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INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

POLICYMAKERS SUMMARY

WORKING GROUP III

RESPONSE STRATEGIES WORKING GROUP

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REPORT OF THE

INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE
RESPONSE STRATEGIES WORKING GROUP

EXECUTIVE SUMMARY

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1.0 INTRODUCTION

Global climate change is an issue which concerns the entire international community. Should significant climate change occur, the effects on the global environment and the resources relied upon by mankind and natural ecosystems could be significant. As described in the IPCC Impacts Working Group report, these could include a rise in the sea level and impacts on agriculture, forestry, ecosystems and biodiversity, hydrology and water resources, oceans, and human settlements.

The IPCC's Response Strategies Working Group (RSWG) explored possible options for responding to climate change at the national, regional, and international levels. In carrying out this work the RSWG considered the anthropogenic sources of greenhouse gas emissions, a range of measures for limiting the increase in atmospheric concentrations of such gases, and options for adapting to possible climatic changes. The RSWG also reviewed specific mechanisms for implementing response strategies, including a possible framework convention on climate change.

The RSWG has identified a large number of short and long term response options for consideration by members of the international community in addressing climate change. These include a wide array of options for limiting net greenhouse gas emissions from the energy, industry, agriculture, and forestry sectors through the adoption of a variety of technologies and resource use strategies. Measures have also been identified which may enhance the ability of coastal regions and natural resources to adapt to a changing climate.

Because of the short time frame involved in the preparation of this report, it was not possible to carry out a complete review of all aspects of climate change response options. The costs, effectiveness, and other economic and social implications of each of these options have not been evaluated and require further analysis. In addition, the effectiveness and desirability of specific options will depend on circumstances which vary substantially from country to country. Hence, much analysis needs to be done on an individual country by country basis.

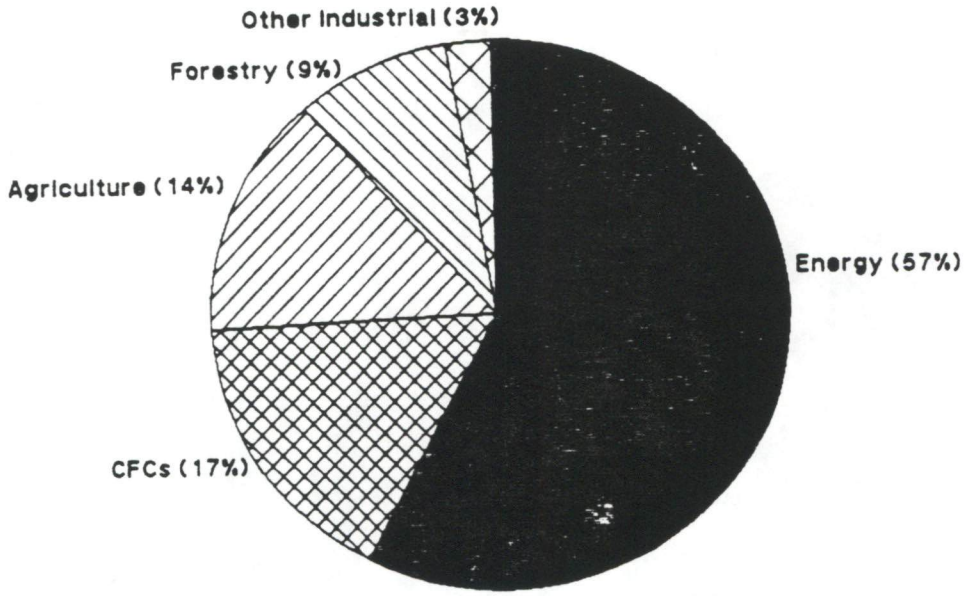
Nonetheless, this report provides an important interim assessment for policy makers. It identifies the major issues which need to be considered in the development of national, regional, and international climate change response strategies. The report also provides an overview of the main issues which should be considered in future international negotiations related to climate change.

2.0 ANTHROPOGENIC GREENHOUSE GAS SOURCES

A wide range of human activities result in the release of greenhouse gases into the atmosphere. Anthropogenic emissions can be categorized as arising from energy production and use, non-energy industrial activities (primarily the production and use of CFCs), agricultural systems, and changes in land-use patterns (including deforestation and biomass burning). The relative contributions of these activities to radiative forcing are shown below in Figure 1 (see Science Working Group report for further explanation of the radiative forcing of the various greenhouse gases).

Figure 1

Current Anthropogenic Contributions to Radiative Forcing by Sector



The largest anthropogenic source of radiative forcing is energy production and use. The consumption of energy from fossil fuels (coal, petroleum, and natural gas) for industrial, commercial, residential, transportation, and other purposes results in large emissions of CO2 and other gases and accounts for an estimated 57 percent of the radiative forcing resulting from human activities. Industrial activities not related to energy use comprise another 20 percent of anthropogenic contributions. The vast majority of these emissions result from the production and use of CFCs and other halocarbons in various industrial processes.

Agricultural systems account for about 14 percent of the radiative forcing resulting from human activities. Significant amounts of methane are released in the process of rice cultivation and from livestock systems, while nitrous oxide is released during the use of nitrogenous fertilizers. Approximately 9 percent of anthropogenic contributions are the result of deforestation, biomass burning, and other land-use patterns which release CO2, methane, and nitrous oxide.

Estimates of current greenhouse gas emissions, however, are imprecise because of uncertainties regarding both total emissions and emissions from each source. Emissions from certain sources are particularly difficult to measure. For example, estimates of CO2 emissions from deforestation and of methane emissions from rice cultivation, livestock systems, and biomass burning vary by factors of two or more.

3.0 FUTURE GREENHOUSE GAS EMISSIONS

Greenhouse gas emissions from most sources are likely to increase significantly in the future. As economic and population growth continues,

in particular in the developing countries, there is expected to be an increase in energy use, industrial and agricultural activity, deforestation, and other activities which result in greenhouse gas emissions. Although some controls have been put in place under the Montreal Protocol for certain CFCs and halons, emissions of CO2, methane, nitrous oxide, and other greenhouse gases are likely to increase under current patterns of economic activity and growth.

However, there are significant limitations on our ability to estimate future rates of population and economic growth, individual behavior, technological innovation, and other factors which are crucial for determining emission rates over the course of the next century. This lends very great uncertainty to projections of greenhouse gas emissions over several decades or longer. Reflecting these inherent difficulties, the RSWG's work on emissions scenarios is incomplete and preliminary.

3.1 Emissions Scenarios

One of the RSWG's first tasks was to prepare some initial scenarios of possible future greenhouse gas emissions for the use of the three IPCC Working Groups. An experts' group was formed which looked at four hypothetical future patterns of greenhouse gas emissions and their effect on the atmosphere. The cumulative effect of these emissions was calculated using the concept of equivalent CO2 concentrations (e.g. the contributions of all greenhouse gases to radiative forcing are converted into their equivalent in terms of CO2 concentrations).

The scenarios assumed future emissions patterns which would result in: (1) the equivalent of a doubling of atmospheric concentrations of CO2 from pre-industrial levels* by about 2030, with continued increases throughout the century; (2) the equivalent of a CO2 doubling by approximately 2060, with continued increases; (3) the equivalent of a CO2 doubling by about 2090, with stabilization of atmospheric concentrations of greenhouse gases thereafter; and (4) the stabilization of atmospheric concentrations of greenhouse gases at a level less than a CO2 equivalent doubling.

The first of the scenarios, called the 2030 High Emissions Scenario, assumes that few or no steps are taken to limit greenhouse gas emissions. Energy use and clearing of tropical forests continues and fossil fuels, in particular coal, remain the world's primary energy source. The Montreal Protocol comes into effect but without strengthening and with less than 100 percent compliance. Under this scenario, the equivalent of a doubling of pre-industrial CO2 levels occurs by around 2030.

The second of the scenarios, the 2060 Low Emissions Scenario, assumes that a number of environmental and economic concerns result in steps to reduce the growth of greenhouse gas emissions. Energy efficiency measures, which

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* **The total radiative forcing at any time is the sum of those from the individual greenhouse gases. For simplicity, total forcing is expressed in terms of the amount of CO2 which would give that forcing; this is termed the equivalent carbon dioxide concentration (see the Science Working Group report).**

might only be possible with government intervention, are implemented, emissions controls are adopted globally, and the share of the world's primary energy provided by natural gas increases. Full compliance with the Montreal Protocol is achieved and tropical deforestation is halted and reversed. Under this scenario, the cumulative effect of such measures is a CO2 equivalent doubling around 2060.

The remaining two scenarios reflect futures where steps in addition to those in the 2060 Low Emissions Scenario are taken to reduce greenhouse gas emissions. These steps include rapid utilization of renewable energy sources, strengthening of the Montreal Protocol, and adoption of agricultural policies to reduce emissions from livestock systems, rice paddies, and fertilizers.

All of the above scenarios, while hypothetical and based on highly variable assumptions, provide a conceptual basis for considering possible future patterns of emissions and the broad responses that might affect those patterns. However, they represent assumptions rather than cases derived from specific studies. In addition, no assessment was made of the economic costs, technological feasibility, or market potential of the underlying policy assumptions.

3.2 Reference Case

In addition to these scenarios, the RSWG obtained a limited amount of data from various sources on possible greenhouse gas emissions from a number of countries over the next several decades, under the assumption that no specific efforts are made to limit such emissions. Estimates of future emissions of CO2 and methane from the energy sector were developed based on the work of analysts from over 21 countries and submissions from various international organizations. Future emissions of CO2 from tropical deforestation represent the average of two scenarios adopted by RSWG agriculture and forestry experts.

Global estimates of greenhouse gas emissions over the next several decades were derived from these studies through a process of integration. This has been labelled the "Reference Case". However, the various studies used differing assumptions and methodologies, thus complicating the integration process. As a result, the final emissions estimates are subject to considerable uncertainty.

The Reference Case, which was projected to the year 2025, contains higher emissions of CO2 and methane than any of the emissions scenarios discussed in Section 3.1 above. It indicates a sharp increase in CO2 emissions from fossil fuel combustion, from 5.2 billion tons of carbon (Bt C) in 1985 to 12.2 Bt C in 2025. Methane emissions from coal mining and natural gas production and transport also increase rapidly as fossil fuel use increases. The mid-range estimate of CO2 emissions from deforestation increases from 1.7 Bt C in 1985 to 2.6 Bt C in 2025. Emissions from the agriculture sector, on the other hand, grow more slowly than from the energy sector or from deforestation.

CO2 emissions in the Reference Case are nearly 20 percent greater than those in the 2030 High Emissions Scenario, while methane emissions are more than 10 percent higher. The emissions projected under the

Reference Case, with the comparable figures from the 2030 High Emissions Scenario, are shown in Table 1. Nitrous oxide and CFC emissions, as well as methane emissions from biomass sources, are not shown since such estimates were not developed for the Reference Case.

Table 1

Greenhouse Gas Emissions from the RSWG Scenarios

	Reference Case		2030 High Emissions Scenario	
	1985	2025	1985	2025
CO_2 Emissions (Bt C)				
Energy	5.2	12.4	5.3	10.2
Deforestation	1.7	2.6	0.7	1.4
Cement	0.1	0.2	0.1	0.2
Total	**7.0**	**15.2**	**6.1**	**11.8**
CH_4 Emissions (Tg CH_4)				
Coal Mining	44	126	35	85
Natural Gas	22	59	45	74
Rice	110	149	110	149
Enteric Ferm.	75	125	74	125
Animal Wastes	37	59		
Landfills	30	60	40	71
Subtotal	**318**	**577**	**304**	**503**
Biomass Burning			57	79
Natural			179	179
Total			**541**	**761**

At the IPCC Second Plenary Session in June 1989 participants agreed that the 2030 High Emissions Scenario should be labelled the "business-as-usual" scenario, i.e. the level of atmospheric concentrations of greenhouse gases which might occur in the absence of policies to limit emissions. The Reference Case was developed after the IPCC's Second Plenary Session. At least for emissions of CO2 and methane, the Reference Case is closest to the 2030 High Emissions Scenario. As noted above, however, all of these figures are subject to considerable uncertainty. They thus cannot be considered to be predictions of future emissions patterns. Research on future emissions is an important area for further cooperative work.

The Reference Case also indicates that future emissions patterns by world region may be significantly different than those which exist at the present time. It is estimated that, of global CO2 emissions in 1985, emissions from the OECD countries accounted for nearly 50 percent of global emissions, emissions from centrally planned European countries about 25 percent, and emissions from the rest of the world the remaining 25 percent. The Reference Case indicates that by 2025, under the assumptions used in the case studies, these ratios of global CO2 emissions could be around 33, 22, and 44 percent, respectively, for the OECD, centrally planned Europe, and the rest of the world.

4.0 RESPONSE STRATEGIES FOR ADDRESSING CLIMATE CHANGE

Because climate change could potentially result in significant impacts on the global environment and human activities, it is important to begin considering now what measures might be taken in response. The RSWG identified a wide range of options for the international community to consider. These include measures both to limit net greenhouse gas emissions and to increase the ability of society and ecosystems to adapt to a changing climate.

The consideration of climate change response strategies, however, presents formidable difficulties for policy makers. On the one hand, the information available to make sound policy analyses is inadequate because of: (a) remaining scientific uncertainties regarding the magnitude, timing, rate, and regional consequences of potential climate change; (b) uncertainty with respect to how effective specific response options or groups of options would be in actually averting potential climate change; and (c) uncertainty with respect to the costs, effects on economic growth, and other economic and social implications of specific response options or groups of options. On the other hand, the potentially serious consequences of climate change on the global environment may support implementation of some response strategies even in the face of such significant uncertainties.

Recognizing these factors, a large number of options were preliminarily assessed. It appears that some of these options may be economically and socially feasible for implementation in the near-term while others, because they are not yet technically or economically viable, may be more appropriate for implementation in the longer-term. In general, the RSWG found that the most effective response strategies, especially in the short-term, are those which are:

- Beneficial for reasons other than climate change and justifiable in their own right, for example increased energy efficiency, better management of forests and other natural resources, and reductions in emissions of CFCs and other ozone depleting substances that are also radiatively important gases;

- Economically efficient and cost effective, in particular those that use market-based mechanisms;

- Able to serve multiple social, economic, and environmental purposes;

- Flexible, so that they can be easily modified to respond to increased scientific and economic understanding of climate change;

- Compatible with the concept of sustainable economic growth and development;

- Administratively practical and effective in terms of application, monitoring, and enforcement; and

- Which reflect obligations of both developed and developing countries in addressing this issue, while recognizing the special needs of developing countries.

The degree to which options are viable will also vary considerably depending on the region or country involved. For each country, the socioeconomic implications of specific options will depend on its social, environmental, and economic context. Only through careful analysis of all available options will it be possible to determine which are best suited to the circumstances of a particular country or region.

5.0 OPTIONS FOR LIMITING GREENHOUSE GAS EMISSIONS

The RSWG reviewed potential measures for mitigating climate change by limiting net emissions of greenhouse gases from the energy, industry, transportation, forestry, agriculture, and other sectors. These measures include those which limit emissions from greenhouse gas sources (such as energy production and use) as well as those which increase the use of natural sinks (such as forests and other biomass) for sequestering greenhouse gases. A discussion of both short and long term options for each major emissions sector is provided below.

5.1 Limitation of Net Emissions from the Energy Sector

The energy sector plays a vitally important role in economic well-being and development for all nations. At the same time, because energy production and use accounts for an estimated 57 percent of current anthropogenic greenhouse gas emissions, energy policies need to ensure that sustained economic growth occurs in a manner that, globally, conserves the environment for future generations. However, there is no single, quick-fix technological option for limiting greenhouse gas emissions from energy sources. A comprehensive strategy is necessary which deals with improving efficiency on both the demand and supply sides as a priority and emphasizes technological research, development, and deployment.

Various potential options have been identified for reducing greenhouse gas emissions from energy systems. The most relevant categories of options appear to be:

- efficiency improvements and conservation in energy supply, conversion, and end-use[1];

- fuel substitution by energy sources which are lower emitters of greenhouse gases[2] (e.g. natural gas, nuclear, and renewable sources); and

- reduction of greenhouse gas emissions by removal, fixation, or the maintenance and enhancement of sinks[3].

From an analysis of the technologies in these categories, it appears that some technologies are available now or in the short-term with at least some economic and market potential while others need further development to lower costs or to improve their environmental characteristics. Tables 2 and 3 provide various examples of technological options within each of the broad categories defined above, and their possible application in the short, medium, and longer-term.

This distinction among time frames is used in order to reflect the remaining technological needs in each category and to assist in formulating technological strategies. Short-term technologies are those which apparently are or will be both technically and economically ready for introduction and/or demonstration up to the year 2005 and beyond. Mid-term technologies are those which, while technically available now, are not yet economic and thus may not be implemented until the period from 2005 to 2030. Longer-term technologies are not yet available but may emerge after 2030 as a result of research and development.

The technical, economic, and market potential of technological options will vary depending upon the sector in which they are to be applied. The technical potential of an energy technology is its capacity to reduce potential emissions, irrespective of the costs involved, and is largely a function of technical feasibility and resource availability. Economic potential refers to whether the application of the options is economically efficient and cost-effective - it may be significantly less than technical potential where there are positive resource costs. Market potential refers to whether the consumer or user is likely to adopt the option - it might be even less than economic potential due to market imperfections, attitudes to risk, and the presence of non-monetary costs.

There is, in general, extensive information available on the technical potential of the many technological options listed. The economic and market potential, however, depends on the specific circumstances (national, local and even sectoral) in which the option is to be applied and thus can only be analyzed on a country by country basis. Hence, much important analysis can be done only on an individual country by country basis.

The short-term technological potential of particular relevance to the developed world is discussed by sector below. Technological potential for developing countries has not been developed in the same detail due to a lack of information.

Transportation Sector:

Substantial technical potential exists for fuel substitution through the use of fuels derived from natural gas, ethanol, or other fuels from biomass sources[4]. Substantial technical potential also exists for electric or hydrogen-fueled vehicles, which could also reduce emissions with appropriate primary energy sources. Presently, however, the economic and market potentials of most of these options are very low because (a) petroleum fuels are relatively cheap; (b) alternative non-CO2 producing fuels are relatively costly; and (c) some alternative vehicular technologies have performance drawbacks.

The technical potential for vehicle efficiency improvements is significant despite the substantial improvements already made. Economic and market potentials are constrained, however, by replacement rates of vehicles, consumer demand and preference for larger, more powerful and better equipped cars, and higher incremental costs. Improved driver behavior, vehicle maintenance, traffic management, and promotion of public transportation could also reduce CO2 emissions.

Buildings Sector:

The technical potential for energy efficiency gains in the residential and commercial sectors is substantial[5]. Energy requirements for heating and cooling new homes could be roughly half the current average. Retrofitting existing homes could reduce energy requirements an average of around 25 percent. In addition, reductions of energy use in existing commercial buildings of at least 50 percent may be technically feasible, while new commercial buildings could be up to 75 percent more efficient than existing commercial buildings.

However, market potential is lower and depends on the building's replacement rate. The realization of significant gains in this sector requires the involvement of government, the many concerned institutions, and ultimately the individual residential or commercial consumer. This sector therefore requires special efforts in order to achieve substantial levels of market penetration of energy efficient technologies which are also economic. Institutional barriers must be removed and careful attention given to the design of research and development programs for this sector.

Industry Sector:

The technical potential for efficiency improvements in the industry sector ranges from 13 percent in some sub-sectors to over 40 percent in others[6]. The most dramatic efficiency improvements over the last 15 years have been in the energy-intensive industries. Technical options exist for accelerating this trend and for achieving similar savings in other industries. Such options stem mainly from recent improvements in process technologies, as well as better design and materials. Considerable opportunities for energy savings exist in the industrial sector by the recycling of energy-intensive waste. There may also be significant technical potential for reducing greenhouse gas emissions through industrial fuel switching, especially since many industrial boilers are already dual-fuel capable with natural gas being the fuel typically substituted for fuel oil under present circumstances. Combined heat and power, cogeneration, combustion of biomass wastes, methane from landfills, and other renewable energy sources also have potential to reduce growth in emissions.

Electricity Sector:

Under current price conditions, both efficiency and fuel substitution are largely dependent on the rate of retirement of existing power plants, the growth in demand for electricity, and the cost of the replacement plant[6]. The technical potential for greater efficiency in electricity generation can be in the range of 15 to 20 percent (with lower gains for plants which are already relatively efficient). Fuel substitution could achieve in the range of 30 percent (from oil to natural gas) to 40 percent (from coal to natural gas). Much greater

reductions would be possible with greater penetration of low-emitting sources such as nuclear power, hydroelectric, or other renewable energies[7]. In addition, the electricity sector has the technical potential to substantially increase its efficiency where cogeneration of electricity and heat or combined cycle power generation can be applied.

The economic potential for greater fuel efficiency is considerably lower and for substitution from coal or oil to natural gas or non-fossil fuel is critically dependent on the relative prices and availability of the fuels in question. In evaluating switching between fossil fuels it is necessary to account for potential increases in methane emissions from the production and transmission of the fuels in calculating the net benefit of such strategies. Overall, efficiency of the electricity system can be improved through the use of least cost utility planning, whose goal is to meet energy service requirements through the least cost combination of supply additions and demand management.

5.2 Limitation of Net Emissions from the Industry Sector

The most significant source of greenhouse gases associated with industrial activity not related to energy use is the production and use of CFCs and other halocarbons. CFCs represent a very important source of greenhouse gas emissions, about 17 percent of global contributions to radiative forcing. However, the RSWG did not consider control strategies for these gases since this issue is already addressed under the Montreal Protocol on Substances that Deplete the Ozone Layer.

5.3 Limitation of Net Emissions from the Agriculture Sector

About 14 percent of anthropogenic greenhouse gas emissions can be attributed to the agricultural sector, in particular livestock systems, rice cultivation, and the use of nitrogenous fertilizers. Limitation of emissions from this sector presents a challenge because the processes by which greenhouse gases, in particular methane and nitrous oxide, are released in agricultural activities are not well understood. In addition, response options in the agricultural sector must be designed to ensure maintenance of food supply. There appear, however, to be a number of short-term response options, some economically viable in their own right, which could contribute to a limitation of net emissions from agricultural sources. In addition, there are a number of promising technologies and practices which, in the longer-term, could significantly reduce greenhouse gas emissions.

Short-Term Options:

Livestock systems: Methane emissions could be reduced through improved management of livestock wastes; expansion of supplemental feeding practices; and increased use of production and growth enhancing agents[8].

Fertilizer use: Nitrous oxide emissions may be reduced by using improved fertilizer formulations and application technology and practices.

Marginal lands: Areas marginally suitable for annual cropping systems may be shifted to perennial cover crops for fodder or pastoral land uses, or forests if soils are suitable. Such actions would increase carbon uptake, both in the vegetation and soil, and would yield other benefits.[9]

Sustainable agricultural practices: Where appropriate, minimum or no-till systems should be introduced for those countries currently using tillage as part of the annual cropping sequence, thus increasing soil organic matter and reducing CO2 emissions.

Longer-Term Options:

Rice cultivation: A comprehensive approach, including management of water regimes, improvement of cultivars, efficient use of fertilizers, and other management practices, could lead to a 10 to 30 percent reduction in methane emissions from flooded rice cultivation, although substantial research is necessary to develop and demonstrate these practices.[10]

Livestock: Through a number of technologies it appears that methane emissions may be reduced from livestock systems by 25 to 75 percent per unit of product in dairy and meat production, although many uncertainties exist.

Fertilizers: Fertilizer-derived emissions of nitrous oxide potentially can be reduced (although to what extent is uncertain) through changes in practices such as using fertilizers with controlled nitrogen conversion rates, improving fertilizer-use efficiency, and adopting alternative agricultural systems.

5.4 Limitation of Net Emissions from Forestry and Other Activities

Forestry practices and other human activities associated with land-use, such as biomass burning and landfills, account for about 9 percent of anthropogenic greenhouse gas emissions. A number of short and long term response options for limiting net emissions from these sectors have been identified.

Short-Term Options:

Forestry: Development and implementation of policies to reduce deforestation and forest degradation and to ensure the health and sustainable management of existing forests in order to enhance CO2 sinks.[11]

-- Substitution of wood for high energy input materials and further recycling of forest products in order to enhance long term CO2 storage.

-- Strengthening and extension of existing international institutions and programs such as the Tropical Forestry Action Plan process and the International Tropical Timber Organization.

-- Development of a global network of remote sensing data collection and analysis stations to provide the real-time data on deforestation and biomass burning patterns necessary for national forestry plans and fire management.

-- Conversion of marginal agricultural land to forests in order to enhance CO2 sequestering.

-- Replacement of fossil energy sources with wood through the use of managed sources of biomass, such as greater or more efficient fuel-wood plantations, in particular in temperate and boreal regions.

Biomass Burning: Reduction of biomass burning through fire management programs and widespread use of alternative sustainable agricultural practices.

Waste Management: Development of landfill methane recovery systems and flaring and biogas systems to treat wastewater in order to reduce methane emissions.[12]

Longer-Term Options:

Forestry: Development and implementation of improved silvicultural measures and genetically improved trees to increase wood production and thus foster carbon fixation.

-- Enhancement of forest protection through the incorporation of strategies for fire, insects, and diseases into future management plans and through the development of silvicultural adjustment and stress management strategies.

-- Development of national plans to expand temperate forest biomass which are intensively managed, thereby providing specific opportunities to limit net CO2 emissions.

-- Integration of agriculture and forestry plans in a manner which reconciles the demands on tropical forests for the expansion of agriculture.

Biomass burning: Widespread adoption of sustainable agricultural practices, use of biomass as a fuel, and improved fire management and protection systems in order to reduce trace gas emission from biomass burning and other land use practices.

Waste Management: Use of gas collection and flaring to reduce methane emissions from landfills and development of biogas plants to reduce methane emissions from wastewater treatment. Demonstration, training, and technology transfer are necessary to realize these potentials, which may range from 30 to 90 percent for landfills and up to 100 percent for wastewater treatment.

6.0 TARGETS AND TIMETABLES FOR GREENHOUSE GAS EMISSIONS

There has been considerable international discussion of targets for specific greenhouse gas emissions, in particular CO2, which is the most abundant of the gases. At the November 1989 Noordwijk Conference on Atmospheric Pollution and Climatic Change, the final declaration called on the IPCC to examine possible quantitative targets for greenhouse gas emissions, including a stabilization of CO2 emissions by the year 2000 and a 20 percent reduction in CO2 emissions by 2005. The Conference also called for assessing the feasibility of increasing net global forest growth by 12 million hectares per year.

The RSWG has made consideration of the feasibility of quantitative targets a priority task, although it was not possible to complete such an analysis by the time of this report's publication. The primary constraint on conducting this analysis is the serious lack of data on the economic and social costs of the various response options for limiting net greenhouse gas emissions. While the technical potential of a number of options has been demonstrated, there is very little information available on the actual economic costs associated with implementation of such options. An adequate understanding of the benefits, in terms of changes in climate variables that are avoided, is also seriously lacking. It is imperative that further work on the cost and benefit implications of response strategies be undertaken. These issues have been identified as one of the most important areas for future research by the RSWG, concerned international organizations, and individual countries.

In addition, it appears that the capacity of regions and countries varies greatly. Using a scenario based on 20 country studies submitted to the RSWG, some broad generalizations are possible for the energy sector:

- West European countries, including the European Community, may be able to stabilize or reduce CO2 emissions by early in the next decade through a variety of measures including taxes, energy efficiency programs, nuclear power, natural gas, and renewables.

- East European countries and the USSR may be able to slow the growth of or stabilize CO2 emissions over the next two decades, if policies to restructure their economies, increase efficiency, and promote economic development and substitution are successfully implemented.

- Developing countries may be able to reduce the annual growth in CO2 emission from over 3 percent to around 2 percent, while maintaining economic growth. The largest opportunities in developing countries appear to be increased efficiency in both energy supply and demand.

- North American and Pacific OECD countries may be able to slow the growth in CO2 emissions by increased efficiency in energy supply and demand, fuel switching to nuclear, natural gas and renewables, and other measures.

7.0 MEASURES FOR ADAPTING TO CLIMATE CHANGE

In addition to the limitation options discussed above, the RSWG reviewed measures for adapting to potential climate change. The consideration of adaptation options is critical for a number of reasons. First, because it is believed that there is likely to be a lag time between emissions and subsequent climate change, the climate may already be committed to a certain degree of change. Implementation of adaptation measures may thus be necessary regardless of any limitation actions which may be taken. Secondly, natural climatic variability itself necessitates adaptation.

Furthermore, should significant adverse climate change occur, it would be necessary to consider limitation and adaptation strategies as part of an integrated package in which policies adopted in the two areas complement each other so as to minimize costs. Limitation and adaptation options

should be developed and analyzed recognizing the relationship between the timing and costs of limitation and adaptation. For example, the slower the rate of climate change, the easier it would be to adapt, and vice versa. It is similarly important to address those cases where limitation and adaptation policies may work at cross purposes. A truly comprehensive approach should recognize that controlling the different gases might have different effects on the adaptive capacity of natural resources.

The RSWG explored two broad categories of adaptation options:

- o Coastal zone management, or options which maximize the ability of coastal regions to adapt to possible sea level rise and increased frequency and severity of storms; and

- o Resource use and management, or options which address the potential impacts of climate change on food security, water availability, natural and managed ecosystems, land, and biodiversity.

7.1 Coastal Zone Management

Global climate change is projected to raise sea level by as much as [Note: figure to be obtained from WGI] and, in some areas, to increase the frequency and severity of storms. Although there remain substantial uncertainties regarding the possible rate and magnitude of sea level rise, hundreds of thousands of square kilometers of coastal wetlands and other lowlands could be inundated, while ocean beaches could erode perhaps as much as one hundred meters over the next century. Flooding could threaten lives, agriculture, livestock, and structures, while saltwater could advance inland into aquifers, estuaries, and soils, thus threatening water supplies, ecosystems, and agriculture in some areas.

Some nations would be particularly vulnerable to such changes. Eight to ten million people live within one meter of high tide in each of the unprotected river deltas of Bangladesh, Egypt, and Vietnam. Half a million people live in various coral atoll nations that lie almost entirely within three meters of sea level, such as the Maldives, the Marshall Islands, Tuvalu, Kiribati, and Tokelau. Even in nations that are not, on the whole, particularly vulnerable to sea level rise, some low-lying areas or regions dependent on fisheries resources could be threatened.

Available responses to sea level rise fall broadly into three categories:

- o Retreat: Under this option no actions would be taken to protect the land from the sea - the focus would instead be on providing for people and ecosystems to shift landward in an optimal fashion. This choice could be motivated by either excessive costs of protection or by a desire to maintain ecosystems.

- o Accommodation: Under this strategy, while no attempt would be made to protect the land at risk, measures would be taken to allow for continued habitation of the area. Specific responses under this options would include erecting flood shelters, elevating buildings on pilings, converting agriculture to fish ponds, or growing flood- or salt-tolerant species.

o Protection: A protection strategy uses site-specific features such as sea walls, dikes, dunes, and vegetation to protect the land from the sea so that existing land uses can be retained.

There are varying socio-economic implications for each of these options. Retreat could lead to a loss of property, potentially costly resettlement of populations, and, in some notable cases, refugee problems. Accommodation could result in declining property values, increased damage from storms, and costs for modifying infrastructure. The protection option would involve the considerable economic costs of building sea walls and other structures (even ignoring the impacts of flooding and salt water intrusion, a one meter rise would require 360,000 kilometers of coastal defenses) and could have negative impacts on fisheries, wildlife and recreation. The loss of traditional environments could potentially disrupt family life and create social instability.

Actions to Prepare for Possible Sea Level Rise:

A number of response options are available which not only enhance the ability of coastal nations to adapt to sea level rise, but are also beneficial in their own right. Implementation of such options would be most effective if undertaken in the short-term, not because there is an impending catastrophe, but because there are opportunities to avoid adverse impacts by acting now - opportunities which may not be as effective if the process is delayed. These options include:

National Coastal Planning:

o Development and implementation in the short term of comprehensive national coastal zone management plans which (a) deal with both sea level rise and other impacts of global climate change and (b) ensure that risks to populations are minimized while recognizing the need to protect and maintain important coastal ecosystems.

o Identification of coastal areas at risk. National efforts are needed to (a) identify functions and resources at risk from a one meter rise in sea level and (b) assess the implications of adaptive response measures on them.

o Provisions to ensure that coastal development does not increase vulnerability to sea level rise. Actions in particular need of review include river levees and dams, conversions of mangroves and other wetlands for agriculture and human habitation, and increased settlement in low-lying areas. In addition, while structural measures to prepare for sea level rise are not yet warranted, the design and location of coastal infrastructure and coastal defenses should include consideration of sea level rise and other impacts of climate change. It is sometimes less expensive to design a structure today, incorporating these factors, than to rebuild it later.

o Review and strengthening of emergency preparedness and coastal zone response mechanisms. Efforts are needed to develop emergency preparedness plans for reducing vulnerability to coastal storms through better evacuation planning and the development of coastal defense mechanisms that recognize the impact of sea level rise.

International Cooperation:

- Maintenance of a continuing international focus on the impacts of sea level rise. An international organization for focusing attention and awareness of sea level change and climate impacts on the coastal zone may be required to encourage the nations of the world to develop appropriate responses.

- Provision of technical assistance to developing nations. Institutions offering financial support should take into account the need for technical assistance in developing coastal management plans, assessing coastal resources at risk, and increasing a nation's ability - through education, training, and technology transfer - to address sea level rise.

- Support by international organizations for national efforts to limit population growth in coastal areas. In the final analysis, rapid population growth is the underlying problem with the greatest impact on both the efficacy of coastal zone management and the success of adaptive response options.

Research, Data, and Information:

- Strengthening of research on the impacts of global climate change on sea level rise. International and national climate research programs need to be directed at understanding and predicting changes in sea level, extreme events, precipitation, and other impacts of global climate change on coastal areas.

- Development and implementation of a global ocean observing network, for example through the efforts of the IOC, WMO,and UNEP to establish a coordinated international ocean observing network that will allow for accurate assessment and continuous monitoring of changes in the world's oceans and coastal areas, particularly sea level change.

- Dissemination of data and information on sea level change and adaptive options. An international mechanism could be identified for collecting and disseminating important data and information on climate change and its impact on sea level and the coastal zone and on various adaptive options. Sharing this information with developing countries is critically important for preparation of coastal management plans.

7.2 Resource Use and Management

Global climate change could have significant impacts upon the very resources that humans and other species rely on to live. These resources include water, agriculture, livestock, fisheries, land, forests, and wildlife. The RSWG addressed these resource issues in the context of considering options for ensuring food security; conserving species diversity; maintaining water supplies; and using land rationally for managed and unmanaged ecosystems.

The potential impacts of climate change on natural resources and human activities are very poorly understood. First, credible regional estimates of changes in critical climatic factors, such as temperature, soil moisture,

annual and seasonal variability, and frequencies of droughts, floods and storms, are simply not available. For many of these critical climatic factors even the direction of change is uncertain. Secondly, methods for translating these changes into effects on the quantity and quality of resources are generally lacking. While it is clear that some of the impacts of climate change on resources could be negative and others positive, a more specific quantification of those impacts is not possible at this time. In general, however, it can be said that: (a) those resources which are managed by humans (e.g. agriculture, forestry) are more suited to successful adaptation than unmanaged ecosystems; and (b) the faster the rate of change, the greater the impact.

It should be noted that there already exists a large reservoir of experience and knowledge to help formulate and implement adaptation response strategies in the event of climate change. Through the ages societies and all living things have developed the capability, and a suite of responses, to adapt to the climate's natural variability and to extreme events (e.g. droughts, floods). Several climatic zones span the globe, and resource use and management is an ongoing challenge in each of these zones. Therefore, society could borrow from these experiences in developing policies to adapt to possible climate change. In addition, expected future economic and technological progress should provide the financial and technical resources required to better adapt to a changing climate.

In recognition of the uncertainties regarding the impacts of climate change on resource use and management, the following sections provide general, rather than specific, options in three categories. The appropriateness of these options for individual countries may vary depending on the specific social, environmental and economic context.

Short-Term Research Related Options:

There are a number of actions which would augment our knowledge base for making reasoned judgments about response strategies. These include:

- Developing inventories, data bases, monitoring systems, and catalogues of the current state of resources and resource use and management practices.

- Improving our scientific understanding of and predictive tools for critical climatic factors, their impacts on natural resources, and their socio-economic consequences.

- Undertaking studies and assessments to gauge the resilience and adaptability of resources and their vulnerability to climate change.

- Encouraging research and development by both public and private enterprises directed toward more efficient resource use and biotechnological innovation (with adequate safeguards for health, safety, and the environment), including allowing innovators to profit from their work.

- Continuing existing research and development of methods to cope with the potentially worst consequences of climate change, such as developing more drought- or salinity-resistant cultivars or using classical and modern breeding techniques to help keep farming and forestry options open.

- Increasing research on the preservation of biological resources in situ and ex situ, including investigations into the size and location of protected natural areas and conservation corridors.

Short-Term Policy Options:

Some response strategies are available which are probably economically justified under present-day conditions and which could be undertaken for sound resource management reasons, even in the absence of climate change. In general, these relate to improving the efficiency of natural resource use, fuller utilization of the "harvested" component of resources, and waste reduction. Measures that could be implemented in the short-term include:

- Increased emphasis on the development and adoption of technologies which may increase the productivity or efficiency (per unit of land or water) of crops, forests, livestock, fisheries, and human settlements, consistent with the principles of sustainable economic growth and development. Such efficiencies reduce the demand for land for human activities and could also help reduce emissions of greenhouse gases. Examples of specific options include more efficient milk and meat production; improved food storage and distribution; and better water management practices.

- Increased promotion and strengthening of resource conservation and sustainable resource use -- especially in highly vulnerable areas. Various initiatives could be explored for conserving the most sensitive and valuable resources, including strengthening conservation measures, managing development of highly vulnerable resources, and promoting reforestation and afforestation.

- Acceleration of economic development efforts in developing countries. Because these countries often have largely resource-based economies, efforts at improving agriculture and natural resource use would be particularly beneficial. Such efforts would also promote capital formation, which would generally make adaptation to climate change and sustainable development more feasible.

- Developing methods whereby local populations and resource users gain a stake in conservation and sustainable resource use, for example by investing resource users with clear property rights and long-term tenure, and allowing voluntary water transfer or other market mechanisms.

- Decentralizing, as practicable, decision-making on resource use and management.

Longer-Term Options:

There are also a number of other possible responses which are costly or otherwise appear to be more appropriate for consideration in the longer-term, once uncertainties regarding climate change impacts are reduced. Options in this category include:

- Building large capital structures (such as dams) to provide for enhanced availability of water and other resources.

- Strengthening and enlarging protected natural areas and establishing conservation corridors to enhance the adaptation prospects for unmanaged ecosystems.

- Reviewing and possibly eliminating direct and indirect subsidies and incentives for inefficient resource use.

8.0 MECHANISMS FOR IMPLEMENTING RESPONSE STRATEGIES

The RSWG also considered in detail several priority areas which must be addressed in order to adequately implement limitation or adaptation responses. These "implementation mechanisms" represent the primary vehicles through which national and international responses to climate can be brought into force. The specific implementation mechanisms considered were:

- Public information and education;

- Technology development and transfer;

- Economic (market) mechanisms;

- Financial mechanisms;

- Legal and institutional mechanisms, including possible elements of a framework convention on climate change.

The results of the RSWG's deliberations on these issues are provided below.

8.1 Public Information and Education

A well informed global population is essential for addressing and coping with an issue as complex as potential climate change. Because climate change has the potential to affect, either directly or indirectly, almost every sector of society, broad global understanding of the issue will facilitate the adoption and implementation of such response options as may be necessary and appropriate. The dissemination of information also represents a powerful economic instrument for ensuring that markets accurately take into account potential consequences and/or opportunities of climate change.

The core aims of public education and information programs are to:

- Promote awareness and knowledge of climate change issues;

- Encourage positive practices to limit and/or adapt to climate change; and

- Encourage wide participation by all countries, both developed and developing, in addressing climate change issues and developing appropriate responses.

Given the importance of a well-informed population, the RSWG developed suggestions and approaches for improving international awareness of the potential causes and impacts of climate change. In this process it was recognized that, while broad-based understanding is essential,

no single mechanism can work for every group or in every culture or country. The social, economic, and cultural diversity of nations will likely require educational approaches and information tailored to the specific requirements and resources of particular locales, countries, or regions.

A number of national and international actions could be taken to disseminate broadly information on climate change. These include the:

- o Establishment of national committees or clearing houses to collect, develop, and disseminate accurate information on climate change issues. This could help provide focal points for information on issues such as energy efficiency, energy savings, forestry, agriculture, etc.

- o Use by international organizations (UNESCO, UNEP, WMO, etc.) of IPCC reports in developing and providing to all countries an adequate understanding for future actions.

- o Use of an existing international institution, or development of a new institution, to serve as a clearinghouse for informational and educational materials.

8.2 Technology Development and Transfer

The development and transfer of technologies is vital to any effort to address global climate change. The development of new technologies may provide the means by which societies can meet their energy, food, and other needs in the face of changes in global climate, while at the same time minimizing emissions of greenhouse gases. Prompt transfer of technologies, especially to developing countries, is likewise an important aspect of any effort to limit or adapt to climate change.

Technology Research and Development Issues:

Technological development is needed to limit or reduce anthropogenic greenhouse gas emissions; absorb such gases by protecting and increasing sinks; adapt human activities and resource use and management to the impacts of climate change; and detect and predict climate change and its impacts. Technology development could be pursued in a wide range of activities such as energy, industry, agriculture, transport, water supply, coastal protection, and management of natural resources. Some of the primary areas where further technology research and development is needed include:

- o Energy, in particular those technologies which provide for using fossil energy resources more efficiently and which promote the use of non-fossil energy sources (e.g. renewable energy sources and safe nuclear power).

- o Natural Resources, including technologies and practices for increasing yields of forests and other greenhouse gas sinks, reducing emissions from agricultural sources, and measures for enhancing the ability of resources to adapt to climate change.

- o Monitoring, in particular those technologies which enhance our ability to make accurate predictions about the magnitude, timing, and regional impacts of climate change.

Technology Transfer:

The fastest rate of increase of greenhouse gases emission is occurring in developing countries. As a result, there is a need for the transfer of technologies for limiting climate change to the developing countries. Such advanced technologies may provide an alternative which would allow developing countries to encourage economic growth and limit greenhouse gas emissions. A number of efforts are currently underway through bilateral and multilateral arrangements which could be further expanded.

A number of impediments, however, hinder the effective transfer of technologies to developing countries. These include lack of financial resources, necessary institutions, and trained human resources. Existing institutions could be strengthened to finance technology transfers, train human resources, and evaluate, introduce, and operate new technologies.

Existing legal provisions and restrictive trade practices are also possible constraints. In this context, the issue of intellectual property rights presents a case where international opinion is mixed. Some hold that the universal international protection of such rights will promote the effective development and transfer of technologies, while others hold that provisions for the protection of intellectual property rights should be determined by the recipient countries, in accordance with their particular legal regimes. Because of the importance of technology transfer, this issue should be addressed in the short-term.

8.3 Economic Mechanisms

It is important that any potential measures to limit or adapt to global climate change be as economically efficient and cost-effective as possible, while taking into account important social implications. In general, environmental objectives can be achieved either through regulations requiring the use of a specific technology or attainment of specified goals, or economic instruments such as emissions fees, subsidies, tradeable permits, or sanctions.

Economic instruments, through their encouragement of flexible selection of abatement measures, frequently offer the possibility of achieving environmental improvements at lower cost than regulatory mechanisms. Unlike many regulations, they tend to encourage innovation and the development of improved technologies and practices for reducing emissions. Economic mechanisms also have the potential to provide the signals necessary for more environmentally sensitive operation of markets. It is unlikely, however, that economic instruments will be applicable to all circumstances.

Three factors are considered as potential barriers to the operation of markets and/or the achievement of environmental objectives through market mechanisms. These are: information problems, which can often cause markets to produce less effective or unfavorable environmental outcomes; existing measures and institutions, which can encourage individuals to behave in environmentally damaging ways; and balancing competing objectives (social, environmental, and economic). An initial response strategy may therefore be to address information problems directly and to review existing measures which may be barriers.

A general advantage of market based economic instruments is that they encourage limitations or reductions in emissions by those who can achieve them at least cost. They also provide an ongoing incentive for industry and individual consumers to apply the most efficient limitation/reduction measures through, for example, more efficient and cleaner technologies. Such incentives may be lacking in the case of regulations.

Regulations, are the customary means of controlling pollution in both market and centrally planned economies. An advantage of regulations is that, in certain circumstances, they create more certainty as to desired outcomes, whereas major disadvantages are that they may discourage innovation, introduce inflexibilities in meeting objectives, can discourage resource use efficiency, and offer few or no incentives to reduce emissions below specified levels.

A number of specific economic instruments were identified that might be used as alternatives or supplements to regulatory actions in meeting environmental goals:

- A system of tradeable emissions permits: An emission permit system is based on the concept that the economic costs of attaining a given environmental goal can be minimized by allowing for the trading of emissions rights. Once an overall limit on emissions has been set, emissions entitlements amounting to that limit could be provided to emitting sources and free trading of such entitlements allowed. This would reduce the costs of meeting a given emission target because: (a) as in trade, comparative advantages between trading entities would be maximized; and (b) economic incentives would be created for the development of improved greenhouse gas limitation technologies, sink enhancement, and resource use efficiency (energy conservation).

- A system of emission charges: Emission charges are levied on specified emissions depending on their level of contribution to climate change. Such charges may provide a means of encouraging emitters to limit or reduce emissions and provide an incentive for diverse parties to implement efficient means of limiting or reducing emissions. Another advantage of charges is that they generate revenue which could provide a funding base for further pollution abatement, research, and administration, or allow other taxes to be lowered.

- Subsidies: Subsidies are aimed at encouraging environmentally sound actions by lowering their costs. Subsidies could be used, inter alia, to encourage the use of energy-efficient equipment and non-fossil energy sources, and the development and greater use of environmentally sound technologies.

- Sanctions: A final type of economic instrument is the use of economic sanctions for the enforcement of international agreements. This would require an international convention to establish a system of agreed trade or financial sanctions to be imposed on countries not adhering to agreed regimes.

It has also been suggested that the environmental protection value could be maximized and the economic costs of meeting possible greenhouse gas limitation targets (should such be considered necessary in the future) minimized

by considering all greenhouse gas sources and sinks comprehensively. Under this approach individual countries would be assigned an allowable emissions level, in terms of a parameter or "index" such as CO2 equivalency, for all their net greenhouse gas emissions. Countries would then be free to determine what specific measures to implement domestically to meet that target by limiting sources or enhancing sinks of any combination of greenhouse gases. This would avoid ignoring important greenhouse gases, foster sink development, and enable countries to implement the domestic program which allows them to meet a given target at the least cost for their specific economic and social position.

Each of the approaches outlined above, however, poses potentially significant challenges in terms of implementation and acceptability. There is an incomplete understanding of the economic and social consequences of these various approaches. It is evident that further work is required in all countries, and in ongoing IPCC work, to fully evaluate the practicality of such measures and costs and benefits associated with different mechanisms. It is appreciated that each instrument assessed has a role in meeting greenhouse emission objectives, but the suitability of particular instruments is dependent on the particular circumstances and at this stage no measure can be considered universally superior to all other available mechanisms.

8.4 Financial Mechanisms

Industrialized and developing countries alike have a common responsibility to address the potential consequences of global climate change. Responses to climate change can not be effective unless there is broad participation from all countries, regardless of their level of development or economic structure. However, the special circumstances of the developing countries, including their vulnerability to the consequences of climate change and their lack of financial resources, must be recognized. Financial assistance to developing countries represents an important mechanism for assisting them in undertaking adequate measures to limit or adapt to climate change.

Bilateral and multilateral development agencies should be used and could be encouraged to strengthen and expand their fields of competence into new areas that are responsive to environmental necessity. Climate change goals would be furthered by a concerted effort by all of these institutions to formulate coordinated and integrated strategies which assure that all development assistance investments, whether undertaken with existing or additional funds, take into account climate change issues.

Financial resources channelled to developing countries would be most effective if focused on those activities which contribute both to limiting greenhouse gas emissions and promoting economic development. Areas for assistance could include:

- Efficient use of fossil energy resources and the increased use of low-fossil or non-fossil fuels;

- Rational forest management practices and agricultural techniques which reduce greenhouse gas emissions;

- Measures which enhance the ability of developing countries to develop programs to address climate change, including research and development activities and public awareness and education;

- Participation by developing countries in international fora on global climate change, such as the IPCC.

A number of possible sources for generating financial resources were considered. These include general taxation, specific taxation on greenhouse gas emissions, and emissions trading. Creative suggestions include using undisbursed official resources, a fixed percentage tax on travel tickets, a climate lottery, and levies on countries that have been unable to meet their obligations. The question has also been raised of whether such financial assistance should only be given to those countries which abstain from activities producing greenhouse gases and whether assistance should be provided for adaptation purposes.

With respect to institutional mechanisms for providing financial assistance to developing countries, several tracks could be considered:

- One track builds on work underway or planned in existing institutions. In this regard, the World Bank, a number of the regional banks, other multilateral organizations, and bilateral agencies have initiated efforts to incorporate global climate change issues into their programs. Bilateral donors could further integrate and reinforce the environmental components of their assistance programs and develop co-financing arrangements with multilateral institutions.

- Parallel to this track some have raised the possibility that the creation of new mechanisms and facilities such as a new international fund is already justified. Such new instruments could be located within the World Bank systems (with new rules) or elsewhere.

- In addition, individual developing countries could also initiate studies, with donor assistance, on their current and projected emissions levels and assistance needs for limiting such emissions.

- Further consideration is also needed of the important contributions which the private sector might make, through technology transfer, foreign direct investment, and other means, to assist developing countries to respond to climate change.

8.5 Legal and Institutional Mechanisms

A number of institutions and international legal mechanisms exist which have a bearing on the climate change issue, in particular those dealing with the environment, science and technology, energy, natural resources, and financial assistance. One of these existing international legal mechanisms, the Vienna Convention on the Protection of the Ozone Layer and its associated Montreal Protocol on Substances that Deplete the Ozone Layer, deals specifically with reducing emissions of important greenhouse gases which also deplete the ozone layer. However, there is a general view that, while existing legal instruments and institutions related to climate change should be fully utilized and further strengthened, they are insufficient alone to meet the challenge.

A very broad international consensus has therefore emerged in the RSWG, confirmed notably at the 44th United Nations General Assembly, on the need for a framework convention on climate change. Such a convention should generally follow the format of the Vienna Convention for the Protection of the Ozone Layer in laying down, at a minimum, general principles and obligations. It should further be framed in such a way as to gain the adherence of the largest possible number and most suitably balanced range of countries, while permitting timely action to be taken. In addition, it should contain provisions for the adoption of separate annexes/protocol(s) to deal with specific obligations. As part of the commitment of the parties to action on greenhouse gas emissions and the adverse effects of climate change, the convention should also address the particular needs of the developing countries, the question of the development and transfer of technology, and institutional requirements.

A number of overarching issues will have to be decided in the negotiation of a convention. These include:

- the political imperative of striking the correct balance: on the one hand, between the arguments for a far-reaching, action-oriented convention and the need for urgent adoption of such a convention so as to begin tackling the problem of climate change; and, on the other hand, between the costs of inaction and the lack of scientific certainty;

- the extent to which specific obligations, particularly on the control of emissions of greenhouse gases, should be included in the convention itself or be the subject of a separate protocol(s);

- the timing of negotiation of such a protocol(s) in relation to the negotiations on the convention.

In addition, specific issues will need to be addressed, such as:

- Financial needs of developing countries: The need for additional resources for developing countries and the manner in which this should be addressed, particularly in terms of the nature, size and conditions of the funding, will have to be considered by the negotiating parties even if detailed arrangements form the subject of a separate protocol.

- Development and transfer of technology: The basis on which the promotion of the development and transfer of technology and provision of technical assistance to developing countries should take place will need to be elaborated, taking into account considerations such as terms of transfer, intellectual property rights, and the environmental soundness of such technology.

- Institutions: Views differ substantially on the role and powers of the institutions to be created by the convention, particularly in exercising supervision and control over the obligations undertaken.

Many countries and international organizations have called for the initiation of international negotiations on a framework convention after completion of the IPCC's first assessment report. The RSWG's analysis of possible elements of a framework convention is intended to provide guidance on the major issues which will likely need to be considered in preparing for such negotiations.

9.0 CONCLUSION

Global climate change is an issue which concerns the entire international community. All countries contribute to the atmospheric concentration of greenhouse gases and, if present trends continue, it is expected that emissions of these gases from all regions of the world will rise through the next century. The potential consequences of global climate change could likewise be felt in all regions of the world.

A large number of response options have been identified at the national, regional, and international levels to address climate change issues. Actions can be taken both to limit the net quantity of greenhouse gases which are being released into the atmosphere and to adapt to changes in the global climate. While a great many possible response options have been identified in this report, some warrant special attention as being particularly important and feasible for introduction in the short term. These include:

- Implementation of measures which are already economically and socially justifiable in their own right and which also provide benefits from a climate change standpoint. Examples include increased energy efficiency, improved use of forests and other natural resources, and reductions in emissions of CFCs.

- Development by individual countries of national inventories of greenhouse gas emissions and national plans evaluating those measures which could be undertaken to limit greenhouse gas emissions or adapt to the potential impacts of global climate change.

- Strengthening of existing national, regional, and international institutions which have a bearing on climate change, in particular those which improve our scientific and economic understanding of climate change, promote the development of technologies for limiting or adapting to such change, or assist developing countries in addressing this issue.

- Development of a framework convention on climate change which can gain the adherence of the vast majority of the international community and which lays down general principles and obligations for addressing climate change.

- Increased research and development of technologies and practices that reduce greenhouse gas emissions or enhance the ability of countries to adapt to climate change.

- Increased research to reduce the scientific uncertainties regarding the magnitude, timing, and regional impacts of global climate change.

- Increased research with respect to how effective specific response options or groups of options would be in actually averting potential climate change.

- Increased research to understand the economic aspects of specific response options so as to provide an adequate information base for making sound policies.

The RSWG will continue its work to further define and evaluate the available response options. A number of potential future activities have been

identified and are being developed into specific work programs. The participation of the largest possible number of countries in this work is important and is strongly encouraged.

The efforts of the participating countries in the RSWG process have served to increase international awareness of the climate change issue and possible response strategies. This first assessment report provides important information for policy makers considering national, regional, and international climate change strategies. We believe these efforts have served and will continue to serve to bring the international community closer together in the process of developing a consensus on addressing this vital issue.

Table 2
Examples of Short-Term Options

I. IMPROVE EFFICIENCY IN THE PRODUCTION, CONVERSION AND USE OF ENERGY

Electricity Generation	Industry Sector	Transport Sector	Building Sector
. Improved efficiency in electricity generation - Repowering of existing facilities with high efficiency systems; - Introduction of integrated gasification combined cycle systems; - Introduction of atmospheric fluidised bed combustion; - Introduction of pressurised fluidised bed combustion with combined cycle power systems; - Improvement of boiler efficiency. . Improved system for co-generation of electricity and steam. . Improved operation and maintenance. . Introduction of photovoltaics, especially for local electricity generation. . Introduction of fuel cells.	. Promotion of further efficiency improvements in production process; . Materials recycling (particularly energy-intensive materials); . Substitution with lower energy intensity materials; . Improved electromechanical drives and motors; . Thermal process optimisation, including energy cascading and co-generation. . Improved operation and maintenance.	. Improved fuel efficiency of road vehicles; - Electronic engine management and transmission control systems; - advanced vehicle design; - regular vehicle maintenance; - higher capacity trucks; - improved efficiency in transport facilities; - regenerating units; . Technology development in public transportation; - Intra-city modal shift (e.g. car to bus or metro); - advanced train control system to increase traffic density on urban rail lines; - High-speed inter-city trains; - Better intermodal integration. . Reduced size and weight, with use of lightweight composite materials and structural ceramics; improved aerodynamics, combustion chamber components, better lubricants ,and tyre design, etc.). . Driver behaviour, traffic management, and vehicle maintenance.	. Improved heating and cooling equipment and systems; - Improvement of energy efficiency of air conditioning. - Promotion of introduction of area heating and cooling including use of heat pumps. - Improved burner efficiency. - Use of heat pumps in buildings; - Use of advanced electronic energy management control systems. . Improved space conditioning efficiency in house/building; - Improved heat efficiency through highly efficient insulating materials; - Better building design (orientation, window, building, envelope, etc.); - Improved air-to-air heat exchangers. . Improved lighting efficiency. . Improved appliance efficiency. . Improved operation and maintenance. . Improved efficiency of cook stoves (in developing countries).

Table 2 (continued)

II. NON FOSSIL AND LOW EMISSION ENERGY SOURCES

Electricity Generation	Other Sectors
- Construction of small-scale and large-scale hydro projects; - Expansion of conventional nuclear power plants; - Construction of gas-fired power plants; - Standardised design of nuclear power plants to improve economics and safety; - Development of geothermal energy projects; - Introduction of wind turbines; - Expansion of sustainable biomass combustion. - Replacement of scrubbers and other energy consuming control technology with more energy efficient emission control.	. Substitution of natural gas and biomass for heating oil and coal; . Solar heating . Technologies for producing and utilising alternative fuels; - Improved storage and combustion systems for natural gas; - introduction of flexible-fuel and alcohol fuel vehicles.

III. REMOVAL, RECIRCULATION OR FIXATION

Energy/Industry	Landfills
. Recovery and use of leaked or released CH_4 from fossil fuel storage, coal mining; . Improved maintenance of oil and natural gas and oil production and distribution systems to reduce CH_4 leakage; . Improved emission control of CO, SO_x, NO_x and VOCs to protect sinks of greenhouse gases.	. Recycle and incineration of waste materials to reduce CH_4 emissions; . Use or flaring of CH_4 emissions; . Improved maintenance of landfill to decrease CH_4 emissions

Table 3
Examples of Medium-/Long-Term Options

I. IMPROVE EFFICIENCY IN THE PRODUCTION, CONVERSION AND THE USE OF ENERGY

Electricity Generation	Industry Sector	Transport Sector	Building Sector
. Advanced technologies for storage of intermittent energy; . Advanced batteries; . Compressed air energy storage; . Superconducting energy storage;	. Increased use of less energy-intensive materials; . Advanced process technologies; . Use of biological phenomena in processes; . Localised process energy conversion; . Use of fuel cells for co-generation.	. Improved fuel efficiency of road vehicles; . Improvements in aircraft and ship design: - Advanced propulsion concepts; - Ultra high-bypass aircraft engines; - Contra-rotating ship propulsion.	Improved energy storage systems; - Use of information technology to anticipate and satisfy energy needs; - Use of hydrogen to store energy for use in buildings. Improved building systems; - New Building materials for better insulation at reduced cost; - Windows which adjust opacity to maximise solar gain. New food storage systems which eliminate refrigeration requirements.

Table 3 (Continued)

III. NON FOSSIL AND LOW EMISSION ENERGY SOURCES

Electricity Generation	Other Sectors
. Nuclear power plants: - Passive safety features to improve reliability and acceptability. . Solar power technologies: - Solar thermal; - Solar photovoltaic (especially for local electricity generation). . Advanced fuel cell technologies.	Other technologies for producing and utilising alternative fuels; - Improved storage and combustion systems for hydrogen; - Control of gases boiled off from cryogenic fuels; - Improvements in performance of metal hydrides; - High-yield processes to convert lingo-cellulosic biomass into alcohol fuels; - Introduction of electric and hybrid vehicles; - Reduced re-charging time for advanced batteries.

III. REMOVAL, RECIRCULATION OR FIXATION

. Improved combustion conditions to reduce N_2O emissions.

. Treatment of exhaust gas to reduce N_2O emissions.

. CO_2 separation and geological and marine disposal.

FOOTNOTES

[1] Energy and Industry Subgroup Report, Section 4.5.1.1

[2] Energy and Industry Subgroup Report, Section 3.2.2

[3] Energy and Industry Subgroup Report, Section 3.2.3

[4] Energy and Industry Subgroup Report, Section 4.6.1

[5] Energy and Industry Subgroup Report, Section 3.4.1.

[6] Energy and Industry Subgroup Report, Section 3.6.1

[7] Energy and Industry Subgroup Report, Section 3.2.2.2

[8] Agriculture, Forestry, and Other Activities Report, Section 3.4.2

[9] Agriculture, Forestry, and Other Activities Report, Section 3.4.4

[10] Agriculture, Forestry, and Other Activities Report, Section 3.4.1

[11] Agriculture, Forestry, and Other Activities Report. Section 2.0

[12] Agriculture, Forestry, and Other Activities Report. Section 4.2

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U.S. GLOBAL CLIMATE CHANGE POLICY

Overview:

The United States recognizes that climate change presents a potentially serious threat to the global environment and that the international community should cooperate on measures to address this concern. We support the negotiation of a framework convention on climate change to provide the basis for enhanced international cooperation in addressing this issue.

There remain, however, significant scientific uncertainties regarding the magnitude, timing, and regional impacts of climate change. Furthermore, our understanding of the potential economic consequences of measures to limit or adapt to climate change is very limited. We thus support enhanced efforts to improve international understanding of the scientific and economic aspects of this issue.

Given the significant remaining scientific and economic uncertainties, we believe it is premature at this time to implement stringent measures for limiting greenhouse gas emissions solely to mitigate potential climate change. However, while we take steps to refine our understanding of the scientific and economic issues, we support implementing now those measures which are justified in their own right and which might also provide climate change benefits. Should an improved understanding of the climate change issue indicate that further mitigation efforts are warranted, these can be addressed through a protocol(s) to the framework convention.

U.S. Position on Specific Issues

o International Cooperation:

-- We support international cooperation to assess all aspects of climate change. The United States has been a major supporter and contributor to the activities of the Intergovernmental Panel on Climate Change (IPCC), the primary international forum for addressing this issue.

-- We support the negotiation of a framework convention on climate change. President Bush has offered the United States as the venue for the first round of such talks. We believe the negotiations should begin as soon as feasible after completion of the IPCC's first assessment report.

-- Like the Vienna Convention for the Protection of the Ozone Layer, the framework convention on climate change should include general obligations, cooperation in research and monitoring, exchange of information, conference of the parties, secretariat, and provision for possible subsequent adoption of protocols.

-- Specific agreements on measures for limiting or adapting to climate change should be addressed in a subsequent protocol(s) to the convention as our scientific/economic understanding develops.

o Scientific Understanding:

-- Climate change is arguably the most complex international science policy issue the world has faced. Because there remain significant uncertainties about the timing, magnitude, and regional effects of climate change, further research is essential.

-- This research effort must be international and encompass all the regions of the world. To address this issue the USG is undertaking by far the world's largest global change research program ($1.1 billion in FY1991) and is planning to contribute to the WMO Climate Studies Fund to support increased international efforts in climatology. We urge all countries to increase their research efforts in order to advance the world's understanding of this problem.

o Economic Aspects of Climate Change:

-- Although various formulas for limiting greenhouse gas emissions have been proposed, very little work has been done on the economic costs of measures to limit or adapt to climate change. Some preliminary studies show that the costs of stringent measures to limit greenhouse gas emissions could be severe.

-- More economic research, comparable to efforts underway in the scientific area, is needed to reduce the uncertainties regarding the economic impacts of limitation measures. The USG is accelerating work on this issue domestically. We support international efforts to address this vital issue, for example within the IPCC, OECD, and other multilateral fora.

-- More work is also necessary on the potential costs and benefits of global greenhouse gas limitation measures on U.S. trade and competitiveness as a result of economic restructuring and the development of new markets for advanced technologies related to global change.

o Interim ("No-Regrets") Measures:

-- While we are pursuing the serious scientific and economic research that is critical to any responsible approach to climate change, we support taking prompt actions that are fully justified on independent grounds and which might also be beneficial from a climate change standpoint.

-- As reflected in the President's February 5 speech, these so-called "no-regrets" measures include: (1) phasing out CFCs by the year 2000; (2) increasing energy efficiency measures, inter alia, through the National Energy Strategy, Clean Air Act, and new technology development; and (3) implementing a major domestic reforestation initiative and seeking to arrest tropical deforestation through multilateral channels.

o Targets and Timetables:

-- We do not believe there is sufficient evidence at this time to warrant stringent measures, with potentially serious negative economic consequences, to limit greenhouse gas emissions. The global implementation of interim ("no regrets") measures such as those listed above could significantly limit world greenhouse gas emissions without imposing costly and politically divisive formal targets.

-- While we supported the Noordwijk Conference goal of stabilizing greenhouse gas emissions as soon as feasible, the understanding of what greenhouse gas emissions limitations can be achieved without unacceptable negative economic impacts is unclear. Work is continuing domestically and in the IPCC and other fora to assess the economic implications of this and other goals.

-- Should an improved understanding of the climate change issue indicate that specific limitation efforts are warranted, these can be addressed through a protocol(s) to the framework convention. Such a protocol(s) must have the adherence of countries representing much of the world's land mass and population to be effective.

-- Should the international community eventually agree that greenhouse gas targets and timetables are necessary, we would support a comprehensive approach to consider all greenhouse gas sources and sinks collectively. In addition, we would support implementation mechanisms which are economically efficient and market driven.

-- We have thus proposed that any such protocol address all greenhouse gases, their sources and sinks, comprehensively. We have also proposed that the international community consider the economic advantages of a system of international emissions trading.

o Financial Aid and Technology Transfer Issues:

-- Within the IPCC, LDC representatives have called for: (1) the establishment of new funding sources for climate change related projects in LDCs; and (2) the transfer of technology to LDCs on preferential and non-commercial terms.

-- The U.S. position is that: (1) existing financial assistance mechanisms and levels should be evaluated for their applicability to LDC climate change needs before the establishment of new sources or additional amounts of funding is considered; and (2) intellectual property rights must be protected in technology transfer arrangements, which should rely to the fullest possible extent on commercial exchanges and channels.

U.S. Department of Justice

Land and Natural Resources Division

Office of the Assistant Attorney General

Washington, D.C. 20530

July 11, 1990

MEMORANDUM

TO: Stephen I. Danzansky
Deputy Assistant to the President
Director of Cabinet Affairs

CC: C. Boyden Gray
Counsel to the President

D. Allan Bromley
Assistant to the President
for Science & Technology

FROM: Dick Stewart DS
Assistant Attorney General

SUBJECT: OECD Workshop on Emissions Trading in Greenhouse Gases

Following my memorandum of June 29, I have explored further with Fred Bernthal (NSF) and Dick Smith (State/OES) the options for organizing the OECD Workshop on Emissions Trading proposed for this coming December by Paul Stolpman of OECD. We believe that the Workshop would function best if it were sponsored jointly by the OECD and the Intergovernmental Panel on Climate Change (IPCC). IPCC involvement would keep the Workshop linked to the central existing forum for climate discussions and thereby avoid encouraging the proliferation of new and independent fora serving the parochial interests of groups of nations. OECD has suggested cosponsorship by UNEP itself, but that arrangement could obscure the central role of the IPCC, which is a joint project of WMO and UNEP. The chief advantage of a prominent UNEP role, expanding participation by developing nations, could be served by the link with the IPCC and perhaps by appropriate contact with the IPCC's Special Committee on the Participation of the Developing Countries (chaired by M. Ripert of France). This could be accomplished by cosponsorship by the IPCC's Response Strategies Working Group (RSWG).

In order to accomplish these arrangements, we will, unless instructed otherwise, suggest to Mr. Stolpman that he write directly to RSWG Chair Fred Bernthal asking for IPCC/RSWG cosponsorship. The small meeting of experts to plan the

Workshop, suggested by Stolpman for early August, would then proceed with this organization in mind.

CC: Fred Bernthal
Robert E. Grady
Theresa Gorman
Dick Schmalensee
Curtis Boehlen, Dick Smith, Chris Dawson, Dan Reifsnyder
Dick Morgenstern
Mark Kerrigan

U.S. Department of Justice
Land and Natural Resources Division

Office of the Assistant Attorney General
Washington, D.C. 20530

May 7, 1990

MEMORANDUM

TO: C. Boyden Gray
Counsel to the President

D. Allan Bromley
Assistant to the President
for Science & Technology

Stephen I. Danzansky
Deputy Assistant to the President
Director of Cabinet Affairs

Theresa Gorman
Associate Director for Environment, Energy
and Natural Resources Policy

FROM: Dick Stewart
Assistant Attorney General

SUBJECT: Task Force to Further Develop the "Comprehensive" and "Trading" Approaches to Possible Climate Change Agreements

On April 27-28, I attended the IPCC Seminar on Economic and Financial Measures in Paris. There was considerable interest in our "comprehensive" and "emissions trading" approaches, particularly from the Australians, Dutch, Germans, Japanese, and New Zealanders. There were many tough questions as to how these concepts could be institutionalized and put into operation. The OECD representatives present volunteered to host a future seminar to examine these issues.

Advancing these approaches in international fora, with an eye to possible negotiations of a framework convention on climate which may begin as early as this fall, will necessitate further attention to the practical details involved, addressing the institutional, scientific, environmental and economic underpinnings.

I propose creation of a small task force to develop further the "comprehensive" and "trading" approaches and consider

how they might be implemented. The Task Force would develop materials for review and clearance by the DPC Working Group on Global Change. If at all possible, I would like to have revised versions of our February "Informal Seminar" papers prepared for distribution at the RSWG meeting in Geneva the week of June 4, and to follow up with an OECD-sponsored seminar at some point later this summer.[1] The proposed "Comprehensive/Trading Task Force" could develop our thinking on these topics and prepare further materials.

Among the questions to be addressed are the following:

1. What are the gaps and difficulties confronting development of a comprehensive approach for all greenhouse gases, their sources and sinks? For example, for which gases, sources and sinks is more information needed to measure and monitor net emissions? What remains to be done to develop a comparative index of the environmental impacts of the various gases? If a comprehensive approach is not immediately feasible for all relevant gases, sources and sinks, for which is it feasible, and how might additional gases, sources, and sinks be folded into a comprehensive approach as the science and data improve and as the time to negotiate relevant international instruments advances?

2. What institutions for monitoring and compliance assurance would be established in connection with a comprehensive approach?

3. What would be the relation between a comprehensive approach and agreements that deal with particular gases, sources, and sinks, such as the Montreal Protocol on Substances That Deplete the Ozone Layer, the Sulphur and Nitrogen protocols and the upcoming Volatile Organic Compounds (VOCs) protocol to the Long-Range Transboundary Air Pollution (LRTAP) convention, and a possible agreement on forests?

4. What gases, sources and sinks could feasibly be included in a trading system, either domestic or international?

5. What institutions would be needed to monitor and/or administer trading? What would be the respective roles of international organizations, national governments and private firms in the operation of international trading? Who would trade, what would be the currency of trades, how would trading be

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[1] I think it would be helpful, from the viewpoint of involving the developing countries, to see if UNEP would co-sponsor the seminar, and to schedule it immediately before or after an IPCC or other function which developing countries would be likely to attend. In addition, the UN Commission on Trade and Development may be interested.

facilitated and monitored, and would trading involve, sales, leases, or other arrangements? How would these issues apply to domestic trading and international trading?

6. What should be done to allay concerns about "hoarding" of tradeable rights, the moral aspects of "licenses to pollute," and fears that developed nations would buy up all of the developing nations' rights?

7. What would be the likely environmental and economic benefits for the U.S. and the world of employing the comprehensive and trading approaches?

I propose a Task Force initially consisting of representatives from CEA, DOC, DOE, DOJ, EPA, State, USDA, and USTR. We would maintain regular liaison with your offices; we would be pleased to have representatives from your offices attend meetings.

U.S. Department of Justice

Land and Natural Resources Division

Office of the Assistant Attorney General

Washington, D.C. 20530

May 14, 1990

MEMORANDUM

TO: Terry Davies, EPA/OPPE
Gary Evans, USDA
Bob Reinstein, USTR
Dick Schmalensee, CEA
Dick Smith, State/OES
J.R. Spradley, DOC/NOAA
Linda Stuntz, DOE/OPPA

CC: Theresa Gorman, OPD
Jeff Holmstead, WH Counsel
Nancy Maynard, OSTP

FROM: Dick Stewart DS/sow
Assistant Attorney General

SUBJECT: Issues to be Considered by the Task Force on the "Comprehensive" and "Trading" Approaches to Possible Climate Change Agreements

For your consideration, attached please find a draft list of issues that the task force might explore. There may be other issues and sub-issues that need to be considered as well, and I look forward to hearing your views on Wednesday, May 16.

COMPREHENSIVE/EMISSIONS TRADING TASK FORCE

Draft List of Issues 5/14/90

Issues to be developed in further detail by the task force might include:

I. "Comprehensive" approach:

1. Gaps and difficulties in measuring sources and sinks of greenhouse gases. For some, measurement information is available, e.g. fossil fuel combustion emissions of CO2, while for others, measurement information is currently highly uncertain, e.g. certain emissions of CH4. What would be needed to overcome these gaps and difficulties, and how long would it take?

2. Related difficulties in developing the capacity to monitor net emissions of greenhouse gases. Issues include monitoring nonpoint sources and sinks such as agricultural fields, forests, and plankton; monitoring and verifying changes in total abundance of sources and sinks; monitoring and verifying changes in source output rates and sink uptake rates; development of reliable and more easily monitorable proxies or surrogates for actual source output and sink uptake; burdens of proof in demonstrating new net emissions rates and new monitoring methods; economic incentives to develop improved monitoring methods.

3. Developing institutions for monitoring and compliance assurance.

4. Developing a comparative parameter or "index" of the environmental impacts of the various gases. Issues include defining the lifetimes of certain gases, relating the index function to ambient concentrations of gases (the "saturation" or "window" question), use and choice of discount rates, incorporating non-warming impacts of gases, mapping the index function over time, and relating the index to net emissions from different sources and sinks.

5. If a comprehensive approach is not immediately feasible for all relevant gases, sources and sinks, an agreement might target first those for which it is feasible, and then phase in additional gases, sources, and sinks as the science and data improve. The initial agreement or set of agreements should not preclude a comprehensive approach; should promote attention to all gases, sources and sinks; should promote relevant scientific research; and could provide incentives for development of a

comprehensive approach, e.g. by rewarding those who demonstrate the capacity to monitor (or even limit) net emissions of various gases, including gases not covered in the original agreement.

6. Relationship between a comprehensive approach and agreements that deal with particular gases, sources, and sinks, such as the Montreal Protocol on Substances that Deplete the Ozone Layer, the sulphur and nitrogen protocols and the upcoming volatile organic compounds (VOCs) protocol to the Long-Range Transboundary Air Pollution (LRTAP) convention, and a possible agreement on forests. The comprehensive approach can remain consistent with these other specific agreements if it provides additional incentives to reduce the deleterious activities addressed by those agreements, but does not allow nations to escape their obligations under those agreements.[1] Categorically excluding the subjects of these other agreements from the climate agreement would forfeit the chance to add incentives for additional reductions in the deleterious activities.

7. Initial allocations. How might they differ under the comprehensive and gas-by-gas approaches? Issues in setting baselines.

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[1]Take, for example, the case of CFCs and halons, which are both ozone-depleting substances regulated under the Montreal Protocol and greenhouse gases likely to be regulated in a comprehensive approach. Under the comprehensive approach, nations would be free to vary their mix of reductions of CO2 and CFCs/halons, except that CFC/halon reductions must still be at least as deep and as rapid as those called for in the Montreal Protocol and its progeny (i.e. London June 1990). In other words, only additional reductions in CFCs/halons beyond or faster than the reductions called for under the Montreal Protocol (likely to be a phaseout by 2000) could serve to offset CO2 reductions, thereby enabling the nation to forego some reductions in CO2; extra reductions in CO2 could not allow a nation to reduce CFCs/halons less strictly or less rapidly than it is required to accomplish under the Montreal Protocol.

At the same time, the question of the baseline to be used for the greenhouse gas agreement would remain open: the agreement could give nations credit for all reductions in CFCs and halons after a certain date or level, or only for reductions that go beyond their Montreal Protocol obligations. The choice of the baseline for computation would not lift the legal obligation to comply with the Montreal Protocol. On the other hand, using a baseline that accounts for only reductions in CFCs and halons beyond those mandated under the Montreal Protocol could give nations a prospective incentive to slow down the negotiations of more stringent reduction schedules under the Montreal Protocol, whereas a baseline counting all reductions in CFCs and halons would not.

8. Defining the terms of agreement and the terms for admission to an initial or subsequent agreement. These could differ for different nations or categories of nations, and could include research commitments as well as emissions limitation commitments.

9. Documenting the advantages to the comprehensive approach: avoids ignoring important gases, offers flexibility to different economic, institutional and social circumstances, enhances sink development.

II. "Emissions trading" approach:

A. National (Domestic) Trading

1. Informal vs. formal trading: considerations may differ depending on whether joint arrangements are permissible subject to governmental oversight (informal trading) or whether an allowance/permit system is created (formal trading). That is, informal trading can occur through ad hoc mutual reallocations of emissions by two or more parties to meet their aggregate obligations. Formal trading involves the inventory, registration, or issuance of some kind of permits or allowances, with subsequent trading to be denominated in these permits or allowances. Variations and permutations of these approaches can also be devised.

2. Identifying which gases, sources and sinks could feasibly be included in a trading system.

3. Identifying who would trade, and to whom emissions and emissions reductions are assigned. For example, emissions attributable to electricity use (and attendant tradeable allowances) could be assigned to utilities, appliance manufacturers, end users (businesses, farms & households), or some combination. Similarly, emissions attributable to gasoline combustion (and attendant tradeable allowances) could be assigned to oil extraction companies, oil refiners, automobile manufacturers, automobile owners, or some combination.

4. Consideration given in return for emissions allowances, including financial and technology assistance that may flow to allowance sellers. Important distributional impacts may concern national policymakers, as they have in the debates about the Clean Air Act here.

5. Facilitating trades. National and subnational governmental bodies could act as information clearinghouses, allowance/permit banks, brokers, auctioneers, and so forth. Private entities might also take on these roles.

6. Monitoring trading. Emissions would have to be monitored under any agreement, but trading would require some oversight of the trades. Depending on who does the trading, monitoring could be designed in different ways. National or subnational governmental bodies could perform this role, perhaps hiring private contractors. Monitoring could consist of spot checks, on site verification (e.g. of sinks), reporting or registration requirements, designated times and places for trading, or other arrangements. Administrative costs and financing of such institutions need to be considered.

7. Nature and duration of allowance/permit rights. Trading could involve, sales, leases, or other arrangements. Allowances could expire or diminish in face value over time. Sophisticated markets for trade currency might arise (as well as black markets if conditions limit the transferability of allowances), including futures and options markets. The tax status of allowance transactions could also be important. These arrangements can be structured to address concerns about "hoarding" and market-cornering by wealthy parties (see below).

8. Dealing with moral concerns about trading, such as the "license to pollute" issue and the notion that extra reductions should "go to benefit society." Comparison to regulation and emissions taxes.

9. Dealing with economic concerns about trading. Concerns may include: "hoarding" of tradeable rights; fears that wealthy parties would buy up all of the poorer parties' rights; monopsony and monopoly problems; hindrances to trading related to inadequate awareness of other market participants; problems of transferring allowances across industry lines and along vertical market lines.

10. Possible environmental concerns. Trading in greenhouse gases generally has no "hotspot" problem because the gases mix globally in the atmosphere. But there may be spatial distribution issues regarding, e.g., the residence time of short-lived gases such as CH4, and the toxicity of gases such as CO and tropospheric O3. These issues may be too detailed and insufficiently significant to address at this time.

11. Initial and subsequent allocation of allowances: how would it differ if trading is available or not. Would the option of trading ease or exacerbate "gaming" of the initial allocation? What would the length of rights be? What flexibility should government have to modify the total stock? Would government derive revenue by auctioning rights off, taxing them, or other means?

12. Use of empirical experience with trading to deal with these issues. Also, what trading has occurred under the Montreal Protocol?

13. Documenting and predicting the advantages to trading: allocative efficiency (possibly start with an explanation of the ordinary gains from trade), incentives to reduce emissions, dynamic efficiency and innovation, incentives to use resources efficiently, incentives for sink enhancement, more affordable pollution control, equity.

14. Relationship to other laws, e.g. laws pertaining to clean air, energy production, forestry, and agriculture. Relationship of national law to subnational governmental law, e.g. federalism concerns, the ability of states to impose requirements that affect trading, preemption of state law.

B. International Trading

In addition to the elements listed above under national trading, the following issues may be relevant:

1. Informal or formal trading. As with national trading, international trading could initially occur "informally" through ad hoc bilateral or regional governmental treaties. Or more formal trading systems could be created, involving the issuance of allowances or permits in which trades are to be denominated.

2. Identifying who would trade. International trading could be undertaken, on a bilateral, multilateral or regional basis, by national governments. Yet private enterprises may be better situated to identify and make productive trades. Trades by private enterprises could be subject to clearance or monitoring by national governments. A mixed system of trading by both governments and enterprises could also be created.

Nations with different economic systems may find trading to be best conducted by different actors. For example, fully centrally planned economies may not find trading by "private" entities to be appropriate. At the extreme, must a nation have a domestic trading program in operation in order to participate effectively in international trading?

3. International institutions to monitor trading. The questions concerning who would trade have important implications for how trading would be monitored, and for the degree of formality and comprehensiveness of the international institutions monitoring trades. Unrestricted private trading, for example, could require a more elaborate international clearinghouse and monitoring apparatus than might a system limited to trading by national governments. Private trading could also (or alternatively) be monitored by national governments. Trading by national governments would presumably be monitored by an international body. Monitoring could vary from simple reporting requirements to prior approval requirements; procedures could be routine or elaborate. International monitoring mechanisms such as inspections and audits might also raise concerns about sovereignty.

4. Scope of trades. Trading could occur among any interested parties within a global "bubble," or it could be conducted under regional "bubbles." The scope chosen could vary depending on the gas, sources and sinks in question.

5. Consideration for trades and related trade and development issues. Trading of net greenhouse gas emissions would create a new medium of exchange, with associated flows of capital and technology. Trading could be a vehicle for resource transfers to developing nations. If developing nations have lower reduction costs than developed nations, perhaps owing to their ability to shift directly to non-fossil fuel energy sources and their abundant afforestation opportunities, developing nations could earn resources by selling excess allowances. (The same could be true of other low-cost reducers, such as planned economies about to turn over their capital stock, and nations that develop useful innovations.) Some argue that this mechanism poses the risk of undue economic leverage for developing nations, and that it will influence the gaming of initial allocations. Others see this mechanism as a decentralized, market-based alternative to resource flows dictated by international organizations, central international assistance funds, and preferential terms for technology transfer demanded by developing nations. This raises important issues regarding international aid and trade regimes. There may also be important issues regarding international trade regimes, e.g. international energy markets, GATT, efforts by national governments to distort international trade in allowances or to protect domestic allowance holders, and others; and regarding international aid regimes, e.g. alternatives to central aid funds, and the calculation and ownership of the net emissions impacts of ongoing aid-funded projects.

6. Facilitating trades. International organizations and national governments could serve as information clearinghouses, brokers, bankers, auctioneers, and so forth. In some national economies and in the world economy, private entities might also assume these roles.

7. Dealing with moral, environmental and economic concerns. The usual concerns raised by trading may be influenced, in an international context, by the variety of cultures and stages of development of different nations. Some nations have expressed the view that trading is a "license to pollute" and therefore immoral. Experience with some debt-for nature swaps (esp. Bolivia) suggests that trades for sink resources may raise concerns about sovereignty and local opposition to outright sales of sink development rights to other nations. Some nations unfamiliar with trading may express the view that it is simply a means to allow illicit emissions. There are also sharp concerns that developed nations would "buy up" all the allowances held by developing nations. One means for

addressing these concerns would be to make allowances leasable for a term of years rather than fully alienable.

8. Initial allocation of allowances: how will it be set? How will the opportunity to trade affect the allocation-setting process? Will it tend to ease or exacerbate "gaming"? What scope would there be for varying the basis of allocation across nations? What flexibility would there be for subsequently modifying the stock of rights? The opportunity for modifications in the allocation of rights among nations (as opposed to the total stock) could discourage trading, because nations anticipating the allocations to be renegotiated might fear that selling some of their allowances would demonstrate that their initial allocations were "too high" and should be reduced.

9. Use of empirical experience with international trading to support discussion. Trading in goods, services, currencies, debt-for-nature, under the Montreal Protocol, etc.

10. Documenting and predicting the advantages to international trading. The advantages mentioned under national trading must be considered in the international context.

11. Relationship to other international law and international institutions.

III. Common issues:

1. What would be the likely environmental and economic benefits for the U.S. and the world of employing (a) the comprehensive approach, (b) the trading approach, or (c) both? A preliminary calculation could be undertaken to confirm that these are likely to be desirable approaches. Then a more in-depth study could be pursued, perhaps through an independent think tank.

2. Although the benefits from these approaches are probably greatest when they are universally adopted, universal adoption is not absolutely necessary. For example, if full adoption of the comprehensive and emissions trading approaches is not forthcoming, an international target could be written in terms of "net CO2 equivalent emissions," and then could allow emitters to demonstrate compliance however they wished -- reducing other gases, enhancing sinks, purchasing extra reductions abroad, innovating CO2 scrubbers, etc. -- so long as the emitter demonstrated the efficacy of its chosen approach. This would authorize both the comprehensive and emissions trading approaches, but put the burden of proof on -- and gives incentives to -- the emitter to demonstrate the alternative approaches. Emitters would be influenced by the forum and the process chosen for deciding whether an emitter has satisfactorily demonstrated the efficacy of its approach.

IV. Possible subgroup tasks:

1. Collect current information on measuring sources and sinks of greenhouse gases; identify next steps needed to measure and to monitor net emissions; estimate the costs (in time and money) of achieving needed capabilities.

2. Design a comparative index of environmental impacts of greenhouse gases, including warming and non-warming impacts.

3. Begin work on a model of greenhouse gas limits, for the United States and selected other national (domestic) applications, which apply only to CO2, or to several gases. Assess economic and environmental results.

4. Begin work on models of trading: (a) Model of greenhouse gas limits, with and without trading, for the United States and selected other national (domestic) applications. Scenarios: limits apply only to CO2, or to several gases; trading is informal, or formal; trading involves sinks, or not; sales or leases; expiration of allowances; etc. Assess economic and environmental results. (b) Model of greenhouse gas limits, with and without international trading. Scenarios: limits apply only to CO2, or to several gases; nations trade, or private entities trade; trading is informal, or formal; trading involves sinks, or not; sales or leases; expiration of allowances; etc. Assess economic and environmental results.

5. Develop the institutional underpinnings of international trading: identify international entities that could assist in monitoring and facilitating trading (e.g. stock exchanges, agencies with relevant information (IEA? TFAP?)), and international instruments that might apply to such trading (e.g. GATT). Identify who would trade. Issues of monitoring and assuring compliance.

U.S. Department of Justice

Land and Natural Resources Division

Office of the Assistant Attorney General

Washington, D.C. 20530

May 8, 1990

MEMORANDUM

TO: Terry Davies, EPA/OPPE
Gary Evans, USDA
Bob Reinstein, USTR
Dick Schmalensee, CEA
Dick Smith, State/OES
J.R. Spradley, DOC/NOAA
Linda Stuntz, DOE/OPPA

CC: Theresa Gorman, OPD
Jeff Holmstead, WH Counsel
Nancy Maynard, OSTP

FROM: Dick Stewart DS
Assistant Attorney General

SUBJECT: Task Force to Further Develop the "Comprehensive" and "Trading" Approaches to Possible Climate Change Agreements

We have been asked to chair a small task force to further develop the "comprehensive" and "emissions trading" approaches to possible agreements on climate change, and we invite your participation on that task force. Advancing these approaches in international fora, with an eye to possible negotiations of a framework convention on climate which may begin as early as this fall, will necessitate further attention to the practical details involved, addressing the institutional, scientific, environmental and economic underpinnings. The task force would develop concepts, options and materials elaborating the "comprehensive" and "emissions trading" approaches.

On April 27-28, I attended the IPCC Seminar on Economic and Financial Measures in Paris. There was considerable interest in our "comprehensive" and "emissions trading" approaches, particularly from the Australians, Dutch, Germans, Japanese, and New Zealanders. There were many tough questions as to how these concepts could be institutionalized and put into operation. The OECD representatives present volunteered to host a future seminar to examine these issues.

If at all possible, it would be desirable to have revised versions of our February "Informal Seminar" papers prepared for distribution at the RSWG meeting in Geneva the week of June 4, and to follow up with an OECD-sponsored seminar at some point later this summer. The proposed task force could develop our thinking on these topics and prepare further materials.

Among the questions to be addressed by the task force will be the following:

1. What are the gaps and difficulties confronting development of a comprehensive approach for all greenhouse gases, their sources and sinks? For example, for which gases, sources and sinks is more information needed to measure and monitor net emissions? What remains to be done to develop a comparative index of the environmental impacts of the various gases? If a comprehensive approach is not immediately feasible for all relevant gases, sources and sinks, for which is it feasible, and how might additional gases, sources, and sinks be folded into a comprehensive approach as the science and data improve and as the time to negotiate relevant international instruments advances?

2. What institutions for monitoring and compliance assurance would be established in connection with a comprehensive approach?

3. What would be the relation between a comprehensive approach and agreements that deal with particular gases, sources, and sinks, such as the Montreal Protocol on Substances That Deplete the Ozone Layer, the Sulphur and Nitrogen protocols and the upcoming Volatile Organic Compounds (VOCs) protocol to the Long-Range Transboundary Air Pollution (LRTAP) convention, and a possible agreement on forests?

4. What gases, sources and sinks could feasibly be included in a trading system, either domestic or international?

5. What institutions would be needed to monitor and/or administer trading? What would be the respective roles of international organizations, national governments and private firms in the operation of international trading? Who would trade, what would be the currency of trades, how would trading be facilitated and monitored, and would trading involve, sales, leases, or other arrangements? How would these issues apply to domestic trading and international trading?

6. What should be done to allay concerns about "hoarding" of tradeable rights, the moral aspects of "licenses to pollute," and fears that developed nations would buy up all of the developing nations' rights?

7. What would be the likely environmental and economic benefits for the U.S. and the world of employing the comprehensive and trading approaches?

We would like to convene the first meeting of this small task force late this week or early next week. My office will contact you to arrange a time. A more detailed agenda and draft work plan will be distributed in advance of the meeting. I look forward to working with you.

THE WHITE HOUSE

WASHINGTON

June 11, 1990

MEMORANDUM FOR FRED BERNTHAL
STEVE DANZANSKY
CHRIS DAWSON
MIKE DELAND
THERESA GORMAN
BOB GRADY
BOYDEN GRAY
HENSON MOORE
BILL REILLY
DICK SCHMALENSEE
RICHARD STEWART

FROM: ALLAN BROMLEY

SUBJECT: Global Change Strategy Task Force Meeting

The Global Change Strategy Task Force will meet this afternoon at 2:00 p.m. in Room 22 of the Old Executive Office Building.

We will hear a briefing from Fred Bernthal on last week's meeting of the IPCC Response Strategies Working Group and the UNEP/WMO Bureau meeting in Geneva. We will also review and discuss testimony on the state of the international science on global climate change, to be delivered tomorrow by Dr. Bob Watson, Allan Hecht and Fred Bernthal at a hearing of the Senate Commerce, Science and Transportation Committee, chaired by Senator Al Gore. Copies of the testimony of Watson and Hecht are attached; copies of Bernthal's testimony will be distributed at the meeting.

DRAFT--6-7-90

EPA Contact
Tom Dickerson
382-5417

TESTIMONY OF
ALAN HECHT
DEPUTY ASSISTANT ADMINISTRATOR
OFFICE OF INTERNATIONAL ACTIVITIES
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SENATE COMMITTEE ON COMMERCE, SCIENCE,
AND TRANSPORTATION
UNITED STATES SENATE

June 12, 1990

Good afternoon, Mr. Chairman and members of the Committee. My name is Alan Hecht, and I am Deputy Assistant Administrator for International Activities at the U.S. Environmental Protection Agency. It is with great pleasure that I appear before you today to testify on the views of the international scientific community regarding global climate change. I understand that you are specifically interested in the recent findings of Working Group II under the Intergovernmental Panel on Climate Change (IPCC). Since the beginning of the IPCC I have served as coordinator of U.S. activities related to Working Group II.

The Intergovernmental Panel on Climate Change (IPCC)

Chaired by Dr. Bert Bolin of Sweden, the IPCC was established in 1988, under the joint auspices of the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO), to oversee internationally coordinated assessments of the magnitude, timing, and potential impacts of climate change. At the IPCC's first meeting in November 1988, the Panel set up three working groups to help carry out its work:

(1) the scientific assessment working group chaired by the United Kingdom (WG-I);

(2) the impact assessment working group chaired by the Soviet Union (WG-II); and

(3) the response strategies working group (RSWG) chaired by the United States (WG-III).

The United States has been an active participant in all three working groups, which have met on numerous occasions over the last couple of years to continue their work. I have just returned from the final meetings of the WG-II in Moscow and WG-III in Geneva. The IPCC and its three working groups will be presenting their preliminary findings at the Second World Climate Conference in October 1990.

Organization of Working Group II

As I just mentioned, Working Group II (WG-II) on Impacts was charged with describing the environmental and socio-economic implications of possible climate changes over the next decades due to increasing concentrations of greenhouse gases in the atmosphere.

The U.S.S.R. chaired this group with Japan and Australia serving as vice-chairs. Scientists from approximately 10 countries played the major role in preparing chapters of the report (Table 1). Dozens of scientists around the world contributed material to the lead authors of each chapter. Over 30 countries and organizations [e.g. (OPEC)] attended the final meeting in Moscow, May 28-31, where the report was adopted by the working group.

Ideally the IPCC process should have proceeded in stages where WG-I would have had the time to produce scenarios which could have been used as a basis for the analyses of WG-II. However, work among all groups proceeded in parallel. As a result, and in order to complete its work in time, WG-II was forced to use a number of scenarios based on existing models and analyses in the literature. These scenarios, largely drawn from the Villach Report and several reports by the National Research Council, have the features of:

- doubling between now and 2025 and 2050 of the greenhouse gases radiatively equivalent to CO_2 in the atmosphere;
- an eventual increase of global mean temperature of 1.5°c to 4.5°c above pre-industrial values;
- an unequal global distribution of this temperature rise, namely a temperature increase of half the global mean in the tropical regions and twice the global mean in the polar regions;
- a sea level rise of 0.3 to 0.5M by 2050 and about 1.0m by 2100.

The temperature scenarios compare reasonably well with the latest assessment of WG-I of an effective doubling of CO_2 for the IPCC ~~"business as usual scenario"~~[1] This would lead to a mean global temperature increase of about 1°c above the present value by 2025 and about 3°c before the end of the next century.

The sea level scenarios used by WG-II are, however, higher than current estimates given by WG-I. Under the IPCC ~~business as~~

[1] This scenario assumes that few or no steps are taken to limit greenhouse gas emissions. Current energy use and levels of tropical forests clearing continue and fossil fuels, particularly coal, remain the world's primary energy source.

~~usual scenario~~, an average rate of global mean sea level rise of about 6 cm per decade is projected by WG-I for the next decades. This amounts to a rise of about 20 cm by 2030 and 65cm by the end of the next century. Each of these estimates would be characterized by significant regional variations. The assessment literature is largely based on assuming a sea level rise of 50 to 2000 cms.

I emphasize that the majority of the analysis done by WG-II reflects analysis of the available literature as opposed to new and in depth original studies. This literature reflects a wide variety of methodologies. The report does not critically review existing methodologies.

The studies in this report also generally assume current societal, technological and environmental conditions. Some studies assume natural adaptation or some limited societal response. Such factors as changes in technology, which would effect sensitivity to climate change, are usually not considered.

In general, effects studies must rely on <u>regionally</u> detailed climate forecasts in which there is little confidence at present (see WG-I report). Thus the results in the WG-II report are best described as environmental sensitivity studies with respect to a range of climate scenarios. There is one major disagreement between WG-I and WG-II, centering around the use of paleoclimate scenarios as "predictors" of future climates.

Paleoclimate analogs are proposed by Soviet scientists as a means by which future climate can be predicted. The methodology assumes that past warm geologic intervals provide insight into possible future climate conditions. Constant general circulation models (GCMs) are based on mathematical representation of the physical process in the atmosphere and the interactions of the atmosphere with the earth's surface and oceans. There is considerable scientific debate about the merits and demerits of each of these as discussed in the report of WG-I.[2]

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[2] The scientific basis for paleoanalogs is described in the book Anthropogenic Climate Change (in Russian) edited by M. Budyko and Y. Izrael. The English version will be published by University of Arizona Press in 1990. Budyko is the leading proponent of this theory which has its critics in the USSR. The basic argument is that past warm intervals, especially, the Holocene (5000-6000 years ago), the Eemian (125,000 years ago) and the mid Pliocene (about 4-5 million years ago) represent times when the global average temperatures were respectively 1°, 2° and 4°c above the present. Budyko also believes that the CO_2 levels in the atmosphere were near 550 ppm in the Pliocene, an issue disputed by WG-1 report. Assuming that the intervals can serve as models of the future, Soviet scientists have attempted to reconstruct the spatial patterns of past temperature and precipitation (mainly for the USSR) for each period. They conclude that the spatial patterns are similar for all of these intervals. From this analysis Budyko concludes that the overall climate effect is largely beneficial with abundant precipitation occurring in areas now relatively dry.

The science under pinning this approach is uncertain. A two year cooperative US-USSR effort, under the US-USSR Environmental Agreement, to evaluate this approach has been underway and the results of this study will be published in a book Prospects of Future Climate Change (1990) edited by M. MacCracken and Alan Hecht (US) and M. Budyko and Y. Izrael (USSR). Further testing and evaluation of this approach is underway. Outside of the USSR this approach is not widely accepted. IPCC WG-1 in their evaluation concludes: "We cannot therefore advocate the use of paleoclimates as predictions of regional climate change due to future increases in greenhouse gases..". Largely at the request of IPCC WG-2 Chairman, WG-2 has included impacts based on

WG-II has chosen to use both GCM and paleoanalog scenarios as a basis for its impact assessments (except for sealevel rise). These scenarios provide a different set of boundary conditions which in some cases, e.g. in agriculture, give different results.

While the report recognizes the importance of rate of climate change as a major societal factor, the subject is not discussed in detail. Finally, while the report was intended to deal with both environmental and economic impacts, the report contains very little economic analyses.

With respect to overall organization, the full report of WG-II was extensively reviewed by over 30 U.S. scientists and by a review panel organized under the leadership of the National Climate Program Office with support from the National Oceanic and Atmospheric Administration (NOAA). These reviews were sent to lead authors to assist them in preparing their final chapters. Similar extensive reviews were conducted by Canada, U.K. and Australia.

Major Conclusions

- The major conclusion of Working Group-II is that the projected climate changes of the "business as usual" scenario are likely to have significant impacts on a broad range of managed and unmanaged ecological systems with the greatest impacts on those regions exposed to natural hazards, or under environmental or economic stress. While on balance, the evidence is that food production at the global level can be maintained at essentially the same level as would have occurred without climate change, the cost of achieving this is unclear. There may, however, be severe effects in some regions particularly those with high present day

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paleoclimate scenarios in its reports.

vulnerability. The inability to provide detailed regional scenarios of climate change limits the ability to adequately estimate potential regional impacts.

- The rotation period of forests is long and current forests will grow mature and decline during a climate in which they are increasingly more poorly adapted. Actual impacts depend on the physiological adaptability of trees and a range of biological relationships (e.g. parasites, competition, etc.). Large losses from both factors in the form of forest declines can occur. The most sensitive areas will be where species are close to their biological limits in terms of temperature and moisture.

- The rate of projected climatic changes is the major factor determining the type and degree of climatic impacts on natural terrestrial ecosystems. ~~Current models predict the WG-III "business as usual" scenario of future trace gas emissions that the global mean annual temperature is likely to increase~~ at a rate of 0.2-0.5°C per decade. This rate of increase is greater than seen over the past 10,000 years. These rates are likely to be faster than the ability of some species to respond and these responses may be sudden or gradual.

  Some species could be lost due to increased stress leading to a reduction in global biological diversity. Most at risk are those communities in which the options for adaptability are limited (e.g., montane, alpine, polar, island and coastal communities, remnant vegetation, and heritage sites and reserves) and those communities where climate changes add to existing stresses.

- Relatively small ~~comitate~~ changes can cause large water resource problems in many areas, especially arid and semi-arid regions and those humid areas where demand or pollution has led to water scarcity. Little is known about regional details of greenhouse gas-induced hydrometeorological change. It appears that many areas will have increased precipitation, soil moisture and water storage, thus altering patterns of agriculture, ecosystems and other water use. Water availability will decrease in other areas, a most important factor for already marginal situations, such as the Sahelian zone in Africa.

- The most vulnerable human settlements are those especially exposed to natural hazards e.g., coastal or river flooding, severe drought, landslides, severe wind storms and tropical cyclones. The most vulnerable populations are in developing countries, in the lower income groups, residents of coastal lowlands and islands, populations in semi-arid grasslands, and the urban poor in squatter settlements, slums and shanty

towns, especially in megacities. In coastal lowlands such as in Bangladesh, Viet Nam, Egypt, and China as well as in small island nations inundation due to sea level rise and storm surges could lead to significant movements of people. Major health impacts are possible, especially in large urban areas, due to changes in availability of water and food and increased health problems due to heat stress spreading of infections. Changes in precipitation and temperature could radically alter the patterns of vector-borne and viral diseases by shifting them to higher latitudes and thus put large populations at risk. These changes could initiate, as similar events have in the past, large migrations of people leading a number of years to severe disruptions of settlement patterns and social instability in some areas.

- A 30-50 cm sea level rise (projected by 2050) would contaminate the water supply of several atoll nations such as the Marshall Islands and Maldive, and threaten tourist beaches around the world. A 1 m rise by 2100 or later would render some island states uninhabitable, displace tens of millions of people seriously threaten low-lying urban areas, flood productive land, contaminate fresh water supplies and change coastlines. Coastal protection would involve very significant costs (see WG-III Report). Rapid sea level rise would change coastal ecology and threaten many important fisheries.

- Reductions in sea ice will benefit shipping, but seriously impact ice-dependent marine mammals and birds. Impacts on the global oceans will include changes in the heat balance, shifts in ocean to absorb heat and CO_2, and changes in upwelling zones associated with fisheries. Effects will vary by geographic zones, with changes in habitats and a decrease in biological diversity and shifts in marine organisms and productive zones, including commercially important species. Such regional shifts in fisheries will have major socio-economic impacts.

- The global areal extent and volume of elements of the terrestrial cryosphere (seasonal snow cover, near-surface layers of permafrost and some masses of ice) will be substantially reduced. These reductions, when reflected regionally, could have significant impacts on related ecosystems and social and economic activities.

- Permafrost, which currently underlies 20-25% of the land mass of the Northern Hemisphere, could experience significant degradation within the next 40-50 years. Projected increases in the thickness of the freeze-thaw (active) layer above the permafrost and a recession of permafrost to higher latitudes and altitude could lead to increases in certain instability, erosion and landslides in those areas which currently contain

permafrost. As a result, overlying ecosystems could be significantly altered and the integrity of man-made structures and facilities reduced thereby influencing existing human settlements and development opportunities.

Working Group

Recommendations for Future Impact Studies

IPCC WG-II was unable to address one aspect of its mandate, namely an analysis of likely social-economic impacts of climate change. This remains a major task for the future. The available literature on economic impacts is diverse and subject to considerable controversy. A great deal of future work is needed to provide credible economic analyses of possible impacts.

Other areas where the Working Group has identified the need for additional work are:

- Improved knowledge of effects of changes in climate on crop yields and livestock productivity in different regional and under different types of management.
- Better understanding of response of ecosystems to different rates of climate change.
- Mapping of low coastal areas subject to inundation from sea level rise of various magnitudes with particular stress on regional and local conditions (e.g., land subsidence) that will amplify the impacts.

Analysis of Overall IPCC Process

Let me make some observations on the overall IPCC and in particular the activities of WG-II. The IPCC has been successful in a number of ways:

- It has drawn governments into an active debate on climate change issues.

Furthermore, impacts are dependent on the rate and strength of climate change which are currently highly uncertain. Analysis of the sensitivity of impacts to different rates and strengths are nee

analysis and

- It has identified crucial policy and technical issues for future debate.
- It has created a number of informal networks and channels of communications among scientists and between governments.
- It has established a common framework, based on the assessment reports, from which governments can begin negotiations of a framework convention.

While the IPCC has encouraged the active participation of existing international institutions (e.g. IIASA, OEC), future activities might more actively draw on the excellent technical capabilities of these organizations.

Many existing organizations have experience in climate impact studies and can make significant contributions to improving existing methodologies in this field.

Finally, Mr. Chairman, one of the most important and immediate tasks is the dissemination of the conclusions of the IPCC reports to all countries. It is clear to me from our discussions in WG-II that many developing countries are unfamiliar with many aspects of the climate change issue. Presentations of the IPCC results in easily understood ways would greatly increase appreciation of the strengths and weaknesses of the current understanding of climate change and its potential impacts on society.

Thank you; I appreciate having been given the opportunity to discuss these important issues. I would be happy to address any questions which you may have at this time.

TABLE 1

Chapter	Lead Country Authors*
Agriculture and Forestry	U.K., U.S.S.R., India (49)
Natural Terrestrial Ecosystem	Canada, U.S.S.R., U.S. (17)
Hydrology and Water Resources	U.S., U.S.S.R., Algeria (N.A.)
Human Settlement, Energy Transport, Industry, Health	Japan, U.S. (31)
Oceans and Coastal Zones	U.S.S.R., U.S. (28)
Snow Cover, Ice and Permafrost	Canada, U.S.S.R. (28)

* Numbers in ( ) are expert contributions for sections of the report. Countries which contributed material include (other than those listed above) Australia, Benin, Brazil, Ethiopia, Costa Rica, Czechoslovakia, East Germany, Finland, FRG, Hungary, Ireland, Israel, Kenya, Netherlands, New Zealand, Nigeria, Norway, Mexico, Philippines, PRC, Poland, Thailand, U.K., Vietnam and OECD and IIASA.

INSERTS TO EPA OVERSIGHT JUNE 12, 1990

[A]

2030 High Emissions Scenario

[B]

Given the time available, it was not possible to examine in detail the sensitivity of impact estimates to the high uncertainties about the rate and strength of global climate changes or to the even higher uncertainties about regional changes.

[C]

Current models, assuming the WG-III High Emissions Scenario of future trace gas emissions, conclude that the global mean annual temperature is likely to increase...

[D]

While useful as indications of possible types of impacts, these conclusions are based on specific scenarios and hence are of very limited policy usefulness. Impacts are dependent upon the rate and strength of global climate change, which are currently highly uncertain, and also upon regional variations which can not now be simulated with any confidence. Hence, the Working Group conclusions are not predictions of what will happen. Because of the high uncertainties, analyses of the sensitivity of impacts to different rates and strengths of climate change are needed, but are not yet available.

Bob Grady—
You need to decide whether you want this in or out. OSTP wants out, NRD wants in. Given what we've done to Watson's testimony, I think we should not conclude what the usefulness is to policy. Your call. Nancy

Statement of

Dr. Robert T. Watson

Earth Science and Applications Division

Office of Space Science and Applications

National Aeronautics and Space Administration

before the

Committee on

Commerce, Science, and Transportation

U.S. Senate

Mr. Chairman and Members of the Committee:

I am pleased to be here today to discuss the international Scientific Assessment of Climate Change conducted under the auspices of Working Group I of the Intergovernmental Panel on Climate Change (IPCC), which was sponsored by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP).

This testimony will briefly present the background, participation, scope, review process, timetable, assessment outline, relation to policy, and executive summary of the IPCC scientific assessment (the executive summary appended to this testimony is verbatim from the IPCC assessment).

The dramatic rise in world population and industrial activities during the last century has generated concern that human activities are affecting the global environment. In particular, one global environmental change which may affect both human well being and the quality of life is global ~~warming~~; ~~warming~~ caused by increasing atmospheric concentrations of radiatively active trace gases such as carbon dioxide, methane, nitrous oxide, chlorofluorocarbons and tropospheric ozone. ~~This~~ environmental issue is no longer the sole concern of the scientific community and environmental groups, ~~but its importance has now been recognized by governments around the world.~~ The current interest in the global ~~warming~~ issue has resulted in the endorsement, at the highest levels of governments, for comprehensive scientific, technical and economic assessments to be performed. The IPCC assessments are in response to the need for such assessments.

Background

The World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) sponsored the Intergovernmental Panel on Climate Change (IPCC) to produce an international, state-of-the-knowledge review of climate change. This review includes three companion IPCC assessments of global climate change: (i) science, (ii) socio-economic impacts, and (iii) ~~policy options~~. The IPCC assigned lead responsibilities for the preparation of the three assessments reports as

follows: (i) Science - United Kingdom; (ii) Socio-Economic Impacts - USSR; and (iii) ~~Policy Options~~ Response Strategies - USA.

The scientific assessment of climate change is a peer-reviewed scientific document written by world renowned scientists, accompanied by a "Policymakers Summary" which is directed to government officials. The scientific assessment was completed, and the executive summary released, on May 25, 1990. The policymakers summary and the main assessment were delivered to the IPCC secretariat June 4, 1990.

Participation

The Scientific Assessment of Climate Change was chaired by Dr. J. Houghton, Director General of the British Meteorological Office, and prepared and peer-reviewed by the most knowledgeable scientists in the world on this subject. About 250 scientists participated in the preparation of the assessment, with an additional comparable number conducting the peer review. The assessment was coordinated, and initial drafts of the policymakers summary and its executive summary prepared, by a small core team of scientists at Bracknell, UK. I represented the U.S. as a member of this core team. The lead authors were selected by the intergovernmental IPCC Science Working Group (WG 1), and were responsible for the preparation of their sections. Daniel Albritton (NOAA) and I (NASA) were the U. S. Representatives on the IPCC Science Working Group on behalf of the Committee on Earth Sciences (CES).

Scope

The main features of the Scientific Assessment of Climate Change are the following:

- The scope encompassed the full climate change phenomenon, namely: climate forcing agents; processes involved in climate change; climate model formulation; tests of climate models; simulation of past climate changes; predictions of future climate; past climate record; and, physical (sea level) and biological responses to climate change.

- A special emphasis throughout the assessment was an identification of gaps in the knowledge and a better quantification of uncertainties.

Review Process

The scientific assessment was subjected to several levels of peer review, as outlined in the timetable below. The assessment (the main assessment, the policymakers summary and its executive summary) was peer reviewed both formally and informally by the international scientific community. This was followed by an intergovernmental review of the policymakers summary and its executive summary to ensure consistency between the main assessment and these two summaries.

Timetable

The major events and milestones for the Scientific Assessment of Climate Change included:

9 - 11 Nov 1988	First meeting of the IPCC held to establish the goals, scope, chairs, and schedule of all three assessments. (Geneva, Switzerland)
24 - 26 Jan 1989	First plenary meeting of the Science Working Group (WG 1) held to: establish the features of the Scientific Assessment of Climate Change; select lead authors; and, evaluate required interactions with the other IPCC Working Groups. (Oxford, United Kingdom)
7- 8 March 1989	Meeting of lead authors of the Scientific Assessment of Climate Change met to establish: the detailed structure and contents of the Assessment; the participants; and, the schedule of working meetings. (Princeton, USA)
April 1989 - Jan 1990	Subgroup meetings held to draft the individual sections of the Assessment.
Dec 1989 - Jan 1990	Section drafts available for initial informal peer review by the international scientific community.
Feb 1990	Second draft of assessment sections integrated into complete report, and an initial policymakers and executive summary prepared and distributed to lead authors and a small core review group.
26 Feb - 2 Mar 1990	Meeting of the lead authors of the Science Working Group and limited number of other experts (two per section) held to review the second draft of the Assessment (including policymakers summary and its executive summary). (Edinburgh, United Kingdom)
2 - 11 Mar 1990	Lead authors redraft assessment based on reviewers comments.
12 Mar - 9 April 1990	Third draft of the Assessment, including the policymakers summary and its executive summary, is distributed to the international scientific community for the second stage formal peer review.
10 - 27 April 1990	Lead authors revised assessment based on peer review comments.
7 - 18 May 1990	Governmental review of "final" version of assessment conducted, (primarily the policymakers summary and its executive summary).
21 - 25 May 1990	Second plenary meeting of the Science Working Group (WG 1), with lead authors, held to review the "final" draft Scientific Assessment of Climate Change. (Windsor, United Kingdom)
4 June 1990	Final Scientific Assessment of Climate Change delivered to IPCC secretariat.
12 - 16 Nov 1990	Second World Climate Conference scheduled, at which the reports of the IPCC will be presented. (Geneva, Switzerland)

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It is also important to note several other aspects of the document that also should be considered by policymakers.

- Even though the assessment represents a general consensus of views of the global change scientific community, there likely will be some scientific viewpoints that fall outside the ranges of the assessment.

- Because the principal focus of the assessment was on the anthropogenic courses of climate change, issues related to the natural sources and sinks in the carbon cycle, although discussed, were not assessed in the same degree of detail.

- The assessment reflects the current state of scientific research. The pace of scientific research in this field has been accelerated rapidly in recent years, resulting in a need to be continually cognizant of new knowledge.

Finally, I would reiterate that the scope of the assessment was limited to science issues. The question of impacts and response strategies, both mitigation and adaptation, must also be considered by the policymakers. In addition, the economic and other human implications both of climate change and of the potential response strategies which might be made to such change are of critical concern to policymakers.

THE PURPOSE OF THE IPCC SCIENTIFIC ASSESSMENT WAS TO PROVIDE INTERNATIONAL POLICY-MAKERS WITH A STATE-OF-THE-KNOWLEDGE REVIEW OF THE SCIENCE OF GLOBAL CHANGE. AS SUCH,

Relation to Policy

~~While~~ the Scientific Assessment of Climate Change is a scientific document, its ~~value to decisionmakers should be considerable. The reasons for this are severalfold:~~ AN IMPORTANT IN SEVERAL RESPECTS.

- It ~~is a strong~~ REPRESENTS A, single, concise statement from the GLOBAL CHANGE scientific community.

In the Assessment, major representatives of the GLOBAL CHANGE scientific community spoke at one forum regarding the knowns and unknowns of climate change, including global warming. The Assessment can, therefore, serve as a common reference point ~~for decisionmakers~~, in contrast to sporadic and separate statements reflecting the opinions of individuals.

- It is an international scientific assessment.

THE ASSESSMENT REFLECTS THE WORK OF AN INTERNATIONAL GROUP OF SCIENTISTS, ~~All nations now have a common basis of scientific input for their decision making~~, as opposed to only several national statements.

- The scientific scope is ~~comprehensive~~ BROAD.

The Assessment provides ~~decisionmakers with a single, homogeneous~~ A summary of the current scientific understanding of the whole climate change phenomenon, ranging from the causes of change to the physical and biological responses to that change. ~~This is likely to be more useful than separate reviews of components of the phenomenon conducted at different times and perhaps for different purposes.~~

- Both natural ~~and~~ THE VARIABILITY OF CLIMATE CHANGE AS WELL AS human-induced climate change were considered.

In contrast to considering only the potential perturbation of climate by human activities, the Assessment placed predicted change in the context of the observed and predicted changes that are a natural part of the climate system. The comparison of the two affords ~~immediate and straightforward~~ GREATER insight into the significance of any predicted human-induced perturbations. RESULTING FROM ANTHROPOGENIC SOURCES

- The focus on identifying gaps in the knowledge and quantifying uncertainties will aid risk analysis.

There is a highly relevant difference between (a) "The predicted range of possibilities is from X to Z, with a best estimate of Y" and (b) "The prediction is Y" with regard to decision making; the first statement explicitly reflects the existence of uncertainties in the prediction.

→ INSERT

Executive Summary

The Executive Summary of the Scientific Assessment of Climate Change was released on May 25, 1990. It summarizes the state of knowledge concerning global climate change, notes the uncertainties associated with our current knowledge, offers predictions and judgements relating to global change, and provides an overview of the areas in which we must improve our predictive capacity. The Executive Summary has been carefully scrutinized to assure that its statements accurately reflect the main assessment. A verbatim copy of the Executive Summary is appended to my testimony.

Conclusions

I believe that the IPCC scientific assessment represents a strong, concise statement from the international scientific community, ~~and that it~~ will provide ~~the required~~ scientific basis for ~~both national and~~ international ~~policy formulation~~. The assessment recognizes that while there are many uncertainties in our scientific knowledge, particularly with respect to our ability to predict the magnitude, timing, and regional patterns of climate change, first, there is no doubt that human activities are causing the atmospheric concentrations of greenhouse gases, particularly carbon dioxide, methane, the chlorofluorocarbons, and nitrous oxide to increase. And second, that current models predict that with the IPCC ~~"business as usual"~~ scenario of future trace gas emissions, the Earth's global mean temperature is likely to increase at a rate of between 0.2 to 0.5 degrees centigrade per decade. The assessment also noted that while the Earth's global mean temperature has increased between 0.3 and 0.6 degrees centigrade over the last 100 years, that this observed increase cannot be used to either validate or invalidate the "global warming" hypothesis, because while the magnitude of the observed warming is broadly consistent with the predicted global warming due to the increased concentrations of greenhouse gases, it is also comparable to natural variability.

Discussions.

AN IMPORTANT

2030. High Emissions Scenario (Scenario A)

However, I must stress once again that there are significant uncertainties associated with the current models, especially in their representation of important feedback mechanisms and uncertainties associated with the sources and sinks of greenhouse gases. The assessment recommends that improving our knowledge of these complex processes and the long-term collection of climate-related variables is critical to improving our predictive capability.

Intergovernmental Panel on Climate Change Working Group I

SCIENTIFIC ASSESSMENT OF CLIMATE CHANGE

Report to IPCC, 25 May 1990

Executive Summary

We are certain of the following:

• there is a natural greenhouse effect which already keeps the Earth warmer than it would otherwise be.

• emissions resulting from human activities are substantially increasing the atmospheric concentrations of the greenhouse gases: carbon dioxide, methane, the chlorofluorocarbons and nitrous oxide. These increases will enhance the greenhouse effect, resulting on average in an additional warming of the Earth's surface. The main greenhouse gas, water vapour, will increase in response to global warming and further enhance it.

We calculate with confidence that:

• some gases are potentially more effective than others at changing climate, and their relative effectiveness can be estimated. Carbon dioxide has been responsible for over half the enhanced greenhouse effect in the past, and is likely to remain so in the future.

• atmospheric concentrations of the long-lived gases (carbon dioxide, nitrous oxide and the CFCs) adjust only slowly to changes in emissions. Continued emissions of these gases at present rates would commit us to increased concentrations for decades to centuries. The longer emissions continue to increase at present day rates, the greater reductions would have to be for concentrations to stabilise at a given level.

• the long-lived gases would require immediate reductions in emissions from human activities of over 60% to stabilise their concentrations at today's levels; methane would require a 15-20% reduction.

Based on current model results, we predict:

• under the IPCC Business-as-Usual (Scenario A) emissions of greenhouse gases, a rate of increase of global mean temperature during the next century of about 0.3°C per decade (with an uncertainty range of 0.2°C to 0.5°C per decade); this is greater than that seen over the past 10,000 years. This will result in a likely increase in global mean temperature of about 1°C above the present value by 2025 and 3°C before the end of the next century. The rise will not be steady because of the influence of other factors.

• under the other IPCC emission scenarios which assume progressively increasing levels of controls, rates of increase in global mean temperature of about 0.2°C per decade (scenario B), just above 0.1°C per decade (scenario C) and about 0.1°C per decade (scenario D).

• that land surfaces warm more rapidly than the ocean, and high northern latitudes warm more than the global mean in winter.

• regional climate changes different from the global mean, although our confidence in the prediction of the detail of regional changes is low. For example, temperature increases in Southern Europe and central North America are predicted to be higher than the global mean, accompanied on average by reduced summer precipitation and soil moisture. There are less consistent predictions for the tropics and the southern hemisphere.

• under the IPCC Business as Usual emissions scenario, an average rate of global mean sea level rise of about 6cm per decade over the next century (with an uncertainty range of 3 - 10 cm per decade), mainly due to thermal expansion of the oceans and the melting of some land ice. This amounts to a rise of about 20cm in global mean sea level by 2030, and 65cm by the end of the next century. There will be significant regional variations.

There are many uncertainties in our predictions particularly with regard to the timing, magnitude and regional patterns of climate change:

- sources and sinks of greenhouse gases, which affect predictions of future concentrations
- clouds, which strongly influence the magnitude of climate change
- oceans, which influence the timing and patterns of climate change
- polar ice sheets which affect predictions of sea level rise

These processes are already partially understood, and we are confident that the uncertainties can be reduced by further research. However, the complexity of the system means that we cannot rule out surprises.

Our judgement is that:

• Global - mean surface air temperature has increased by 0.3°C to 0.6°C over the last 100 years, with the five global-average warmest years being in the 1980s. Over the same period global sea level has increased by 10-20cm. These increases have not been smooth with time, nor uniform over the globe.

• The size of this warming is broadly consistent with predictions of climate models, but it is also of the same magnitude as natural climate variability. Thus the observed increase could be largely due to this natural variability; alternatively this variability and other human factors could have offset a still larger human-induced greenhouse warming. The unequivocal detection of the enhanced greenhouse effect from observations is not likely for a decade or more.

• There is no firm evidence that climate has become more variable over the last few decades. However, with an increase in the mean temperature, episodes of high temperatures will most likely become more frequent in the future, and cold episodes less frequent.

• Ecosystems affect climate, and will be affected by a changing climate and by increasing carbon dioxide concentrations. Rapid changes in climate will change the composition of ecosystems; some systems will benefit while others will be unable to migrate or adapt fast enough and may become extinct. Enhanced levels of carbon dioxide may increase productivity and efficiency of water use of vegetation. The effect of warming on biological processes, although poorly understood, may increase the atmospheric concentrations of natural greenhouse gases.

To improve our predictive capability, we need:

- to understand better the various climate-related processes, particularly those associated with clouds, oceans and the carbon cycle
- to improve the systematic observation of climate-related variables on a global basis, and further investigate changes which took place in the past
- to develop improved models of the earth's climate system.
- to increase support for national and international research activities, especially in developing countries
- to facilitate international exchange of climate data

Assessment outline.

The Scientific Assessment of Climate Change has eleven sections and an annex.

Section 1.	**Greenhouse Gases and Aerosols**
Lead Authors:	Watson (USA), Siegenthaler (Switzerland), Oeschger (Switzerland), and Rodhe (Sweden).
Section 2.	**Relative Importance of Climate Forcing Agencies**
Lead Authors:	Shine (UK), Morcrette (France), Derwent (UK), and Wuebbles (USA).
Section 3.	**Processes and Modelling**
Lead Authors:	Cubasch (FRG) and Cess (USA).
Section 4.	**Validation of Climate Models**
Lead Authors:	Gates (USA), Rowntree (UK), and Zeng (PRC).
Section 5.	**Equilibrium Climate Change**
Lead Authors:	Mitchell (UK), Tokioka (Japan), Manabe (USA), and Meleshko (USSR).
Section 6.	**Time-Dependent Greenhouse-Gas-Induced Climate Change**
Lead Authors:	Bretherton (USA), Bryan (USA) and Woods (UK).
Section 7.	**Observed Climate Variations and Change**
Lead Authors:	Folland (USA), Karl (USA), and Vinnikov (USSR).
Section 8.	**Detection of the Greenhouse Effect in the Observations**
Lead Authors:	Wigley (UK) and Barnett USA).
Section 9.	**Sea Level Rise**
Lead Authors:	Warrick (UK) and Oerlemans (Netherlands).
Section 10.	**Effects on Ecosystems**
Lead Authors:	Melillo (USA), Salati (Brazil), Sinha (India), and Woodward (UK).
Section 11.	**Narrowing the Uncertainties**
Lead Authors:	McBean (Canada) and McCarthy (USA)

THE WHITE HOUSE

WASHINGTON

May 21, 1990

MEMORANDUM FOR FRED BERNTHAL
CHRIS DAWSON
THERESA GORMAN
BOB GRADY
BOYDEN GRAY
HENSON MOORE
BILL REILLY
DICK SCHMALENSEE

FROM: ALLAN BROMLEY
STEPHEN DANZANSKY

SUBJECT: Meeting of Global Change Strategy Task Force

The Global Change Strategy Task Force will meet Tuesday, May 22 at 4:30 p.m. in Room 340 of the Old Executive Office Building. An agenda is attached.

Our work will focus principally on the upcoming meetings of the IPCC working groups, which begin with Working Group 1 (Science) this week. Each working group is preparing a policymakers summary, which will in turn be incorporated into the summary document to be discussed at the next IPCC plenary meeting in August. Attached you will find the summary of Working Group 3 on Response Strategies, which is chaired by the U.S. The summary was the subject of a meeting of the Working Group on Climate at the State Department last Friday, and we should have available for tomorrow's meeting a compilation of the preliminary comments of the various agencies. Please review the summary and provide any comments at tomorrow's meeting.

Also attached you will find a statement of the U.S. Policy Overview on Global Change. It was prepared by the State Department in anticipation of the White House Conference on Science and Economics Research Related to Global Change, based on prior statements of U.S. policy, but was not subjected to interagency or White House Review at that time. It has subsequently been revised slightly. This document was also the subject of review by the Working Group on Climate, and we should have a compilation of comments on it available tomorrow also. Although this document will not be discussed at the Response Strategies Working Group meeting in Geneva which begins June 4, it will be helpful to have it as support for the positions of the U.S. delegation.

Please call Marcy Anderson at 6630 to advise of your attendance at tomorrow's meeting.

GLOBAL CHANGE STRATEGY TASK FORCE

AGENDA

May 22, 1990

I. Status of IPCC Working Groups and Process Overview

II. Negotiation of Global Climate Change Convention - Comprehensive Approach on Greenhouse Gases, Timing, Chairman and Level of Participation

III. Review of Statement of U.S. Global Climate Change Policy

IV. Review of Response Strategies Working Group Policymakers Summary

V. Future of IPCC and Response Strategies Working Group

THE WHITE HOUSE

WASHINGTON

October 2, 1990

MEMORANDUM FOR MEMBERS OF THE GLOBAL CHANGE STRATEGY TASK FORCE

FROM: D. ALLAN BROMLEY

SUBJECT: GLOBAL CHANGE STRATEGY TASK FORCE MEETING

The Global Change Strategy Task Force will meet October 3, 1990, at 10:00am in room 22 of the Old Executive Office Building.

The Department of State will present a debriefing on the preparatory meetings for the Framework Convention and the Second World Climate Conference. Alternative strategies and approaches to these meetings may be presented. In addition, we will receive an update on the status of activities of the Comprehensive/ Incentives Approach Task Force by Richard Stewart, Assistant Attorney General, Environment and Natural Resources Division. Attached, for informational purposes only, is a copy of their draft report, entitled "Interim Report: Research and Analysis to Support the Comprehensive and Incentive Approaches." An outline of the report was sent out earlier, under separate cover.

24 — 365 mc/cm3

1 ppm = 2600 mc/cm3

3 hour 1300 mc/cubic m3

.75 ppm

GOL

THE WHITE HOUSE

WASHINGTON

AGENDA

GLOBAL CHANGE STRATEGY TASK FORCE MEETING

October 3, 1990

1. Debriefing on Framework Convention
2. Debriefing on Second World Climate Conference
3. Report from Task Force on Comprehensive/Incentives Approach
4. Other business

10/2/90
REVIEW DRAFT
Do not quote,
cite or
distribute

Task Force on Comprehensive and Incentives Approaches to Climate

Interim Report:
Research and Analysis to Support the
Comprehensive and Incentives Approaches

October 2, 1990

Introduction

This Administration has developed new approaches to the design of potential climate change policy, the "comprehensive" and "economic incentives"[1] approaches. The United States first clearly presented these approaches to the Intergovernmental Panel on Climate Change (IPCC) by letter in December 1989. They were presented more fully through an "Informal Seminar" for the IPCC Response Strategies Working Group (RSWG) officers in February 1990, accompanied by a booklet of Discussion Papers that have since been widely distributed. The new approaches have been reflected in U.S. positions in the IPCC and now in the IPCC report itself, and in several speeches, including the President's April 18 closing remarks to the White House Conference on Science and Economics Research relating to Global Change, and his July 11 news conference following the Houston Economic Summit meeting.

The discussion to date has largely been of a conceptual nature. Work must now be done on the practical workings of these approaches, and to the research and analysis that would be needed to assess their utility and to support their implementation. This Task Force was organized in May 1990 to specify, encourage, and coordinate this work. The Task Force is an interagency effort chaired by DOJ and involving representatives of numerous agencies, including CEA, CEES, CEQ, DOC/NOAA, DOE, DOI, DOJ, EPA, NASA, NSF, OPD, OSTP, State, USDA, USTR, Treasury, and WH Counsel. This "Interim Report" is provided to identify the research and analysis needed, the current Administration efforts

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[1]The "economic incentives" approach was originally focused on emissions trading, but has since been broadened to encompass other market-based economic instruments, including emissions taxes.

in that direction, and the further work required. Work is needed in several scientific, economic and institutional research areas that bear on or underlie these approaches, including efforts to quantify sources and sinks of multiple greenhouse gases and fill gaps in information on those sources and sinks, to quantify the relative environmental impacts of these gases, to compare the cost-effectiveness of these approaches and their alternatives, and to develop institutional arrangements that could translate these approaches from concept to practicality. In light of the plethora of upcoming discussions, workshops, conferences, international meetings, ministerial conferences and full negotiations -- including the first session of negotiations on a framework convention on climate change, to be hosted by the United States in February 1991 -- prompt attention to these topics is needed to prepare U.S. representatives for effective participation and to assess choices the U.S. may need to make in responding to others' proposals or putting forward its own.

Policy context

These approaches address the "how to" question -- how to design any policy that might be adopted to respond to potential climate change. Their principal aim is to improve the framework of policy analysis and the cost-effectiveness of any proposed policy choice. They do not address the larger cost-benefit question of "how much" policy action should be taken -- what level of social investment, if any, is warranted by risks of potential climate change. The work of this task force does not imply that a choice has been made to implement some policy action.

Furthermore, the "comprehensive" and "economic incentives" concepts are "approaches" or heuristics that offer insight into any discussion of response strategies for potential climate change. The utility of these approaches is not limited to the design of emissions limitation policies. Whether the strategy is pursuing scientific research, promoting new technology, enumerating the measures justified on other grounds that also have potential climate benefits,[2] or designing actual

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[2]The major uncertainties surrounding potential climate change, potential response strategies, and the costs and benefits of both, have suggested a strategy of pursuing those policies which are justified on other (non-climate) grounds yet which also help to address potential climate change. More precisely, these are climate-relevant policies pursued in the face of uncertainties about predicted climate change which are so great that the present expected loss due to climate change (and thus the expected climate-related benefits of the policy) cannot

(continued...)

emissions limitations policies (whether domestic or international), these approaches suggest the desirable breadth, emphasis and direction of the strategy. The "comprehensive" and "economic incentives" approaches to potential climate change policy were originally developed in response to the piecemeal (CO_2-focused), command-and-control regulatory approach then dominating the discussion in the IPCC, but the approaches apply to the full array of policy types and options. And they apply to domestic as well as international discussions.

For example, a nation following the strategy of enumerating climate-relavent measures justified on other grounds could use the comprehensive approach to calculate the aggregate impact on net greenhouse gas emissions made by its various measures. A framework convention on climate change could take a comprehensive approach to the cooperative scientific and economic research to which the parties commit, including the development of international monitoring networks, as well as to any national emissions reporting, or to credit to be given under any future obligation for nations' current voluntary emissions-limiting activities. An economic incentives approach could be applied to adaptation measures desirable in long-range investments, such as coastal construction or water use planning.

Summary of the Approaches

The two approaches are compatible, but need not be employed together. Both approaches offer the possibility of designing environmental policies that achieve goals at lower cost and that highten the possibility for diverse, innovative, flexible, and cost-effective responses.

Comprehensive approach. The "comprehensive" approach seeks to address all the important contributors to potential climate change, in contrast to a piecemeal focus on CO_2 from the energy sector. It therefore addresses all radiatively active trace gases (RATGs), primarily consisting of the greenhouse gases (GHGs), and their sources and sinks. GHGs include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), halocarbons such as chlorofluorocarbons (CFCs) and related substances (HCFCs, HFCs),

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[2](...continued)
confidently be said to exceed a de minimis level. Examples include emissions-limiting or adaptive steps taken for non-climate reasons, such as phasing out CFCs, afforestation, improving energy efficiency, and developing more drought-resistant strains of crops. Other examples could include reducing landfill emissions of NMHCs and CH_4, reducing auto emissions of CO and NOx, and encouraging coastal development to account for current subsidence trends.

and tropospheric ozone (O3), whose precursors include oxides of nitrogen (NOx), non-methane hydrocarbons (NMHCs) (also referred to as "volatile organic compounds," VOCs), and carbon monoxide (CO).[3] Different RATGs arise from different sources and are removed from the atmosphere by different sinks, yielding a "net emissions" budget. Different RATGs have different impacts on the environment; for example, each gas has a different ability to trap certain radiated energy ("radiative forcing") or to reflect it. In order to relate the comparative environmental impacts of the various RATGs, the comprehensive approach employs a parameter or "index" that calculates the relative contribution of increments of each gas to physical effects, such as radiative forcing, used as proxies for global externalities. The comprehensive approach thereby avoids ignoring the important gases that would be omitted from a CO2-only approach, and avoids ignoring important sources and sinks that would be omitted from an energy-only approach.

As a means of developing an agenda for science and economics research, such as research on the likelihood or impacts of potential climate change, the comprehensive approach suggests the scope of the research agenda: the range of relevant inquiry, the gases and sectors relevant as inputs to economic models of RATG emissions, and the relative environmental externalities (both negative and positive) related to emissions of each gas.

As an approach to technology development, the comprehensive approach assists in identifying and comparing the relative importance of technologies and practices affecting potential climate outcomes.

As a means of enumerating climate-relevant measures justified on other grounds, the comprehensive approach provides a metric for identifying and assessing the policy actions that are relavent in the climate context. It could form the basis for calculating the aggregate impact of various such measures on a nation's net RATG emissions.

As an approach to emissions limitation rules or obligations, the comprehensive approach provides an environmentally coherent and least-cost design for limitations policy. A piecemeal approach, focused on one gas (e.g. CO2) or one sector (e.g. energy), would omit salient RATGs, sources and

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[3]Other RATGs affect the radiative balance of the atmosphere, but unlike GHGs, their main influence is not through absorption of energy reradiated from the Earth's surface. Aerosol particulates such as sulfur dioxide (SO2), which generally reflect insolation and thus may exert a net cooling influence, are RATGs but not GHGs. A fully comprehensive approach would encompass all such RATGs.

sinks. By aiming narrowly, it could very well induce unintended shifts of economic activities to unregulated modes that offset or even increase emissions of RATGs, much as focusing on air emissions alone can shift pollutants to toxic solid sludge discharges. For example, focusing on CO2 alone could induce fuel-switching from high-CO2 coal to lower-CO2 natural gas, meanwhile leading to increased emissions of CH4 from natural gas transmission leaks. The comprehensive approach cures these defects of a piecemeal approach. It also allows the flexibility to choose the least-cost mix of policy options yielding the desired overall RATG limitation. And, by addressing "net emissions," it encourages sink enhancement such as through afforestation or safeguards against pollution of oceanic phytoplankton. The comprehensive approach can be applied to a variety of emissions limitation measures,[4] including emissions taxes and emissions trading, and including both domestic and international measures. If applied internationally, it has the additional benefit of affording each nation the flexibility and discretion to decide the mix of domestic policies regarding the array of gases, sources and sinks that that nation determines would best accomplish policy goals in light of its unique social, economic, cultural and institutional circumstances.

Economic incentives approach. The "economic incentives" approach similarly applies to a variety of policy options. In the emissions limitation area, it encompasses the panoply of market-based economic instruments, including emissions trading and emissions taxes, imposed to force internalization of the external environmental costs accompanying emissions. It includes the use of incentives to promote innovation in technologies and practices, and addresses adaptation as well as emissions limitation. These incentives could be applied domestically or internationally.

As one example, application of emissions trading to emissions limitation obligations would allow those emitting a substance to achieve compliance with limits on such emissions by voluntary agreements to reallocate emissions among individual emitters so long as the aggregate output did not exceed their overall limit. Thus, reductions would be obtained most at those places where reductions cost least. This could be accomplished by authorizing informal reallocations among emitters, or by formally issuing "allowances" and then authorizing a market in

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[4]In light of the relative weighting of the various RATGs according to their environmental externalities and the flexibility afforded to choose a least-cost mix of measures, it is possible that the comprehensive approach could achieve an aggregate net RATG emissions limit by restricting emissions of some gases while allowing emissions of other gas(es) to rise.

the allowances. Experience with emissions trading in the U.S. indicates that it can achieve environmental quality goals at substantially lower cost, and therefore could be of use to nations domestically as they implement any limits on greenhouse gases. Several U.S. applications of emissions trading have been highly successful, such as the phasedown of lead in gasoline; some others have been instructive of the limits of emissions trading, especially when it is applied in the context of other regulatory restrictions on emitters. Allowing emissions trading among nations -- probably initially as informal reallocations accomplished through bilateral national accords -- could similarly be advantageous in the context of any international efforts to develop new technologies or limit emissions.

Emissions taxes would in theory also produce least-cost results. In general, while emissions trading provides more certainty about the quantity of emissions limitation achieved, emissions taxes provide more certainty about the cost imposed on emitters. Domestic use of emissions taxes could be apt where certainty as to cost is more important, or where revenue raising is an important goal. Imposition of international emissions taxes could raise additional institutional, political and sovereignty concerns -- such as whether nations would cede their sovereignty to an international tax authority, how the tax would be set, how it would be made equivalent across economies, and how the potentially enormous revenues raised would be allotted and expended -- that would probably not attend informal bilateral international emissions trading or domestic taxes.

As another example, market mechanisms could be used to encourage efficient adaptation practices. Long-range investments, such as coastal construction or water use planning, might, because of market failures or other institutional failures, be undertaken without giving appropriate weight to any climate change risks (e.g. rising sea levels or shifting precipitation). Such failures might be addressed by informational or incentive-based policies, such as by requiring coastal construction to purchase subsidence insurance, or by fostering a market in water resources that provides incentives for efficient use and long-range risk management.

Research and Analyses

The remainder of this Interim Report describes the research and analysis tasks needed to develop and support the comprehensive and incentives approaches. Our interagency task force has endeavored to identify all of the current agency activities related to each task, although we expect to learn of additional activities as this report is shortly completed.

A companion report being prepared jointly by the CEES' two working groups, Global Change and Mitigation & Adaptation Research Strategies, titled "Research in Support of a Comprehensive Approach to Trace Gas Emissions" (draft 10 September 1990), provides substantial additional detail on the ongoing scientific research relavent to these approaches and the research needed in the future.

Priorities and Timelines

For each task described below, our interagency task force has suggested a priority value and a timeline on which work could and should be completed to be most useful. The suggested relative priority is identified for each task as "high," or "medium," with the understanding that this list is itself a capsule summary of the highest priority items and does not mention numerous tasks judged to be somewhat relevant but not warranting inclusion here.

A time horizon of 3 months, 18 months, or 5 years is typically suggested for each task.[5] The timeline developed is a combination of the practical pace of research, which suggested a breakdown of tasks into very short-term (3 months), near-term (18 months), or longer-term (5 years) horizons for each task; and the pace of international discussions, which suggested milestones at January 1991, the eve of the first negotiating session on a framework convention (3 to 4 months), June 1992, the target signing date for the convention (roughly 20 months), or 1995, the tentative time for the next full IPCC report (5 years).

The priorities and timelines suggested for each task are suggestions, and we anticipate further discussion and revision on these points.

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[5]For certain tasks the timeline is different due to particular scheduling dates; for example, the Second World Climate Conference will be held at the end of this month.

Research and Analysis Underlying the Comprehensive Approach

I. Measuring and Monitoring Atmospheric Greenhouse Gas (GHG) concentrations

Any environmental impacts resulting from GHGs would be associated with changing actual concentrations in the atmosphere, not emissions per se. The comprehensive approach underscores the necessity of gathering data on atmospheric concentrations of all relevant GHGs. Over the last decade much work along these lines has already been undertaken or accelerated, including (i) direct measurement through ground station, aerial, and satellite observation of atmospheric (tropospheric and stratospheric) concentrations of several trace gases (chiefly CO2, CH4, N2O, O3, and CFCs), and (ii) sample records of past climate change found in ice cores, tree rings, and other sites. Measuring and monitoring past, current and future concentrations, temporal and spatial (e.g. vertical) distributions, chemistry, removal, and other dynamics of GHGs will remain an essential function under a comprehensive approach.

-- Current Administration efforts:

- Under the U.S. Global Change Research Program, several CEES agencies are conducting relevant research. For example, DOE, NASA, NOAA and NSF are conducting or will soon conduct direct measurement of atmospheric concentrations and distributions of CO2, CH4, N2O, tropospheric O3, CFCs, CO, NOx and NMHCs. NASA, NSF and DOI are studying sample records of CO2 and CH4 in ice cores and tree rings. NASA and NOAA conduct direct observations of stratospheric O3 and related substances. EPA monitors ambient concentrations of NOx, O3, NMHCs, SO2, and CO. Internationally, the United States participates in the work of the World Meteorological Organization (WMO), the World Climate Program (WCP), the International Geosphere-Biosphere Program (IGBP), and many other monitoring efforts.

-- Future work:

- Ensure coverage of all relevant RATGs. Priority: high. Timeline: continuous.
- Advance the comprehensive approach in any framework convention on climate change. The science research section of the convention must address all the relevant RATGs. It should build networks of cooperative monitoring among nations. Priority: high. Timeline: 3 months to 18 months.

- Advance the comprehensive approach in the Second World Climate Conference. Priority: high. Timeline: 1 month and thereafter.
- Advance the comprehensive approach in the World Climate Program. Priority: high. Timeline: 1 month and thereafter.
- Ensure coverage of relevant temporal and spatial distributions.
- Advance understanding of chemical interactions among trace gases.
- Advance understanding of quantitative link between trace gases and radiative forcing.

II. **Impacts of RATGs: Comparative Indices**

Changing concentrations of RATGs in the atmosphere are of interest because those gases may yield environmental impacts on societies and ecosystems. Different substances in the atmosphere have different environmental impacts; it goes almost without saying that the environmental impacts of atmospheric oxygen, water vapor, and CO2 are quite varied, and are believed to be fundamental to the present habitability of the planet. Incremental changes in concentrations of trace gases such as GHGs will similarly have various impacts depending on the particular gas at issue.

(A) Radiative forcing index

In the climate change context, the principal impact of RATGs under study has been radiative forcing. Radiative forcing is not the ultimate environmental impact of actual concern to societies and ecosystems; it is rather an intermediate physical effect that serves as a useful proxy or metric for assessing the impacts of different RATGs on the potential for warming-induced climate change, including atmospheric temperature change, changing precipitation, changing soil moisture, sea level rise, and temporal and regional variations, all of which in turn could affect biological and other systems. Molecules of different RATGs have different radiative forcing properties, and estimates of the relative radiative forcing of incremental amounts of GHGs can provide a common scale along which to compare the gases. A comparative parameter of relative radiative forcing, sometimes called a "global warming potential" (GWP) index or an index of "CO2 equivalence," has been developed by several scientists. The index incorporates the instantaneous radiative forcing of each type of molecule, its dissipation function and hence its typical residence time in the atmosphere, and the discount rate applied

or the time horizon over which the forcing function is integrated.

-- Current Administration efforts:

- Considerable work has been done on the relative radiative forcing of many RATGs. Estimates of instantaneous radiative forcing, derived from laboratory tests of molecular properties, are well established, as are residence times for several RATGs.

Work in this area has been done by NASA, NOAA, NSF, EPA, and DOE, and has been reviewed and reported by IPCC WG I.

-- Overview of needed work:

Priority: In general, this task is extremely urgent, as it constitutes the technical focal point of the comprehensive approach.

Timeline: Current work on relative radiative forcing is very active; the science is maturing; and robust, reliable, consensus estimates will likely be ready in the near term (6 to 18 months), though with continued uncertainties on specific aspects.

-- Future work:

- Convene international workshop(s) to discuss current work and needed improvements, to build understanding among diverse and representative experts, and to encourage multidisciplinary efforts. EPA, NOAA and NASA are jointly planning to host such a conference in November 1990. Priority: high. Timeline: 3 months.
- Harmonize various quantitative approaches and extend international understanding of indices. Priority: high. Timeline: 3 to 18 months.
- Improve accuracy of dissipation functions and hence of estimated residence times of RATGs. Scientific uncertainties in the current estimates remain surrounding the residence time of CO2, due to complications in the carbon cycle and uncertainties in CO2 sink removal processes. Atmospheric chemical reactions involving other gases, such as CH4 and precursors to tropospheric O3, complicate estimates of their residence times. Recent work at NOAA is substantially improving estimates of the dissipation rate and residence time of CH4. As work is ongoing, uncertainties in best estimates can be expressed and revised. Priority: high. Timeline: 3 months to 5 years, varying by gas.
- Incorporate indirect effects attributable to various gases' atmospheric reactions. Certain trace gases react to form other radiatively important trace gases,

or react with substances that would otherwise affect RATG abundances. Much of this work has already been conducted, hence: Priority: medium. Timeline: 18 months to 5 years, depending on gas.

- Take account of "saturation" effects. Radiative forcing by each RATG occurs within a different segment of the electromagnetic spectrum; as that segment or "band" becomes occluded, additional increments of the gas have diminishing marginal radiative forcing impacts. Radiative forcing estimates thus depend on, and need to be expressed in terms of, projected concentrations of relevant RATGs. Much of this information is already available and needs to be incorporated into expressed estimates. Priority: medium to high, depending on significiance of the effect for each gas. Timeline: 18 months.
- Take account of the implications that vertical and other distribution of RATGs in the atmosphere may have for calculated index values. This factor is quite important for O3 and its determinants -- CH4, CO, NOx, NMHCs. Priority: high for relavent gases. Timeline: 18 months.
- Improve use of discount rates/time horizons. IPCC WGI expresses GWPs in three selected time horizons; analysis is needed of which of these three horizons, or which other horizon, is appropriate for policymaking. More broadly, better understanding is needed of the scientific and economic basis for choosing different discount rates. Priority: high. Timeline: 3 to 18 months.
- The indices calulated to date have often focused on GHGs and omitted other RATGs. Assess implications of including other relevant substances, such as anthropogenic aerosol particulates (e.g. SO2), in the index. Priority: medium. Timeline: 3 to 18 months.
- Develop institutional mechanisms for adopting a consensus index and adjusting it to new research results. Because uncertainties remain in certain aspects of the index, index values may change as new scientific information is discovered. If an internationally agreed index is used as a tool for design of national policy portfolios to limit net index-weighted RATG emissions, changes in the index values could mean changes in the costs to each nation of its policy package. Mechanisms should be developed for giving advance indication of index uncertainties and likely changes in the index, incorporating new scientific information, and smoothing transitions to new index values. Such mechanisms could include objective science panels and periodic reassessments. Priority: high. Timeline: 3 to 18 months.

(B) Global change index

As indicated above, radiative forcing is only an intermediate physical effect of trace gases, and is really a proxy used as a common metric to compare diverse RATGs.[6] But RATGs have multiple attributes; they yield other, non-warming environmental impacts of global and local significance which may be more important (in magnitude, timing, or other features) than their contributions to radiative forcing. For example, CO, NOx, urban O3, and SO2 are reactive and/or toxic; CFCs and related substances deplete the stratospheric ozone layer; higher CO2 concentrations increase plant photosynthesis and increase plants' water use efficiency. Optimal policy choices would entail developing a comparative index that incorporates the full externalities (social and ecological costs) imposed by increments of each RATG. Without such a "complete" index, a simple radiative forcing index could provide signals or incentives that yield desirable changes in aggregate radiative forcing but undesirable changes in other impacts; in other words, significant externalities will remain uninternalized.[7]

At the same time, a fully "complete" index poses quite difficult analytic and technical problems. Data are not adequate on important aspects of the magnitude and variations of the diverese impacts; for example, data are lacking on the effects of ozone depletion on UV-B irradiance, and on the effects of changes in UV-B irradiance on biota. Comparing the dissimilar warming and non-warming impacts on a common scale, something like comparing apples and oranges, is a challenge requiring serious analytic efforts.

A somewhat more realistically achievable index would incorporate only the key "global change" attributes of each RATG, namely their radiative forcing and the other salient non-warming global impacts of GHGs, such as the direct effects of CO2 on vegetation and the ozone depletion impacts associated with CFCs and other halocarbons. Essentially local attributes of the

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[6]Measurement of the ultimate impacts of warming itself on biological and other systems, though critical for assessing the costs and benefits of climate change, are not incorporated into the radiative forcing index because such impacts stem from warming generically, and do not vary depending on the type of gas enhancing the warming.

[7]It is worth noting that, in contrast to the warming-specific term GWP, the phrase "CO2 equivalence," though unfortunate for its focus of attention on CO2, does offer the opportunity to introduce non-warming effects into the generic concept of "equivalence."

gases, such as their toxicity, would be left to local policy strategies. This "global change" index would capture the main global externalities associated with the gases, providing significantly more optimal policy signals than an index limited to radiative forcing. It would nonetheless require effort and time to construct.

The desirability of a "global change" index faces a dilemma: pushing too hard for a more complete index could undercut the legitimacy of the radiative forcing index, leading to the latter's disparagement or rejection by other nations, or perhaps to the view that one must wait years for a more complete index. This in turn could encourage the reinvigoration of gas-by-gas policy proposals. A two-pronged effort is therefore needed, to build, improve and promote the radiative forcing index, and at the same time to work on a global change index without undercutting the radiative forcing index.

-- Current Administration efforts:
- Conceptual thinking about design of a global change index. (DOJ, USDA)
- Efforts to quantify direct environmental impacts of CO2 enrichment, chiefly its impacts on agricultural and forestry output, and on water resources. (DOE, USDA, DOI, EPA, NSF). These efforts are high priority in any event.
- Efforts to quantify environmental impacts of stratospheric ozone depletion and resultant UV-B irradiance due to halocarbon emissions, such as impacts on agriculture, phytoplankton, and cancers. (USDA, EPA). These efforts are high priority in any event.

-- Future work:
- Address technical and analytic issues in a global change index. Whereas the common proxy or metric used in current indices is radiative forcing, a global change index would require a common metric among the various warming and non-warming impacts. It would also require application of discount rates because different impacts may occur at different times; for example, CO2 enrichment will likely occur much sooner than any observed warming due to CO2. (DOJ, USDA, DOI). Priority: medium. Timeline: 18 months.
- Undertake preliminary design and rough quantitative estimate of a global change index, in order to assess the difference between the relative RATG values obtained in a global change index versus a radiative forcing index. This effort would also indicate whether a global change index is sufficiently different to be worth developing. Priority: medium. Timeline: 3 to 18 months.

- Improve understanding of direct environmental impacts of CO2 enrichment, including the impact of CO2 in concert with changes in other environmental variables such as temperature, moisture, and other pollutants. (DOE, USDA, DOI, EPA, NSF). Priority: high. Timeline:
- Improve understanding of impacts of ozone depletion, including measuring UV-B irradiance and assessing impacts of UV-B radiation on biological systems. (USDA, EPA). Priority: high. Timeline:

III. **Measuring and Monitoring net GHG emissions**

Assessment of current and future net emissions is critical to the task of predicting the contribution of net emissions to atmospheric concentrations and hence to forecasting potential climate change, regardless of whether any emissions limitations are ever adopted.

The comprehensive approach emphasizes attention to all RATGs, sources and sinks. Baseline data on all of these is not always currently available. In addition, much of the data that are available derives from estimates using data on inputs (e.g. fuel quantities) and knowledge of or assumptions about input-output ratios associated with technologies or practices. Better measurement, forecasting and actual monitoring of net RATG emissions is suggested by, and needed to support, the comprehensive approach.

The ability to better monitor future emissions could also be useful in verifying the implementation of limitation actions and in assuring others' compliance with their claims and with international obligations. This is true of domestic limitations rules as well as international obligations; if a domestic GHG emissions limitation policy is to be effective and, in particular, is to employ performance standards rather than technology-based standards, it will require sound emissions monitoring techniques.

(A) Measuring net GHG emissions

-- Current Administration efforts:
- Numerous agencies collect and analyze data on various gases, sources, sinks, sectors, and industries, and thereby measure emissions from a variety of sources (e.g. energy utilities, mobile sources, land use, agriculture) and uptake by a variety of sinks (e.g. oceans, forests, soils, grasses).
- Efforts are underway to assemble "inventories" of net

emissions of GHGs for many nations,[8] chiefly EPA's analysis of CO2, CH4, CFCs, HCFCs, N2O, CO, NOx, and NMHCs for the US and other nations.
- Data are generally adequate on US and other industrialized nations' emissions of GHGs from fossil fuel combustion (generally measured by data on fuel inputs and knowledge of typical combustion techniques), and on world emissions of halocarbons (generally measured by production, consumption and storage rates).

-- Future work:
- Ensure that measurement covers all relevant GHGs, sources and sinks. Priority: high. Timeline: continuous.
- Improve data on other nations. Data on developing nations are particularly scant. The framework convention could call for development of information on all nations, including through a network of cooperative international measuring. Priority: high. Timeline: 18 months to 5 years.
- Develop technologies for measuring net GHG emissions, including direct observation and remote sensing. Priority: medium. Timeline: 18 months to 5 years.
- Develop a data set of emissions/uptake factors for current and potential technologies and practices, covering all relevant gases, sources and sinks. Priority: high. Timeline: 18 months.
- Develop practical proxies or surrogates, such as fuel or fertilizer input data coupled with assumed output rates (e.g. combustion or cultivation techniques), or acreage or livestock data coupled with assumed output rates, to generate emissions factors to assist in measuring emissions. Ensure that measurement uncertainties and assumptions, and use of

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[8] Efforts outside the government include: OECD project, soliciting data from member states on all GHGs; WRI project (in conjunction with UNEP/UNDP) on all nations' net emissions of CO2, CH4, CFCs; Harvard Kennedy School survey of many nations' emissions of CO2 and CFCs.

proxies/surrogates, do not distort policy responses.[9] Priority: high. Timeline: 18 months.
- Improve understanding of the processes involved in natural emissions and sink uptake, and how these activities might be influenced by climate change. Priority: high. Timeline: 3 months to 5 years.
- Ensure that data presentations are comprehensive, e.g. avoid CO2-only or fossil fuels-only charts in IPCC, NES, OTA, and other reports except as adjuncts to complete GHG presentation. Priority: high. Timeline: continuous.
- Ensure that data presentations include the scientific uncertainties involved. Priority: medium. Timeline: continuous.

(B) Forecasting future net emissions

-- Current Administration efforts:
- Use of economic models to generate scenarios of future emissions. EPA, DOE, and NSF are conducting such work, using a variety of economic models. U.S. agency work was reviewed and reported in the IPCC WGI/WGIII emissions scenarios.

-- Future work:
- Current economic models tend to focus on CO2, separate sectors, and industrialized nations. Need to make use of new and expanded models that overhaul and elaborate current economic models to cover multiple RATGs, multiple sectors, and other important improvements. Ensure that these models include GHG sinks and other aspects of the comprehensive approach. DOE has a three-year phased project underway to accomplish this; EPA is working on improving its models. Priority: high. Timeline: 18 months to 5 years.

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[9]For example, measurement of CH4 emissions based on a proxy such as total acreage of rice cultivation might imply that the only option to reduce emissions is reduced rice cultivation, whereas changed practices using existing or new rice strains might accomplish the same at lower socioeconomic cost. In general, the use of proxies should not be allowed to conceal opportunities for changing the emissions factors or other assumptions from which the proxies derive.

(C) Monitoring net emissions in the future

This task is useful to test empirically the effects on RATG net emissions of observed changes in economic activity, economic structure, and technologies and practices. It is also useful to evaluate accomplishment of nations' espoused policies and of any limitation agreements reached in international accords.

-- Current Administration efforts:
- Efforts to improve monitoring of non-point emissions, including CH4 emissions from rice cultivation (EPA) and ruminant animal husbandry (EPA); and GHG emissions from biomass burning (deforestation) (EPA, NASA, USDA).
- Efforts to improve monitoring of CH4 emissions from energy systems such as natural gas transmission and fossil fuels extraction (DOE, EPA).

-- Future work:
- Use proxies/surrogates, developed for measurement of net emissions (section (A) above), to monitor emissions through monitoring of inputs, technologies and practices. Priority: high. Timeline: 18 months.
- Expand monitoring capacity and data to cover all relevant gases, sources, and sinks: data are especially needed on non-point sources of CH4 and N2O, e.g. agriculture, livestock; hydroxyl chemistry and atmospheric chemical reactions yielding tropospheric O3; non-point sources and sinks of CO2, including oceanic biota, terrestrial biota, long-term sequestration, plant lifecycles, grasses, soils, and trees, extent and effects of deforestation, and sink behavior. Priority: high. Timeline: 18 months to 5 years.
- Expand monitoring capacity and data to cover all nations. Current data generally cover industrialized nations. Develop an international network of cooperrative net emissions monitoring. Priority: high. Timeline: 18 months to 5 years, depending on gas and sources/sinks.
- Harmonize techniques and data among nations and analysts. For example, resolve differences among nations monitoring deforestation (Brazil is urging that only its satellites produce reliable estimates of Brazilian land use). Priority: high. Timeline: 18 months to 5 years.
- Develop monitoring technologies and capabilities, as described under "(A) Measuring net GHG emissions" (above). Priority: medium. Timeline: 18 months to 5 years.
- Identify potential international and national methods for monitoring net GHG emissions; assess institutional,

political, social, and economic constraints on such monitoring, and means to overcome such constraints. Priority: high. Timeline: 3 to 18 months.
- Assess options for monitoring arrangements, including arrangements for monitoring and reporting and their relation to sovereignty concerns, e.g. voluntary or mandatory national reporting; "national technical means" of observation of other nations' activities; remote sensing; atmospheric observations; international oversight bodies (e.g. UNEP investigators); permission for on-site inspections; bilateral trade partner review under emissions trading; incentives and institutional designs to encourage development and application of accurate monitoring & reporting, for example by assuring credit for net GHG limitation actions (e.g. climate-relavent actions justified on other grounds) upon a showing by the emitter of successful monitoring practices (see section VI below); verification and enforcement procedures and their rules, reporting and enforcement procedures, burdens of proof, forum (international or bilateral, political or scientific adjudicators, etc.). Examine role of nongovernmental organizations and public. Priority: high. Timeline: 18 months.

IV. **Evaluating current national policies and proposals**

Whether or not international agreement is reached on response strategies to potential climate change, nations are already announcing their intention to restrict emissions of one or more RATGs or to expand RATG sinks. The U.S. policy of pursuing climate-relavent measures justified on other grounds has been articulated in qualitative form; at some point the U.S. -- or others -- may choose to present quantifications of the net RATG effects of these U.S. measures. The comprehensive approach provides the basis for computing the aggregate impact of such diverse measures. In addition, it may be valuable for the U.S. to assess the policy claims and policy proposals being made by other nations, using the comprehensive approach, and to examine the policy opportunities that would face other nations under a comprehensive approach.

(A) <u>Extent and costs of net GHG limitations achieved by U.S. policy options within a comprehensive framework.</u>

As described in the Introduction, it is useful to identify actions taken for other (non-climate) reasons but which influence net RATG emissions. One may calculate the percent limitations or reductions achieved by these policy actions using the comprehensive approach, and also calculate the marginal, average, and total cost per policy action.

This could be a first step toward assessing the marginal and total costs of RATG avoidance from different gas/source/sink policy options and hence toward assessing the relative cost-effectiveness of the comprehensive versus piecemeal approaches.

-- Current Administration efforts:
- analysis of US policies in EPA Cost Study/"Comprehensive Budget" analysis (covering U.S. energy efficiency and clean energy initiatives, CFC phaseout, afforestation, landfill rules, and other policies) through 2000. Priority: high. Timeline: 3 months.
- DOE/NES analysis of US energy policies through 2030, including NES options, afforestation, and CFCs. Priority: high. Timeline: 3 months.
- DOC study of future emissions under different tax options and under EC-wide strategy or global strategy. Priority: high. Timeline: 3 months.

-- Future work:
- Improve basis for projecting emissions limitations achieved by current policies
- Expand to cover influence of changes in agricultural subsidies, other relevant policy measures
- Look beyond 2000.

(B) Analysis of net GHG limitations achieved by other nations' policies

Analysis similar to that described for U.S. "no regrets" measures above should be undertaken for the policies announced and implemented by, proposed by, or available to, foreign nations. Certain nations have suggested unilateral limits on CO2 emissions (e.g. Sweden, possibly Japan), on nuclear power (Sweden, GDR), on SO2, NOx, and NMHCs (U.S.); and others have announced willingness to enact CO2 limits if others do too (e.g. U.K., Netherlands), and others have endorsed the Noordwijk Declaration's suggestion of CO2 emissions stabilization by industrialized countries by 2000.

-- Current work:
- Obtain information on each nation's policies.

-- Future work:
- Using a comprehensive approach, calculate the value of current policies in place in nations abroad, as

described above for U.S. actions.[10] Assess how other nations would fare under a comprehensive approach. Priority: high. Timeline: 3 months.
- Include consideration of foreign nations' agricultural subsidies and other relevant policies regarding non-point sources. Priority: high. Timeline: 3 months.
- Expand to cover developing nations. Priority: high. Timeline: 3 months.
- Using a comprehensive approach, calculate the influence each foreign proposal would have on net RATG emissions and GHG concentrations. Priority: high. Timeline: 3 months.
- Include modeling of international energy markets and effect of price responses to unilateral demand reductions. Priority: high. Timeline: 3 to 18 months.

V. Evaluating the comparative cost-effectiveness of piecemeal, partial, and comprehensive approaches.

Advocacy of the comprehensive approach is based in part on the intuitively strong hypothesis that the marginal costs of control vary across gases, sources, sinks, and nations, so that for any assumed limitation obligation,[11] each nation's least-cost mix of limitation strategies would be different and all nations, regardless of their current RATG inventories, would be better off under a comprehensive approach than under an approach which placed separate limitation obligations on each gas or sector.[12]

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[10]Special attention may be due the range of CFC-substitutes to be used by each nation. Japan, for example, is apparently presenting figures that show larger reductions in radiative forcing from phasing out unit amounts of CFCs than is the U.S., suggesting that Japan may be counting on selecting CFC-substitutes with lower GWPs than those to be used in the U.S. This also suggests that the Montreal Protocol, although potentially helpful as a no regrets measure, may not by itself be sufficient to address climate concerns associated with ozone-depleting substances.

[11]As stated in the Introduction, given an assumed objective, the task is to assess the comparative costs of achieving it under different policy designs. This task does not assess the overall rationality or economic efficiency of the chosen objective.

[12] The aggregate shares calculated in the inventories (in Part III(B), above) do not indicate the costs of incremental limitations for each nation. Simply because a nation currently has a large share in methane, for example, does not mean that

(continued...)

This task is needed to test that hypothesis and, if confirmed, to demonstrate the value of the comprehensive approach.

(A) Marginal costs: information and analyses needed to map full comparative cost-effectiveness functions and variations by gas, source, sink, sector, nation.

This task moves beyond analyses of specific existing policy programs and evaluates the full marginal cost functions facing policy makers and private actors.

-- Current Administration efforts:
- DOE/NES analysis for US energy sector policies and afforestation

-- Future work:
- Expand to cover all relevant gases, sources, sinks, sectors. Priority: high. Timeline: 3 months.
- Expand to cover other nations. Priority: high. Timeline: 3 months.
- Assess full social costs, using general equilibrium model rather than expenditures by the regulated industry.[13] Make use of forthcoming models. Analyze costs over time, relation to innovation.[14] Priority: high. Timeline: 18 months.
- Include (qualitative) evaluation of non-economic costs to response options, e.g. cultural or institutional barriers to certain policies. Priority: medium. Timeline: 18 months.
- Assess informational, administrative, and other transactions costs of piecemeal, partial and

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[12](...continued)
that nation would find methane reductions costlier than CO2 reductions, at the margin. Economic analysis is needed to test the hypothesis of varying costs and to demonstrate the benefits to every nation of being afforded the cross-gas, cross-sector, and source-sink flexibility of the comprehensive approach.

[13] The comparative impacts on macroeconomic and international variables (e.g. trade, competitiveness, economic growth) would require separate study.

[14] Evaluation should also address the likely economic impacts in the US and worldwide of potential future changes in the understanding of the gas-comparison index, and means to cushion adverse impacts (e.g. periodic public science reviews).

comprehensive approaches. Priority: medium. Timeline: 18 months.
- Evaluate the benefits (effectiveness) of policies, in terms of RATGs avoided. Priority: high. Timeline: 3 to 18 months.

(B) Use cost-effectiveness analyses to evaluate costs and benefits to the US and other nations of possible piecemeal, partial and comprehensive options that will be suggested for international policy design

This task moves beyond the analysis of current policy proposals suggested in section IV above to examine the marginal costs of policy designs, and to consider both proposed and hypothetical policy designs. It also focuses on international accords rather than national actions. This task is essential if U.S. policy makers and negotiators are to be able to assess policy proposals that inevitably be made as negotiations on a framework convention on climate change unfold.

Potential policy designs to be compared include: CO2 only, all RATs, or all RATGs except those covered under the Montreal Protocol; sources only, point sources only, all sources and sinks, or sources and terrestrial sinks only; all sectors, or certain sectors (e.g. energy, industry, transport, agriculture, forestry).

Priority: high. Timeline: 3 to 18 months.

(C) Evaluate the environmental effectiveness of comprehensive and piecemeal approaches: propensity and impact of induced shifts in residuals

Thus far, for any given policy goal, a piecemeal (e.g. CO2-only) approach and a comprehensive approach have been assumed to yield identical results in terms of aggregated GWP (or full environmental impacts). In other words, whether a reduction in net index-weighted ("CO2-equivalent") emissions were achieved in CO2 or in a combination of gases, the overall calculated effect on the index value of concern would be the same.

But such analysis fails to account for actual economic and social responses to policy interventions. Advocacy of the comprehensive approach is based in part on the intuitively strong hypothesis that including all gases, sources and sinks ensures better effectiveness in any effort to limit contributions to potential radiative forcing (or full impacts), because piecemeal rules applying to one gas, source (or sector), or sink will engender shifts of

socioeconomic activity from regulated to unregulated modes, undercutting achievement of policy goals. Case studies will be especially helpful to illustrate these issues.

-- Current Administration efforts:
- Understanding of prior piecemeal approaches in environmental regulation and their resultant shifts of residuals, including single-medium approaches, e.g. to discharges into air, land, and water; and single-pollutant approaches, e.g. to SO2.
- DOE/NES study will address CO2 and CH4 emissions from energy sector; it should consider potential GHG-related environmental effects of fuel switching, new energy sources, and sectoral shifts.

-- Future work:
- Develop "crisp retorts" to piecemeal approaches: Conduct case studies of cross-gas shifts: e.g. fossil fuel switching (coal to natural gas) induced by CO2-only policies could have attendant impacts on CO2-to-CH4 emissions shifts due to CH4 leakage from natural gas transport.[15] Expand cross-gas shift studies, e.g. apply coal-to-gas CO2-CH4 shift analysis to actual global GHG output and in light of likely GHG emissions/leaks from future coal and gas facilities. Priority: high. Timeline: 3 months.
- Evaluate cross-source/sector shifts: e.g. under a transport-only policy (such as a high CAFE statute), possible shift from fossil fuel combustion on board vehicles to electric cars powered by central utility combustion, or to use of intensely cultivated biomass fuels; e.g. under an energy-only or fossil fuel-only policy, possible shift to biomass fuels whose cultivation emits other GHGs. Priority: high. Timeline: 3 months.
- Include consideration of international market responses to unilateral policy choices. Assess cross-boundary shifts, through price effects and industry flight, of unilateral or OECD-only policies. Priority: high. Timeline: 3 months.

(D) Evaluate the environmental benefits of a "net emissions" approach

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[15] See, e.g., Rodhe, Science 8 June 1990. Using a 100-year time horizon and a CO2-equivalent GWP for CH4 of 10, Rodhe estimates that if a CO2-reduction policy were accomplished by fuel switching from coal to natural gas, a 3-6% CH4 leakage rate from natural gas transport facilities would fully offset all the CO2 reductions resulting from the fuel switch.

A net emissions approach, encompassing both sources and sinks, would encourage sink protection and expansion, whereas a source-only approach would not. Sink policies encouraged could include afforestation and protection of marine phytoplankton from pollution. This task is to evaluate the side benefits of likely sink policies, e.g. reduced soil erosion, enhanced biodiversity, protected phytoplankton, and better timber management.

VI. **Bridging from piecemeal to comprehensive approaches**

(A) Addressing the objection that the comprehensive approach is technically difficult or infeasible

As discussed in the introduction, the comprehensive approach can be applied to assist in design of various policies, including research strategies, technology development strategies, enumeration of steps justified on other grounds, and emissions limitation strategies. For most of these options, the comprehensive approach can be applied immediately, despite potential uncertainties, as a general guide to intelligent analysis of the scope and relative importance of policy choices.

For implementing emissions limitations, however, prompt application of the comprehensive approach might be somewhat more difficult. In principle, a comprehensive approach appears to be the most appropriate way to design any emissions limitation policy. But as indicated above, there are noteworthy gaps and uncertainties in the information on emissions of certain gases from certain sources and uptake by certain sinks. If emissions limitations were to be imposed today, a fully comprehensive approach would not be available. If emissions limitations are not needed immediately, work on the comprehensive approach can continue toward a time when limitations might be agreed. If emissions limitations are to be agreed at some point before all informational gaps are filled, a partially comprehensive approach could be employed with a mechanism for moving to a fully comprehensive approach as these gaps are filled.[16]

The issue for policy makers is not whether the comprehensive approach is "feasible," but whether at any point the social costs of implementing an incompletely comprehensive approach -- in terms of environmental effectiveness and economic efficiency, as

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[16]Yet it must be recognized that piecemeal approaches, once adopted, generally attract vested interests who resist any efforts to expand toward a comprehensive approach.

described in section V above -- are outweighed by the social costs of obtaining additional information (including costs of delay). Such costs would also include transactions costs and administrative costs. In other words, one must ask whether the marginal value of additional information (leading to a more comprehensive approach) exceeds the marginal cost of obtaining additional information. Another way of examining the issue is to ask at what point would one know enough to proceed comprehensively; and to ask how (and at what cost) a comprehensive approach could evolve from incremental steps. Further, one would consider institutional means to incorporate incentives into any partial strategy that encourage evolution toward a comprehensive approach.

The scientific building blocks of the comprehensive approach are described above in sections I-III. Any framework convention should foster scientific research through a comprehensive approach. In addition, consideration of the need to bridge from a partial to a comprehensive approach would include:

-- Future work:
- Assess the time and expense needed to answer scientific questions, develop proxy measurement devices, and build monitoring capabilities to achieve a workable comprehensive approach.
- Assess other constraints to employment of a fully comprehensive approach, including institutional, political, cultural and economic obstacles.
- Compare the costs of acquiring this needed information to the socioeconomic and environmental costs (and foregone benefits) of adopting a piecemeal policy design for want of such information.
- Develop policy and institutional designs that offer incentives for needed research. For example, an emissions limitation obligation in an international agreement could be framed in a piecemeal fashion but offer the opportunity to emitters to achieve compliance through limitation actions addressing other GHGs, sources or sinks, so long as the emitter demonstrates the accomplishment. This would give emitters incentives to undertake the research needed to develop new monitoring capabilities.
- Consider intermediate approaches such as incremental or phased-in designs toward comprehensivity, and means to bridge from them to a fully comprehensive approach.

Overview: Priority: high. Timeline: 3 to 18 months.

(B) Integrating prior and concurrent law and policies into a comprehensive approach.

Even if a fully comprehensive approach were available for use in emissions limitations at any relevant point, it is apparent that other treaties, laws and policies will already be addressing discrete RATGs, sources, and sinks. Some means would be needed to accommodate and integrate these diverse endeavors into the comprehensive approach. Several options are available for such integration. One option is to use a comprehensive approach to net RATGs in any emissions limitation protocol while varying the baseline of allowed credit according to prior treaty obligations. Another option is to have the convention mandate that any future protocol (if any) employ a comprehensive approach. A related option is to incorporate in a framework convention on climate the assurance to nations, in advance of any hypothetical future protocol obligations (not yet agreed to), that they would receive credit against any such obligations for current or past (after a certain date) net emissions limitations actions, whether taken pursuant to treaties or national policies; the convention would further calculate the value of such actions according to the comprehensive approach. This would assure credit for measures justified on other grounds, avoid disincentives to those actions, and give root to the comprehensive approach, while not yet committing to emissions limitations obligations.

-- Current Administration efforts:
- devising means to ensure that international agreement integrates (gives credit for) current actions, other international agreements (forestry, VOCs, GHGs covered by ozone agreements), other domestic laws and initiatives. (DOJ, EPA, State)

-- Future work:
- Demonstrate incentive advantages of integration
  - lack of integration would yield perverse disincentives to take actions, even actions that are justified on other grounds, lest they be denied credit once emissions limitations are agreed. Priority: high. Timeline: 3 months.
- Address possible overclaiming (see "monitoring" and "verification," above). Priority: medium. Timeline: 18 months.
- Analyze advantages for other nations under integrated design. Priority: high. Timeline: 3 months.
- Analyze environmental advantages of integration. Priority: medium. Timeline: 3 months.
- Address issues of legal grafting presented by terms or design of other agreements, laws. Priority: high. Timeline: 3 months.

- Consider possible offset model (e.g. defining any limitation obligations in terms of CO2 emissions, to satisfy those eager for CO2 limits, but authorize offsets for any verifiable limits on any GHG, source, or sink, thus effectively constructing a comprehensive approach). Priority: medium. Timeline: 3 to 18 months.

Research and Analysis Underlying the Incentives Approach

As described in the Introduction, a variety of market-based incentives might be considered in the climate change context. The possible uses and advantages of these approaches are summarized in the Introduction.

I. **Emissions trading**

(A) Domestic trading

-- Current Administration efforts:
- review of past and current experience, e.g. lead phasedown, netting/bubble/offset program, CFCs trading, new acid precipitation trading scheme. Primarily EPA, DOE, CEA.
- consider application to GHGs; consider issues of implementation, e.g. informal versus formal trading; who would trade; duration of allowances; means of distributing allowances; market power; hoarding; scope of GHGs, sectors, sources and sinks; monitoring trades; etc.

-- Future work:
- Evaluate the comparative cost-effectiveness of emissions trading and command-and-control approaches. Priority: high. Timeline: 3 to 18 months.

(B) International trading

-- Current Administration efforts:
- present US experience and suggestions at international discussion on application to climate

-- Future work:
- Extend analysis of above issues to international context, e.g. informal versus formal trading; who

would trade; duration of allowances; means of distributing allowances; market power; hoarding; scope of trading among GHGs, sources, sinks, sectors, industries, geographical areas, stages of development; monitoring trades. Priority: medium. Timeline: 3 to 18 months.
- In addition, consider international institutions; trade, assistance and national income implications; sovereignty issues; cultural or ethical objections to so-called "selling the right to pollute"; trading as a decentralized, market-based vehicle for resource and technology transfers.[17] Priority: medium. Timeline: 3 to 18 months.
- Assess informational, administrative, and other transactions costs of emissions trading and command and control policies. Priority: medium. Timeline: 3 to 18 months.
- Identify opportunities for cross-national trades, and hence likely trading partners (for the US and worldwide). Priority: high. Timeline: 3 months.
- Evaluate the comparative cost-effectiveness of emissions trading and command-and-control approaches. Priority: medium. Timeline: 3 months.

II. Emissions fees

Fees might be employed domestically or internationally to address GHG emissions. Options discussed to date include carbon taxes based on the carbon content of energy fuels, and energy taxes. Other options include an energy sector tax that covers both CO2 and CH4 emissions from energy activities, using their GWP index ratings to weight the tax; and a more general multi-sector tax calibrated to the GWP index (or full environmental impacts index) rating of each gas.

-- Current Administration efforts:
- analysis of energy sector taxes in DOE/NES
- analysis of various fees in EPA "Comprehensive Budget" analysis
- related efforts: numerous studies have used assumed taxes to examine costs of GHG limitations policies. E.g. CBO (Montgomery), Manne & Richels, Nordhaus. See CEA overview of Economics of Global Change.

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[17] In addition, consider the options for trading within regional associations such as OECD, EC, ASEAN. Evidently the EC and OECD are both considering association-wide policies.

-- Future work:
- Improve assessment of tax implications. Consider international fuels market impacts; use general equilibrium models; address fiscal concerns. Priority: high. Timeline: 3 months.
- Consider variety of tax policy designs, including, carbon, energy, GWP within energy sector, etc. Priority: high. Timeline: 3 months.
- Much of this kind of consideration must be deferred to budget negotiations.

III. Adaptation Incentives

Market mechanisms and institutional reforms could be used to encourage efficient adaptation practices. Because of current institutional or market failures, long-range investments, such as coastal construction or water use planning, might be undertaken without giving appropriate weight to any climate change risks (e.g. rising sea levels or shifting precipitation). Such institutional or market failures might be addressed by informational or incentive-based policies, such as requiring coastal construction to purchase subsidence insurance, or encouraging long-range water use planning to take account of potential precipitation patterns. Some of these types of policies were addressed in the IPCC/RSWG RUMS and CZMS reports.

IV. Economic instruments in general

-- Future work:
- Pursue contacts with OECD regarding Environment Ministerial in January, Economic Instruments analytic workplan (experts meeting now tentatively slated for October 1990), and potential OECD Workshop on Economic Instruments.[18] Priority: high. Timeline: 3 to 18 months.

- Develop suggestions for economic analysis and study of economic instruments in upcoming IPCC Future Workplan discussions (tentatively slated for December or January). Priority: high. Timeline: 3 to 18 months.

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[18] Preparing for the suggested OECD Workshop on Economic Instruments, tentatively slated for December 1990, will involve considerations of forum and cosponsorship, logistics and timing, relation to other OECD meetings, relation to other international meetings, invitees, topics to address, an October experts meeting, relation to the upcoming IPCC meeting on Future Work of the IPCC, and US presentation(s) at the December Workshop.

- Continue to work with CEES groups, including the new Ad Hoc Economics task group, to develop economic analysis of policy proposals and designs (addressing "comprehensive approach" issues as well as "incentives" approach issues). Priority: high. Timeline: 3 months to 5 years.

Proposed Agenda

First Negotiating Session

Framework Convention on Climate Change

Washington, D.C.

February 4 - 14, 1991

1. Welcoming Remarks

2. Opening of Meeting: Remarks by WMO Sec-Gen Obasi, UNEP Ex Director Tolba, IPCC Chair Bolin

3. Adoption of Rules of Procedure: Draft to be available

4. Adoption of Agenda

5. Election of Chair

6. Election of Bureau: Refer to Prepcom report and recommendations

7. Organization of Work: To cover hours of sessions, meeting rooms, translation facilities (available only for negotiationg group and subgroups, not regional and other interest groups)

8. Credentials Committee

9. Statements by Governments: To be brief (10 min max) and focused on issues raised in IPCC and other supporting documents

10. Preparation of Legal Negotiating Text
    a. work program
    b. establishment of subgroups
    c. legal drafting group
    d. review of draft legal text

11. Future Work
    a. relationship with IPCC
    b. time and place of next meeting

12. Adoption of Report

13. Close of Meeting

Suggested timing for proposed agenda:

4	Monday	Agenda items 1 to 8
5	Tuesday	Agenda item 9
6	Wednesday	Agenda item 9 cont'd
7	Thursday	Agenda item 10
8	Friday	Agenda item 10 cont'd
11	Monday	Agenda item 10 cont'd
12	Tuesday	Agenda item 10 cont'd
13	Wednesday	Agenda item 10c and 11
14	Thursday	Agenda item 10d, 12 and 13

AD HOC WORKING GROUP OF GOVERNMENT
REPRESENTATIVES TO PREPARE FOR
NEGOTIATIONS ON A FRAMEWORK
CONVENTION ON CLIMATE CHANGE

UNEP/WMO
Prep./FCCC/L.1/REPORT

Geneva, 24-26 September 1990

I. INTRODUCTION

1. The meeting of the Ad Hoc Working Group of Government Representatives to prepare for negotiations on a Framework Convention on Climate Change was held in Geneva, from 24-26 September 1990, at the International Conference Centre. The meeting was convened in pursuance of Resolution 8 (EC-XLII) adopted by the Executive Council of WMO at its forty-second session in June 1990 and decision SS. II/3 adopted by the special session of the Governing Council of UNEP in August 1990 both entitled "Framework Convention on Climate Change".

II. ORGANIZATIONAL MATTERS

A. Opening of the meeting

2. In his opening statement, Professor G.O.P. Obasi, Secretary-General of WMO summarized the background to the preparation for negotiations and emphasized the sound and thorough technical basis provided by the recent report of the Intergovernmental Panel on Climate Change.

He stressed WMO's role as the independent authoritative scientific voice and pledged WMO's full support in any agreed international strategy, through the World Climate Programme and through the Global Atmosphere Watch, the World Weather Watch and other related international programmes. He recognized that calls for equity raised problems in agreeing on what was equitable and that a great deal of economic and social data would need to be co-ordinated and reviewed in this particular light and interpreted with wisdom.

He emphasized the need for this short meeting to concentrate on organizational preparations for the first negotiating session in the United States in February 1991. The real issues behind the negotiations need to be identified only. Discussing and resolving them are matters for the negotiations and not this preparatory meeting.

He proposed that as the negotiations proceeded to a more formal stage it would be necessary to adhere closely to UN type rules of procedure. He also advocated an effective, inexpensive, even frugal, secretariat for negotiations and invited views on its role.

(ID: FCCC/FINAL)

Finally Professor Obasi assured representatives of his own availability and that of the WMO Secretariat to assist them in their enormous task. He wished them success and that their discussions might be marked by wisdom and courage.

3. The Executive Director of UNEP, Dr. M.K. Tolba, in his opening statement emphasized that this meeting is to prepare the ground for the start of negotiations of an international accord to deal with one of the most serious threats facing the world that of climate change and global warming.

To deal with it, governments will have to agree binding international legal instruments specifying clear commitments, defined responsibilities, targets and schedules and workable and equitable institutional mechanisms.

He stressed that recently the world community accepts the fact that climate change is a global issue which has to be addressed in some one-and-a-half years, to reach Rio de Janeiro with some meaningful document in hand.

Dr. Tolba emphasized that both the Secretary-General of the WMO and he -- as Executive Director of UNEP -- have been requested by their governing bodies to prepare for negotiations now. The task of this meeting is to consider how to proceed in the forthcoming negotiations and to decide on a realistic timetable for future meetings, taking into account of the difficulties many developing countries face, and which the Governing Council of UNEP asked to avoid -- the proliferation of venues of meetings and the coincidence of their dates.

He said both Professor Obasi and himself recommend that negotiations be conducted in the main ad hoc working group of legal and technical experts, under which sub-working groups could be established. Those could deal with the following issues: greenhouse gas emissions, energy efficiency, afforestation, research, monitoring and assessment and the special situation of developing countries. This meeting is expected to advise the first negotiating session on the points that need to be addressed by them under these issues. It is not expected to start the negotiations here. This is the job of the negotiation group. The note by the Secretary-General of WMO and the Executive Director of UNEP which was prepared for this meeting, sets out a number of these points for consideration, for example, which gases ought to be included in atmospheric concentrations stabilization and emission reductions, target dates, base year, criteria for calculating emission levels -- per capita, per unit of GNP or GDP, according to area of the country, its climatic conditions, the size of natural carbon sinks, energy consumption per production unit or a mixture of all these or other criteria.

Of all the issues highlighted, Dr. Tolba said three would dwarf the negotiating process, namely: financial requirements, technology transfer and economic reforms. The financial mechanisms and technology transfer agreement contained in the amended Montreal Protocol could act as one guide to future negotiations. With regard to economic reforms, consideration could be given to issues like CO_2 tax, pollution charges and a global permit trading scheme, whereby emitters who can achieve specific targets have the option of trading excess emissions to countries unable to meet immediate targets.

Dr. Tolba emphasized that this meeting is not only an organizational meeting but the preparatory meeting for the negotiations which goes beyond organization only. The report of this meeting is going to be the main document for the negotiating session in Washington D.C. Taking into account the time constraints, this meeting may not be able go into details but hopefully will consider the essential elements to be included into future legal acts dealing with climate change.

B. Attendance

4. The meeting was attended by representatives of the following countries: Algeria, Argentina, Australia, Austria, Bahamas, Bangladesh, Belgium, Bhutan, Brazil, Bulgaria, Canada, Central African Republic, Chile, China, Colombia, Côte d'Ivoire, Democratic People's Republic of Korea, Denmark, Egypt, El Salvador, Ethiopia, Finland, France, Germany, Federal Republic of, Ghana, Greece, Honduras, India, Indonesia, Ireland, Israel, Italy, Japan, Kenya, Kiribati, Malaysia, Maldives, Mali, Malta, Mexico, Morocco, Nauru, Netherlands, New Zealand, Nicaragua, Nigeria, Norway, Papua New Guinea, Peru, Philippines, Portugal, Republic of Korea, Saudi Arabia, Singapore, Spain, Sri Lanka, Sudan, Sweden, Switzerland, Thailand, Tunisia, Turkey, Uganda, USSR, United Kingdom, United Republic of Tanzania, U.S.A., Uruguay, Venezuela, Yugoslavia and Zimbabwe.

5. The following organizations attended the meeting as observers: UNDP, UNCTC, Unesco and its IOC, FAO, UNCED, CEC, EC Council, IPCC, ICSU, IPIECA, IUCN, Environmental Law Institute, Environmental Defense Fund, Greenpeace International, Leadership Council for Effective Climate Change Policy and World Wide Fund for Nature.

C. Bureau

6. The following Bureau was elected by the meeting:

Chairman	-	Mr. I. Topkov, Bulgaria
Vice Chairman	-	Mr J.P. Bruce, Canada
Vice Chairman	-	Mr. A. Al-Gain, Saudi Arabia
Rapporteur	-	Mr. L.G. Meira Filho, Brazil

D. Adoption of the Agenda

7. The following agenda was adopted by the meeting:

1. Opening remarks by Secretary-General of WMO and Executive Director of UNEP;
2. Election of Bureau for the preparatory meeting of the working group.
3. Adoption of agenda.
4. Organization of the negotiations for the framework convention.
5. Adoption of the report.
6. Closure of the session.

III. Discussion on Agenda item 4

8. During the general discussion on the organization of the negotiations for the framework convention delegations made the following main points: Regarding the option that the negotiations would be carried by an ad hoc working group of legal and technical experts, several delegations, while agreeing with the general approach, proposed that, because of the importance of these negotiations, the group carrying it out should be given a title commensurate with its job e.g., International Forum, Intergovernmental Negotiating Committee or a UN specialized conference.

9. Most of the speakers referred with appreciation to the relevant decisions of the UNEP Governing Council and the resolutions of the WMO Executive Council which led to the convening of this session. Delegations agreed that both WMO and UNEP should assist the negotiations, particularly taking into account the urgency of the problems to be solved and the very good past experience regarding the development of international legal instruments, for example, the Vienna Convention for the Protection of the Ozone Layer and its Montreal Protocol. On relations between the negotiating group and the UN Conference on Environment and Development, it was agreed that the framework convention should, if possible, be ready for signing in conjunction with the 1992 UNCED Conference in Brazil in June 1992. The Preparatory Committee of UNCED should be kept informed on the progress of the negotiations. Representatives noted that, in accordance with UN General Assembly Resolution 44/207, preparations for the negotiations will be reported to its 45th session as a contribution to its discussions on the ways and means and modalities to be adopted for the negotiating process. It was emphasized by a few delegations that a meaningful legal act for adoption in 1992 should be a target but not at the expense of agreeing to an instrument of only declaratory character. Others cautioned that if necessary the negotiations should continue after 1992.

10. Most of the delegations suggested Geneva, Switzerland, as the venue for the negotiating sessions. Several developing countries delegations considered it more convenient for them if some of the negotiating sessions were held elsewhere than Geneva, with Nairobi being prefered by most of those suggesting this option. Some suggested that meetings alternate between Geneva and Nairobi; others indicated that, while the prefered place for meetings would be Geneva, at least one session in 1991 should take place in Nairobi. The Secretariat reminded the meeting of a decision of UNEP's Governing Council at its special session in July 1990, which requested that meetings other than the first negotiating sessions scheduled for Washington D.C., should be held alternatively in Geneva and Nairobi. A few delegations indicated that if venues other than those with the customary UN conference facilities were proposed then the arrangements for sessions should follow the normal UN practices for organizing such meetings.

11. Regarding the duration of the meetings, most of the speakers suggested two weeks as the maximum duration of each meeting. Several delegations considered one week to be more appropriate. Another considered that two weeks would be not enough. Some delegations considered a three months interval

between negotiating meetings to be too short to allow proper consultations in their countries. Several delegations suggested a four month interval.

12. It was the general feeling that negotiations should take place in one single forum and that agreements reached in the negotiating forum, should not be reopened by another body. Several delegations suggested that the rules of procedure for the negotiating process should be developed, based on existing rules of procedure. One delegation recommended that decision-making in the rules of procedure should be based on consensus. Another cautioned against that. A few delegations suggested that the current meeting prepare the draft rules of procedure to be presented to the negotiating forum which is scheduled for February 1991 in Washington D.C. this year.

13. All governments should be invited to all negotiation sessions, and the participation of developing countries should be ensured. It was a common agreement that the negotiating meetings should be carried in the six official languages of the UN and that the documentation for the meetings should be distributed to countries well in advance to allow them time for full preparation for the meetings. Delegations agreed that relevant NGOs should be allowed to attend the negotiations as observers, taking into account their participation in the development of recent international legal instruments in the field of the environment. UN practice will provide useful guidance in this respect.

14. Regarding the proposed small supporting meeting sessions mentioned in the Note prepared jointly by the Executive Director of UNEP and the Secretary-General of WMO for the use of the working group and annexed to their letter of 24 August 1990, reservations were expressed by several delegations that many developing countries would not be able to attend such meetings and therefore the geopolitical representation might be unbalanced. Some delegations emphasized that it would be useful to provide for the setting up of substantive groups as part of the negotiating process. The need to establish a legal/drafting group was particularly emphasized. It was also suggested that the special situation of developing countries could be addressed either within these substantive subgroups or in a separate one.

15. All delegates agreed that the proper representation of developing countries had to be ensured and that the best way would be through the creation of a trust fund similar to that established for the IPCC. Some delegations expressed willingness to support such a fund. Some delegations called for allowing for more regional participation for example the South Pacific Forum.

16. Regarding the structure of the Bureau, all delegates agreed that the Bureau should not be too large but should ensure proper geopolitical representation. It was suggested that the Bureau should be of a permanent character and that its Chairman and members should attend every negotiating session.

17 Many delegations suggested the establishment of a secretariat dealing with the negotiation process, separate from the IPCC Secretariat but located in Geneva, to allow regular interaction and exchange of information. The Secretariat would consist of UNEP and WMO staff supplemented by other professionals seconded by other UN agencies. One delegation suggested that staff might also be seconded by governments. The role of the IPCC in the negotiating process as a scientific and technical input-providing body was particularly emphasized.

18. Regarding the documents to serve as a base for the substantive discussions at the negotiating groups, most delegations suggested that the main document to serve as a basis for negotiations should be the IPCC First Assessment Report - including its identification of legal and institutional mechanisms and the Policymakers summary of Working Group III, particularly the elements on Pages 41 and 42. This document should be supplemented by the outcome of other international meetings, eg. the Toronto and Noordwijk Declarations. Some delegations suggested that the list of elements presented in the Note for this meeting by the Executive Director of UNEP and Secretary-General of WMO should also be taken into account at the discussions. One delegation drew attention to other useful documents which could be consulted, including the report of the Ottawa meeting on legal issues relating to the development of a climate convention and that part of the report of the World Commission on Environment and Development dealing with principles of Environmental Law. It was suggested that the Secretariat should gather documents together and that they should be presented to the first negotiating meeting in Washington with commentary. It is expected that at the Washington meeting, a legal drafting group will be convened to prepare, on the basis of consideration of the above documentation by the negotiating forum, the draft legal instrument or instruments as may be agreed upon. In refering to the IPCC report some delegations said that it had deficiencies. Not all developing countries had been able to participate in the IPCC process and the product contained a bias in favour of developed country opinion. Two delegations said that relying solely on IPCC documentation would propagate the bias into the negotiating forum. Delegates agreed that written contributions be solicited from developing countries relating to their specific concerns. These contributions should be translated and distributed to all governments and considered during the negotiating process. Some developing countries delegations complained that documentation of the kind foreseen during the negotiations invariably arrived late, due to poor communications in some developing countries, and asked that the secretariat consider priority distribution to these countries. Another delegate said that it would be helpful if the distribution of documents was not limited to the constituencies of WMO and UNEP but made more widely available within countries which might consider an appropriate network to ensure this.

19. The meeting was divided on whether or not protocols and other related legal instruments should be negotiated simultaneously with the convention. Many delegations suggested that the convention should contain specific obligations in order that the legal instrument could be effective in environmental protection. Many delegations expressed the view that protocols to the convention, which are required as part of an effective international regime on climate change, should be negotiated so as to enable their adoption at the same time as the convention. The meeting considered it important to

draw up a schedule of activities from the present up to the time of the proposed adoption of the treaty in 1992.

20. In order to ensure efficiency, one delegate said that each meeting should last for the shortest possible period of time, drawing upon the "marginal utility" principle to ensure efficiency. That delegation, Italy, offered to host convention-related meetings and workshops, especially those on the subject of energy efficiency. Some delegations, however, felt there was a need to limit the establishment of subgroups with some considering them unnecessary altogether. Several delegations asked for elaboration of plans to interact with the Preparatory Committee for UNCED and on how the adoption of the two conventions currently being negotiated, i.e., on climate and biodiversity, would be co-ordinated with UNCED. The question of the relationship of the negotiation to the UN General Assembly was raised and there was widespread agreement that a clear set of recommendations should be transmitted from the present meeting to the Assembly, concentrating on, inter alia, the rules of procedure; financial arrangements; composition of the bureau and the secretariat; basic documentation, the ways to achieve universal participation, the frequency and nature of the negotiating process and the venue and other organizational aspects.

21. A few delegations insisted that the negotiations be conducted in a forum duly established by the UN General Assembly, and that the best way to to provide the necessary legitimacy and universality to the process would be through convening a UN Specialized Conference. It was important that the process of negotiations be conducted according to the principle of transparency in the negotiations, without which universal acceptance might suffer; it was equally important in this connection to avoid the practice of non-announced meetings in the negotiating process, irrespective of the forum to be chosen. One delegation further warned that it was not possible for the meeting to decide on the need for subgroup meetings, it could only recommend the need for establishing subgroups, recalling that it was within the purview of the United Nations General Assembly to establish the ways, means and modalities for conducting the negotiations. Supporting this view, another delegation said that the issues of financing and frequency of meetings similarly needed the opinion of the General Assembly.

22. Many countries, in particular African countries, drew attention to the importance of climate to their development and the sensitivity of many economic sectors to drought and flood. Several delegations said that the convention should include reference to drought and flood impacts and that it should also refer to the need for action plans on climate change, including monitoring, data acquisition and regional climate modelling. Several delegations expressed the need for better information disemination on the climate change issue to sensitise more people to the potential risks and on the need for action. The need for regional meetings on the issue and the involving of relevant regional organizations was also expressed. It was proposed that the composition of the Bureau for the negotiating body should include a fair and balanced representation from regions of the world that are seriously at risk by drought, desertification and land degradation processes.

The countries most affected by this change-of-climate-risk are those in the IGADD-region (Eastern African countries) and the Sahelian and Magrehb countries. These regions should be given special consideration during the formulation of the Bureau for the composition of the negotiating body. Another representative drew attention to concerns associated with arid lands such as the Arabian peninsular. The attention of the meeting was also drawn to the vulnerability and risks of drought and desertification associated with potential climate change in other regions, such as Australia and North-east Brazil.

23. Several delegations, including those of small and lowlying island states and coastal areas, spoke of the unique vulnerability of such states to sea-level rise and the need to give prominence to this issue within the convention. Such countries are unique in that their physical and cultural survival is at risk from sea-level rise and consequent anihilation of their homelands. These delegations considered that they should be represented on the proposed Bureau, citing the degree of risk as a further criterion for determining the composition of the Bureau. The majority of delegations did not oppose the fact that these concerns would be taken into account when the negotiating body discusses the composition of the Bureau.

24. The representative of the Commission of European Communities reported on the outcome of the session of the European Council held in June 1990 in Dublin and attended by Heads of State and of Governments of the Community. The Heads of Governments considered that the Community and its member states had a special responsibility to encourage and participate in international action aimed at tackling global environmental problems. Among comments on the structure of the future negotiations, the same representative said the European Community attached great importance to the full participation of developing countries to the negotiating process and said favourable consideration would be given towards providing support for this participation. Many individual states also indicated their intention to provide financial support through contribution to the Trust Fund. Some delegations noted their recent increased contributions to UNEP and indicated that they expected a proportion of the costs, especially that of the joint secretariat, to be met from UNEP and WMO funds.

25. The Chairman of the Intergovernmental Panel on Climate Change (IPCC) confirmed the Panel's willingness to assist the negotiations process. It intended to meet the short term needs of the negotiations towards elaboration of the convention by 1992 and also to satisfy longer term goals of improved knowledge. He informed the meeting of plans to hold a fifth IPCC meeting, in February 1991 soon after the first negotiating session in Washington D.C., in order to assess how to address the key issues identified at the meeting which were relevant to the IPCC. The IPCC would, if requested, make a presentation to the first negotiating session on how the IPCC could fulfil the supporting role suggested for it.

26. The Intergovernmental Oceanographic Commission (IOC) of UNESCO said there was a need to strengthen ocean and coastal area monitoring and that IOC, together with UNEP and WMO, had been invited by the Preparatory Committee of UNCED to to study related ways and means through the establishment of a global

ocean observing system (GOOS). He drew attention to the report by an IOC Ad Hoc Group of Experts which recommends the need to establish a protocol among member states in 1992 in order to implement GOOS in a timely fashion. The representative said that resources for monitoring, assessment and technical training, and assistance for developing countries were insufficient. He concluded by expressing his organization's willingness to support the negotiations.

27. Similar support was expressed by the representative of FAO who expressed FAO's intention to nominate a full time liaison officer to support the convention process. He suggested that similar liaison persons should be nominated by UNEP and WMO to liaise on the proposed FAO forest convention. The representative urged close co-ordination in developing legislation on forests in view of the common objectives and the need for coherent action. He suggested that, initially, the negotiating group should consider all aspects of forest conservation and that FAO were willing to co-sponsor a sub-group on these issues. The development of a forest convention was suggested by the FAO representative to be undertaken contiguously with the elaboration of treaties on climate and biodiversity. Some representatives said that the development of a forest convention should not complicate or delay negotiations of a climate convention and related legal instruments. Other however, several delegations responded negatively to this suggestion, fearing that the attention of governments would be diverted towards an issue which did not demand the same priority and would also duplicate the current and ongoing negotiations for a convention on biodiversity. Some of them noted that the state of the deliberations on forestry differed from that on climate change. The representive of FAO reassured the delegates of FAO's appreciation of their concern about conflicts between conventions and stated that he was sure that the Committee on Forestry would not make any recommendation that would conflict with the recommendations of the present meeting. He confirmed that FAO's support for the climate convention process was not dependent on a forest convention's being developed.

Many delegations said that the development of a forest convention should not complicate or delay negotiation on a climate convention and related legal instruments.

IV. RECOMMENDATIONS

The ad-hoc working group of government representatives to prepare for negotiations on a framework convention on climate change adopted by consensus the recommendations listed below in Section A, and identified the option below in Section B, regarding the organization of the negotiating process for a framework convention on climate change. Both sections are submitted for consideration initially by the forty-fifth session of the United Nations General Assembly in pursuance of its resolution 44/207 to recommend ways, means and modalities for further pursuing negotiations, taking into account the work of the Preparatory Committee of the UN Conference on Environment and Development, and then by the negotiating body at its first substantive session scheduled for February 1991 in Washington, D. C., USA.

A. Recommendations adopted by consensus

1. The negotiating process should be organized and conducted in such a manner as to ensure openness, transparency, universality and legitimacy. It should reflect the full participation and commitment of all States to the negotiations.

2. There should be a single negotiating process leading to a framework convention on climate change and any related legal instruments as might be agreed upon.

3. The negotiating body will discuss the policy issues. Governments will need to be represented at a level appropriate for this. The name of the body should also reflect this function in accordance with options suggested in this document.

4. The negotiating body should respond to UN General Assembly decisions. It should also regularly inform the Assembly, through appropriate channels, of progress in its deliberations.

5. The bureau of the negotiating body should reflect a proper geographical representation, balance of interests and specific concerns as mentioned in the Report, and be of strength sufficient to ensure equity and still limited to ensure effectiveness.

6. It is highly desirable that an effective framework convention on climate change, containing appropriate commitments, be ready for signing by governments and by regional economic integration organizations in conjuction with the United Nations Conference on Environment and Development (UNCED) in Brazil, in June 1992. Any related legal instruments might be developed on the basis of consensus decision by the negotiating body.

7. Participation of the maximum number of States and regional economic integration organizations in the negotiating process is considered essential for its success. Countries which have not done so, are urged to set up a national co-ordinating group to handle national information requirements relevant to the negotiations, and to serve as a link to the Secretariat of the negotiations. The special problems associated with ensuring the participation of developing countries, and the recommendations contained in the report of the IPCC to overcome these problems, should receive particular attention. To ensure adequate participation of the developing countries, small island states and least developed countries, a special Trust Fund should be created, on a similar basis to that for the UNCED and the IPCC, to assist in their adequate participation.

8. Rules of procedure of the negotiating body need to be elaborated for approval by the first negotiating session. They should be based on existing relevant rules of procedure, be acceptable by all States, Members of the UN, the Specialized Agencies, IAEA, and regional economic integration organizations, be compatible with the status of the negotiating body, and be such as to ensure active participation by all governments through fully accredited representatives, and be consistent with Recommendation 1 above.

9. Most negotiating sessions should have a maximum duration of two weeks, within available resources.

10. A tentative calendar, to be reviewed at the end of each negotiating session, should be as follows:

February 1991 - Washington D. C., USA
May - June 1991
August - September 1991
November -December 1991

and whichever meetings are needed in 1992, leading into the UN Conference on Environment and Development, Brazil, June 1992.

11. Non-governmental organizations with a substantive interest in the field should be permitted to attend negotiating sessions as observers. The practices of the UN and of the Preparatory Committee for UNCED will provide useful guidance before rules of procedure are finalized.

12. The negotiating body must have a strong, efficient secretariat at its disposal. This would be best assured if the secretariat were:

(1) located in Geneva and working closely with the IPCC Secretariat, although independent of it,

and

(2) the joint administrative responsibility of WMO and UNEP under the guidance of the negotiating body; this arrangement should be reviewed at the time of the first negotiating meeting in Washington in February 1991.

It should be of an appropriate size and quality, (the professionals consisting mainly of WMO and UNEP staff supplemented by professionals seconded by other UN agencies) and be adequately funded, to ensure that meetings are served to UN standards; in particular that documents were always to be available in the six official languages of the UN according to an agreed timetable and that interpretation in the six languages should be available at all negotiating sessions and at meetings of any sub-groups. It should work closely, and as necessary, with agencies of the UN and other international bodies concerned with climate related issues.

13. Taking into account paragraph 6 above, the Preparatory Committee of the UN Conference on Environment and Development should be kept informed of the progress of negotiations.

14. The negotiating body should have a link with the Intergovernmental Panel on Climate Change (IPCC) to ensure that the IPCC can respond to the needs and requests of the negotiators for objective scientific and technical advice.

15. Depending on the decision on ways, means and modalities to be taken in UN General Assembly, the negotiating body may establish sub-groups as needed. Some sub-groups might be required only at a later stage of the negotiations. If there are sub-groups to the negotiating body, not more than two meetings of the main body or sub-groups should be in session simultaneously.

16. The main documentation to serve as a basis for negotiations should be the IPCC First Assessment Report - including its legal and institutional mechanisms - and the background documentation. Other supplementary documents for consideration would include those resulting from previous international conferences on the subject and from the forthcoming Second World Climate Conference and such other documents as the negotiating body chooses.

17. A list of the elements identified by the IPCC for possible inclusion in the framework convention, or other related legal instruments, documents containing such elements, and comparative presentation of general principles of relevant treaties, should be before the negotiating body.

18. Individual governments are encouraged to present papers to the negotiating body, with help from the Secretariat within available resources.

19. The funding of the sessions of the negotiating body, and of the supporting secretariat, should be arranged through provisions in the regular budget of WMO and UNEP and/or with the use of a Trust Fund arrangement and/or other relevant funds.

20. After the first session of the negotiating body in Washington D.C. in February 1991, subsequent meetings should take place in Geneva with at least one of them in 1991 in Nairobi to be decided at the first session in Washington.

B. Option identified by the Ad-hoc Working Group

1. The negotiating body could be an "Intergovernmental Negotiating Committee for a framework convention on climate change", under the auspices of WMO and UNEP, or a "Specialized Conference for the Negotiation of a Framework Convention on Climate Change" with a Secretary-General appointed by the Secretary-General of the United Nations.

V. ADOPTION OF THE REPORT

29 The report of the meeting was adopted on 26 September 1990 at 11.25pm.

VI. CLOSURE OF THE SESSION

30. After usual exchange of courtesies the chairman declared the meeting closed at 11.30pm.

Annex 1

October 2, 1990

TASK FORCE ON COMPREHENSIVE AND INCENTIVES APPROACHES TO CLIMATE

RESEARCH AND ANALYSIS PRIORITIES FOR THE NEXT THREE MONTHS

1. Draft a framework convention that Work w/ State

-- includes a science research section that addresses all GHGs, sources and sinks;

-- provides for an international monitoring agenda for all GHGs, sources and sinks

-- adopts or provides for development of a GHG index based on the radiative forcing and other environmental effects of all GHGs, and possibly incorporating radioactively active trace gases (e.g. sulfate aerosols)

-- provides that any protocol(s) shall, to the extent feasible, be comprehensive.

-- Mandates that any limitation protocols(s) (a) provides for voluntary trading among nations in net GHG reductions (b) provides "credit" for net GHG reductions achieved by nations unilaterally through measures justified on other grounds, or through other international, regional, or bilateral agreements (e.g. forestry)

2. Develop an improved GHG index and an international process for refining the index. Include, to the extent possible, environmental effects other than radiative forcing.

3. Develop a plan for developing an international net GHG monitoring system.

4. Prepare "crisp retorts" to proposal for piecemeal measures by pointing out the environmental and economic drawbacks of agreements limited to particular GHGs, sources and sinks, sectors, or groups of nations, or that use command and control approaches. These also apply to congressional proposals.

5. Develop quantitative analysis and empirical examples to show the environmental and economic advantages of a comprehensive approach.

6. Update "report card" on the contributions to reducing net GHG of US actions being taken on other grounds. Conduct similar analyses of selected other nations.

7. Development of a concise but sophisticated vision of decision making under uncertainty to counter simplistic versions of the "precautionary principle."

8. Develop capacity to analyze economic and environmental costs and benefits of likely proposals by other nations.

9. Systematic intelligence gathering on the views and economic initiatives of other nations who will be influential in negotiations, and efforts to persuade them of our approach.

Reviewed by Monday
Friday to Ken Yale.

MINISTERIAL DECLARATION

PREAMBLE

We, Ministers from __ countries, assembled in Geneva, Switzerland, from 6 to 7 November 1990 at the Second World Climate Conference.

Conscious of our responsibility to present and future generations to preserve, protect and defend our fragile planet;

Alarmed by recent evidence that our actions may be altering the atmosphere which nurtures life and sets Earth apart from all other planets;

Uncertain still of what may follow, and at what cost, but convinced that delay will constrain our ability to act;

We embark now with common resolve on an effort which will require strength, resolution and steadfast purpose, an effort which will test every virtue of our peoples, but without which we can have no hope of success.

RISKS AND UNCERTAINTIES

1. Science tells us that gases produced by human activities -- the so-called greenhouse gases -- are accumulating in the atmosphere. Many of these gases are produced naturally and are essential to the habitability of our planet; still, the human contribution, particularly since the dawn of the industrial age, has perturbed their delicate balance in the atmosphere.

2. Science also warns us that the accumulation of greenhouse gases produced by human activities will lead inevitably to a global warming, perhaps at rates faster than any experienced since life as we know it began. Science predicts that the warming will not be even, that it is likely to occur more rapidly at higher latitudes, but that, once begun, we may neither be able to control or reverse it.

3. The state of our knowledge is imperfect -- many important uncertainties remain. Still we are aware that a signficant warming may have harmful consequences for our planet and our peoples. Seas may rise, storms may increase and intensify and many species of life may not be able to adapt.

4. Facing such risks, but acknowledging great uncertainties, we must determine how extensively we must act, what the costs of action and inaction may be, and what measure of success will likely grace our efforts.

5. At this Second World Climate Conference we reaffirm our support for the World Climate Programme and for other cooperative scientific initiatives to resolve the questions before us.

PAST AND PROLOGUE

6. We recall that this endeavor is not without precedent. Our nations have already developed a common stragegy to address a related global crisis -- stratospheric ozone depletion. From a modest beginning in 1985, we have quickly narrowed scientific uncertainties and summoned the resolve to take more stringent but necessary action. That action is also the most significant first step to limit the accumulation in the atmosphere of greenhouse gases from human activities.

7. We have also concluded an unprecedented international effort to analyze the science, impacts, and response options for further dealing with climate change. This effort, initiated under the joint auspices of the World Meteorological Organization and the United Nations Environment Programme, has produced the First Assessment Report of the Intergovernmental Panel on Climate Change. The Report has heightened our awareness and enlisted an increasing number of nations in the search for solutions.

8. We have thus set the stage for negotiations on a framework convention on climate change. We note with satisfaction that these negotiations will begin in three months time and that all parties have resolved to complete the convention, together with any related legal instruments as may then be agreed, by the time of the United Nations Conference on Environment and Development in June 1992.

9. We further note that the United Nations General Assembly will shortly consider ways, means and modalities for further pursuing these negotiations on the basis of recommendations produced one month ago by government representatives.

CALL FOR A GLOBAL STRATEGY

10. While uncertainty complicates our task, it will neither delay nor deter us. We must develop a global strategy to preserve our atmosphere. Our strategy must seek both to slow the predicted rise in temperature and to help us adapt to its effects.

11. It must be <u>universal</u>, involving all nations of the world, for only together can we hope to prevail.

12. It must be comprehensive, addressing all sources and sinks of the gases we produce, for the problem has many aspects, which must be considered together if our efforts are to succeed.

13. It must be equitable, taking into account our differing abilities to act and our differing contributions to past and anticipated future accumulations of greenhouse gases.

14. It must be pragmatic, recognizing our common desire to grow and provide for our peoples, without which prospect hope for human prosperity and dignity will wither.

15. It must also be farsighted, recognizing that future innovation will open possibilities as yet unknown, if we but direct our collective ingenuity to shape that future.

THE EFFORT REQUIRED

16. The challenge before us is great. How we meet it may influence life to come on our planet. We are aware that the effort required will be among the most complex and difficult ever undertaken. Our negotiators must find ways to accomodate a wide range of legitimate concerns while ensuring that we develop a specific program of action.

17. Foremost among these concerns is that shared by all countries -- that the actions we agree to take not foreclose economic growth. This concern is particularly acute among developing countries who have not yet attained the level of prosperity that prevails among countries of the industrialized world. Still, it is not unique to them, for disparities exist as well within the industrialized world.

18. We are aware that negotiators must also find ways to accomodate:

--the concerns of countries now determined to limit and reduce growing emissions of greenhouse gases as well as the concerns of countries whose growth depends on fossil fuel production;

--the concerns of countries, whose forests are integrally tied to their economic development yet which provide a critical element of the world's defense against global warming;

--the concerns of countries which bear a proportionately large degree of risk from the anticipated impacts of climate change, particularly countries in arid and semi-arid regions and small, low-lying coastal and island countries; and

--the concerns of all who understand that the burgeoning growth in our planet's population must be taken into account in our efforts to deal with global climate change.

19. We acknowledge that we must also deal anew with issues we have encountered in other fora, issues whose resolution often still eludes us. In particular, negotiators must develop:

--ways to assure that adequate financial resources are made available to countries that would otherwise be unable to join fully in this common effort;

--ways to assure that know-how and technological innovation continue to advance and are made affordable and widely available to solve this common problem;

--ways to assure that knowledge and information are fully and openly shared; and

--ways to assure that the educational and scientific infrastructure in all countries, particularly in the developing countries, is extended and enhanced to enable each of us fully to appreciate the scientific basis for climate change, the potential impacts of such change and evaluations of practical response strategies.

OUR COMMON FUTURE

20. Generations past once relied on faith in moving toward the future. Later generations placed their faith in reason. As we move now toward the second millenium we must seek to marry the two. We must urgently resolve the uncertainties that confront us. We must also accept that full knowledge may elude us for some time. We must begin now to take sustained, pragmatic action to secure our common future. We dedicate ourselves henceforth to develop a phased, flexible response that will enable us to take action now even as we seek to resolve remaining uncertainties and develop a comprehensive action plan for the future.

THE WHITE HOUSE *BULLETIN*

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TO: THERESA GORMAN

SUBJECT: TODAY'S BRIEFING

DATE: THURSDAY, OCTOBER 25, 1990 -- 11:00 AM

SINCE THE MORNING PAPERS:

*** CIA Director Webster, in a speech today, reported that more Iraqi troops have moved into Kuwait and are along the Kuwaiti border. *** Defense Secretary Cheney says US will continue its military buildup in the Middle East. Another 20,000 troops may soon be deployed to join the already 220,000 troops in the region. If conflict breaks out, up to 100,000 more troops may be sent. *** Five Americans have arrived in New York from Iraq, with nine more expected to arrive later today. Meanwhile, Iraq has said it will release all French hostages. *** President Bush signed a temporary spending bill to keep the government going through midnight Saturday, and has canceled campaign plans to stay in Washington today and keep tabs on the budget. *** Israel continues to ignore two U.N. Security Council resolutions, insisting its own investigation into Palestinian deaths on the Temple Mount is sufficient. *** A famine of biblical proportions threatens the Sudan, according to a U.S. relief worker who warns that as many as 11 million people may starve to death unless relief efforts are stepped up and pressure increased on the Sudanese government to get the food to its people.

IN THE WHITE HOUSE AND AROUND THE ADMINISTRATION:

o **The Uruguay Round of the GATT negotiations are not speeding toward a timely and successful conclusion**, according to a number of Administration officials. "While the record to date paints a dismal picture," one official said yesterday, "we may see a flurry of action at the eleventh hour." Charles Schultz, Senior Fellow for Economic Studies at the Brookings Institution and former Chairman of the Council of Economic Advisors under President Carter, concurred, telling the Bulletin yesterday: "It is just like the budget negotiations -- nobody likes to put their final card down until the very last minute. My instinct tells me that when President Bush and the EC prime ministers -- and it will ultimately get up to that level -- face failure right smack in the face, the prime ministers will blink. They will somehow cobble together a compromise on agriculture, enabling the other things to go through. I would guess the probability of this is around 60-40."

Global warming

o **A U.S. delegation led by NOAA Administrator John Knauss will take the message of "let's get serious in February" to the Second World Climate Conference in Geneva**, according to a number of involved Administration officials. The international conference -- which will begin with scientific discussions this Monday, with the ministerial session scheduled for November 6 and 7 -- will address the issue commonly referred to as

global warming. During the Geneva meeting, the U.S. expects a number of Western European governments along with Japan to push strenuously for targets and timetables for greenhouse gas reductions, "as they have been doing at every international meeting in the last year." Japan will unveil its target to stabilize carbon dioxide emissions on a per-capita basis, in the year 2000 and beyond at about the same level as 1990. These expected pronouncements from other nations were criticized this morning by an involved Administration official: "While the Japanese position looks like stabilization at 1990, it is not. It is an 18% increase over 1988, steadily increasing as the population grows. Australia wants to reduce emissions of greenhouse gases by 20% by the year 2005, but this declaration is really no more than a feasibility study and has no legal significance unless adopted by the territories. France has set a stabilization target which is actually above its current emission level. The U.S. is not in favor of continued political statements in the form of declarations. This is all a shell game with these countries and they are not making legal commitments. Even the UK, which says it is going to stabilize to 1990 levels by 2005, seals its lips when you ask how long after 2005 they will hold at that level." While these nations are expected to push strongly at the end of the meeting for a declaration which includes targets, the U.S. negotiating position will be that the opening round of negotiations on a framework convention (scheduled for early February in Washington, D.C.) is the right time and setting for such discussions. The President's Science Advisor Allan Bromley recently chaired a meeting at which the instructions for the Knauss delegation were provided. The U.S. will issue a statement to the conference restating Secretary Baker's "no regrets policy." The statement will highlight progress that the U.S. has already made on the issue -- CFC reductions, the clean air act, the President's tree-planting initiative, energy-efficiency initiatives, as well as the leading role provided by the U.S in providing climate-change research. According to one U.S. official, "these actions will bring the U.S. to 1987 levels of net greenhouse gas emissions by the year 2000, which is really better than the other nations are doing."

- **While reserving judgement, the White House is optimistic that the final language of the clean air bill will allow the President to sign it into law.** According to one Administration official, "We haven't seen the fine print yet, so that is a caveat, but we are optimistic. The President very much wants the bill. We think it will be okay, but I want to reserve judgement until we see the bill."

- **The House Republican vote on the budget package is expected to be in the neighborhood of 115-60 against,** according to sources on Capitol Hill, whose formulations are based on predictions that those Republicans who opposed the summit package will also oppose the current package, and that the "Group of 71" who voted for the original summit package will likely lose between 10 and 15 votes. Republican Deputy Whip Robert Walker, however, told the Bulletin this morning that "as certain elements inside the package become known to Members, there is some chance that there will be even greater defections from the Group of 71." Walker mentioned specifically a provision in the budget agreement that would eliminate the option to withdraw lump-sum retirement benefits for all federal employees except Members of Congress. "My guess is that will be seen as the feathering of a nest that most Members are not willing to countenance."

- **Speculation is mounting that Connie Newman is already on the short, short list to replace Elizabeth Dole at the Labor Department.** Newman has several things going for her. For starters, she is very well thought of among the government employee unions. And, the political advantages she carries being a woman and Black are further accented by what some say would be almost a storybook ascension up the government career ladder from

a G-2 secretary to cabinet secretary.

- **Vice President Quayle will travel to Indiana and Illinois on Friday and Saturday.** On Friday, Quayle will attend a VIP reception and convocation at DePauw University in Greencastle, Indiana, after which he will attend a fundraising reception for Rick Hawks in Fort Wayne. On Saturday, Quayle will travel to Chicago, where he and Indiana Senatorial candidate Dan Coats will begin a "Dan Coats Victory Train Ride" from Randolph Street Station to Hammond, Indiana, and then to New Carlisle, Indiana. Quayle will attend an event for John Hiler for Congress in South Bend, Indiana, and from there will travel to Springfield, Illinois, where he will stump at a picnic for gubernatorial candidate Jim Edgar. Quayle will return to Washington Saturday evening.

- **President Bush has canceled his campaign schedule today** which would have taken him to Albuquerque with Interior Secretary Lujan. Instead, Lujan and HUD Secretary Kemp will be stumping there for gubernatorial candidate Frank Bond.

BUDGET FIGURES:

- **The budget package agreed to by the Democratic leadership would:**
  - -- Raise the federal gasoline tax from 9 cents a gallon to 14 cents a gallon.
  - -- Raise top marginal income tax rate from 28 percent to 31 percent.
  - -- Tax capital gains at 28 percent, three percent lower than the top marginal income tax rate.
  - -- Phase-out personal exemptions for individuals whose taxable income is between $100,000 and $200,000 and for those filing jointly with taxable incomes between $150,000 and $275,000.
  - -- Reduce itemized deductions for the next five years by three percent of the amount of gross income over $100,000.
  - -- Increase the income subject to Medicare payroll tax from $51,300 to $125,000.
  - -- Not levy a surtax on millionaires.

POLITICAL ANALYSIS:

This morning, the Bulletin invites two Republican political consultants and two Republican Congressmen to discuss if and how President Bush and the Republican Party can increase their party's political fortunes going into the 1990 elections.

BULLETIN: Can the President still turn his political fortunes and those of his party around before the election, and, if so, how?

Doug Bailey, Republican Publisher of the Political Hotline: It would be very difficult, but the beginning would be to articulate the domestic priorities of his administration. That is his biggest problem. There is nothing for candidates to hold on to. They don't know where the President is anymore, which is to say, his agenda -- the "vision thing." Unless those priorities are communicated, it is very difficult for candidates to know what it is they are supposed to say. That, of all problems, is the biggest one.

I think that the President's slide in the polls came quickly, but that's the nature of the TV world. The shelf life of moods; the shelf life of issues; the shelf life of phrases, the shelf life of opinion is not very long these days. Good news can replace bad news in a hurry. But in terms of what is in his control to do, the single most important thing for him to do is articulate what the priorities of the White House are. Without that, many candidates are left high and dry.

BULLETIN: What sort of spin can Republican Congressmen put on this budget deal going into their election?

Lyn Nofziger, Republican political and communications consultant: The only thing that Republicans who vote for this package can do is to go out and say: "Well, it would have been worse if we hadn't held the line. And if we hadn't fought all this time, the Democrats would have raised our taxes more than is now the case. We were outnumbered. And if you vote those guys into office this election, then you're going to see more and more taxes; and they're going to hit the middle class, because that's where they always hit. We held this to a minimum."

If I were a Republican in the Congress, I'd vote against any bill that increases gasoline taxes because you're hitting everybody. You're hitting the lower middle-class guy who's moved 40 miles out so he can afford to buy a house. And all of sudden you're increasing his gasoline prices. When you increase gas prices, you increase the price of every product that is shipped -- and most of our products are shipped by truck.

If I were up for re-election I would vote against this bill. If I voted for it, I'd say: "Listen, this is the best we could get; we held it to a minimum. The Democrats would have raised taxes a lot more and they will raise your taxes again."

BULLETIN: What should Republican Congressmen be doing as they go into the final days of the election?

Congressman John Kyle (R-AZ): Our strategy up to now has been to run on the Republican philosophy that you should not need to raise more revenues to achieve deficit reduction. That should be done primarily through spending reductions. Secondly, the worst thing you could do for the economy is things like raising gas taxes -- things which are antithetical to spurring economic growth. After this package passes -- if it does -- I think it will not be too long before it is evident that this country is digging itself deeper and deeper into a recession. Frankly, the points I'm going to be making going into the election and even after the election are similar to what I had to do with catastrophic health insurance. I'll have to say: "I am predicting to you that this will result in disaster." I'll hate to say "I told you so," but I'll bet you that I'll have to. Then we'll have to get to work fixing it. The problem is, however, that it's going to be tough to fix the economy once we've gone deeper into recession.

Congressman Robert Walker (R-PA): The political climate on matters of taxation hasn't changed in over a decade. The strong generic support for the Republican Party has come from younger voters. That's where we have gained over the years. Those younger voters are families struggling to make it. They don't want to pay more taxes as they struggle with raising kids and paying for education and all the things which come along with having to live and work in society. That is where our base of support is. When they become convinced that we no longer care about them, they are not going to vote for Republicans. Events of the last five months have begun to concern them about the Republican commitment to keeping their taxes down. Republicans who reaffirm their support for no new taxes will get overwhelming approval from the people who are making up our generic vote nationwide. Those who do not may not do so well.

PERSONNEL:

- **Solly J. Thomas has been appointed the Executive Director of the Federal Labor Relations Authority.** A graduate of Notre Dame, Thomas came to the Authority from the U.S. International Trade Commission where he served since 1987 as Executive Assistant to the Chairman.