GLOBAL CLIMATE CHANGE

One of the world's most significant environmental problems for the next 100 years may be global climate change caused by man. This change is due to continuing buildup in the upper atmosphere of gases like CO_2, nitrous oxide, methane, and the chlorofluorocarbons. Since these gases absorb and emit radiation, they are capable of influencing the earth's climate and of creating what is known as "greenhouse warming." Some of these gases adversely affect ozone which is also a greenhouse gas in the upper atmosphere.

This issue of global climate change is increasingly in the news, and environmentalists have identified it as an issue to emphasize. The Federal Government supports extensive research related to the climate, and that research serves as the basis for the environmentalists' policy recommendations. Within the next year, we will be pressured to increase regulation of chlorofluorocarbons.

With business as usual, the combined concentrations of CO_2 and other greenhouse gases could be equivalent, by the middle to late 21st century, to a doubling of CO_2 from pre-industrial levels. The most sophisticated, but still imprecise, models of the climatic system predict this would increase the global surface temperature between 3 and 8 degrees F. An increase of 3 degrees F. is greater than the world has experienced naturally in the last 6,000 years.

A global warming of 3 to 8 degrees F. could lead to global changes in precipitation patterns and a sea level rise of 8 to 40 inches. Unfortunately, regional climatic effects, like precipitation changes and days of extreme high or low temperatures, cannot be calculated with any reliability. Projections about the number of days a city will have over 100 degrees F. temperatures are only speculations.

Ozone is the principal gas in the upper atmosphere that prevents harmful solar ultraviolet radiation from reaching the surface of the earth. Nitrous oxide and chlorofluorocarbons lead to the destruction of ozone. Depletion of the ozone layer may lead to, among other things, increased skin cancer and crop damage. For the past several years, total ozone over a large area of Antarctica has decreased in September and October at the end of the long polar night, creating the "ozone hole," with concentrations recovering again in the following few weeks. Since the drop is apparently becoming larger each year, some argue that this may be an early sign of major, global depletion of the ozone layer.

The complexity of the global climatic system, our imperfect models, and major gaps in present knowledge makes precision impossible until further research progress is made.

The United States currently generates about 25 percent of the world's atmospheric CO_2 and larger percentages of the other greenhouse gases. The percentage contributions of all nations are expected to change as the developing nations increase their generation of CO_2 and other greenhouse gases. Thus, this is a global issue caused by and affecting all countries.

Concern over the potential consequences of increasing atmospheric concentrations of the greenhouse gases has caused interest among many agencies, Congressional committees, international organizations, and environmental groups. Several international, interdisciplinary research programs are underway. The International Convention for Protection of the Ozone Layer which provides for no regulation but international exchange of data and research was signed last summer. The Senate held hearings on global climate change in December 1985 and June 1986. Media coverage is picking up. EPA must decide by November 1987 whether further regulation of chlorofluorocarbons is required.

NSF, NOAA, NASA, and the Departments of Agriculture, Defense, and Energy have climate related research programs underway totaling about $140 million annually, and NASA has a $600 million upper atmosphere research satellite project scheduled for 1989.

A group of knowledgeable scientists and analysts believe that society must begin to identify and discuss the implications of this issue to the environment, human health, and the economy. Policy analysis, they say, must go parallel with the scientific efforts; it should not wait for more concrete scientific results. However, continued extensive scientific effort is required to provide facts and scientific tools to improve our imprecise state of knowledge.

This issue is within the province of and under discussion by the Energy, Natural Resources, and Environment Working Group of the Domestic Policy Council.

Office of Policy Development
October 3, 1986

Additional Background Relating to Global Climate Change

Ozone at low altitudes in the atmosphere can adversely affect human health, materials, and plants. EPA is obligated under the Clean Air Act and court order to take action to protect human health against non-attainment of the existing ozone standard. There is no significant movement of ozone from the lower to the upper atmosphere.

An ad hoc subgroup of a Domestic Policy Council Working Group is evaluating policy issues related to global climate change.

GLOBAL CLIMATE CHANGE

One of the world's most significant environmental problems for the next 100 years may be global climate change due to man caused, continuing buildup in the atmosphere of "greenhouse" gases like CO_2 nitrous oxide, methane, and the chlorofluorocarbons. Since these gases absorb infrared radiation emitted by the earth and redirect it back toward the earth thus reducing the amount of energy emitted into space, they are capable of influencing the earth's climate. While early concerns focused on the role of CO_2 in the global warming process, the role of the other gases in changing the climate may also be important. If present trends continue, the combined concentrations of atmospheric CO_2 and other greenhouse gases could be radiatively equivalent to a doubling of CO_2 from pre-industrial levels, as early as the middle of but more probably later in, the 21st century.

The most sophisticated, but still imprecise, models of the climatic system predict increases of the global mean equilibrium surface temperature of between 3 and 8 degrees F. (with higher rises near the poles and lesser near the equator) with the predicted doubling of atmospheric CO_2 (or equivalent) concentrations. Most recent work tends toward the upper limit, although this is not yet apparent from observations. An increase of 3 degrees F. is greater than the world has experienced naturally in the last 6,000 years.

A global warming of 3 to 8 degrees F. could lead to global changes in precipitation patterns and a sea level rise of 8 to 40 inches. A rise of 40 inches would inundate some major coastal regions, e.g., parts of Louisiana and Florida. An 8 inch rise would erode most sandy beaches along the U.S. Atlantic and Gulf coasts 30 yards inland.

Regional climatic effects, like precipitation changes and days of extreme high or low temperatures, are even more difficult to model than global effects and cannot be calculated with any reliability. Projections about the number of days a city will have over 100 degrees F. temperatures are only speculations.

Ozone is a greenhouse gas and the principal gas at high altitudes in the atmosphere that prevents harmful solar ultraviolet radiation from reaching the surface of the earth. Nitrous oxide, and chlorofluorocarbons are precursors to catalysts for the destruction of ozone. Depletion of the ozone layer may lead to, among other things, increased skin cancer and crop damage. For the past several years, total ozone over a large area of Antartica has decreased in September and October at the end of the long polar night, creating the "ozone hole," with concentrations recovering again in the following few weeks. That the drop is becoming larger each year has sparked discussion that this may be an early sign of major, global depletion of the ozone layer.

Ozone at low altitudes in the atmosphere can adversely affect human health, materials, and plants. EPA is obligated under the Clean Air Act to take action to protect human health against

non-attainment of the existing ozone standard. There is no significant movement of ozone from the lower to the upper atmosphere.

One important aspect of the ozone and global warming issues is that the atmospheric lifetimes of some greenhouse gases are known to be very long. Consequently, if there is a change in climate or atmospheric ozone caused by increasing concentrations of these gases, any partial recovery of the system may take decades or centuries after the emission of these gases is terminated.

The complexity of the global climatic system, our imperfect models, and major gaps in present knowledge -- particularly in the area of ocean-atmosphere interactions and clouds -- makes precision impossible until further research progress is made. Most of the global climate change issues are related.

The United States currently generates about 25 percent of the world's atmospheric CO_2, Western Europe about 17 percent, and the developing nations over 12 percent. The United States and Western Europe generate larger percentages of the other greenhouse gases. All these percentages are expected to change as the developing nations increase their contribution. Thus, this is a globally caused and globally affected issue.

Concern over the potential consequences of increasing atmospheric concentrations of the greenhouse gases has caused interest among many agencies, Congressional Committees, international organizations, and environmental groups. Several international, interdisciplinary research programs are underway. The International Convention for Protection of the Ozone Layer was signed last summer. The Senate held hearings on global climate change in December 1985 and June 1986. Increased media coverage is occurring. EPA must decide by November 1987 whether further regulation of chlorofluorocarbons is required.

NASA, NSF, NOAA, EPA, and the Department of Energy have large research programs underway. About $23 million per year deals with CO_2, $75 million with climate, $30 million with the upper atmosphere and ozone, and NASA has a $600 million upper atmosphere research satellite project scheduled for 1989.

There is general agreement that immediate, drastic policy action is not required. However, increased regulation of chlorofluorocarbons is being supported by some. A group of scientists and analysts believe that society must begin to identify and discuss implications to the environment, human health, and the economy. Policy analysis of this type, they say, must go parallel with the scientific efforts; it should not wait for more concrete scientific results. However, continued extensive scientific effort is required to provide facts and scientific tools to reduce our current admittedly imprecise state of knowledge. New agricultural, energy, or other major systems including societal adjustments may need to be developed and deployed over the next 50 to 100 years. It is not too soon to begin the research required for such systems and to begin discussions with other countries about the implications of the buildup.
8/7/86