

ESCAPING THE HEAT TRAP !**Statement from Non-Governmental Organizations
on Policies to Prevent Climate Change****1. THE CHALLENGE**

Concentrations of greenhouse gases including carbon dioxide, chloro-fluorocarbons, tropospheric ozone, nitrous oxide, and methane are rising rapidly. These gases have already raised the average temperature of the earth. Rapid warming of the planet will lead to climatic instability that could disrupt precipitation and agricultural patterns, shift the location of deserts, collapse ecological systems, increase the probability and severity of droughts, hurricanes, and floods, and raise the level of the world's oceans. Some of these impacts are likely to fall on nations least able to respond to climate change. Each of these consequences could have devastating political and economic impacts. Unfortunately, past emissions of these gases have already committed us to significant climate change.

Solving the problem will require an extraordinary level of organization and leadership by political leaders. Yet governments are late getting started. Worst still, the longer a solution is delayed, the more costly will be the ultimate social impacts and remedies. If we wait to confirm empirically scientific forecasts of possible consequences, it will be too late to turn back.

Therefore, we believe the time has come to act to slow and then stop the anthropogenic warming of the earth. At the same time, we must set the stage for responding to climate changes that are already inevitable. Although there is still uncertainty with regard to the sources and sinks of a small proportion of greenhouse gases and the precise regional impacts of climate change, the potential consequences are sufficient to require an immediate global emissions reduction.

The one source that stands out above all others in dealing with this problem is the burning of fossil fuels. Fossil-fuel combustion is responsible for more than 50% of the warming contributed by current greenhouse gas emissions. We submit the following strategies for stabilizing the concentrations of greenhouse gases to ensure the habitability of the planet and the well-being of human society and the natural world.

2. ENERGY POLICIES

Reducing emissions of CO₂ is the single most important measure to arrest climate change. The key factors in CO₂ emission levels are the amounts and types of fuels burned throughout the world and the rates of deforestation and afforestation. As the primary sources of the present excessive atmospheric loadings of greenhouse gases, the developed countries of the world should take the initiative in reducing emissions before internationally binding agreements are reached.

The major, wealthy CO₂-producing nations should commit themselves to the goal of reducing CO₂ emissions by approximately 20% by the year 2000, and approximately 50% by the year 2015. Policies to attain this objective

should be judged by the principle of achieving the desired emissions reductions at the least economic cost. Least-cost energy planning should be instituted to assure this result.

The cornerstone of policies to attain the CO₂ reduction objective should be a dramatically increased efficiency in energy use. With strong energy efficiency policies, it should be possible to improve substantially on the rate of the energy efficiency improvement of the past decade.

Increased efficiency is not only the single most important and economic policy for reducing CO₂ emissions, it also has a key role in encouraging rapid and sustainable development in the developing countries, reducing both consumer costs and other forms of harmful air pollution.

In addition, the following policies should be part of the energy policies consistent with reducing greenhouse gas emissions:

- Establishment of explicit carbon emission "budgets" within an international framework of agreements.
- A major rationalization of energy pricing, subsidies and tax policies, such as carbon taxes or permits to ensure that the true costs of energy production, including effects on the environment, such as CO₂ emissions, are reflected in the price.
- Policies to encourage fuel switching to less CO₂-intensive fuels as a short-term measure.
- Policies to assure production of more fuel-efficient motor vehicles, aimed at assuring an increase in fuel economies at least 50% greater by the turn of the century, and doubling by the year 2010.
- Policies to encourage more efficient energy supply systems, such as cogeneration.
- Redirection of research and development budgets away from conventional energy supply options and towards energy efficient technologies and renewable energy sources.
- Developed world financial institutions, such as the World Bank, would support measures to increase efficiency in energy use and reduce emissions of CO₂ in the developing world by:
 - redirecting the priorities of international aid and lending agencies
 - funding for research and commercial demonstrations to encourage technological innovation in energy use and production applicable in the developing nations
- Nuclear power can reduce CO₂ emissions. However, as the World Commission for Environment and Development concluded, current nuclear technology brings a range of environmental, social, economic and political problems, including catastrophic accidents, weapons proliferation and waste disposal. It is also the least economic option for both developed and developing countries for reducing CO₂ emissions and would require time-scales of many decades to have a marginal impact. It should be given the lowest priority in combatting global warming.

3. FORESTRY POLICIES

Current rates of world-wide deforestation are about 10 times the rate of reforestation. This imbalance is particularly acute for tropical forests, which at present rates of destruction will disappear by about 2010. This imbalance compounds CO₂ buildup by increasing CO₂ emissions and decreasing CO₂ uptake by the forests. By the year 2000, the relative rates of deforestation and reforestation should reach equilibrium, and then reverse. A range of options, including debt swapping and major changes in overseas aid policies should be utilized to attain this objective. In addition nations should be encouraged to enter into international agreements to maintain forests as carbon sinks to be able to comply with national carbon budgets.

4. CHLOROFLUOROCARBON POLICIES

The deterioration of the global ozone layer is a crisis threatening the continuing ability of the planet to support life. Despite scientific warnings of ozone depletion, the dramatic loss of ozone over Antarctica clearly demonstrates the limits of current scientific ability to completely predict atmospheric change. Because this phenomenon was beyond worst case projections, it should serve as a warning that the global climate change could exceed today's predictions.

A phaseout of production and emissions of ozone-depleting substances must be implemented as soon as possible. The fact that emissions of substances that deplete the ozone layer represent 15-20% of the gases contributing to the current greenhouse forcing adds urgency to control efforts.

The current Montréal Protocol sets a significant precedent for international cooperation on the control of trace gases in the atmosphere. However, it will not provide adequate protection for the ozone layer nor prevent CFCs from contributing to the greenhouse effect, even when fully implemented. Thus while it is necessary to swiftly ratify the protocol so that it enters into force on January 1, 1989, signatory nations must soon after reconvene to strengthen the protocol. Current scientific evidence for ozone depletion and global warming provides a new imperative.

The protocol should incorporate a stringent two-part approach. Firstly, it should require a phaseout of fully-halogenated CFC production by 1995. Secondly, a concurrent assessment must be made of the ozone-depleting and greenhouse warming potential of substitute chemicals. A major international effort must be made to research and develop completely safe alternatives. The protocol should also incorporate a timetable for eliminating dangerous substitutes.

To ensure world-wide action, a vigorous diplomatic initiative must be launched to encourage non-participating nations to join the Montréal Protocol. This initiative can be strengthened through transfers of non-fully halogenated CFCs and non-greenhouse gas based technologies.

Because of the long atmospheric lifetimes of CFCs and halons, actions to minimize the emissions of these gases must be taken while the Montréal Protocol is being strengthened and implemented. Individual nations should consider short-term steps including eliminating non-essential uses of CFCs and halons; installing emission control technologies; implementing recycling and recovery technologies; and safely destroying ozone-depleting compounds before they can enter the atmosphere. Governments should also consider taking measures that raise the price of CFCs and halons. High market prices

will induce conservation programs and create opportunities for alternative chemicals and processes to be competitive.

5. METHANE, NITROUS OXIDE AND TROPOSPHERIC OZONE

Methane (CH_4), ozone (O_3) and nitrous oxide (N_2O) collectively contribute about 25% of the current forcing toward greenhouse warming. Our understanding of the sources of these emissions and their growth is less complete than for carbon dioxide (CO_2) and chlorofluorocarbons (CFCs). We do know that the concentrations of each of these gases have been rising steadily in recent years; methane and tropospheric ozone at 1% and nitrous oxides at 0.25% per year.

It is essential that an aggressive monitoring and research effort be mounted immediately to assess reliably the sources and interrelationships between these greenhouse gases. Despite the need for more information concerning these trace gases, enough is known about them to recommend immediate steps to reduce emissions. These policies fall into three categories: 1) improving efficiency, 2) reducing emissions and 3) emphasizing the solution of linked problems.

5.1 Improving Efficiency

- Improved energy efficiency will reduce combustion, which will lower the emissions of hydrocarbons, carbon monoxide and nitrous oxides slowing the formation of tropospheric ozone and the emission of methane from fossil fuels.
- Improved agricultural productivity can reduce methane emissions by reducing the number of acres devoted to rice production and reduce fertilizer application and thus N_2O emissions. Improved livestock productivity will reduce animal numbers and methane emissions per animal through improved nutrition. These policies are also consistent with general economic development objectives.

5.2 Reducing Emissions

- Immediate world-wide adoption of existing and commercially demonstrated automobile emissions control technologies, such as catalytic converters. This would result in significant reductions in the formation of tropospheric ozone and methane.
- Ending deforestation would slow the buildup of nitrous oxides from biomass burning and forest decay, and methane from termites.
- Halting the flaring of natural gas and recycling solid waste could make modest contributions to slowing methane emissions.

5.3 Emphasizing the Solution of Linked Problems

- The slowing of ozone depletion requires the phaseout of the emissions of ozone-depleting substances and would have additional benefits in reducing the formation of tropospheric ozone that would otherwise occur.
- Addressing acid deposition by reducing nitrogen oxides would also have benefits in reducing tropospheric ozone precursors and formation. A NO_x convention to reduce emissions should be adopted and ratified.

- Energy policies for the management of other greenhouse gases would also tend to reduce the emissions of methane and nitrous oxides and the formation of tropospheric ozone.
- World-wide urbanization is increasing rapidly and transit demand is enormous and growing. Solutions to this problem include public transit and urban cars fuelled by alternative low carbon fuels.

6. CONCLUSIONS

We conclude by emphasizing five key points:

1. There is an urgent need for political leadership at the highest levels.
2. Unilateral reductions of CO₂ emissions by the world's leading economic powers and CO₂ producers should start now and reach 20% by the year 2000.
3. Fully-halogenated CFCs should be phased out by 1995.
4. A global convention and protocol to protect the earth's climate by stabilizing the concentrations of greenhouse gases should be negotiated by 1992.
5. Mechanisms for promoting afforestation policies should be given the highest priority.

ÉCHAPPER AU PIÈGE THERMIQUE!

Énoncé de lignes de conduite pour prévenir le changement climatique
Émis par les organisations non gouvernementales participant à la
Conférence sur l'atmosphère en évolution

1. LE PROBLÈME

La concentration des gaz à effet de serre, notamment du gaz carbonique, des chlorofluorocarbones, de l'ozone troposphérique, de l'oxyde azoteux et du méthane, s'accroît rapidement. Ces gaz ont déjà fait monter la température moyenne de la terre. Le réchauffement rapide de la planète conduira à une instabilité climatique qui pourrait perturber la configuration des précipitations et de l'agriculture, déplacer les déserts, faire s'effondrer les systèmes écologiques, accroître la probabilité et la gravité des sécheresses, des ouragans et des inondations, faire monter le niveau des océans. Certains de ces effets toucheront probablement les nations les moins aptes à réagir au changement climatique. Chacun de ces effets pourrait avoir de désastreuses répercussions politiques et économiques. Malheureusement, les émissions antérieures de ces gaz entraînent déjà un changement climatique sensible.

La résolution du problème nécessitera un niveau extraordinaire d'organisation et de leadership de la part des dirigeants politiques. Pourtant, les gouvernements tardent à passer à l'action. Pis encore, les répercussions et les remèdes sociaux reviendront en fin de compte d'autant plus cher qu'on retardera. Si nous attendons de pouvoir confirmer empiriquement la prévision

scientifique des conséquences éventuelles, il sera trop tard pour retourner en arrière.

En conséquence, nous estimons que le moment est venu de ralentir, puis d'arrêter le réchauffement anthropique de la terre. Par la même occasion, il faut nous préparer à réagir aux changements climatiques inévitables. Il existe encore de l'incertitude au sujet des sources et des puits d'une petite proportion des gaz à effet de serre et des répercussions régionales précises du changement climatique, mais les conséquences éventuelles justifient à elles seules une réduction immédiate des émissions mondiales.

La plus grande cause de ce problème réside dans l'utilisation de combustibles fossiles, responsable de plus de 50 p. 100 du réchauffement attribuable aux émissions actuelles. Pour stabiliser la concentration des gaz à effet de serre, nous proposons les stratégies suivantes qui assureraient l'habitabilité de la planète et le bien-être de la société humaine et du monde naturel.

2. LIGNES DE CONDUITE CONCERNANT L'ÉNERGIE

La réduction des émissions de CO₂ est de loin la mesure la plus importante qui permettrait d'arrêter le changement climatique. Les facteurs clés, à l'égard de la concentration des émissions de CO₂, sont la quantité et le type de combustibles brûlés dans le monde entier et le rythme de déboisement et de reboisement. Sources premières de l'actuelle surcharge de gaz à effet de serre dans l'atmosphère, les pays développés du monde entier devraient prendre l'initiative, en réduisant les émissions avant qu'on ne parvienne à des ententes liant les pays à l'échelle internationale.

Les grandes nations riches, productrices de CO₂, devraient s'engager à réduire les émissions de CO₂ d'environ 20 p. 100 d'ici l'an 2000 et d'environ 50 p. 100 d'ici 2015. Les lignes de conduite visant à faire atteindre ces objectifs devraient suivre le principe suivant : réaliser la réduction voulue des émissions au moindre coût pour l'économie. Pour obtenir ce résultat, nous devrions pratiquer une planification d'énergie au moindre coût.

Pour réaliser la réduction visée de CO₂, il s'agirait avant tout d'améliorer d'une façon spectaculaire l'efficacité de l'utilisation d'énergie. Grâce à de vigoureuses lignes de conduite en la matière, il devrait être possible d'accélérer l'amélioration observée ces dix dernières années dans l'efficacité d'utilisation de l'énergie.

Une meilleure efficacité non seulement est le plus important des éléments économiques pour la réduction des émissions de CO₂, mais aussi joue un rôle capital dans l'encouragement d'un développement rapide et sans effet néfaste dans les pays en voie de développement, en réduisant tant le coût pour le consommateur que d'autres formes nocives de pollution atmosphérique.

En outre, les lignes de conduite suivantes devraient faire partie des mesures en matière d'énergie compatibles avec la réduction des émissions des gaz à effet de serre :

- Instauration d'un bilan explicite des émissions de carbone dans le cadre d'ententes internationales.
- Rationalisation fondamentale de l'établissement du prix, des subventions et des taxes en matière d'énergie (instauration par exemple de

taxes ou de permis touchant le carbone) pour que le coût réel de la production d'énergie, y compris les effets sur l'environnement (comme les émissions de CO₂) entre en ligne de compte.

- Encouragement de l'adoption de combustibles produisant moins de CO₂, à titre de mesure à court terme.
- Production de véhicules à moteur à consommation plus efficace, visant à augmenter d'au moins 50 p. 100 les économies de carburant d'ici à la fin du siècle et du double d'ici l'an 2010.
- Encouragement de sources d'énergie plus efficaces, comme la co-génération.
- Réaffectation des budgets de recherche et de développement au profit de techniques d'utilisation efficace de l'énergie et de sources d'énergie renouvelables plutôt qu'aux options classiques de sources d'énergie.
- Appui par des institutions financières du monde industrialisé, comme la Banque mondiale, de mesures destinées à rendre plus efficace l'utilisation de l'énergie et à réduire les émissions de CO₂ dans le Tiers monde, à savoir:
 - réorientation des priorités de l'aide internationale et des organismes de prêts;
 - financement de la recherche et des manifestations commerciales afin d'encourager l'innovation technique en matière d'utilisation et de production d'énergie dans les nations en voie de développement.
- L'énergie nucléaire peut réduire les émissions de CO₂. Cependant, selon les conclusions de la Commission mondiale pour l'environnement et le développement, les techniques nucléaires actuelles sont sources de divers problèmes environnementaux, sociaux, économiques et politiques, sans oublier les catastrophes, la prolifération des armes et le problème des déchets solides. Cette forme d'énergie représente aussi l'option la moins économique dont disposent les pays développés ou les pays en voie de développement pour réduire les émissions de CO₂ et il faudrait bien des décennies pour que l'effet se fasse sentir. Il convient donc d'accorder à l'option nucléaire la dernière place dans la lutte contre le réchauffement.

3. LIGNES DE CONDUITE CONCERNANT LES FORÊTS

Le rythme du déboisement dans le monde est dix fois plus élevé que celui du reboisement. Ce déséquilibre est particulièrement marqué en ce qui concerne les forêts tropicales qui, au rythme de destruction actuel, auront disparu d'ici l'an 2010 environ. En outre, ce déséquilibre aggrave l'accumulation de CO₂ car il accroît les émissions et réduit la quantité de CO₂ absorbé par les forêts. Vers l'an 2000, le déboisement et le reboisement devraient parvenir à un équilibre, puis la tendance devrait s'inverser. Pour atteindre cet objectif, il convient de recourir à diverses options, dont l'effacement des dettes et un changement radical de politiques en matière d'aide aux pays d'outre-mer. Il convient de plus d'encourager les nations à signer des accords internationaux visant à maintenir les forêts comme puits de carbone afin qu'elles soient en mesure de respecter le bilan national de carbone.

4. LIGNES DE CONDUITE CONCERNANT LES CHLOROFLUOROCARBONES

La dégradation de la couche d'ozone mondiale met en péril l'habitabilité de la planète. Malgré les avertissements du milieu scientifique concernant la destruction de l'ozone, la découverte récente du trou d'ozone spectaculaire au-dessus de l'Antarctique démontre clairement les limites de la capacité scientifique actuelle de prévoir complètement le changement atmosphérique. Ce phénomène a dépassé les projections du scénario le plus pessimiste, ce qui nous montre que le changement climatique mondial pourrait bien dépasser les prévisions que nous faisons aujourd'hui.

Nous devons dès que possible cesser de produire et de libérer les substances qui détruisent la couche d'ozone. Il est d'autant plus urgent d'instaurer des réductions que les substances qui détruisent la couche d'ozone représentent 15 à 20 p. 100 des gaz qui contribuent au problème actuel de l'effet de serre.

Le Protocole de Montréal actuel établit un précédent marquant dans le domaine de la coopération internationale en matière de réduction des gaz à l'état de trace dans l'atmosphère. Cependant, même lorsqu'il sera intégralement appliqué, il ne permettra pas une protection suffisante de la couche d'ozone, ni ne pourra empêcher les CFC de contribuer à l'effet de serre. Par conséquent, bien qu'il soit nécessaire de ratifier rapidement le Protocole pour qu'il entre en vigueur le 1^{er} janvier 1989, les nations signataires doivent se réunir de nouveau au plus vite pour le renforcer. Les preuves scientifiques actuelles de la destruction de l'ozone et du réchauffement mondial rendent cette nécessité encore plus impérieuse.

Il y a lieu de procéder en deux étapes rigoureuses pour instaurer le Protocole. En premier lieu, il convient d'éliminer la production des CFC complètement halogénés d'ici à 1995. Simultanément, il faut évaluer les produits chimiques de remplacement quant à leur coefficient d'appauvrissement de la couche d'ozone et à leur contribution à l'effet de serre. Il faut unir nos efforts à l'échelle internationale pour trouver et mettre au point des produits de remplacement d'une innocuité parfaite. Il convient aussi d'incorporer au Protocole un calendrier pour fixer l'élimination des substituts dangereux.

Afin que des mesures soient prises à l'échelle mondiale, nous devons lancer une vigoureuse campagne diplomatique pour encourager les nations qui n'ont pas encore signé le Protocole de Montréal à le faire. Pour ce faire, on pourrait procéder au transfert des techniques faisant appel à des CFC partiellement halogénés et à des gaz ne contribuant pas à l'effet de serre.

Étant donné la très longue vie dans l'atmosphère des CFC et des halons, c'est dès maintenant, avant que le Protocole de Montréal ne soit mis en application, qu'il faut prendre des mesures pour réduire l'émission de ces gaz. Les nations devraient envisager à titre individuel des mesures à court terme, notamment l'élimination des usages non essentiels des CFC et des halons; l'installation de techniques de réduction des émissions; la mise en oeuvre de techniques de recyclage et de récupération; et la destruction sans danger, avant leur entrée dans l'atmosphère, des composés qui détruisent l'ozone. Les gouvernements doivent aussi envisager des mesures pour augmenter le prix de ces substances. Un prix élevé encouragera les programmes de protection et rendra compétitifs les produits chimiques et procédés de remplacement.

5. LIGNES DE CONDUITE CONCERNANT LE MÉTHANE, L'OXYDE AZOTEUX ET L'OZONE TROPOSPHÉRIQUE

Le méthane (CH_4), l'ozone (O_3) et l'oxyde azoteux (N_2O) représentent à eux trois environ 25 p. 100 des forces actuelles contribuant au réchauffement par l'effet de serre. Nous ne comprenons pas encore aussi bien la source de ces émissions ni leur croissance que celles du gaz carbonique et des CFC. Ce que nous savons par contre, c'est que leur concentration augmente constamment depuis quelques années: le méthane et l'ozone troposphérique de 1 p. 100 par an et l'oxyde azoteux de 0,25 p. 100 par an.

Il est essentiel de mettre sur pied immédiatement un vigoureux programme de surveillance et de recherche pour évaluer de façon fiable les sources de ces gaz à effet de serre et leurs relations. Nous avons effectivement besoin d'en savoir davantage sur ces gaz à l'état de traces, mais nous en savons déjà suffisamment pour recommander des mesures immédiates visant à réduire ces émissions. Les mesures tombent dans trois catégories: 1) améliorer l'efficacité; 2) réduire les émissions; 3) résoudre les problèmes connexes.

5.1 Améliorer l'efficacité

- En améliorant l'efficacité en matière d'énergie, on réduit la combustion, ce qui réduit les émissions d'hydrocarbures, d'oxydes de carbone et d'oxyde azoteux et ralentit la formation d'ozone troposphérique et de méthane à partir des combustibles fossiles.
- En améliorant la productivité agricole, on peut réduire les émissions de méthane grâce à la réduction de la superficie consacrée à la production du riz, et on peut réduire l'application d'engrais et, par conséquent, les émissions de N_2O . En améliorant la productivité du bétail, on réduit le nombre d'animaux, et en améliorant la nutrition, on réduit les émissions de méthane par animal. Ces mesures correspondent aux objectifs généraux de développement économique.

5.2 Réduction des émissions

- En adoptant immédiatement à l'échelle mondiale des techniques existantes et éprouvées pour réduire les émissions des véhicules, comme par exemple les convertisseurs catalytiques, on entraîne la réduction marquée de la formation de l'ozone troposphérique et du méthane.
- En mettant fin au déboisement, on freine l'accumulation d'oxyde azoteux à partir de la combustion de la biomasse et de la décomposition forestière, et la formation de méthane par les termites.
- En cessant le torchage du gaz naturel et en recyclant les déchets solides, on peut contribuer modestement au ralentissement des émissions de méthane.

5.3 Résoudre des problèmes connexes

- Pour ralentir la destruction de l'ozone, il faut éliminer l'émission des substances qui le détruisent, ce qui a en outre l'avantage de réduire la formation de l'ozone troposphérique qui, autrement se produirait.

- En réduisant l'oxyde azoteux pour régler les problèmes des dépôts acides, on réduit du même coup les précurseurs de l'ozone troposphérique et donc la formation de l'ozone. Il convient d'adopter et de ratifier une convention en vue de réduire les NO_x.
- En adoptant des stratégies politiques en matière d'énergie pour réduire les autres gaz à effet de serre, on réduirait aussi les émissions de méthane et d'oxyde azoteux, et la formation d'ozone troposphérique.
- L'urbanisation s'accroît rapidement dans le monde entier et les besoins en transports, déjà considérables, sont en constante augmentation. Pour résoudre ce problème, il faut que les véhicules urbains et les transports en commun utilisent d'autres carburants à faible teneur en carbone.

6. CONCLUSIONS

Pour conclure, soulignons cinq points clés :

1. Il existe un besoin impérieux de prise en main politique aux niveaux les plus élevés.
2. Il convient que les grandes puissances économiques et les producteurs de CO₂ réduisent unilatéralement les émissions de CO₂ dès à présent, les réductions devant atteindre 20 p. 100 d'ici l'an 2000.
3. Il y a lieu d'éliminer les CFC complètement halogénés d'ici 1995.
4. Il convient de négocier d'ici 1992 une convention mondiale assortie d'un protocole pour protéger le climat de la terre en stabilisant la concentration des gaz à effet de serre.
5. Il convient d'accorder la priorité aux mécanismes visant à encourager une politique de reboisement.

APPENDICES

APPENDIX 1

PROGRAM OF THE WORLD CONFERENCE ON
THE CHANGING ATMOSPHERE: IMPLICATIONS FOR GLOBAL SECURITY

27-30 JUNE 1988

- Host:** The Honourable Tom McMillan
Minister of the Environment, CANADA
- Sponsored by** Government of CANADA
Agriculture
Canadian International Development Agency
Energy, Mines and Resources
Environment
External Affairs
Fisheries and Oceans
Health and Welfare
Indian and Northern Affairs
International Development Research Centre
Secretary of State
- Supported by** United Nations Environment Programme
World Meteorological Organization
- Conference Director** Howard L. Ferguson
Assistant Deputy Minister
Environment Canada, CANADA
- Conference Secretary** Gordon A. McKay
Atmospheric Environment Service, CANADA

Monday, 27 June 1988

Morning Introduction and Welcome

General Chairman: Mr. Stephen Lewis,
Ambassador and Permanent Representative of
Canada to the United Nations

SESSION 1 OPENING PRESENTATIONS

Opening Address

The Right Honourable Brian Mulroney
Prime Minister of Canada

Keynote Address

The Honourable Gro Harlem Brundtland
Prime Minister of Norway

SESSION 2 SCIENTIFIC BASIS OF CONCERN

Convenor: Dr. Thomas Malone, President Sigma Xi
St. Joseph College, West Hartford, Conn., U.S.A.

The Global Greenhouse Effect
Dr. F. Kenneth Hare, Chairman
Canadian Climate Program Planning Board, Toronto, Ontario,
CANADA

Atmospheric Ozone
Dr. Robert Watson, Chief, Upper Atmosphere Research Program
National Aeronautics and Space Administration, Washington, D.C.,
U.S.A.

Luncheon Speaker: David T. Buzzelli
Chairman of the Board, President and Chief Executive
Officer, Dow Chemical Canada Incorporated
Sarnia, Ontario, CANADA

Afternoon **SESSION 2 - CONTINUED**

Long-Range Transport of Airborne Pollutants
Dr. Göran Persson, Assistant Director General
National Environmental Protection Board (SNV)
Solna, SWEDEN

The Challenge of Global Change
Professor Michael McElroy, Chairman, Department of Earth and
Planetary Sciences, Harvard University
Cambridge, Mass., U.S.A.

SESSION 3 RESPONSES TO CONCERNS

Convenor: Mr. Mohamed Sahnoun
Algerian Ambassador to the United States
Washington, D.C., U.S.A.

**Our Changing Atmosphere: Energy Policies, Air Pollution and
Global Warming**
Dr. Irving M. Mintzer, Senior Associate, World Resources
Institute, Washington D.C., U.S.A.

**International Co-operation in Atmospheric Sciences and the
Changing Atmosphere**
Professor Godwin O.P. Obasi, Secretary-General
World Meteorological Organization, Geneva, SWITZERLAND

Managing the Changing Global Atmosphere through Sustainable Development

Professor Emil Salim, Minister of State for Population and Environment, INDONESIA

Evening

RECEPTION AND DINNER

Host: The Honourable Tom McMillan
Minister of the Environment, CANADA

Speaker: The Honorable Timothy E. Wirth
United States Senate, Washington, D.C., U.S.A.

Tuesday, 28 June 1988

Morning

SESSION 4 SOCIO-ECONOMIC IMPLICATIONS

Convenor: The Honourable Brenda M. Robertson
Senate of Canada, Ottawa, Ontario, CANADA

Food Security in the Changing Global Climate
Professor Suresh Sinha, Professor of Eminence
Water Technology Centre, New Delhi, INDIA

Forests and Atmospheric Change
Dr. Jag Maini, Assistant Deputy Minister
Canadian Forestry Service, Ottawa, Ontario, CANADA

Implications of A Changing Atmosphere on Water Resources
Professor Jaromir Nemeč, Chief, Water Resources, Development
and Management Services, Food and Agriculture Organization,
Rome, ITALY

Natural Disasters and the Human Costs in Urban Areas of Latin America
Dr. Jorge Hardoy, Director, Latin American Office
International Institute for Environment and Development
Buenos Aires, ARGENTINA

Health Effects Issues Associated with Regional and Global Air Pollution Problems
Dr. Lester Grant, Director, Environmental Criteria and
Assessment Office, US EPA,
Research Triangle Park, N.C., U.S.A.

Strategies to Cope with Climate Change
Mr. William Mansfield III, Deputy Executive Director
United Nations Environment Programme, Nairobi, KENYA

Luncheon

Speaker: Sister Aida Velasquez, Luzon Coordinator
Secretariat for an Ecologically Sound Philippines

Afternoon **WORKING GROUPS ON POLICY IMPLICATIONS**

Convenor: H.L. Ferguson, Conference Director
 Assistant Deputy Minister
 Environment Canada, Toronto, Ontario, CANADA

Policy Exercises: Introduction to Working Groups
 Dr. G. Goodman, The Beijer Institute, Stockholm, SWEDEN

Wednesday, 29 June 1988

Morning **Working Groups in Session (Continued)**

Afternoon **SESSION 5 WORKING GROUP REPORTS**

Convenor: Ambassador Stephen Lewis

Evening **SESSION 5 Continued**

Open Session - Briefing of Working Group Reports for Media and
 Observers

Thursday, 30 June 1988

Morning **SESSION 6 CONCLUDING SESSION**

Convenor: Ambassador Stephen Lewis

Presentation and Discussion of the Conference Statement

Panel Discussion: Environment and Development

Panelists: Dr. José Goldemberg, President, University of São Paulo
 São Paulo, BRAZIL

E.H.T.M. Nijpels, Minister of Public Housing,
 Physical Planning and Environment
 THE NETHERLANDS

Yuri Sedunov, State Committee For Hydrometeorology and
 Control of the Natural Environment
 Moscow, USSR

Marcel Masse, Minister of Energy, Mines and Resources
 CANADA

Cheikh Cissokho, Minister of Rural Development
 SENEGAL

Congressman George E. Brown, Jr., 36th District -
 California, U.S. House of Representatives
 Washington, D.C., U.S.A.

Dr. Stephen Schneider, National Center for Atmospheric
Research
Boulder, Colorado, U.S.A.

Professor Emil Salim, Minister of State for Population
and Environment
INDONESIA

Afternoon

Closing Address

The Honourable Tom McMillan

Conference Closing

Ambassador Stephen Lewis

ANNEXE 1

PROGRAMME DE
L'ATMOSPHÈRE EN ÉVOLUTION
IMPLICATIONS POUR LA SÉCURITÉ DU GLOBE

27 au 30 juin 1988

- Congrès inauguré par L'honorable Tom McMillan
Ministre de l'Environnement du Canada
- Sous l'égide du Gouvernement du Canada
Affaires Extérieures
Affaires Indiennes et du Nord
Agence canadienne de développement international
Agriculture
Centre de recherches pour le développement international
Énergie, Mines et Ressources
Environnement
Pêches et Océans
Santé et Bien-être social
Secrétariat d'État
- Soutien financier Programmes des Nations Unies pour l'Environnement
Organisation météorologique mondiale
- Directeur de la conférence Howard L. Ferguson
Sous-ministre adjoint
Environnement Canada
Toronto (Ontario)
Canada
- Secrétaire de la conférence Gordon A. McKay
Service de l'Environnement atmosphérique
Toronto (Ontario)
Canada

Lundi 27 June 1988

Matin Inscriptions et Renseignements

Président de la conférence: M. Stephen Lewis
Représentant permanent du Canada et
Ambassadeur auprès des Nations-Unies

1^{re} SESSION PRÉSENTATIONS D'OUVERTURE

Discours inaugural

Le très honorable Brian Mulroney, C.P., député
Premier ministre du Canada

Discours de circonstance

Mme. Gro Harlem Brundtland
Premier ministre de la Norvège

2^e SESSION FONDAMENTS SCIENTIFIQUES DES QUESTIONS

Animateur: Thomas Malone, Président de Sigma Xi
Collège Saint-Joseph, West Hartford, Conn., É-U.

L'effet de serre à l'échelle mondiale

Dr. F. Kenneth Hare, Président
Conseil de la planification du Programme climatologique
canadien, Toronto (Ontario), Canada

L'ozone atmosphérique

Dr. Robert Watson, Chef, Upper Atmosphere Research Program
National Aeronautics and Space Administration, Washington,
D.C., E-U.

Déjeuner

Conférencier: David T. Buzzelli
Président du Conseil Dow Chemical Canada Inc.
Sarnia (Ontario) Canada

Après-midi

2^e SESSION - (suite)

Transport à longue distance des polluants atmosphériques

Dr. Göran Persson, Directeur général adjoint
Conseil national de protection de l'environnement (SNV)
Solna, Suède

Relations entre substances chimiques et impacts écologiques

Professeur Michael McElroy, Président, Département des
sciences planétaires et de la Terre, Université Harvard
Cambridge, Mass., E-U.

3^e SESSION RÉPONSES AUX QUESTIONS

Animateur: Mr. Mohamed Sahnoun
Ambassadeur d'Algérie auprès des États-Unis
Washington, D.C., E-U.

Notre atmosphère en évolution : Les politiques énergétiques,
la pollution de l'air et le réchauffement mondial

Dr. Irving M. Mintzer, Directeur associé principal, Institut
des ressources mondiales, Washington, D.C., É-U.

Coopération internationale dans le domaine des sciences
atmosphériques et de l'atmosphère en évolution

Professeur Godwin D.P. Obasi, Secrétaire-général
Organisation météorologique mondiale, Genève (Suisse)

Environnement et Développement
 Professeur Emil Salin, Ministre d'état pour la population et
 l'environnement, Indonésie

Soir

RECEPTION ET DÎNER

Hôte: L'honorable Tom McMillan
 Ministre de l'Environnement du Canada

Conférencier: L'honorable Timothy E. Wirth
 Sénat des États-Unis, Washington, D.C., É-U.

Mardi 28 juin 1988

Matin

4^e SESSION RÉPERCUSSIONS SOCIO-ÉCONOMIQUES

Animateur: L'honorable Brenda M. Robertson
 Sénat du Canada, Ottawa (Ontario) Canada

La sécurité alimentaire en présence d'un climat mondial en
 évolution

Professeur Suresh Sinha, Professeur éminent
 Centre des techniques de l'eau, Nouvelle Delhi, Inde

Les forêts et changements atmosphériques

Dr. Jag Maini, Sous-ministre adjoint
 Service canadien des Forêts, Ottawa (Ontario) Canada

Incidences de l'évolution de l'atmosphère sur les ressources
 en eau

Professeur Jaromir Nemeč, Chef, Service d'exploitation et de
 la gestion des ressources en eau de l'Organisation des
 Nations Unies pour l'alimentation et l'agriculture (OAA)
 Rome, Italie

Les désastres naturels et leurs répercussions sur les
 populations urbaines de l'amérique latine

Dr. Jorge Hardoy, Directeur, Bureau latino-américain
 Institut international pour l'environnement et développement
 Buenos Aires, Argentine

Conséquences de la pollution atmosphérique régionale et
 mondiale pour la santé humaine

Dr. Lester Grant, Directeur, Environmental Criteria and
 Assessment Office, US EPA,
 Research Triangle Park, N.C., É-U.

Stratégies d'adaptation au climat en évolution

Mr. William Mansfield III, Directeur adjoint
 Programme des Nations Unies pour l'environnement, Nairobi,
 Kenya

Déjeuner Conférencier: Soeur Aida Velasques, Luzon Coordinator
Secretariat for an Ecologically Sound Philippines

Après-midi **GROUPES DE TRAVAIL SUR LES RÉPERCUSSIONS POLITIQUES**

Animateur: H.L. Ferguson, Sous-ministre adjoint
Environnement Canada
Toronto (Ontario) Canada

Exercices de politiques : Introduction aux groupes de travail
Dr. G. Goodman, Institut Beijer, Stockholm, Suède

Mercredi 29 juin 1988

Matin **Groupes de travail sur les répercussions politiques (suite)**

Après-midi **5^e SESSION RAPPORTS DES GROUPES DE TRAVAIL**

Animateur: L'Ambassadeur Stephen Lewis

Soir **5^e SESSION (suite)**

Session Ouverte - Instructions des rapports des groupes de travail
pour les médias et les observateurs

Jedi 30 juin 1988

Matin **6^e SESSION CLÔTURE**

Animateur: L'Ambassadeur Stephen Lewis

Présentation et discussion de la déclaration de la conférence

Table ronde sur l'environnement et le développement

Spécialistes: Dr. José Goldemberg, Président, Université de Sao Paulo
São Paulo, BRESIL

E.H.T.M. Nijpels, Ministre des logements sociaux, de
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Pays-Bas

Yuri Sedunov, Comité d'État pour l'Hydrométéorologie et
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Moscow, USSR

Marcel Masse, Ministre de l'Énergie, Mines et Ressources
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Cheikh Cissokho, Ministre du développement rural
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M. George E. Brown fils, Membre du Congrès
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États-Unis
Washington, D.C., É.-U.

Dr. Stephen Schneider, (NCAR) Centre National en
Recherche Atmosphérique
Boulder, Colorado, É.-U.

Professeur Emil Salim, Ministre d'État pour la popula-
tion et l'environnement
Indonésie

Après-midi **Allocution de clôture**

L'honorable Tom McMillan

Clôture de la Conférence

L'ambassadeur Stephen Lewis

APPENDIX 2

STATEMENT BY THE PRESIDENT OF THE WORLD METEOROLOGICAL ORGANIZATION
TO THE WORLD CONFERENCE ON THE CHANGING ATMOSPHERE

Zou Jingmeng
People's Republic of China

Your Excellency Mr. McMillan, distinguished guests, ladies and gentlemen.

First of all, allow me to express my sincere thanks for your invitation and regret that I am unable to participate in this important Conference, at this time, because of the commitments of my domestic office.

On behalf of the World Meteorological Organization and in my name, I congratulate you most warmly and wish the Conference every success.

Dear Mr. Minister, and distinguished guests, the major subject of the Conference is to discuss the changing atmosphere and the assessment of its impact on human environment as well as policies in this connection. No question, this is a serious and sublime subject. In the course of the development of human society and industrialization in particular, changes in the atmosphere is becoming more and more pronounced, which gives rise to new problems in the environment where we have human life. In the long-term view, it is essential to the economic development of society, whether or not we can reduce or control the adverse impact of man's activities on the global atmosphere and its changes (subsequent effects). The Canadian Government sponsored and hosted this Conference and provided every facility so that leaders of various governments and scientists from many countries would be able to participate and push forward the study and exploration. I would like to express my appreciation.

WMO, as a United Nations specialized agency has always paid attention to changes in the atmosphere. As early as the late 1950s, WMO started the Global Atmospheric Research Programme to study physical processes in the troposphere and the stratosphere with the aim to improve the forecasting ability. The problem of climate has gradually attracted attention since the 1970s, particularly, since the discovery of the El-Niño and its associated climatic events. The Executive Council at its twenty-ninth session in 1977 decided to institute the World Climate Programme. The First World Climate Conference was convened in 1979. Meanwhile, WMO worked together with ICSU and UNEP in developing the World Climate Programme and its four components:

- Climate Research Programme (WCRP);
- Climate Data Programme (WCDP);
- Climate Applications Programme (WCAP);
- Climate Impact Studies Programme (WCIP).

On a sound scientific basis and in global-scale experiments, many important problems are being tackled in various facets related to global climate. Progress has been made. WMO will convene in 1990 the Second World Climate Conference to review our knowledge of and to explore further climate-related problems.

I am sure that with the joint efforts of decision-makers and scientists, this Conference in Canada will produce positive results that will in turn further draw to the attention of governments and the broad masses of people in various walks of life, the possible impacts of climate change. The Conference will promote the study of policies adapted to each country's situation, thus contributing to the development of human society and the economy.

Once again, I wish the Conference every success.

APPENDIX 3

CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

Lord Caithness
United Kingdom
Minister for the Environment

The principle of sustainable development, to which the United Kingdom is committed, faces possibly its greatest challenge in man-made climate change.

As with many environmental problems, there are great uncertainties about the eventual outcome. It is most important to reduce some of these uncertainties as quickly as possible by co-ordinated international research. I am pleased that the UK is able to play a full part in the World Climate Programme, but also determined that if necessary we should do more.

The size and complexity of the issue means that the uncertainties can be daunting. However, if we are to seek a preventative approach to environmental problems, I believe that we need to set ourselves a timetable for our response that paces the likely development in our understanding over the next ten to fifteen years. In the next few years I see an especially vital role for research. We must establish as soon as possible the scientific credibility of the various scenarios of climate change that are currently being discussed.

Even before that science has been fully established, there are a number of measures that our present understanding could already endorse. For example, the controls on CFCs agreed on last year in Montréal, will not only benefit the ozone layer but also reduce the effect of a number of powerful greenhouse gases. We look forward to the Montréal Protocol entering into force on 1 January next year as planned. In the area of energy, cost-effective measures to promote energy efficiency must be encouraged and emphasis must be placed on realistic energy pricing, reflecting the true cost - including any environmental cost - to the customer. While fossil fuels remain the main sources of power such measures would minimize the amount of carbon dioxide emitted. And we must remember that nuclear power and, in many countries, hydroelectric power are already economically attractive sources with the potential for large-scale development that do not generate greenhouse gases. All these are measures that we should be taking now.

Forests are also an important factor in determining our climate, and we should encourage the good management of world forest resources. The UK Overseas Development Administration is pleased to be able to play its part through support for activities within the international Tropical Forestry Action Plan. This is another example of action taken for sound economic and environmental reasons that would also ameliorate climate change.

The causes and effects of man-made climate change pose difficult and challenging problems, and ones that can only be solved internationally. UNEP and WMO together are well placed to stimulate and co-ordinate this work.

I would like to congratulate the Canadian Environment Minister, Tom McMillan, on his initiative in hosting the meeting in Toronto, and I am sorry that I cannot participate personally. I have asked my delegation, led by my Chief Scientist, Dr. David Fisk, to present this message in my stead. I wish the Conference well in its important task.

APPENDIX 4

PROBLEMS ASSOCIATED WITH SEA-LEVEL RISE AND CLIMATE CHANGE

Sir Peter Marshall
Commonwealth Deputy Secretary-General (Economic)

Canada's partners in the Commonwealth applaud the initiative taken by the Canadian Government in convening this Conference on The Changing Atmosphere: Implications for Global Security. It is an initiative that will play a very important part in raising international consciousness of the problems and in strengthening international determination to take appropriate action to deal with them. I would like briefly to explain the role of the Commonwealth in this regard.

When Commonwealth Heads of Government met in October last year in Vancouver, there was some discussion of environmental issues. The Prime Ministers of India and Zimbabwe, among others, underlined the importance of the concept of "sustainable development", particularly as it had been elaborated by the Brundtland Commission on which the Secretary-General had served, and in which Canadians played such an important part. President Gayoom of the Maldives, in a presentation he later elaborated before the UN General Assembly, described an unprecedented and disastrous inundation of the islands and asked whether or not this was a harbinger of the problems low-lying island states could face with growing frequency if the sea level rose. The President of Bangladesh expressed a similar fear based on his country's experience with sea-borne and other disasters; a modest increase in sea level would not only increase the probability of disasters but flood a substantial amount of densely populated and fertile land. Out of this discussion emerged a consensus that the Commonwealth should attempt a review of the problem in its wider context: how probable climate change and increasingly frequent disasters were; what was the cause; and what options were open to individual countries not just to cope with disasters but to forestall adverse changes by removing their causes.

At the request of Commonwealth Heads of Government, the Commonwealth Secretary-General has set up an expert group under the chairmanship of Dr. Martin Holdgate, who is now the Director-General of the International Union for Conservation of Nature and Natural Resources. The group includes experts from Bangladesh, Canada, Guyana, India, Maldives, New Zealand, Tanzania and Uganda - all serving, as is customary with Commonwealth expert groups, in their private capacities. Collectively they represent a wide range of disciplines, from meteorology through the physical and biological sciences to engineering, economics, and sociology, which are necessary for a synoptic view of such a complicated range of questions. We in the Secretariat are delighted that it has been possible to bring together such a distinguished group. Two of its members are here today in other capacities.

The group will submit their report to Commonwealth Heads of Government when they meet in Kuala Lumpur in October, 1989. Heads of Government at Kuala Lumpur will have very much in mind the Second World Climate Conference which will convene in Geneva in the following year.

The group has held its first meeting and is, of course, still at an early stage in its work. But the methodology that the group are adopting will be of interest to the Conference today. The point of departure is consideration of the substantial volume of scientific evidence and assessment concerning recent changes in climate and possible underlying causes, particularly changing patterns and levels of energy use and changes in agricultural activities. Against this background, the group will be concerned to evaluate the environmental, social and economic impacts of such climate changes, and especially the effects of any sea-level rise on island and low-lying regions. The task will then be to review to what effect practical and feasible protective measures can be taken by the countries likely to be affected: not only, as I suggested earlier, as regards protection against disaster but also as regards forward planning. The next step will be to consider what measures the international community - both within and beyond the Commonwealth - needs to take collectively to complement the measures that countries take individually. Particular emphasis needs naturally enough to be placed on ways of assisting those countries most likely to face adverse effects. Consideration will also need to be given to the best way in which the international community can study these complex scientific and economic questions and resolve outstanding issues, both of science and of policy. The final, most daunting, challenge is to formulate options for possible international action to limit, by acting on underlying causes, man-made climate change.

The main concern of the group, in short, is with the probable developmental impact of climate change; with the practical steps that the governments of the countries concerned can take; and with the supportive and preventive measures that the international community as a whole can adopt.

As I said a moment ago, the group has only just started its work. It is already clear, however, that it faces a problem which will no doubt recur in this meeting: that while within the next century the world will probably experience climate changes on a historically unprecedented time-scale, the degree of scientific uncertainty is such that meaningful planning, especially in particular countries, is extremely difficult. Hence the requirement - and this may be of wider interest to those of you approaching this problem from a policy standpoint - was not to be deflected by the scientific uncertainty but to seek expert advice on a realistic range of probabilities. The advice we received was that it seems reasonable to suppose that global warming from "greenhouse gas" accumulations can be predicted, with a 90% confidence level, to be within the range of 0.8 to 2.8°C by the year 2030 and, with a 45% confidence level, to be in the range of 1 to 2.1°C. The same general confidence can be attached to the prediction of a rise in the sea level. A "best guess" estimate appears to be of 17 to 28 cm by 2030. There are, however, more extreme predictions and of course the date of 2030 has no particular significance; warming is likely to continue for decades afterwards. The group recognizes that even these estimates are conservative and assume that there will be considerable progress in cutting "greenhouse gas" emissions through effective energy conservation policies and the enforcement of the Montréal Protocol on the reduction in the production and use of chlorofluorocarbons. Our work is proceeding on the basis of these assumptions.

What is particularly frustrating for policy-makers is that too little confidence exists in predictions of regional climate change so far, for us to be able to consider the positions of individual members of the Commonwealth, and the practical response open to them. But we have been advised

that regional changes will deviate considerably from the mean and that, on the basis of the current knowledge of climate and ocean dynamics, global warming would mean significant winter warming in high latitudes - affecting Canada and the USSR especially - and greater aridity in existing tropical dry areas, which is of particular concern to Africa and the Indian subcontinent.

Our discussions have so far brought out that what is important in terms of impact is not simply the degree of global warming or sea-level rise but the rate of change. There are particular problems for natural systems (mangroves, corals, forests) that may be unable to adapt fast enough. Current research also suggests a serious potential impact of even small climate changes on commercial crops - such as coffee and cotton. The evidence suggests, too, that there may be an increase in the variance of extreme climate events - that is, in the incidence of disasters. The possibility of an increased risk of sea flooding due to storm surges in low-lying areas is one example, and of particular concern to the Commonwealth Group.

Overall, the capacity of societies to adapt to climate change is constrained by lack of experience (since the changes occur too slowly for individuals to be aware of them), by other, more immediate pressures that require adaptation (such as population growth) and by the lack of opportunities for migration, from areas whose resources become inadequate. The capacity is inevitably least and vulnerability greatest in developing countries, because there are narrower margins of safety, and because there is a greater dependence on land and natural resources. It is this particular vulnerability of developing countries - and the least developed and smallest of them in particular - that we would like the international community to focus on as a matter of priority.

The logic of the situation points to the adoption of preventive strategies rather than to passive acquiescence in damaging changes. In practice, these strategies could centre on CFC control where, thanks to the successful negotiations here in Canada under UNEP, auspicious major strides have been made; and restraint on the use of thermal energy, which we recognize is much more complex and contentious, and which is primarily dependent at present on policies in industrial countries. A meeting of this kind can be particularly valuable in sensitizing public opinion and governments to the need for a long-term future in which energy resources are consumed more frugally and in which there is clear awareness of the damage which could be inflicted on vulnerable societies and on future generations by short-sighted and profligate energy consumption.

I should stress that the Commonwealth exercise is of necessity subject to limitations. The group is not in the business of seeking to advance primary scientific research. But we are already beginning to identify some of the knowledge and research gaps that need to be filled, by ourselves and by others, if there is to be a comprehensive, multi-disciplinary, approach to the problems of climate change and sea-level rise, which we may all agree to be the gravest environmental issue facing humanity. These needs include:

- A comprehensive review of the main research and data collection work being undertaken in the field of climate change by governments and international organizations in order to establish what the gaps (and areas of duplication) and which countries might need help in contributing to research and monitoring activities.

- Surveys, both physical and economic, of the impact that sea-level rise could have on vulnerable low-lying areas. Surveys have been carried out or are being planned for the United States, Egypt, Holland, Maldives and no doubt elsewhere. But little work seems to have been done on some potentially vulnerable low-lying areas - Guyana, Pacific coral islands such as Kiribati, Tuvalu and Tonga and the Asian deltas or low-lying areas (Bangladesh, China, Pakistan among others).
- Making use of recent experience and research resulting from African drought and aridity. An understanding of the nature of the spontaneous response of farmers to changes in climate can help to suggest how adaptation to more fundamental changes might be handled.
- An investigation of possible long-term development implications of climate change. To cite some examples: the planned location of cities and industries; irrigation in low-lying areas; and the problems that might be posed in the area of building standards - for roads, bridges, dams, and flood control systems. These could be radically affected by changes in temperature, moisture and other climate variables.

I mentioned at the outset that Commonwealth Heads of Government would consider the report of the expert group in October next year, that is to say, in advance of the Second World Climate Conference in Geneva. As we see it, one important outcome of our present Conference is to encourage intensive thought about how to prepare for discussion in Geneva of the policy implications, as well as of the fascinating and far-reaching scientific issues. The international community, it could fairly be said, knows that there is a problem. What it is not yet seized of is the best method of organizing itself to deal with it. The task is, of course, a long-term one. But its importance is such as to demand immediate attention. The future begins today.

APPENDIX 5

LIST OF CONFERENCE PARTICIPANTS/
LISTE DES PARTICIPANTS A LA CONFERENCE

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| J. Collinson | - Parcs |
| L. Goulet | - Conservation et Protection |
| E. May | - Cabinet du Ministre |
| J. O'Brian | - Cabinet du Sous-ministre |
| L. Pertus | - Planification |
| F. Roots | - Cabinet du Sous-ministre |
| R.W. Slater | - Planification |

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| S. Cohen | - Service de l'environnement atmosphérique |
| J.G. Côté | - Service de l'environnement atmosphérique |
| D. Egar | - Institut national de recherche sur les eaux |
| G. Fenech | - Service de l'environnement atmosphérique |
| R. Findlay | - Conservation et Protection |
| H. Hengeveld | - Service de l'environnement atmosphérique |
| J. Hollins | - Planification |
| P. Martel | - Service de l'environnement atmosphérique |
| H. Martin | - Service de l'environnement atmosphérique |
| J. Maxwell | - Conservation et Protection |
| B. O'Connor | - Service de l'environnement atmosphérique |
| M. Ouelton | - Planification |
| B. Peters | - Planification |
| D.W. Phillips | - Service de l'environnement atmosphérique |
| J. Reid | - Planification |
| N. Sauvé | - Service de l'environnement atmosphérique |
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| R. Daley | - Environnement |
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| J. Rogers | - Énergie, Mines et Ressources |
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| C. Starrs | - Environnement |
| D. Stewart | - Agriculture |
| J.E. Stewart | - Pêches et Océans |
| R. Torrie | - Torrie-Smith & Associates (Conseil) |
| L. Whitby | - Environnement |