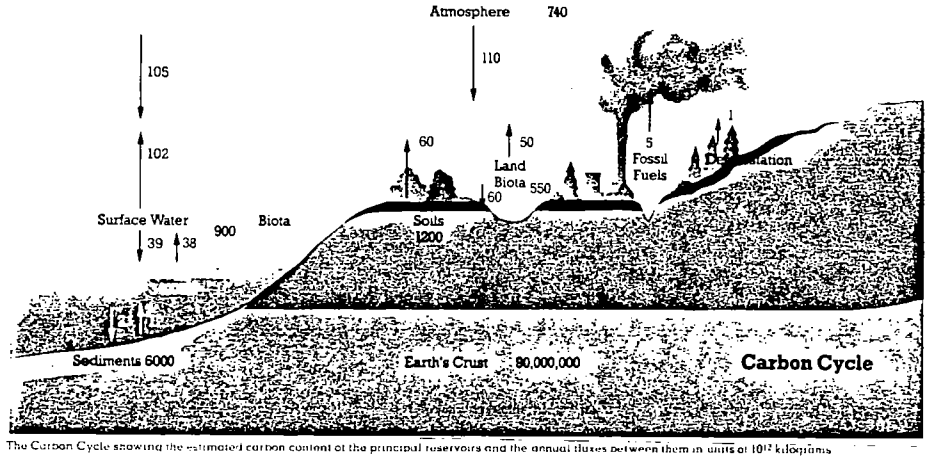
The Hydrological Cycle. Fluxes are given in units of 10^{12} kilograms per year. The percentage of total water in the cycle is also shown.

understanding and quantification of the processes and mechanisms of the cycle would be a major advance. In particular, it is important to understand the dynamics of the major global freshwater reservoirs and their role in relation to the global energy budget, water supply and climate. Global warming is likely to have a significant effect on climate patterns and hence on the hydrological cycle. Most significantly the stability of the West Antarctic Ice Sheet could be put at risk by global warming, and could cause sea levels to rise by as much as 6 metres should there be wholescale melting of the ice sheet. Man's direct influence on the hydrological cycle is confined largely to the land part of the cycle where changes in land use (such as forestry or urbanisation), agriculture (including irrigation) will have an effect on the quantity and quality of available freshwater for the sustenance of life. The dependence of Man on freshwater and the fragility of this dependence is demonstrated by the small proportion (2.6%) of total planetary water which is freshwater, the bulk of which is stored in ice caps and glaciers or at more than 800 metres depth below the surface and therefore difficult to retrieve

The use of water for irrigation is widespread. However, the history and indeed the present practices show that irrigation produces as many problems as it solves. Currently, about 2.8 million square kilometres of farm land are irrigated, representing 18% of the cultivated land in the world. Each year 5000 square kilometres become irrigated for the first time - but roughly the same area of irrigated land becomes desertified. Salination associated with bad drainage and high water tables causes problems and can be on a vast scale: a 1977 estimate suggested that 0.2 million square kilometres of the area under irrigation was waterlogged. If such land is not reclaimed quickly, by drainage, then salination becomes very difficult to reverse. At the same time the need for irrigation has depleted freshwater reservoirs. Important examples are Lake Baikal (which is a significant factor in the Asian climate system) and groundwater reserves which may not be renewable, as in the central and south-western USA.

Biogeochemical Cycles

The study of the sources, pathways and sinks for chemical elements, notably carbon, nitrogen and

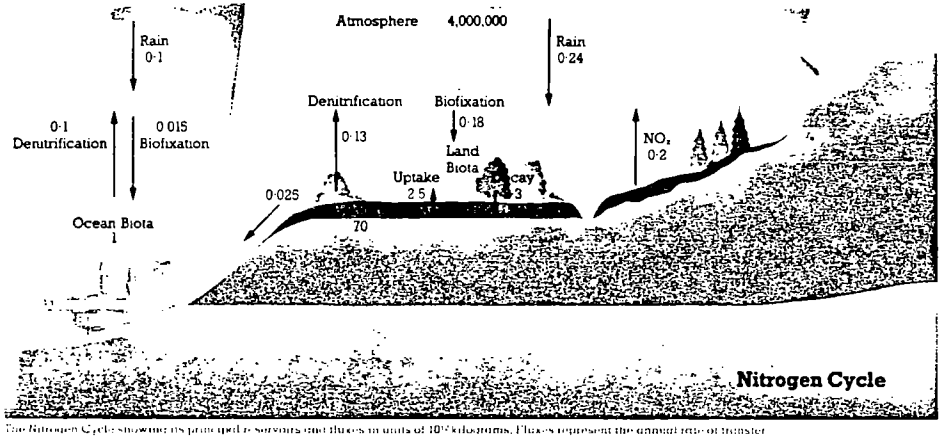


The Carbon Cycle showing the estimated carbon content of the principal reservoirs and the annual fluxes between them in units of 10^{12} kilograms

sulphur, is the third component of the global environmental system.

The carbon cycle is perhaps the most significant of the three elements dealt with in this section in that it is carbon dioxide and methane which have or are likely to have, the greatest effect on climate change. The reservoirs and pathways of the carbon cycle are complex. Major gaps still exist in our knowledge of the carbon cycle and, in particular, the role of the oceans as a sink for CO_2. The uncertainty about the magnitude of this sink means that the interpretation of the carbon cycle in terms of changing atmospheric CO_2 levels is demanding. It is necessary to be able to define the carbon budget much more accurately in order to determine the role of the oceans and the biosphere in this regard. For example, estimates of the amount of organic carbon in World soils range from 700,000 billion to 3000,000 billion tons and the range of estimates for CO_2 released from soils is significant (at 800,000 million ton p.a.) compared to the release from fossil fuel burning (5 billion tons p.a.). There is still some uncertainty about the reasons for rising levels of atmospheric methane which is increasing more than twice as rapidly as CO_2 and has been increasing linearly at least since 1951. As stated earlier, methane is four orders of magnitude more effective as a greenhouse gas than CO_2 and any rise in atmospheric concentration will add significantly to the greenhouse effect.

Nitrogen produces highly reactive oxides in the atmosphere which interlink with the chemistry of other elements and, in the case of nitrous oxide, acts as a greenhouse gas. The availability of nitrogen controls plant growth and hence the rate of photosynthesis in many terrestrial systems. The magnitude of nitrogen fixation in many biological systems is still far from certain and even if known, the ratio of fixation from natural processes to that resulting from human activity needs to be determined. Similarly, natural denitrification processes require further quantification. The effect of increasing fertiliser application in agriculture is bound to have a multiplicity of effects from its presence in groundwater to an increase in nitrate run-off and hence raising coastal water nitrate levels which will, in turn, influence

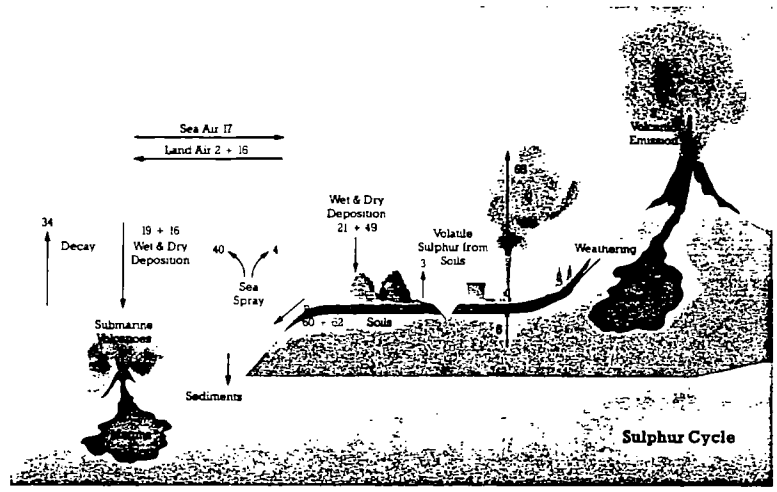


The Nitrogen Cycle showing its principal reservoirs and fluxes in units of 10^{12} kilograms. Fluxes represent the annual rate of transfer

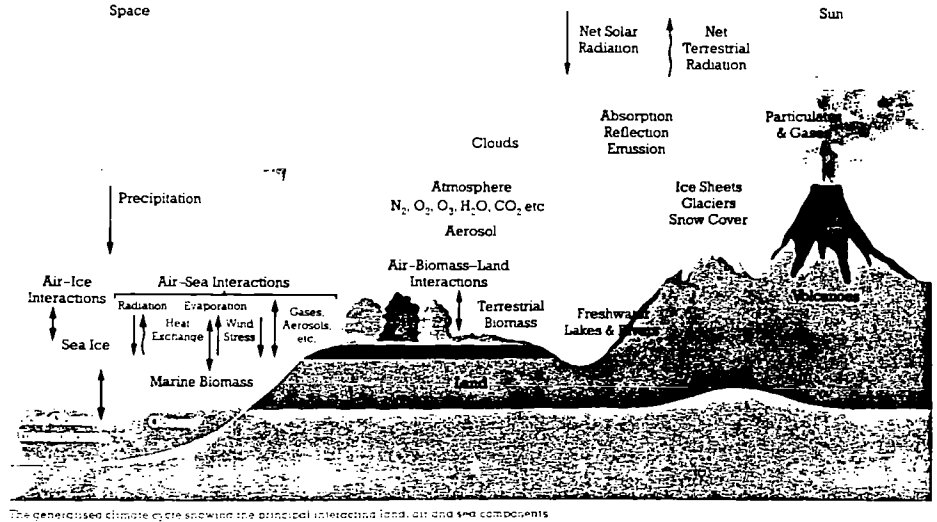
primary production in the sea. Increased primary production thence could have both positive and negative effects on marine environmental conditions and could affect fisheries.

Sulphur is important in the biogeochemical system apart from its obvious role in acid precipitation. The total amount of sulphur now entering the atmosphere has doubled owing to human activity. Additionally, the role of sulphur from natural sources is still far from understood as in the contents of volcanic gases, the production of hydrogen sulphide and dimethyl sulphide (DMS) by marine organisms, sulphate in soils and sulphides and sulphates in mineral deposits. DMS when oxidised to sulphate, has implications for policies for the control of acid precipitation in regions where DMS can be a major source of SO_2. It is also significant in the formation of aerosols which could then have an effect on cloud condensation nucleation. The main natural source of sulphur is from volcanoes and levels of SO_2 from volcanic sources is both variable and unpredictable. Together with dust, volcanic sulphur-bearing aerosols will have a global effect following a major volcanic eruption.

Much environmental research undertaken is concerned with local or regional effects rather than global cycling. For instance, the movement of toxic materials in groundwaters and the radionuclide pathways in the environment are examples of local pollution research. Nevertheless, this is all part of biogeochemical cycling in which local components add up to a global picture of sources, sinks and fluxes of the chemical elements.



The Sulphur Cycle showing fluxes between the components of the system in units of 10^{12} kilograms per year. Figures in black represent natural fluxes and those in red represent Man-made sources of sulphur.

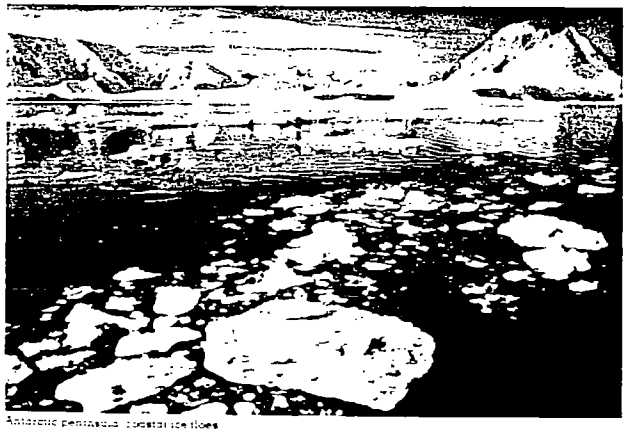


The generalised climate cycle showing the principal interacting land, air and sea components

An International Endeavour

Over the past forty years, the International Council of Scientific Unions (ICSU) has been a major supporter and co-ordinator of international environmental research programmes. These activities have often been achieved with the help from, and in association with, United Nations Educational Scientific and Cultural Organisation (UNESCO) and the United Nations Environment Programme (UNEP). These programmes are often initiated by international groups of interested scientists rather than as a consequence of pressure from potential users of the knowledge likely to be created. The programmes have included the International Geophysical Year (IGY) in 1957/58, the International Biological Programme (IBP) running from 1964 to 1974 and the various programmes of the Scientific Committee on Problems of the Environment (SCOPE). UNEP has also promoted major international environmental programmes and has been especially active in promoting the Global Environment Monitoring System (GEMS) which provides databases for the international community on environmental matters. UNESCO, through its International Hydrological Programme, the Inter-Governmental Oceanographic Commission and the Man and the Biosphere Programme, has worked closely with ICSU and the world scientific community in promoting environmental programmes. Many of the programmes have both a scientific element (ICSU) and a political and training element (UNESCO) and are run on a joint basis.

One of the most significant programmes in terms of global environmental research is the World Climate Programme established in 1979 by the World Meteorological Organisation (WMO) in concert with ICSU. The World Climate Programme (WCP) has four distinct sub-programmes aimed at understanding the mechanisms of world climate and its variability (the World Climate Research Programme - WCRP), the impact of climate change (World Climate Impact Studies), which also involves UNEP; an applications programme which has devoted its attention to the affect of climate change on human health; and a programme to facilitate data exchange. Each part of WCP has developed a series of important international activities. In research, WCRP has developed or is developing a number of projects of significance including the World Ocean Circulation Experiment (WOCE) which brings together a programme of ocean observations using satellites, ships and other platforms; the International Satellite Cloud Climatology Project (ISCCP) to study the role of clouds in the climate system; the International Land Surface Climatology Project (ISLSCP) to study the interactions between land and the atmosphere; and the Global Energy and Water Cycle Experiment (GEWEX) aimed at studying the interactions of energy systems and the hydrological cycle



Antarctic peninsula: coastal ice floes

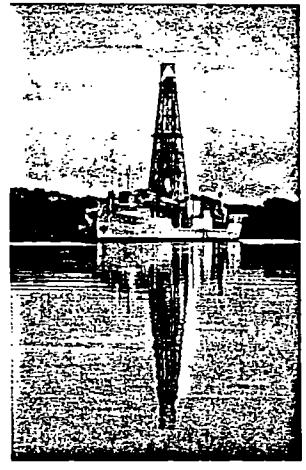
There are also regional (eg in the Atlantic region, the International Council for the Exploration of the Seas, ICES) and national organisations who have sponsored and supported international environmental programmes (eg in the US, the NSF Ocean Drilling Program and the NASA - Global Tropospheric Experiment).

In recent years, the lead in developing an integrated concept of research on the global environment has been taken by the USA, principally through the National Aeronautics and Space Administration (NASA) and the National Science Foundation (NSF).

Although initially developed as a blueprint (Global Habitability) for activities for a space agency, other American agencies have become involved, with the result that a new programme proposal has emerged entitled Earth System Science. This proposal is now seen as a key part of the International Geosphere - Biosphere Programme (IGBP) established in 1987 by ICSU.

IGBP is a major new initiative in international science which attempts an integration of a wide variety of disciplines and areas of study in a global environmental research programme. Emphasis is being put on the need for the development of an adequate global data and information system. The programme has not yet been determined in detail but the programme will emphasise the interactive physical, biological and chemical processes of the Earth system and the manner in which they are influenced by human activity. Priority will be given to systems which have significant change on the timescale of decades to centuries and on the development of practical and predictive capabilities.

In the USA, there are initiatives in Congress to give legislative force to a national global environmental programme which will complement legislation on its National Climate, Arctic Research and National Acid Precipitation Programmes. In Canada, the agency Environment Canada has developed strategy plans which envisage strong links with international environmental science and technology and recognises that access to this international environmental knowledge depends on the national contribution to the global pool and its capacity to understand and interpret it. In Japan, there is



JOIDES Resolution, the drillship of the Ocean Drilling Program

increasing awareness among both Government and the general public of the importance of global environmental research. The World Bank has strengthened its Environment Department and will be influencing policies on the depletion of non-renewable resources and the exploitation of renewable resources such as tropical rain forests. Programmes sponsored by the Commission of the European Communities (CEC) have tended to concentrate on the category of regional issues such as acid precipitation and the pollution of regional seas. However, this pattern is changing as the CEC responds to calls for sustainable development. The CEC can be a major catalyst in developing and facilitating European contributions to major international programmes. These all exemplify the growing awareness and action being taken by national and international bodies to develop an understanding of the global environment. There is also an increasing willingness for nations to come together to take joint on issues of environmental concern as seen in the Montreal Protocol on the production of CFCs. There is now an increasing willingness for nations to come together to consider issues of environmental concern and to take joint action as seen in the Montreal Protocol on the production of CFCs.

The international scene in terms of environmental research is both diverse and complex. It ranges from national programmes open to other nations through bilateral and regional programmes to truly international endeavours, and covers the private, public and voluntary sectors. In the UK involvement in international global environmental research programmes is ubiquitous because there is a strong tradition within the UK of taking part in international scientific programmes. Our contribution to such endeavours has been both strong and welcomed by other participants.

British Involvement

British scientists have made major contributions to the foundations of modern global environmental research; indeed four of the acknowledged pioneers of a global scientific approach -Newton, Hutton, Lyell and Darwin - were British. Today, British scientists remain among the vanguard of scientific enquiry. Our meteorologists are leaders in the provision of global models of the atmosphere; our oceanographers are pioneering global models of the ocean circulation; our geologists and geophysicists are studying the detailed consequences of the revolution in geological thought resulting from the concept of plate tectonics which they did much to create; our palaeoclimatologists are discovering aspects of environmental changes in the past that suggest specifications for models designed to predict climate in the future; our hydrologists, have been pioneers in the study of the hydrological cycle and in quantitative and qualitative water resources; our ecologists are respected worldwide for their contributions to the development and investigations of models of ecosystems; and we have established a formidable tradition in polar research, especially in the Antarctic, which is a key component in the global system. This list is far from complete, but it does reveal a level of intellectual expertise and commitment to the study of global science within Britain. This widespread interest in all the aspects of global environmental research exists within Government, public agencies, the private sector and in universities and polytechnics. This sound scientific base for forward business planning on an identifiable timescale and targets and in policy-making is important. Furthermore, an integrated approach to global environmental research is recognised as providing a large benefit in academic development and in sustaining the UK scientific research base. This will enable the UK to maintain its own research effort, to collaborate with other countries, to advise politicians and industrialists on important environmental issues and provide the trained personnel needed by industry.

Southern Britain

Charles Darwin 1809-1882

It is important for the UK to identify those activities, products and services for which we have expertise and are already in the forefront. On these we should concentrate our future research investment. In this category we may place our capability in global modelling, oceanography, hydrology, plant ecology, software development and database management, satellite instrument development, chemical analysis and microanalysis and earth observation systems from satellites. There are other activities, products and services in which we need to cooperate with other countries through international agencies. Examples include satellite contruction and launching, large-scale ocean drilling for sediment cores, global monitoring networks and some multi-ship research. Lastly we should also identify those activities, products and services for which other countries already lead and which we should therefore leave to oth ers whilst keeping a close watch on the results and seeking opportunities for cooperation. For instance the UK has no very high flying aircraft which can be used for earth observation and for research on atmospheric composition and chemistry.

The Report of the World Commission on Environment and Development (the Brundtland Report) stresses the need for sustainable development in both the developed and the developing nations. This concept is welcomed and endorsed by the UK Government in its response to the report. Global environmental research lies at the core of the concept of sustainable development and will be an input to the formulation of UK aid schemes in response to environmental need. The need for sustainable development is reflected in new looks at the problem of raising living standards, particularly in developing countries, without imposing both an intolerable energy demand and an intolerable pollution burden on the planet. For instance, we must look to the use of more energy-efficient systems of both supply and end-use technologies in both the developed and developing nations.

It should be recognised that global environmental research is of long-term benefit to the UK as it allows for a scientifically-based regulatory framework to be developed in which industry can operate. It provides the basic information on environmental trends and provides opportunities for the development of new technologies in research and in areas in which environmentally acceptable activities are required.

British Involvement

The Importance of Global Environmental Research

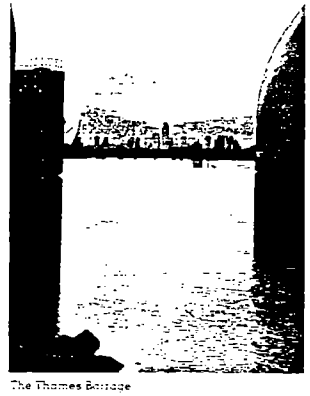
Environmental changes in the British Isles have seldom if ever been so severe or prolonged as to dominate Government policy as they do in many other countries Nevertheless, there have been environmental events in British history that have posed significant

Chernobyl fallout pattern

economic and social problems. Examples include the sequence of severe winters (during the 15th, 16th and 17th centuries) known as the Little Ice Age and the year without a summer in 1816. Recent examples include the drought of 1975 76 and the increase in radioactive fall-out resulting from the Chernobyl nuclear power station accident in 1985 Many of these changes, particularly the weather related events, represent the extremes of the range of variability around mean values of temperature, rainfall, windspeed and solar radiation which, taken over decades, remain relatively stable. Man has developed his mode of living to cope with an environment which in the short term exhibits variability but which in the longer term exhibits stability. Man is aware from historical records of the likely means and variability to be expected though the timing of extreme events is not predictable and it is the surprise associated with the onset of these events such as high or low temperatures, high or low rainfall and high wind speed which cause difficulty to the economy and society.

Some recently observed environmental changes such as the rise in tropospheric carbon dioxide and the seasonal fall in polar stratospheric ozone have reached values which so far as is known the global system in its present form has not previously attained. There are predictions from computer models that these changes will lead to other major environmental perturbations such as global warming, rising sea level, changing geographical distributions of precipitation and solar radiation and increased ultra violet radiation at the Earth's surface. The predictions include major long term alterations to mean values and to associated variability far outside man's previous experience in the last 20,000 years. However these predictions are all based on assumptions and on very inadequate data. If Man is to cope constructively with environmental change then research must have three main objectives. The first is improved predictions of long term environmental scenarios based on more extensive observations of the environmental systems and on enhanced computer models. The second is improved predictions of the impact and timescales of such scenarios upon Man and his resource needs for water, food, energy and minerals and on his societal and political systems. The third is a need to communicate the results.

An immediate aim of global environmental research in the UK is to predict the consequences of changes in the global environment for the national environment. Thus it is already apparent that sea level is rising with effects on coastal erosion, flood control and salt water intrusion into surface and groundwaters It is already confirmed that average temperature has increased by 1°C since the beginning of the century. Together these changes might be expected to lead in decades to changes in natural habitats and to wildlife though the long term records are not sufficiently adequate to relate any faunal and floral changes to environment change. Increases in methane, lead, sulphur dioxide, nitrogen

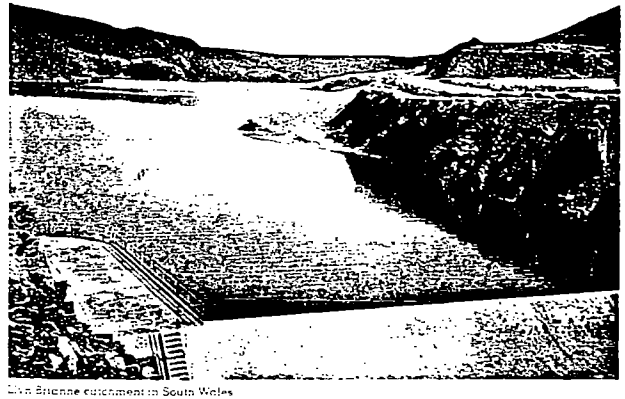


The Thames Barrage

The Importance of Global Environmental Research

oxides and ozone in the atmosphere have also been documented with some associated effects on buildings, human health, and vegetation. Further changes in these environmental parameters are anticipated. Changing climate patterns resulting from a global warming induced by rising levels of CO_2, methane and CFCs, could have a major effect on the British Isles. Such a warming could cause a rising sea level from the thermal expansion of the oceans and later, should the warming continue, from ice cap melting. The UK already spends some £200m per year on coastal defences which demonstrates the need to protect the low lying areas of eastern and southern England as well as many of the major cities, including London, which are particularly vulnerable

Any substantial environmental change will affect large sectors of the UK economy. There have been several recent studies to examine the impact of environmental change on the economy with particular emphasis on agriculture, civil engineering, transport, energy and insurance. The studies are based on the assumptions about future environments with no certainty about whether or when they will occur. The conclusions are that there would be major changes in many aspects of the economy but that none are likely to be disastrous. It is also clear that the different sectors of the economy require different amounts of warning time to adjust to environmental change. Thus there is an immediate need to make a thorough examination of alternative energy sources with respect to environmental effects because investment in power stations must be planned now in relation to electricity production for the next 25 - 30 years. Fossil fuel burning may have to be limited or the balance of energy sources modified if CO_2 emissions are to be reduced. Nuclear power may be substituted if questions related to safety, radiation control and radioactive waste disposal can be answered satisfactorily. Benefits which could be derived from renewable energy sources also need to be taken into account. Other industrial sectors such as building construction and flood control also require immediate consideration Buildings erected now will have a life expectancy of at least 50 years, well into the time when environmental change may dictate their modification. Similarly because sea level is already rising, flood control measures such as the Thames Barrier require continuing appraisal and attention. In some economic sectors, such as agriculture and transport the effects may be accommodated within a much shorter time. Other sectors such as insurance are also likely to be affected. All impact studies so far have been very preliminary and need to be extended when clearer indications of local or regional change emerge from global environmental research.



Llyn Brianne catchment in South Wales

Manufacturing is affected by changing environmental conditions because it not only uses non-renewable resources but it is the origin of many environmental changes such as the depletion of stratospheric ozone due to CFC manufacture, and the increased production of methane. Increasing international pressure for controls and the substitution of 'environment-friendly' products is likely to take place and industry must be able to keep abreast of such trends which are, likely to be driven by results stemming from global environmental research. The Montreal Protocol represented a significant albeit the first step in international action. Other areas where international issues are likely to arise are in the use of fertilisers and pesticides and in many aspects of effluent and pollution control. Such concerns are

Production test of a geotextile, Asia in Southampton

likely to increase rather than diminish with the introduction of the Single European Market in 1992 and the establishment of European-wide environmental policies.

It is important for the manufacturing industry to know very early on in their product process cycles what future environmental factors require to be taken into account. It is expensive for industry to change its planning strategy or designs at a late point in the industrial cycle. Global environmental research is important in providing data at a very early stage which should assist industry in producing products which, from the outset, are environmentally benign.

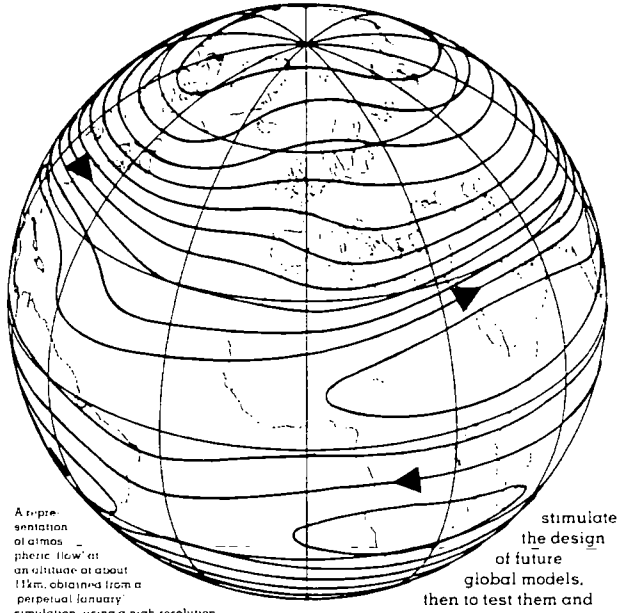
British national interests are not confined to the British Isles. Environmental changes in Europe and beyond have an impact on our economy, directly through our commercial and industrial activities, and indirectly through changes in the price of food and commodities, and the hazards of insurance. Our standing in the world depends increasingly on how other countries perceive we are responding to environmental problems. This view of Britain in the world could well depend on our ability and willingness to contribute to global environmental research and to scientific exploration of distant places, such as Antarctica, which are critical in an understanding of the whole global system.

The UK aid programme is an important part of UK endeavours. It responds to requests from developing countries. Consideration of global environmental research is an important factor in this process and in making UK aid programmes relevant to changing conditions. Many of these economies are fragile and may not be able to cope with the rapid changes which may result from changing climatic conditions.

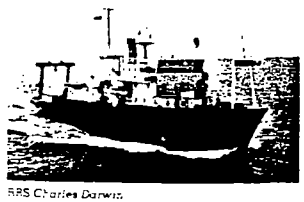
Some Technical Problems

There are some important technical aspects of global environmental research which need to be addressed to which the skills available in the UK may be particularly well placed to contribute. In particular the computer modelling involved in global environmental research requires major contributions to software development for algorithms and for data reduction, storage analysis and interpretation. There are contributions needed in developing satellite instruments for earth observation and environmental monitoring instruments for observing over long time periods and inaccessible areas of the globe such as the deep ocean. There are also needs for specialist vehicles for instrument deployment, maintenance and retrieval on land, at sea and in the air. The UK already has some of these vehicles, including research ships, but they need to be developed and increased.

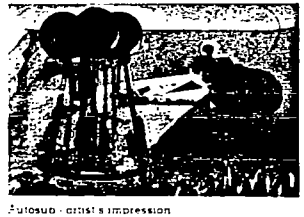
There are two central technical problems in climate modelling which is critical to global environmental research. The first is how to solve the equations in the development of predictive models. They are invariably non-linear and require numerical integration using computers. In practice, the content of the model is limited by the power of the computer available. For the last forty years, computers have increased in speed by a factor of ten every five years, and there is every prospect that such exponential growth will continue into the next century. On that assumption it is possible to plan research in global environmental research on the basis of greatly increased computer power being available after the decade or so of research needed to design, test and collect data for a new model. The second technical problem is how to satisfy the demand for data needed to stimulate the design of future global models, then to test them and finally to operate them. The data have to be global. Some of them must be collected systematically from all round the world, as the meteorologist does for weather forecasting. Others concentrate on particular locations of importance to the model, for example, the Southern Ocean, where the Antarctic Circumpolar Current links the circulations in the



A representation of atmospheric flow at an altitude of about 11km, obtained from a 'perpetual January' simulation, using a high-resolution global atmospheric model. The motion is approximately parallel to the contour lines and its strength is inversely proportional to their spacing.



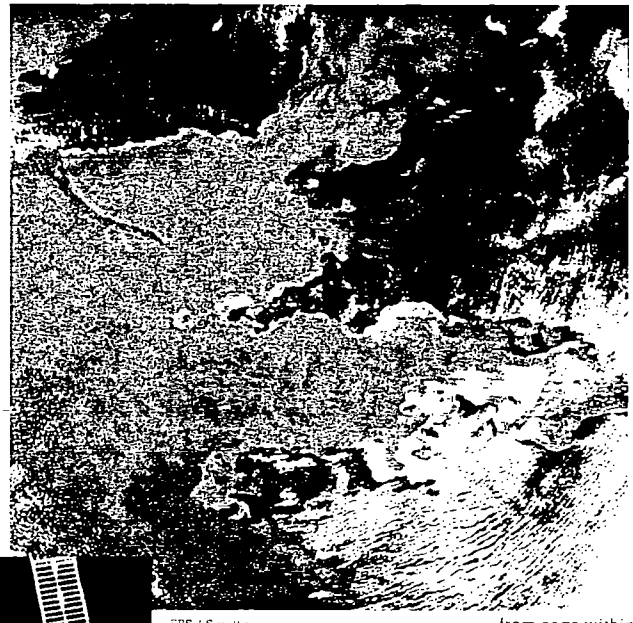
RRS *Charles Darwin*



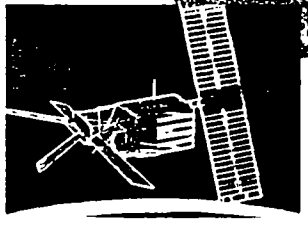
Autosub - artist's impression

Some Technical Problems

Pacific, Atlantic and Indian oceans. Satellite observations provide a unique global coverage of certain aspects of the environment; their development has been the key to the current growth in global environmental research. Satellites also provide a means of data collection from automatic and remote data recorders. Britain has played a significant role in European plans for observing the Earth from space through our participation in ESA. However, satellites cannot meet the whole demand. The satellite data has to be interpreted and validated by extensive collection of



ERS-1 Satellite



contemporary ground data and many of the data needed for global models have to be collected in situ, on the continents or in the oceans. For example, in the oceans, there is great scope for acoustic and optical remote sensing from submerged instruments, and for autonomous unmanned probes that will rove around the deep ocean. Such systems are now being developed in Britain and are very necessary given that our knowledge of the oceans is very incomplete compared with other parts of the global system.

The need to maintain continuous records in order to discern subtle changes and trends is crucial. It is only the painstaking work on observations of CO_2 levels in the atmosphere since the late 1950's that revealed the inexorable rise in atmospheric concentration of that gas. Similarly, observations of stratospheric ozone levels by the British Antarctic Survey at Halley over some 30 years led to the discovery of the ozone hole. We need to sustain long time-series observations, and provide for their analysis and to extend these observations into other diagnostic phenomena. Long-term ecological research sites can be extremely sensitive indicators of climatic or environmental change apart from giving early indications of ecological reactions. Similarly, the extension of our knowledge in time by the use of ice-core chemistry and by sediment cores from both oceans and lakes is useful in disentangling 'natural' environment variability from that induced by Man's activities.

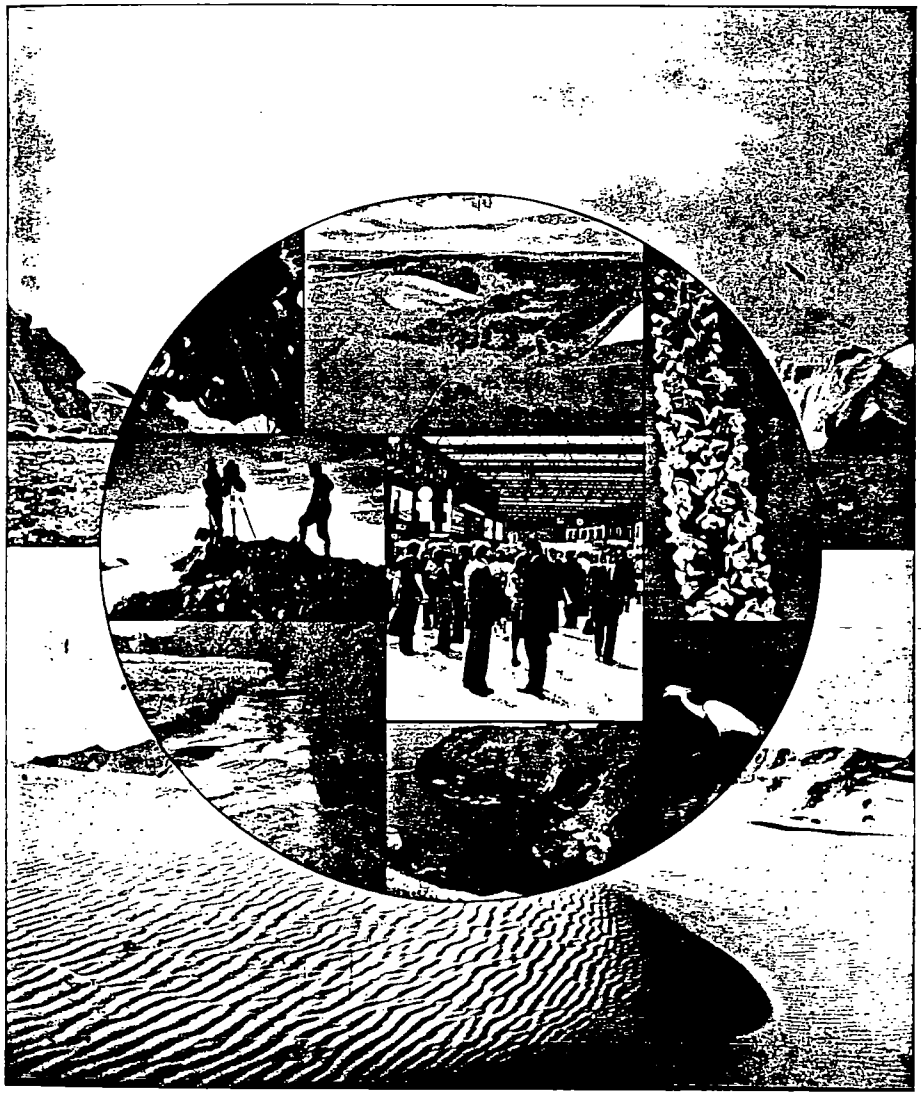
The need to collect data in situ from the continents and from seas within the exclusive economic zones of coastal states poses problems of access. All countries of the World must appreciate that they should participate in global environmental research. Observations in one part of the World may be important in understanding changes in another distant part of the planet. For example, the El Nino phenomenon which directly affects South America can be linked to changing conditions in North America and on the countries of the Western Pacific. All countries should be prepared to

Some Technical Problems

provide data for use in global models which will improve the value of these data and which will lead to a greater understanding of global processes.

In the earth sciences, there are technical and socio-economic problems of prediction of volcanicity and of earthquakes. It is easier for the former rather than the latter if sufficient instrumentation is available. The UK is an acknowledged leader in the development of seismic sensor and recording equipment and in engineering design of structures to withstand earth tremors. This knowledge is being made available worldwide.

The development of predictive mathematical models is essential for understanding physical processes. Modelling will need to embrace biological factors recognising that these are even more complex and increase the uncertainty of prediction. We are now approaching the threshold when biological interactions can be added to the purely physical models used hitherto. At the same time, the current physical models have considerable uncertainties which need to be overcome with refinements to models and the iterative process of model development and more comprehensive data collection



Conclusions

Environmental change at the global level resulting from Man's activities can now be observed. The extension of deserts and widespread soil erosion can be blamed upon the destruction of forests and vegetation cover and on the forms of cultivation practised by Man. The rise in carbon dioxide, methane, sulphur dioxide, nitrogen oxides, CFC's and other gases in the atmosphere can be attributed to Man's activities, including the combustion of fossil fuels and the release of Man-made chemicals. There are predictions based on limited data put into relatively simple computer models which indicate that these activities may lead to global climate changes of temperature and precipitation. In turn global climate changes may lead to melting of the main ice masses, to rising sea level and land inundation, to saline infiltration of freshwater and the possible destruction of major centres of population.

The impact of these changes on the UK and World environment on all aspects of our way of life can be perceived only impressionatically and sketchily but sufficiently to justify research on these impacts and more importantly, in the first instance, on environmental change.

A global environmental research programme should aim:

i to establish the natural variation in the global environment both temporally and geographically;

ii to establish the interaction of the natural variation with Man's activities and so establish the variation in the global environment attributable to man

iii to develop the capability of predicting natural and Man-made variation;

iv to develop means of reducing, preferably eliminating, the undesirable aspects of Man's activities. Global environmental research will involve:

Global environmental research will involve:

i long term earth observation of environmental phenomena from satellite, aircraft, ships, submersibles and land based craft and from instruments and robots;

ii on-site experimentation,

iii data capture, reduction, analysis, storage and interpretation;

iv computer and software development;:

v modelling of global systems for the purpose of predicting future environments.

Global environmental research needs to be pursued urgently and internationally since no one country can afford, or has access to the territory, needed for all the research that is required. The UK, as a major trading nation, will be affected directly and indirectly by the environmental changes should they occur. The UK science community will therefore participate in global environmental research in order to maintain the levels of skill and the understanding of global research and be able to advise objectively Government, industrialists and the public on these issues.

[illegible] GER TO THE UK DOMESTIC ECONOMY

	Sector[1]	Activities[2] within Sector	Potential Significance of GER
1.	Agriculture, forestry & fisheries	Agriculture forms 93%, forestry 3% and fisheries 4% of this sector.	**Very Significant**. Changes in climate, ocean circulation and effects of pollution in regional seas, acid precipitation etc., would have a major influence in all aspects of these activities. Agriculture and forestry are key components of biogeochemical pathways.
2.	Energy and water[3] supply	Includes coal and coke (16%), hydrocarbon extraction and processing (52%); gas and electricity generation (including nuclear power); and water supply. (The other sectors together form 32% of this category).	**Very Significant**. Changes in climate will have a direct effect on energy demand. Similarly water supply is affected by climatic conditions. Nuclear power and groundwater supply raise issues of biogeochemical pathways in terms of waste disposal and in groundwater effects.
3	Manufacturing[4]	Includes metals (4%); minerals & mineral products (6%); chemicals (9%); metal goods (6%); mechanical engineering (14%); electrical engineering (13%); motor vehicles and other transport (11%); food and related products (14%); textiles & clothing (7%); paper and publishing (9%), and all other manufacturing (7%).	**Some Significance.** Dependent on supply of primary products and therefore responsive to changes in factors affecting supply. Climate change could have major effects on transport systems and vehicle design.
4.	Construction industry	Includes UK-based civil engineering. It does not include civil engineering overseas which is a significant part of this sector.	**Significant**. Demands on civil engineering in coastal defences are proportional to climatic effects on sea level. Similarly overseas civil engineering has a direct relationship with environmental changes. Climate change affects building design.
5	Distributive Industries	Includes hotels, catering etc. and miscellaneous items such as scrap metal industry	**Some Significance** Tourism will be susceptible to changing climate.
6.	Transport and communication	All forms of transport and includes telecommunications (24%).	**Some Significance.** Sea and air transport affected by changing environmental conditions.
7	Banking, finance, insurance etc.	Non-life insurance forms 8% of this sector.	**Significant.** Insurance is particularly affected by changing environmental conditions.
8.	Housing Ownership	Does not include house construction.	**Not significant**.
9	Public administration, defence and social security		**Significant**. Changing environmental conditions (both marine & atmospheric) affect defence considerations.
10	Education, R & D and medical and health services	R & D forms 7% of this area. Education includes universities and polytechnics	**Very Significant**. R & D on GER is of crucial importance, as is education at all levels concerning global environmental processes. Changing environmental conditions (as seen in stratospheric ozone depletion and in biogeochemical pathways) will have a direct effect on health and health care
11.	Other Services	Includes local government services, recreational and other services, voluntary bodies and trade unions.	**Mildly Significant.** Changing environmental conditions may make new demands on local services such as recreation.

Notes:

1. [illegible]
2. [illegible]
3. [illegible]
4. [illegible]

Notes

DEPARTMENT OF THE ENVIRONMENT

NEWS RELEASE

654 23 November 1988

SAVING THE OZONE - INTERNATIONAL CONFERENCE

Nicholas Ridley, Secretary of State for the Environment today announced that the Prime Minister and he would host a major international conference on the ozone layer in London during March next year.

In answer to a Parliamentary Question from Tony Baldry, MP Banbury, who asked what further action he intends to take internationally to protect the ozone layer, Mr Ridley said:

"My Rt Hon Friend, the Prime Minister and I propose to call a major international conference on the protection of the ozone layer early next year. It will be in London in March. The Prime Minister will participate. It will be held in association with the United Nations Environment Programme (UNEP) under whose auspices the Montreal Protocol was successfully developed.

2 MARSHAM STREET · LONDON SW1P 3EB · TELEPHONE 01-276 3000

"I shall be inviting Ministers from developed and developing countries, world industry and international organisations. I want the conference to demonstrate that industry has already developed, or soon will, new products and processes that will enable all countries quickly to reduce the use of chloro-fluorocarbons (CFCs) and move to a CFC free world.

"The House is already aware that we are calling for world-wide emissions of CFCs to be reduced by at least 85%, and as soon as possible. I was convinced of this urgent need by the latest scientific evidence. My Noble Friend, the Minister for Housing, Environment and Countryside, will tomorrow, at the Environment Council, be urging our European colleagues to make these reductions by the turn of the century and to agree that the Montreal Protocol must be strengthened to this effect. This further action is essential not only to protect the ozone layer but also because CFCs are powerful greenhouse gases which contribute to the risk of global warming and consequent climate change. The Montreal Protocol will come into force on New Year's Day. Our conference in March will give a political boost to the important first meeting of the Parties in Finland the following month which will begin the formal process of reviewing the protocol. I have told the Executive Director of UNEP that the United Kingdom would like to host the second meeting of the Parties when we hope the reductions we are demanding will be agreed. This will be in April 1990.

"It is not enough for the United Kingdom or even the European Community to take action on its own. A clear commitment is needed from all world governments, including those who have not yet signed the Protocol, if we are to have any chance of preventing further damage to the ozone layer. It is not enough to set objectives. Our London Conference must show how they will be achieved in practice."

NOTE TO EDITORS

In her speech to the Royal Society on 27 September the Prime Minister drew particular attention to the global problems caused by CFCs which not only deplete the ozone layer but are also greenhouse gases.

On 3 October the Government announced that it accepted the scientific evidence presented by the second report of the UK's Stratospheric Ozone Review Group. This said that chlorine in the stratosphere must be stabilised in order to prevent further ozone depletion. To achieve this the Government accepted that worldwide emissions of CFCs must be reduced by at least 85% as soon as possible, and is now urging the world community to adopt policies that will realise such reductions by the turn of the century.

The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted on 16 September 1987 when it was signed by the UK, the European Community and 23 other countries. More than 20 additional countries have signed subsequently. The Protocol provides for the production and consumption of CFCs 11, 12, 113, 114 and 115 to be reduced by 50 per cent in three stages by 1999. It also requires production and consumption of halons 1211, 1301, and 2402 to be frozen from 1992. The Protocol provides for these measures to be reviewed in 1990 and every four years thereafter on the basis of available scientific, environmental, technical and economic information.

It is intended that the Protocol should enter into force on 1 January 1989. The UK, together with the dependent territories, has completed the necessary formalities and is ready to ratify the protocol simultaneously with the European Community next month, as soon as the other member states are ready.

The British aerosol industry has announced its intention of phasing out CFC use in non-essential aerosols by the end of 1989. Other user industries have announced plans for reducing emissions of CFCs and halons by using alternatives (where they are available) by recycling or by adopting less wasteful methods. ICI, one of Europe's major manufacturers of CFCs, has called for an urgent review of the Protocol with a view to reaching agreement on the eventual phaseout of CFCs.

Press Enquiries: 01 276 0920
(Out of Hours: 01 276 4120)
Public Enquiries: 01 276 3000
(Ask for Public Enquiries Unit)

Missing: bits of an ozone layer

"Serendipity" is a word crying out for an opposite. It would sum up the bad luck of those who, having sought a solution to one problem, find that it begets a bigger problem undreamt of before. It would capture the irony of the chlorofluorocarbons (CFCs), gases which are extremely stable and therefore perfect for many good causes, such as refrigeration, but which can therefore survive the long journey to the stratosphere and disrupt the delicate chemistry of the ozone layer.

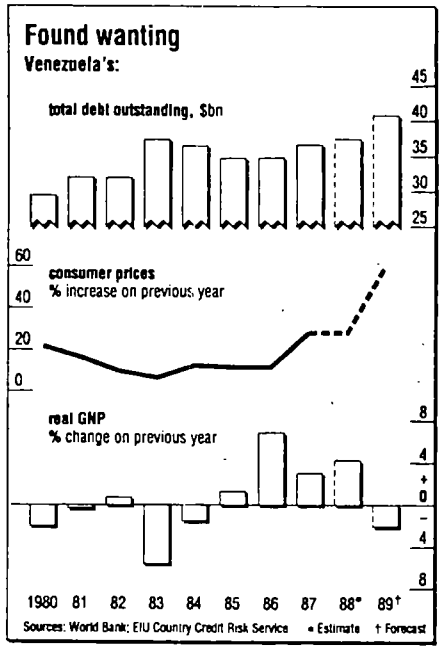
The depletion of the ozone layer increases the amount of dangerous ultraviolet radiation reaching the earth's surface. The technology to replace CFCs in many applications is already available; and in rich countries the political will to do so is growing. Just before a 123-nation conference in London this week on saving the ozone layer, the European Community and the United States announced their intention to ban CFCs—perhaps by as early as the mid-1990s in the case of the Europeans.

Poorer countries face a different problem. At present they use virtually no CFCs. India and China, with a third of the world's population, use 2% of its CFCs. To be good global citizens they must resist the temptation to use more of the gases as their economies grow. "They need not go through a CFC phase at all," says Mrs Margaret Thatcher. But she acknowledges that in order to avoid it the developing world will expect the help of the rich countries.

Many delegates at the London conference favoured creating a "world atmosphere fund", probably under the auspices of the United Nations Environmental Programme, to pay for the transfer of ozone-friendly technology from north to south. Alternatively, the technology could be paid for under bilateral agreements or debt-swaps.

If such arrangements can be made, poor countries may be willing to sign the Montreal Protocol, an agreement on CFCs signed by 21 countries in 1987 and more since. In London 20 extra countries promised to sign up, bringing the total to 53. Unfortunately, the protocol's aim to cut the 1986 level of CFC emissions in half by 1996 is now considered far too low. And there are other gases to be got rid of: the halons in fire extinguishers, which are covered by the protocol, and—according to some scientists—carbon tetrachloride and methyl chloroform, which are not.

A wider lesson to take home from London is that it may be possible to meet a global problem with a global response. If, as they look back, the people of the twenty-third century see the ozone crisis as the beginning of such sensible globalism, they may detect a serendipitous side to it—as the ozone layer above them finally restores itself to the more healthy levels of the 1960s.



connection to Porto Velho is completed, its exports of timber, rubber and Brazil nuts must travel twice as far to Brazilian ports as they would to the Pacific. Freight costs for soyabean exports to Japan from Mato Grosso state would be slashed by direct shipment through Peru, no doubt squeezing American competitors. The $300m highway would also please the army. It has long dreamed of building a road close to the perimeter of its northern borders with Peru, Colombia, Venezuela, Guyana, Surinam and French Guiana.

Foreign complaints about Brazil's treatment of the Amazon have nonetheless made Brazilian environmental groups, including the country's small green party, suddenly fashionable in the press. More important, the powerful TV Globo network has taken up the cause. The environment seems likely to become an issue in November's presidential election. Just possibly, Brazilians will one day conclude that it is in their own interest to protect the Amazon.

Venezuela

Rioting all the way to the bank

FROM A SPECIAL CORRESPONDENT IN CARACAS

AT LEAST 300 and perhaps as many as 600 people may have died but, for the moment, President Carlos Andres Perez is standing firm. The economic reforms that touched off a spasm of rioting, shooting and looting throughout Venezuela on February 27th are to go ahead. So, it seems, are the interest payments on the country's $38 billion of foreign debt (see chart).

Before the rioting subsided, the president showed signs of backing down. "The disturbances were the result of a crisis that can be written in capital letters: the foreign debt," he said. At one point he hinted that Venezuela would suspend interest payments (repayment of the principal is already suspended). But his chief debt negotiator in New York said that the president's remarks had been misunderstood.

With barely a pause to sigh with relief, the American Treasury and a committee of commercial banks are scrambling to come up with bridging loans of more than $1 billion to tide Venezuela over until $1.8 billion of new IMF money can be secured some time in the spring. Venezuela is hoping eventually to obtain $1.6 billion from the banks and $3.78 billion over three years from the IMF. As with Mexico's unused $3.5 billion bridging loan from America last autumn, the conditions of any new Treasury loan for Venezuela will probably be kept secret.

Even for those not already sceptical of Mr James Baker's debt-reduction "plan" of 1985, the Venezuelan mayhem raises troubling questions. Mr Baker wanted the banks to lend more to the debtor countries on condition that the debtors reformed their economies and began to grow their way out of debt. Instead, the banks cut their lending where they could, while many of the debtors flinched at the needed reforms. Venezuela is one of the countries where the Baker plan should be working. It has been democratic for 31 years; its newly elected president was deemed both competent and popular. If Venezuela cannot adopt sound policies without bloodshed, the outlook is bleak for the jittery new democracies in Peru, Brazil and Argentina.

The recent disorder points to the biggest failure of the Baker approach. The creditor countries, acting through the IMF and the World Bank, have done too little to reward the reforming debtors. Venezuela has confirmed that the best way to get prompt help from America is to let a political emergency develop. New credit can then be extracted under duress. A believable promise that the reforming countries would see more foreign capital in return for their efforts

Isaac Burton Tigrett II
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Dallas,TX 75201

Phone: 214/954-0375 FAX: 214/220-0629

March 1, 1989

Senator Albert Gore
393 Russell Avenue
US Senate Office Building
Washington, D.C.

Dear Senator Gore:

I am sure you are aware that they are having an ozone conference in Great Britain at the end of this week or the first of next week. I will be delighted to help you with this in any way.

I am sending to you another package which contains a video and information concerning a very exciting project involving a new environmental group. Many celebrities have now become involved. Please take time to view the video. I am sure you will be very excited about it.

Kind regards,

Isaac Burton Tigrett

Isaac Burton Tigrett
(dictated and signed in his absence)

IBT:mg

New York Times 3-7-89 pg. A25

Ozone And Upheaval

The world will little note nor long remember whether or not John Tower becomes Secretary of Defense. Nor, in the long run — perhaps even in the short — will it much matter whether Eastern Airlines lives or dies. But as these questions dominated the headlines and broadcasts of a journalism that thrives on today:

- More than 100 nations met in London to pursue a challenge set them by the European Community and the Bush Administration to eliminate by the end of the century industrial chemicals threatening the vital ozone layer.
- In the backwash of anti-austerity rioting that left about 300 dead and 2,000 injured in Venezuela, President Carlos Andrés Pérez said (though he later tried to retract it) that his country might have to suspend all debt payments to foreign nations, significantly including the U.S.

There's a pair of stories that really matter, and will for years to come — one a sign of international cooperation on an imminent environmental problem, the other a warning signal about the clear and present danger of third world debt.

But even while they were hauling the bodies off the streets of Caracas, the Bush Administration was focused, like its predecessor, on the tired old question of the contras and the Sandinistas in Nicaragua. That Reagan-generated conflict never did rise, and certainly doesn't now, to the high level of importance implied by the controversy it has aroused.

When Mr. Baker was Treasury Secretary, he developed a plan, largely unsuccessful, to ease the third world debt problem — which hasn't gone away but has grown in severity. Now, instead of tackling it anew, he asks Congress for more aid to the contras. That's a slap in the face to the Central American presidents who recently signed a new peace proposal, and a sad commentary on the new Administration's regional priorities.

Mr. Pérez probably won't actually suspend — not yet — all Venezuela's payments on its $33 billion foreign debt, although principal payments already have been halted. Default would too critically damage his nation's international credit standing. But the rioting that followed his imposition of relatively mild anti-inflation measures suggests that Latin populations — Venezuela's is one of the most democratic — cannot be squeezed forever to pay foreign debts.

The danger is twofold. Tightening austerity measures to enable Latin governments to make huge payments — inflated by high interest rates set a decade ago — to gringo and European bankers ultimately will produce so much popular unrest that default may be forced and democracy could be overthrown. Mexico, Brazil, Argentina, Peru, Venezuela — all bear virtually unbearable debts. Default and upheaval in one could lead to more of the same in the others.

For the U.S., Latin default might threaten the banking system, and the overthrow of democracy obviously would damage hemispheric stability; even if neither happens, forced austerity in Latin America prevents its nations from importing American goods, a heavy burden on the U.S. trade imbalance.

The necessary response, the only effective response, is debt relief — including the stretchout of terms, the reduction of interest rates, even in some cases the forgiveness of loans the Latin nations were pressured into accepting, together with the necessary legislation to make it possible for U.S. commercial banks to take these steps. If any of that is to happen, President Bush and Secretary Baker will have to take the lead.

They already provide such leadership on important environmental questions. Acid rain prevention is high on Mr. Bush's agenda and Mr. Baker's first official pronouncement was a commitment to act against global warming. Now William K. Reilly, the director of the E.P.A., has been sent to London with an important Administration commitment to the worldwide elimination of ozone-threatening chemicals by the year 2000.

Ozone depletion allows more ultraviolet radiation from the sun to reach the earth's surface. That increases the risk of skin cancer and eye cataracts, causes ill effects in crops and aquatic life and may contribute to global warming. Even after the offending chemicals are eliminated, those already in the stratosphere will continue for decades to attack the ozone layer.

The Bush Administration has moved strongly but none too soon against these dangers. A similarly alert response to the debt crisis would make more sense than another dreary round of battle for the contras — or even for poor old battered John Tower. □

Two global issues that far transcend Tower or the airline strike.

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The Environment

Clean Air Backers Like Way Wind Is Blowing

NEW York Times Pg B 6 3-2-89

By PHILIP SHABECOFF
Special to The New York Times

WASHINGTON, March 6 — Almost every year for the last eight years legislation to strengthen the Clean Air Act has been introduced in Congress, and each time it died.

Now there is some optimism that the law may be changed by the 101st Congress. There is, it might be said, something in the air this year.

One thing in the air is more pollution. The Environmental Protection Agency recently reported that urban smog last year was the worst on record. And the Clean Air Act has been in place since 1970.

Richard E. Ayres, chairman of the National Clean Air Coalition of environmental, public health, consumer, labor and church groups, recently told a House committee, "We believe that the declining air quality of our cities can fairly be characterized as a public health crisis."

New Year, Same Issues

The issues in the legislative debate over the Clean Air Act remain essentially unchanged over the years. In addition to dealing with urban smog and the 100 cities across the country that are not cleaning it up, the debate on Capitol Hill will also take in what to do about acid rain in particular and

Bush is gaining credence as a real foe of acid rain.

emission of toxic substances in general.

But this year the lineup of players involved in the legislative contest has been significantly reshuffled. The new heavy hitter favoring tougher air pollution controls is President Bush.

After an an early attempt to weaken the law's standards on protecting public health, the Reagan Administration basically took no direct role in the Congressional debate over clean air. That absence of executive leadership was often mentioned by members of Congress and environmentalists as a prime reason for the lack of progress toward tighter controls.

President Bush, however, has pledged support for a stronger law, including action to reduce the pollutants that cause acid rain, industrial emission of sulfur and nitrogen oxides that fall to earth in rain and snow and kill fish and threaten forests. William K. Reilly, an environmentalist Mr. Bush appointed to head the Environmental Protection Agency, is now preparing the Administration's clean air bill.

'Refreshing,' a New Yorker Says

"For the first time in the history of the acid rain battle in Congress we have in the Oval Office a President who acknowledges the problem exists and has made a commitment to be part of the solution rather than part of the problem," said Representative Sherwood Boehlert, a New York Republican who favors strong legislation because acid rain is harming lakes in his Adirondacks district. "What a refreshing change."

Some recent changes on Capitol Hill could smooth the way for clean air legislation. Most important, perhaps, was the election of Senator George J. Mitchell, Democrat of Maine, as Senate majority leader, replacing Senator Robert Byrd of West Virginia. As chairman of the Senate Environmental Protection Subcommittee in the 100th Congress, Senator Mitchell fought hard for passage of a tighter clean air bill. Senator Byrd, concerned that a such a bill might cost coal miners their jobs, was an obstacle to Senate legislation for years.

Year after year, the Senate Environment Committee, with heavy representation from the New England and Mid-Atlantic States, which suffer the worst effects of acid rain, would report out a new clean air bill; year after year, the bill failed to come to a vote on the floor.

This year, said Senator Max Baucus, Democrat of Montana, the new chairman of the Environmental Protection Subcommittee, an effort would be made to reach out to senators from all parts of the country to try to work out a bill that would be widely acceptable.

New Mood of Compromise

"Things are clearly different this year," said Senator Baucus. "We have a new President who wants an acid rain bill. We have a new majority leader and a new mood to compromise on the bill. The states are less polarized this year than they were before. I just think that all the factors you look at tend to point overwhelmingly to passage of the bill."

In the past the legislative politics affecting the clean air bill in the House was almost the opposite of what obtained in the Senate. There was a good chance that the House would vote a stronger law, but the House Energy and and Commerce Committee could not agree on a bill to send to the floor.

Representative Henry A. Waxman,

Continued on Next Page

Democrat of California, chairman of the Health and Environment Subcommittee, tried again and again to draft legislation that would require much stronger controls on acid rain and urban smog. But Representative John D. Dingell, Democrat of Michigan, chairman of the full committee, sought legislation that he believed would not compromise the competitive position of Detroit's automobile industry.

But Mr. Waxman has recently expressed optimism that a strong clean air bill will pass this year. In part this optimism is based on the fact that the House Speaker, Jim Wright of Texas, has made clean air a top priority.

Industry Hints at Accepting

While industry usually opposes regulation restricting industrial moves and costing industry money, there is a growing business community trend now to accept a strengthened clean air law. For one thing, it looks like it is going to happen whether they like it or not. "Industry sees that the ship is leaving the dock this year and they want to be on it," said a Congressional aide.

S. William Becker, executive director of the State and Territorial Air Pollution Administrators, said that the states were coming up with their own programs like limiting emissions from car exhausts and requiring vapor controls on gas pumps. Industry, he said, is more inclined to compromise "because the alternative in this debate is not to escape regulation but to be regulated 50 different ways by state governments."

He also said the agreement between the Governors of New York and Ohio last year on acid rain legislation showed that the issue was no longer polarizing the states.

Pressure on Economy

William D. Fay, director of the Clean Air Working Group, an industry coalition formed to influence the legislative debate, said that business would welcome a strengthened law if "it doesn't place undue pressure on the economy."

Mr. Fay also said he hoped industry would be represented in the debate and that whatever legislation was acted on would not be written by the National Clean Air Coalition. He said that unless the environmentalists abandoned their "stridency," progress was unlikely.

Mr. Ayres of the Clean Air Coalition said that the environmental groups were willing to work with industry for an acceptable bill. But he added that any adequate bill would have to reduce sulfur emissions by 10 to 12 million tons over 10 years, reduce pollution from automobiles and trucks and sharply cut toxic substances that businesses pour into the air. He said he expected the automobile and electric utility industries to present the chief obstacles.

"If we go at the problem with a positive attitude it is possible to come up with a solution that can reduce pollution without adversely affecting any part of the country," Mr. Ayres said.

Now is time to prepare for farm payments drop

Lincoln Star NEB. 3/7/89

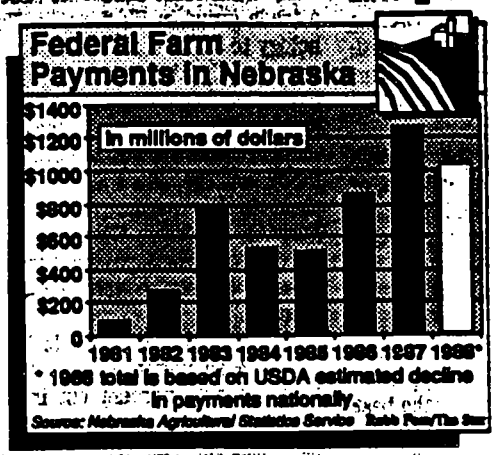
If the big things in life are flowing smoothly, the little things work themselves out.

In the case of the Nebraska economy over the last three years, federal farm payments have been one of the big things — averaging over $1 billion per year. Contrast that dollar inflow to an annual average of less than $500 million in federal payments over the previous five years, and a case can be made that the recent relative health of Nebraska's ag sector rests largely on Uncle Sam's largess.

The current level of federal payments, however, is not likely to continue. And that's a probability that farmers and state government should be dealing with today in planning future expenditures.

Currently, the debate is whether to extend the 1985 farm bill through 1991, or to write a new five-year law. Republicans are leaning toward extending the bill so the new law can take into account international trade negotiations now underway. Democrats are leaning toward rewriting the bill this year.

From a strictly short-term and Nebraska economic perspective, an extension seems the more prudent course, even with another decline in target price levels. It gives the state another year of known, if declining, federal revenues.



Whether in 1991 or 1992, the Nebraska ag sector may face a sharper drop in federal payments in a new farm bill. Budget deficits, urban and social concerns, the Bush administration's stated direction and the lack of an emotion-filled, visible farm crisis all argue that Congress will cut farm subsidy payments sharply.

Our concern could be made moot if commodity prices increased to levels that profits replaced subsidies. At this point, however, that is whistling in the dark.

It's time to recognize that one of the big things in the Nebraska economy is likely to change in the early 1990s.

THE NEW YORK TIMES, SATURDAY, MARCH 4, 1989

DS. 44

Soviet Wheat Purchase

WASHINGTON, March 3 (AP) — The Soviet Union has bought an additional 485,000 metric tons of United States wheat at subsidized prices, the Agriculture Department said Thursday. Melvin E. Sims, general sales manager for the department's Foreign Agricultural Service, said the wheat was part of an authorization on Jan. 25 of more than two million tons under the Export Enhancement Program. Mr. Sims said the wheat is scheduled for April shipment.

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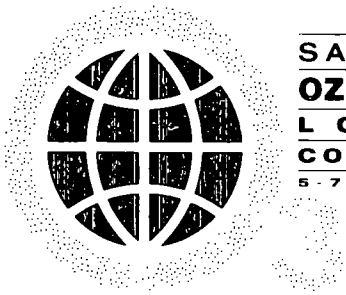


UK STRATOSPHERIC OZONE REVIEW GROUP
SECOND REPORT

The executive summary of the second report of the United Kingdom's Stratospheric Ozone Review Group (SORG) is below as background information for delegates. The report, published in October 1988 reviews recent developments in scientific knowledge and understanding of stratospheric ozone depletion.

SORG was set up in late 1985 by the Department of the Environment and the Meteorological Office to review current understanding of stratospheric ozone and the threat to it from man's activities, and to provide the Department with advice on scientific matters relating to policy issues.

THE SORG REPORT
EXECUTIVE SUMMARY

1 Since the last report from the Group, in 1987, it has become clear that significant depletion of the stratospheric ozone layer results from man's activities.

2 In 1987, the springtime depletion of ozone over Antarctica (the ozone hole) was more severe, and lasted longer, than previously. At altitudes between 14 and 18km the concentration of ozone was depleted by over 95% on occasions, and the total column of ozone was reduced to about 40% of its pre-1975 thickness.

It is now virtually certain that the depletion is caused by man-made chlorofluorocarbons (CFCs) in an atmosphere which has been pre-conditioned by processes involving polar stratospheric clouds. After the polar sunrise high concentrations of active chlorine are released, leading to a rapid depletion of ozone between late August and early October.

3 The role of bromine compounds (including halons) in the Antarctic ozone depletion does not, at present, appear to be large. However, this situation could change if the bromine content of the stratosphere increases significantly.

4 There is evidence of a year-round reduction of ozone of about 5% since 1979, poleward of 60°S. This may be linked to the springtime Antarctic ozone depletion.

5 In the absence of other changes, the Antarctic ozone hole will continue to appear each year until stratospheric chlorine levels fall to those of the mid-1970's. Even if no more man-made chlorine were to be released into the atmosphere, this would take many decades.

6 Evidence has been found for chlorine chemical reactions, similar to those over the Antarctic, over Arctic regions. Although some decreases in ozone have been observed over the Arctic, these are not as drastic as those over the Antarctic. Extensive studies are planned in the Arctic in early 1989.

7 A major reanalysis of global ozone data has been made by the NASA/WMO Ozone Trends Panel. Ground-based measurements between 30°N and 64°N indicate that, after allowance has been made for the effect of solar and other cycles, the annual mean column ozone decreased by 1.7-3% between 1969 and 1986. Within these latitudes the depletion is greatest between 53°N and 64°N in winter months, amounting to about 7%.

These measured changes are significantly larger than those predicted. Existing models used to assess the global effects of CFC emissions significantly underestimate the effects of chlorine in high latitudes. There is a distinct possibility that the effects of chlorine are also underestimated at other latitudes.

8 Models predict that, even with CFC emissions assumed to result from the Montreal Protocol, chlorine in the stratosphere will double over the next 50 years. To stabilize chlorine at present levels would require large cutbacks in CFC emissions; for example, 85% in the case of CFC12.

9 Calculations, using various models and with various emission rates assumed to follow the Montreal Protocol, indicate that by about 2050, globally averaged column ozone will have changed by between +0.25% and −4%. In all calculations, significant depletion is predicted in the upper stratosphere.

It should be noted that, as indicated above, global models may be underpredicting the effect of chlorine.

10 Scientific understanding of the processes which control ozone has improved since the last report. However, many more atmospheric measurements and laboratory and modelling studies are needed to test and refine this. If the UK is to play a significant part in the continuing investigation of ozone and other related environmental problems, there must now be a firm commitment to long-term funding for a programme of instrument development and deployment, study of the data obtained, and of processes relevant to their interpretation. A coordinated European programme is highly desirable.

11 Man-made chlorofluorocarbons are responsible for the Antarctic ozone depletions, and are implicated in the reductions of ozone observed in the mid-latitude Northern Hemisphere. The current terms of the Montreal Protocol, whilst reducing emissions of some of these substances, still permit their concentrations in the atmosphere to increase. Unless emissions are reduced very much further as a matter of urgency, it is likely that more severe depletion of stratospheric ozone will occur. The only way to prevent further depletion, and to allow the atmoshere to recover, is to phase out production of the major man-made carriers of chlorine and bromine to the stratosphere.

SAVING THE OZONE LAYER
LONDON CONFERENCE
5-7 MARCH 1989

FURTHER INFORMATION FOR DELEGATES

Programme

1. Conference Paper SOL 12 contains an updated programme with timings. The final detailed programme will be available at the Conference.

Security and Registration

2. Entry to the Conference Centre will be by special pass only. The pass will be in the form of a lapel badge issued at registration; the lapel badge should be worn at all times while in the building and retained until the end of the Conference. In the interests of all attending the Conference the security arrangements at the Queen Elizabeth II Conference Centre are particularly stringent. Delegates will be asked to walk through the metal archway detector on entering the Conference Centre and pass attaché cases, briefcases or handbags through the X-ray detector.

3. Pressure for registration on the morning of Sunday 5 March is likely to be heavy. Delegates may like to note that the Conference Centre will also be open between 14.00 and 17.00 on the afternoon of Saturday 4 March for registration. We hope that as many delegates as possible will be able to use this opportunity to register.

4. Delegates are asked to be seated in the Churchill Auditorium by 09.50 on Sunday 5 March for the Opening Ceremony, at which the keynote address will be delivered by H. E. President Moi of Kenya.

Government Statements

5. As indicated in Conference Paper SOL 1 (Preliminary Information for Delegates) the conference programme provides opportunities for delegations to make brief country statements. The periods allocated for these are:

Sunday 5 March	12.10 – 12.45	Ministerial Discussion I
	14.15 – 15.15	Ministerial Discussion II
	16.30 – 18.00	Ministerial Discussion III
Monday 6 March	11.15 – 13.00	Ministerial Discussion IV
	14.30 – 17.00	Ministerial Discussion V

A speaking order will be established during the course of the Conference. It would be helpful if delegations could indicate in advance of the Conference if they have any preference for the period in which they would like to make their statement.

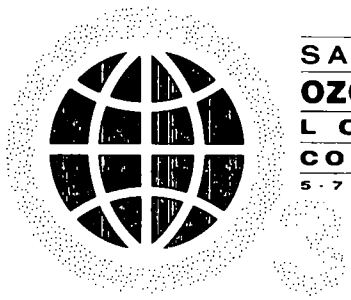
6. Please may we stress that the *maximum* time available to each delegation for its statement is five minutes.

Social

7. Conference Paper SOL 1 gave details of the social events being held in connection with the Conference. We are delighted to announce that HRH The Prince of Wales will attend the dinner for Heads of Delegations on Monday 6 March. Entry to both the dinner and the reception for all delegates on Sunday 5 March will be by invitation only. Invitations for delegates will be distributed at the beginning of the Conference. All delegates are asked if they will kindly wear their lapel badges to the reception.

Telephone

8. The Conference Secretariat telephone number *during the conference* will be 01-798 4312.



VIENNA CONVENTION

The attached copy of the Final Act of the Vienna Convention for the Protection of the Ozone Layer is circulated as background information to the Conference. The Convention entered into force in September 1988.

The Document details the agreements reached and the Final Declarations adopted by the Conference of Plenipotentiaries on the Protection of the Ozone Layer, held in Vienna from 18-22 March 1985. As well as providing the basis for the subsequent Montreal Protocol on Substances that Deplete the Ozone Layer, the Convention covers co-operation in research, systematic observations and information exchange.

The Secretariat has copies of the Convention available in Arabic, Chinese, English, French, Russian and Spanish.

Clinton Presidential Records
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Vienna Convention for the Protection of the Ozone Layer

FINAL ACT

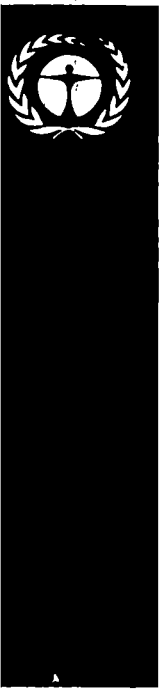
SAVING THE
OZONE LAYER
LONDON
CONFERENCE
5-7 MARCH 1989

MONTREAL PROTOCOL

The attached copy of the Final Act of the Montreal Protocol on Substances that Deplete the Ozone Layer is circulated as background information to the Conference. The Protocol entered into force on 1 January 1989.

The Document details the agreements reached by the Conference of Plenipotentiaries on the Protocol on Chlorofluorocarbons to the Vienna Convention in Montreal in September 1987, on measures to protect the ozone layer by reducing emissions of CFCs and limiting those of halons.

The Secretariat has copies of the Protocol available in Arabic, Chinese, English, French, Russian and Spanish.



MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

FINAL ACT

1987

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1. The Conference of Plenipotentiaries on the Protocol on Chlorofluorocarbons to the Vienna Convention for the Protection of the Ozone Layer was convened by the Executive Director of the United Nations Environment Programme (UNEP) pursuant to decision 13/18 adopted by the Governing Council of UNEP on 23 May 1985.

2. The Conference met at the Headquarters of the International Civil Aviation Organization, Montreal, with the kind support of the Government of Canada, from 14 to 16 September 1987.

3. All States were invited to participate in the Conference. The following States accepted the invitation and participated in the Conference:

Algeria, Argentina, Australia, Austria, Belgium, Brazil, Burkina Faso, Byelorussian Soviet Socialist Republic, Canada, Chile, China, Colombia, Congo, Costa Rica, Czechoslovakia, Denmark, Democratic Yemen, Egypt, Finland, France, Germany, Federal Republic of, Ghana, Greece, Indonesia, Israel, Italy, Japan, Kenya, Korea, Republic of, Luxembourg, Malaysia, Mauritius, Mexico, Morocco, Netherlands, New Zealand, Nigeria, Norway, Panama, Peru, Philippines, Portugal, Senegal, Spain, Sweden, Switzerland, Thailand, Togo, Tunisia, Uganda, Ukrainian Soviet Socialist Republic, Union of Soviet Socialist Republics, United Kingdom of Great Britain and Northern Ireland, United States of America, Venezuela.

4. The European Economic Community also participated.

5. Observers from the following States attended the proceedings of the Conference.

Dominican Republic, Ecuador, Hungary, India, Kuwait, Poland.

6. Observers from the following United Nations bodies, specialized agencies, intergovernmental and non-governmental organizations also attended the Conference:

World Meteorological Organization (WMO), General Agreement on Tariffs and Trade (GATT), International Civil Aviation (ICAO), Organization of African Unity (OAU), Council of the European Communities (CEC), Organization for Economic Co-operation and Development (OECD), International Chamber of Commerce (ICC), Federation of European Aerosol Associations, European Chemical Industry Federation, Chemical Manufacturers Association, Natural Resources Defense Council, World Resources Institute, Environmental Defense Fund, Greenpeace, Friends of the Earth, Seattle Foundation (Canada), Mammouth International Humanitarian Societies Square Project Inc. (Canada), Watto Laboratories International (Canada), Dr. F.A. Homonnay and Associates (Canada), International Organization of Automobile Manufacturers, Alliance for Responsible CFC Policy, Air-Conditioning and Refrigeration Institute (USA), Environmental Protection Agency (USA), Institute for European Environment Policy, National Fire Protection Association, Dupont Canada, The Beloff Group (Canada), Produits Chimiques Allied Canada Inc., United States Air Force.

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7. The Conference was formally opened by Dr. Mostafa K. Tolba, the Executive Director of UNEP. In the course of the inaugural ceremony, the Conference heard a welcoming address by the Honourable Tom McMillan, P.C., M.P., Minister of the Environment, on behalf of the Government of Canada.

8. Dr. Mostafa K. Tolba served as Secretary-General of the Conference and Dr. Iwona Rummel-Bulska (UNEP) served as Executive Secretary.

9. The Conference unanimously elected Ambassador W. Lang (Austria) as its President.

10. The Conference also elected the following officers:

Vice-Presidents: Ambassador E. Hawas (Egypt)
Dr. V. Zakharov (Union of Soviet Socialist Republics)

Rapporteur: Mr. C.R. Roque (Philippines)

11. The Conference adopted the following agenda:

1. Opening of the Conference.

2. Organizational matters:

   (a) Adoption of the rules of procedures;
   (b) Election of the President;
   (c) Election of the Vice-President and Rapporteur;
   (d) Adoption of the agenda;
   (e) Appointment of the members of the Credentials Committee;
   (f) Appointment of the members of the Drafting Committee;
   (g) Organization of the work of the Conference.

3. Consideration of the draft Protocol to the Vienna Convention for the Protection of the Ozone Layer.

4. Report of the Credentials Committee.

5. Adoption of the Protocol to the Vienna Convention for the Protection of the Ozone Layer.

6. Adoption of the Final Act of the Conference.

7. Signature of final instruments.

8. Closure of the Conference.

12. The Conference adopted as its rules of procedure document UNEP/IG./9/2 proposed by the secretariat.

13. In conformity with the rules of procedure, the Conference established the following Committees:

Committee of the Whole:

Chairman: The President of the Conference

General Committee:

Chairman: The President of the Conference

Members: The Vice-President of the Conference, the Rapporteur and the Chairman of the Drafting Committee

Drafting Committee:

Chairman: Mr. Jon J. Allen (Canada)

Members
Argentina
Australia
France
Japan
United Kingdom
United States

Credentials Committee:

Chairman: Ambassador Jose M. Bustani (Brazil)

Members:
Finland
Germany, Federal Republic of
Indonesia
Kenya
Mexico
Norway

14. The main documents which served as the basis for the deliberations of the Conference were:

- Seventh Revised Draft Protocol on [Chlorofluorocarbons] [and Other Ozone Depleting Substances], UNEP/IG.93/3 and Rev. 1;

- Reports of the Ad Hoc Working Group of Legal and Technical Experts for the Elaboration of a Protocol on Chlorofluorocarbons to the Vienna Convention for the Protection of the Ozone Layer (Vienna Group), UNEP/WG.151/L.4, UNEP/WG.167/2 and UNEP/WG.172/2.

15. In addition, the Conference had before it a number of other documents that were made available to it by the Secretariat of UNEP.

16. The Conference approved the recommendation of its Credentials Committee that the credentials of the representatives of the participating States as listed in paragraph 3 should be recognized as being in order.

17. On the basis of the deliberations of the Committee of the Whole, the Conference, on 16 September 1987, adopted the Montreal Protocol on Substances that Deplete the Ozone Layer. The Protocol, which is appended to this Final Act, will be open for signature at the Ministry for External Affairs of Canada in Ottawa from 17 September 1987 to 16 January 1988 and at the United Nations Headquarters in New York from 17 January 1988 to 15 September 1988.

18. The Conference also adopted the following resolutions which are appended to this Final Act:

1. Resolution on the Montreal Protocol.

2. Resolution on the exchange of technical information.

3. Resolution on the reporting of data.

4. Tribute to the Government of Canada.

19. At the time of the adoption of this Final Act, some delegations made declarations which are recorded in this document.

IN WITNESS WHEREOF the representatives have signed this Final Act.

DONE at Montreal, this sixteenth day of September one thousand nine hundred and eighty seven in one original in the Arabic, Chinese, English, French, Russian and Spanish languages, each language version being equally authentic. The original text will be deposited with the Secretary-General of the United Nations.

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1. RESOLUTION ON THE MONTREAL PROTOCOL

The Conference,

Having adopted the Montreal Protocol on Substances that Deplete the Ozone Layer,

Noting with appreciation that the Protocol was opened for signature in Montreal on 16 September 1987,

Recalling the Vienna Convention for the Protection of the Ozone Layer, adopted on 22 March 1985,

Bearing in mind the Resolution of the Conference of Plenipotentiaries on the Protection of the Ozone Layer adopted on the same day which urged in the sixth operative paragraph "all States and regional economic integration organizations, pending entry into force of a protocol, to control their emissions of CFCs, inter alia in aerosols, by any means at their disposal, including controls on production or use, to the maximum extent practicable",

1. Calls upon all States and regional economic integration organizations that have not yet done so to implement the sixth paragraph, bearing in mind the special situation of the developing countries;

2. Appeals to all States to become Parties to the Vienna Convention for the Protection of the Ozone Layer;

3. Urges all States and regional economic integration organizations, including those that have not participated in this Conference, to sign and become Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer;

4. Requests the Executive Director of the United Nations Environment Programme to forward this Resolution to the Secretary-General of the United Nations and to circulate it to all States and regional economic integration organizations.

2. RESOLUTION ON THE EXCHANGE OF TECHNICAL INFORMATION

The Conference,

Having adopted the Montreal Protocol on Substances that Deplete the Ozone Layer,

Realizing the importance of reducing as quickly as possible the emissions of these substances,

Recognizing the need for an early exchange of information on technologies and strategies to achieve this,

1. Requests the Executive Director of the United Nations Environment Programme (UNEP), pending the first meeting of the Parties, to make appropriate arrangements to facilitate the exchange of information on technology referred to in Articles 9 and 10 of the Protocol;

2. Appeals to interested States and regional economic integration organizations to sponsor, at the earliest opportunity, in co-operation with UNEP, a workshop with the aim of:

(a) Exchange information on technologies and administrative strategies for reducing emissions of the substances listed in Annex A to the Protocol and for developing alternatives, taking into account paragraph 2 of Annex II to the Vienna Convention for the Protection of the Ozone Layer; and

(b) Identifying areas in which further research and technical development are required,

3. Urges all interested parties to participate in and contribute to such a workshop and to make expeditious use of the information so gained in order to reduce the emissions of those substances and to develop alternatives.

3. RESOLUTION ON REPORTING OF DATA

The Conference,

Having adopted the Montreal Protocol on Substances that Deplete the Ozone Layer,

Convinced that the timely reporting of complete and accurate data on the production and consumption of controlled substances is critical to the effective and efficient implementation of this Protocol,

1. Calls upon all Signatories to take, expeditiously, all steps necessary to acquire data and report on the production, import and export of controlled substances in a complete and timely fashion in accordance with Article 7 of the Protocol and taking into account paragraph 1 of Article 4 of the Vienna Convention for the Protection of the Ozone Layer;

2. Invites Signatories to consult with other Signatories, and to seek advice and assistance from the United Nations Environment Programme (UNEP) and other relevant international organizations, as necessary, in designing and implementing data reporting systems;

3. Calls upon the Executive Director of UNEP to convene, within six months of the adoption of this Resolution, a meeting of governmental experts with the assistance of experts from relevant international organizations to make recommendations for the harmonization of data on production, imports and exports to ensure consistency and comparability of data on controlled substances.

4. TRIBUTE TO THE GOVERNMENT OF CANADA

The Conference,

Having met in Montreal from 14 to 16 September 1987 at the gracious invitation of the Government of Canada,

Convinced that the efforts made by the Government of Canada and by the civic authorities of Montreal in providing facilities, premises and other resources contributed significantly to the smooth conduct of its proceedings,

Deeply appreciative of the courtesy and hospitality extended by the Government of Canada and the City of Montreal to the members of the delegations, observers and the secretariat attending the Conference,

Expresses its sincere gratitude to the Government of Canada, to the authorities of Montreal and, through them, to the Canadian people and in particular to the population of Montreal for the cordial welcome which they accorded to the Conference and to those associated with its work and for their contribution to the success of the Conference.

DECLARATIONS

made at the time of adoption of the Final Act of the Conference of Plenipotentiaries on the Montreal Protocol on Substances that Deplete the Ozone Layer.

1. Speaking on behalf of the developing countries, the delegate from Egypt stated that the developing countries' understanding on Article 2 of the Montreal Protocol on Substances that Deplete the Ozone Layer is that any of its provisions will in no way affect the agreement reached on subparagraph (c) of Article 3 and on Articles 4 and 5.

2. Speaking on behalf of the European Economic Community, the delegate from Denmark stated that all Member States of the European Economic Community and EEC will sign the Montreal Protocol on Substances that Deplete the Ozone Layer and that all Member States and EEC will ratify the Vienna Convention for the Protection of the Ozone Layer as soon as possible to allow the Montreal Protocol to enter into force on 1 January 1989.

3. The delegate from the Soviet Union stated that while fully sharing the idea that the trade in CFCs should be controlled, the Soviet Union finds it necessary to include into a corresponding Article a provision allowing Parties to fulfil their earlier commitments. That would be consistent with the letter and spirit of all international agreements. At the first meeting of the Parties an effort should be made to introduce amendments and corrections into a number of Articles to make the Protocol more flexible and responsive to the needs of different countries, in particular, those with a low level of consumption of ozone depleting substances. At the first meeting of the Parties, among other things, they should consider, besides the ozone depleting substances, the scientific data on the effect of the use of alternative substances on human health and environment as well as ecological consequences. Scientific experts, to this end, should prepare a review of alternatives. In reiterating the will of our country to develop international co-operation in the field of environmental protection and that of the ozone layer, the delegation of the Soviet Union considers, in general, that the present Protocol seems to be ready for signing and that after having considered the legal basis of the provisions contained in certain Articles formulated in the last few days of the Conference, the question can be solved.

MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

The Parties to this Protocol,

Being Parties to the Vienna Convention for the Protection of the Ozone Layer,

Mindful of their obligation under that Convention to take appropriate measures to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer,

Recognizing that world-wide emissions of certain substances can significantly deplete and otherwise modify the ozone layer in a manner that is likely to result in adverse effects on human health and the environment,

Conscious of the potential climatic effects of emissions of these substances,

Aware that measures taken to protect the ozone layer from depletion should be based on relevant scientific knowledge, taking into account technical and economic considerations,

Determined to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge, taking into account technical and economic considerations,

Acknowledging that special provision is required to meet the needs of developing countries for these substances,

Noting the precautionary measures for controlling emissions of certain chlorofluorocarbons that have already been taken at national and regional levels,

Considering the importance of promoting international co-operation in the research and development of science and technology relating to the control and reduction of emissions of substances that deplete the ozone layer, bearing in mind in particular the needs of developing countries,

HAVE AGREED AS FOLLOWS:

ARTICLE 1: DEFINITIONS

For the purposes of this Protocol:

1. "Convention" means the Vienna Convention for the Protection of the Ozone Layer, adopted on 22 March 1985.

2. "Parties" means, unless the text otherwise indicates, Parties to this Protocol.

3. "Secretariat" means the secretariat of the Convention.

4. "Controlled substance" means a substance listed in Annex A to this Protocol, whether existing alone or in a mixture. It excludes, however, any such substance or mixture which is in a manufactured product other than a container used for the transportation or storage of the substance listed.

5. "Production" means the amount of controlled substances produced minus the amount destroyed by technologies to be approved by the Parties.

6. "Consumption" means production plus imports minus exports of controlled substances.

7. "Calculated levels" of production, imports, exports and consumption means levels determined in accordance with Article 3.

8. "Industrial rationalization" means the transfer of all or a portion of the calculated level of production of one Party to another, for the purpose of achieving economic efficiencies or responding to anticipated shortfalls in supply as a result of plant closures.

ARTICLE 2: CONTROL MEASURES

1. Each Party shall ensure that for the twelve-month period commencing on the first day of the seventh month following the date of the entry into force of this Protocol, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group I of Annex A does not exceed its calculated level of consumption in 1986. By the end of the same period, each Party producing one or more of these substances shall ensure that its calculated level of production of the substances does not exceed its calculated level of production in 1986, except that such level may have increased by no more than ten per cent based on the 1986 level. Such increase shall be permitted only so as to satisfy the basic domestic needs of the Parties operating under Article 5 and for the purposes of industrial rationalization between Parties.

2. Each Party shall ensure that for the twelve-month period commencing on the first day of the thirty-seventh month following the date of the entry into force of this Protocol, and in each twelve month period thereafter, its calculated level of consumption of the controlled substances listed in Group II of Annex A does not exceed its calculated level of consumption in 1986. Each Party producing one or more of these substances shall ensure that its calculated level of production of the substances does not exceed its calculated level of production in 1986, except that such level may have increased by no more than ten per cent based on the 1986 level. Such increase shall be permitted only so as to satisfy the basic domestic needs of the Parties operating under Article 5 and for the purposes of industrial rationalization between Parties. The mechanisms for implementing these measures shall be decided by the Parties at their first meeting following the first scientific review.

3. Each Party shall ensure that for the period 1 July 1993 to 30 June 1994 and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group I of Annex A does not exceed, annually, eighty per cent of its calculated level of consumption in 1986. Each Party producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed, annually, eighty per cent of its calculated level of production in 1986. However, in order to satisfy the basic domestic needs of the Parties operating under Article 5 and for the purposes of industrial rationalization between Parties, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1986.

4. Each Party shall ensure that for the period 1 July 1998 to 30 June 1999, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group I of Annex A does not exceed, annually, fifty per cent of its calculated level of consumption in 1986. Each Party producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed, annually, fifty per cent of its calculated level of production in 1986. However, in order to satisfy the basic domestic needs of the Parties operating under Article 5 and for the purposes of industrial rationalization between Parties, its calculated level of production may exceed that limit by up to fifteen per cent of its calculated level of production in 1986. This paragraph will apply unless the Parties decide otherwise at a meeting by a two-thirds majority of Parties present and voting, representing at least two-thirds of the total calculated level of consumption of these substances of the Parties. This decision shall be considered and made in the light of the assessments referred to in Article 6.

5. Any Party whose calculated level of production in 1986 of the controlled substances in Group I of Annex A was less than twenty-five kilotonnes may, for the purposes of industrial rationalization, transfer to or receive from any other Party, production in excess of the limits set out in paragraphs 1, 3 and 4 provided that the total combined calculated levels of production of the Parties concerned does not exceed the production limits set out in this Article. Any transfer of such production shall be notified to the secretariat, no later than the time of the transfer.

6. Any Party not operating under Article 5, that has facilities for the production of controlled substances under construction, or contracted for, prior to 16 September 1987, and provided for in national legislation prior to 1 January 1987, may add the production from such facilities to its 1986 production of such substances for the purposes of determining its calculated level of production for 1986, provided that such facilities are completed by 31 December 1990 and that such production does not raise that Party's annual calculated level of consumption of the controlled substances above 0.5 kilograms per capita.

7. Any transfer of production pursuant to paragraph 5 or any addition of production pursuant to paragraph 6 shall be notified to the secretariat, no later than the time of the transfer or addition.

8. (a) Any Parties which are Members States of a regional economic integration organization as defined in Article 1 (6) of the Convention may agree that they shall jointly fulfil their obligations respecting consumption under this Article provided that their total combined calculated level of consumption does not exceed the levels required by this Article.

(b) The Parties to any such agreement shall inform the secretariat of the terms of the agreement before the date of the reduction in consumption with which the agreement is concerned.

(c) Such agreement will become operative only if all Member States of the regional economic integration organization and the organization concerned are Parties to the Protocol and have notified the secretariat of their manner of implementation.

9. (a) Based on the assessments made pursuant to Article 6, the Parties may decide whether:

(i) Adjustments to the ozone depleting potentials specified in Annex A should be made and, if so, what the adjustments should be; and

(ii) Further adjustments and reductions of production or consumption of the controlled substances from 1986 levels should be undertaken and, if so, what the scope, amount and timing of any such adjustments and reductions should be;

(b) Proposals for such adjustments shall be communicated to the Parties by the secretariat at least six months before the meeting of the Parties at which they are proposed for adoption;

(c) In taking such decisions, the Parties shall make every effort to reach agreement by consensus. If all efforts at consensus have been exhausted, and no agreement reached, such decisions shall, as a last resort, be adopted by a two-thirds majority vote of the Parties present and voting representing at least fifty per cent of the total consumption of the controlled substances of the Parties;

(d) The decisions, which shall be binding on all Parties, shall forthwith be communicated to the Parties by the Depositary. Unless otherwise provided in the decisions, they shall enter into force on the expiry of six months from the date of the circulation of the communication by the Depositary.

10. (a) Based on the assessments made pursuant to Article 6 of this Protocol and in accordance with the procedure set out in Article 9 of the Convention, the Parties may decide:

(i) Whether any substances, and if so which, should be added to or removed from any annex to this Protocol; and

(ii) The mechanism, scope and timing of the control measures that should apply to those substances;

(b) Any such decision shall become effective, provided that it has been accepted by a two-thirds majority vote of the Parties present and voting.

11. Nothwithstanding the provisions contained in this Article, Parties may take more stringent measures than those required by this Article.

ARTICLE 3: CALCULATION OF CONTROL LEVELS

For the purposes of Articles 2 and 5, each Party shall, for each Group of substances in Annex A, determine its calculated levels of:

(a) Production by:

(i) Multiplying its annual production of each controlled substance by the ozone depleting potential specified in respect of it in Annex A; and

(ii) Adding together, for each such Group, the resulting figures;

(b) Imports and exports, respectively, by following, mutatis mutandis, the procedure set out in subparagraph (a); and

(c) Consumption by adding together its calculated levels of production and imports and subtracting its calculated level of exports as determined in accordance with subparagraphs (a) and (b). However, beginning on 1 January 1993, any export of controlled substances to non-Parties shall not be subtracted in calculating the consumption level of the exporting Party.

ARTICLE 4: CONTROL OF TRADE WITH NON-PARTIES

1. Within one year of the entry into force of this Protocol, each Party shall ban the import of controlled substances from any State not party to this Protocol.

2. Beginning on 1 January 1993, no Party operating under paragraph 1 of Article 5 may export any controlled substances to any State not party to this Protocol.

3. Within three years of the date of the entry into force of this Protocol, the Parties shall, following the procedures in Article 10 of the Convention, elaborate in an annex a list of products containing controlled substances. Parties that have not objected to the annex in accordance with those procedures shall ban, within one year of the annex having become effective, the import of those products from any State not party to this Protocol.

4. Within five years of the entry into force of this Protocol, the Parties shall determine the feasibility of banning or restricting, from States not party to this Protocol, the import of products produced with, but not containing, controlled substances. If determined feasible, the Parties shall, following the procedures in Article 10 of the Convention, elaborate in an annex a list of such products. Parties that have not objected to it in accordance with those procedures shall ban or restrict, within one year of the annex having become effective, the import of those products from any State not party to this Protocol.

5. Each Party shall discourage the export, to any State not party to this Protocol, of technology for producing and for utilizing controlled substances.

6. Each Party shall refrain from providing new subsidies, aid, credits, guarantees or insurance programmes for the export to States not party to this Protocol of products, equipment, plants or technology that would facilitate the production of controlled substances.

7. Paragraphs 5 and 6 shall not apply to products, equipment, plants or technology that improve the containment, recovery, recycling or destruction of controlled substances, promote the development of alternative substances, or otherwise contribute to the reduction of emissions of controlled substances.

8. Nothwithstanding the provisions of this Article, imports referred to in paragraphs 1, 3 and 4 may be permitted from any State not party to this Protocol if that State is determined, by a meeting of the Parties, to be in full compliance with Article 2 and this Article, and has submitted data to that effect as specified in Article 7.

ARTICLE 5: SPECIAL SITUATION OF DEVELOPING COUNTRIES

1. Any Party that is a developing country and whose annual calculated level of consumption of the controlled substances is less than 0.3 kilograms per capita on the date of the entry into force of the Protocol for it, or any time thereafter within ten years of the date of entry into force of the Protocol shall, in order to meet its basic domestic needs, be entitled to delay its compliance with the control measures set out in paragraphs 1 to 4 of Article 2 by ten years after that specified in those paragraphs. However, such Party shall not exceed an annual calculated level of consumption of 0.3 kilograms per capita. Any such Party shall be entitled to use either the average of its annual calculated level of consumption for the period 1995 to 1997 inclusive or a calculated level of consumption of 0.3 kilograms per capita, whichever is the lower, as the basis for its compliance with the control measures.

2. The Parties undertake to facilitate access to environmentally safe alternative substances and technology for Parties that are developing countries and assist them to make expeditious use of such alternatives.

3. The Parties undertake to facilitate bilaterally or multilaterally the provision of subsidies, aid, credits, guarantees or insurance programmes to Parties that are developing countries for the use of alternative technology and for substitute products.

ARTICLE 6: ASSESSMENT AND REVIEW OF CONTROL MEASURES

Beginning in 1990, and at least every four years thereafter, the Parties shall assess the control measures provided for in Article 2 on the basis of available scientfific, environmental, technical and economic information. At least one year before each assessment, the Parties shall convene appropriate panels of experts qualified in the fields mentioned and determine the composition and terms of reference of any such panels. Within one year of being convened, the panels will report their conclusions, through the secretariat, to the Parties.

ARTICLE 7: REPORTING OF DATA

1. Each Party shall provide to the secretariat, within three months of becoming a Party, statistical data on its production, imports and exports of each of the controlled substances for the year 1986, or the best possible estimates of such data where actual data are not available.

2. Each Party shall provide statistical data to the secretariat on its annual production (with separate data on amounts destroyed by technologies to be approved by the Parties), imports, and exports to Parties and non-Parties, respectively, of such substances for the year during which it becomes a Party and for each year thereafter. It shall forward the data no later than nine months after the end of the year to which the data relate.

ARTICLE 8: NON-COMPLIANCE

The Parties, at their first meeting, shall consider and approve procedures and institutional mechanisms for determining non-compliance with the provisions of this Protocol and for treatment of Parties found to be in non-compliance.

ARTICLE 9: RESEARCH, DEVELOPMENT, PUBLIC AWARENESS AND EXCHANGE OF INFORMATION

1. The Parties shall co-operate, consistent with their national laws, regulations and practices and taking into account in particular the needs of developing countries, in promoting, directly or through competent international bodies, research, development and exchange of information on:

(a) Best technologies for improving the containment, recovery, recycling or destruction of controlled substances or otherwise reducing their emissions;

(b) Possible alternatives to controlled substances, to products containing such substances, and to products manufactured with them; and

(c) Costs and benefits of relevant control strategies.

2. The Parties, individually, jointly or through competent international bodies, shall co-operate in promoting public awareness of the environmental effects of the emissions of controlled substances and other substances that deplete the ozone layer.

3. Within two years of the entry into force of this Protocol and every two years thereafter, each Party shall submit to the secretariat a summary of the activities it has conducted pursuant to this Article.

ARTICLE 10: TECHNICAL ASSISTANCE

1. The Parties shall in the context of the provisions of Article 4 of the Convention, and taking into account in particular the needs of developing countries, co-operate in promoting technical assistance to facilitate participation in and implementation of this Protocol.

2. Any Party of Signatory to this Protocol may submit a request to the secretariat for technical assistance for the purposes of implementing or participating in the Protocol.

3. The Parties, at their first meeting, shall begin deliberations on the means of fulfilling the obligations set out in Article 9, and paragraphs 1 and 2 of this Article, including the preparation of workplans. Such workplans shall pay special attention to the needs and circumstances of the developing countries. States and regional economic integration organizations not party to the Protocol should be encouraged to participate in activities specified in such workplans.

ARTICLE 11: MEETINGS OF THE PARTIES

1. The Parties shall hold meetings at regular intervals. The secretariat shall convene the first meeting of the Parties not later than one year after the date of the entry into force of this Protocol and in conjunction with a meeting of the Conference of the Parties to the Convention, if a meeting of the latter is scheduled within that period.

2. Subsequent ordinary meetings of the parties shall be held, unless the Parties otherwise decide, in conjunction with meetings of the Conference of the Parties to the Convention. Extraordinary meetings of the Parties shall be held at such other times as may be deemed necessary by a meeting of the Parties, or at the written request of any Party, provided that, within six months of such a request being communicated to them by the secretariat, it is supported by at least one third of the Parties.

3. The Parties, at their first meeting, shall:

(a) Adopt by consensus rules of procedure for their meetings;

(b) Adopt by consensus the financial rules referred to in paragraph 2 of Article 13;

(c) Establish the panels and determine the terms of reference referred to in Article 6;

(d) Consider and approve the procedures and institutional mechanisms specified in Article 8; and

(e) Begin preparation of workplans pursuant to paragraph 3 of Article 10.

4. The functions of the meetings of the Parties shall be to:

(a) Review the implementation of this Protocol;

(b) Decide on any adjustments or reductions referred to in paragraph 9 of Article 2;

(c) Decide on any addition to, insertion in or removal from any annex of substances and on related control measures in accordance with paragraph 10 of Article 2;

(d) Establish, where necessary, guidelines or procedures for reporting of information as provided for in Article 7 and paragraph 3 of Article 9;

(e) Review requests for technical assistance submitted pursuant to paragraph 2 of Article 10;

(f) Review reports prepared by the secretariat pursuant to subparagraph (c) of Article 12;

(g) Assess, in accordance with Article 6, the control measures provided for in Article 2;

(h) Consider and adopt, as required, proposals for amendment of this Protocol or any annex and for any new annex;

(i) Consider and adopt the budget for implementing this Protocol; and

(j) Consider and undertake any additional action that may be required for the achievement of the purposes of this Protocol.

5. The United Nations, its specialized agencies and the International Atomic Energy Agency, as well as any State not party to this Protocol, may be represented at meetings of the Parties as observers. Any body or agency, whether national or international, governmental or non-governmental, qualified in fields relating to the protection of the ozone layer which has informed the secretariat of its wish to be represented at a meeting of the Parties as an observer may be admitted unless at least one third of the Parties present object. The admission and participation of observers shall be subject to the rules of procedure adopted by the Parties.

ARTICLE 12: SECRETARIAT

For the purposes of this Protocol, the secretariat shall:

(a) Arrange for and service meetings of the Parties as provided for in Article 11;

(b) Receive and make available, upon request by a Party, data provided pursuant to Article 7;

(c) Prepare and distribute regularly to the Parties reports based on information received pursuant to Articles 7 and 9;

(d) Notify the Parties of any request for technical assistance received pursuant to Article 10 so as to facilitate the provision of such assistance;

(e) Encourage non-Parties to attend the meetings of the Parties as observers and to act in accordance with the provisions of this Protocol;

(f) Provide, as appropriate, the information and requests referred to in subparagraphs (c) and (d) to such non-party observers; and

(g) Perform such other functions for the achievement of the purposes of this Protocol as may be assigned to it by the Parties.

ARTICLE 13: FINANCIAL PROVISIONS

1. The funds required for the operation of this Protocol, including those for the functioning of the secretariat related to this Protocol, shall be charged exclusively against contributions from the Parties.

2. The Parties, at their first meeting, shall adopt by consensus financial rules for the operation of this Protocol.

ARTICLE 14: RELATIONSHIP OF THIS PROTOCOL TO THE CONVENTION

Except as otherwise provided in this Protocol, the provisions of the Convention relating to its protocols shall apply to this Protocol.

ARTICLE 15: SIGNATURE

This Protocol shall be open for signature by States and by regional economic integration organizations in Montreal on 16 September 1987, in Ottawa from 17 September 1987 to 16 January 1988, and at United Nations Headquarters in New York from 17 January 1988 to 15 September 1988.

ARTICLE 16: ENTRY INTO FORCE

1. This Protocol shall enter into force on 1 January 1989, provided that at least eleven instruments of ratification, acceptance, approval of the Protocol or accession thereto have been deposited by States or regional economic integration organizations representing at least two-thirds of 1986 estimated global consumption of the controlled substances, and the provisions of paragraph 1 of Article 17 of the Convention have been fulfilled. In the event that these conditions have not been fulfilled by that date, the Protocol shall enter into force on the ninetieth day following the date on which the conditions have been fulfilled.

2. For the purposes of paragraph 1, any such instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by member States of such organization.

3. After the entry into force of this Protocol, any State or regional economic integration organization shall become a Party to it on the ninetieth day following the date of deposit of its instrument of ratification, acceptance, approval or accession.

ARTICLE 17: PARTIES JOINING AFTER ENTRY INTO FORCE

Subject to Article 5, any State or regional economic integration organization which becomes a Party to this Protocol after the date of its entry into force, shall fulfil forthwith the sum of the obligations under Article 2, as well as under Article 4, that apply at that date to the States and regional economic integration organizations that became Parties on the date the Protocol entered into force.

ARTICLE 18: RESERVATIONS

No reservations may be made to this Protocol.

ARTICLE 19: WITHDRAWAL

For the purposes of this Protocol, the provisions of Article 19 of the Convention relating to withdrawal shall apply, except with respect to Parties referred to in paragraph 1 of Article 5. Any such Party may withdraw from this Protocol by giving written notification to the Depositary at any time after four years of assuming the obligations specified in paragraphs 1 to 4 of Article 2. Any such withdrawal shall take effect upon expiry of one year after the date of its receipt by the Depositary, or on such later date as may be specified in the notification of the withdrawal.

ARTICLE 20: AUTHENTIC TEXTS

The original of this Protocol, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the United Nations.

IN WITNESS WHEREOF THE UNDERSIGNED, BEING DULY AUTHORIZED TO THAT EFFECT, HAVE SIGNED THIS PROTOCOL.

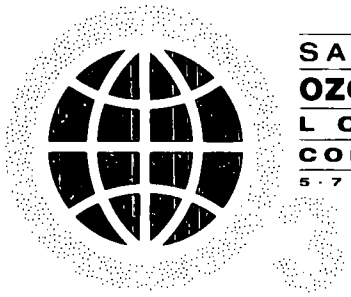
DONE AT MONTREAL THIS SIXTEENTH DAY OF SEPTEMBER, ONE THOUSAND NINE HUNDRED AND EIGHTY SEVEN.

Annex A

CONTROLLED SUBSTANCES

Group	Substance	Ozone Depleting Potential*/
Group I		
$CFCl_3$	(CFC-11)	1.0
CF_2Cl_2	(CFC-12)	1.0
$C_2F_3Cl_3$	(CFC-113)	0.8
$C_2F_4Cl_2$	(CFC-114)	1.0
C_2F_5Cl	(CFC-115)	0.6
Group II		
CF_2BrCl	(halon-1211)	3.0
CF_3Br	(halon-1301)	10.0
$C_2F_4Br_2$	(halon-2402)	(to be determined)

*/ These ozone depleting potentials are estimates based on existing knowledge and will be reviewed and revised periodically.



UNEP WORKSHOP ON SUBSTITUTES AND ALTERNATIVES TO CFCs AND HALONS

The attached paper, containing highlights from the presentations and discussion at the UNEP Workshop on Substitutes and Alternatives to Chlorofluorocarbons (CFCs) and Halons, held in The Hague, 19-21 October 1988, is circulated as background information to the Conference.

The paper (UNEP ref. no. O2L.A16.1/4) describes possible substitutes for CFCs and halons and their uses in various applications, as well as countries' experiences in researching and using alternatives.

Copies are available in English, French and Spanish.

United Nations Environment Programme

Distr.
GENERAL
UNEP/OzL.Alt.1/4/Add.1
21 October 1988

ORIGINAL: ENGLISH

UNEP Workshop on Substitutes and
Alternatives to CFC's and Halons

The Hague, 19-21 October 1988

HIGHLIGHTS FROM THE PRESENTATIONS AND THE DISCUSSION

Addendum to section 2.3.

21% of total CFC is used as foam blowing agents and CFC-11 is the major agent.
Alternatives will be HCFC-123 and HCFC-141b which is flammable.
Application tests are now being carried out but some trails have shown several disadvantages compared with CFC-11, for example, dimensional etability, strength of the formed products and thermal insulation become worse.
Existing foam product makers have to redesign systems. At the moment, the investment costs and the properties of foamed material are not clear.

Addendum to section 3.2.

The electronic industries in Japan do not have confidence in aqueous-cleaning systems at this stage.
Therefore, unfortunately, we see no effective solution other than conservation and recovery of CFC-113 for the CFC reduction within a given period of time, say within ten years.
Regarding the status of conservation measures in Japan, large-scale enterprises, particularly electronic, have already taken conservation measures such as installation of cooling equipments for recovery and adsorbing equipment.
For small scale enterprises provision of such equipment has not been possible as it is relatively expensive at this moment and may not be economically feasible for most of them.
Certain conservation measures, such as strengthening of shielding have been taken not only from the environmental but also from the ecocomic point of view.

British Embassy
3100 Massachusetts Avenue NW Washington DC 20008
Telex Domestic USA 89-2370/89-2384
Telex International 64224(WUI)/440015(ITT)
Telephone (202) 462-1340
Fax Nos: (202) 898 4224
(202) 898 4255

Your reference

FACSIMILE TRANSMISSION LEADER

Our reference

Date

THIS TRANSMISSION CONSISTS OF 4 PAGE(S) PLUS LEADER

FROM Dr DJ Yarrow
SCIENCE, TECHNOLOGY AND ENERGY DEPARTMENT

TO Mr Rick Adcock
Senator Gore's Office

FAX TELEPHONE NUMBER (including area code) 224-0580

SIGNED Liz Tattum

DATE 27 Feb 89

Facsimile

British Embassy
3100 Massachusetts Avenue NW Washington DC 20008
Telex Domestic USA 89-2370/89-2384
Telex International 64224(WUI)/440015(ITT)
Telephone (202) 462-1340

Mr Andrew Sens
Director
Office of Environmental Protection
Room 4325
State Department
Washington DC 20520

Your reference

Our reference 4H12

Date 23 February 1989

Dear Andrew

SAVING THE OZONE LAYER CONFERENCE

1. I attach a detailed programme for the above Conference. I understand a copy has been sent to your Embassy in London.

2. As you are aware delegations are invited, if they wish, to make a statement of up to five minutes. We are now trying to produce a speaking order for these statements and I would be grateful if you could let me know as soon as possible if you have any preference for the timing of presentation of the US statement.

Yours sincerely,

Dr D J Yarrow
First Secretary (Science)

SAVING THE OZONE LAYER CONFERENCE

SATURDAY 4 MARCH

1400-1700 Registration (Sanctuary Foyer).

SUNDAY 5 MARCH

0830-0945 Registration (Sanctuary Foyer).

1000-1030 Opening ceremony with keynote address by HE President Moi of Kenya (Churchill Auditorium)

1030-1100 Coffee break (Benjamin Britten Lounge).

1100-1210 Session: 'Setting the Scene'

- The history of CFCs and Halons
- The Ozone Layer Science: the history; the current state of knowledge; the dangers to human and other life (Fleming/Whittle Rooms)

Speakers will include:

Dr Maurice Verhille, Atochem, France
Dr F S Rowland, University of California
Mr Joseph Farman, British Antarctic Survey
Dr Robert Watson, NASA
Dr Mohammad Ilyas, University of Science of Malaysia

1210-1245 Ministerial Discussion I (an opportunity for delegations to comment on the issues addressed during the Conference or to make brief statements)

1245-1415 Buffet lunch for all delegates (Benjamin Britten Lounge)

1415-1515 Ministerial Discussion II.

1515-1630 Session 2: 'The Response of World Industry'

- Existing alternatives
- New alternatives
- Conservation and recycling
- The retailer's point of view
- Developing country aspects

Speakers will include.

Dr Peter Wallenberg, President, International Chamber of Commerce
Mr Archie Dunham, Group Vice President, Du Pont
Mr Denys Henderson, Chairman, ICI
Dr Kenji Sekidd, Chief Engineer, Semiconductor Group, NEC
Lord Sainsbury of Preston Candover, Chairman, J Sainsbury PLC
Sr Alvaro Umana, Minister of Natural Resources, Mines and Energy, Costa Rica.

1630-1800 Ministerial Discussion III

1830-2000 Reception for all delegates (Durbar Court, FCO)

MONDAY 6 MARCH

1000-1115 Session 3: 'Shared Awareness'

- the implications of the Montreal Protocol process for signatories and non-signatories; the particular needs of developing countries and how to tackle them.

Speakers will include:

Mr Kaj Barlund, Environment Minister, Finland
Lic Patricio Chirinos, Minister for Ecology, Mexico

1115-1300 Ministerial Discussion IV:

1300-1430 Buffet lunch for all delegates (Benjamin Britten Lounge)

1430-1700 Ministerial discussion V:

1700-1800 Session 4: 'Our Common Purpose'

- Synthesis of previous sessions and discussions; the way ahead.

Speakers will include:

Dr Istvan Lang, Secretary General, Hungarian Academy of Sciences
HE Mr Shridath Ramphal, Secretary General to the Commonwealth.
Dr Martin Holdgate, Director General, IUCN; Conference Rapporteur

1930 Dinner for heads of delegation in the British Museum. (Dress: Lounge suit or national dress. HRH The Prince of Wales will attend the dinner).

TUESDAY 7 MARCH Churchill Auditorium

1000-1100 Chairman's summing up.

Adoption of final message.

Closing ceremony.

End of Conference.

1130-1230 UK Press Conference.

Delegates are asked to be seated on Sunday 5 March by 0950 for the opening ceremony.

Mr. Mack 8984374

Doug Yerow British Embassy
Environmental Counsel
858-4324 March 5-7 - London

Called by Thatcher -- there on Sun. + Tues.

"Saving the Ozone Layer"

Clearance for w/ UNEP + to encourage participation w/ Montreal Protocol

Tolba/UNEP very supportive

Presentations @ Ministerial Level

3 delegates per country — still waiting to hear about US delegation

Many speeches / high-level

Industry — Chmn. of ICI
Chmn. of DuPont

Opening address Prime Min. of Kenya

Each country to make a short statement on their CFC policy

(1) Doug Yarrow Brit Embassy
Environmental Counsel
898-4324

(2) Liz Cook
Friends of the Earth
543-4312

→ ~~[illegible]~~ Dept for Agenda
Mar 5-7 [illegible] mtg - London

Dept of Environ is trying to organize an NGO meeting 2 days prior

Mtg. to encourage participation of Protocol demonstrate range of technologies + substitutes —

1st meetings of MP parties on April —
need to get LDCs + [illegible] on board — MP —

Important ones → China, India
→ So. Korea, Taiwan, Thailand

Steve Anderson
John Hoffman } EPA know [illegible]

Saving the O_3 → Int'l Conference

11/23 —— announced

Held in association w/ UNEP —

Inviting Ministers from other countries —
NGOs —

Move to a CFC-free world —

To Strengthen M.P. —

March Conf to give signals
to Finland

Finland mtg. in April to give
1st review of M.P. —

London conf to show how
to achieve CFC-free world —