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Subseries: Global Climate Change Files

OA/ID Number: 62049
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Environment: Global Change [3 of 3] [1991]

Stack:

Row:

Section:

Shelf:

Position:

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"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9120672

FROM: TALLEY, Joanne

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 02/19/91

SUBJECT: GLOBAL WARMING

ASSIGNED TO: Nancy Maynard

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO:

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 03/08/91

FILE: ENVIRONMENT-GLOBAL WARMING

9120672

RECEIVED

91 MAR 8 A8:34

P. O. Box 788
Hobe Sound, FL 33475
February 19, 1991
OFFICE OF THE
DIRECTOR

Bromley

The Honorable John H. Sununu
Chief of Staff
The White House
Washington, DC 20050

Dear Mr. Sununu:

Now is the time (even during a war) to
consider very seriously global warming.

If some action is not taken soon, there will
be no earth left to live on. Our whole world now
has problems with the air it is breathing and this
should be recognized and dealt with by our world
leaders.

Sincerely,

Joanne Talley

Joanne Talley

A Crack in Japan's Nuclear Sangriuu

By DAVID E. SANGER

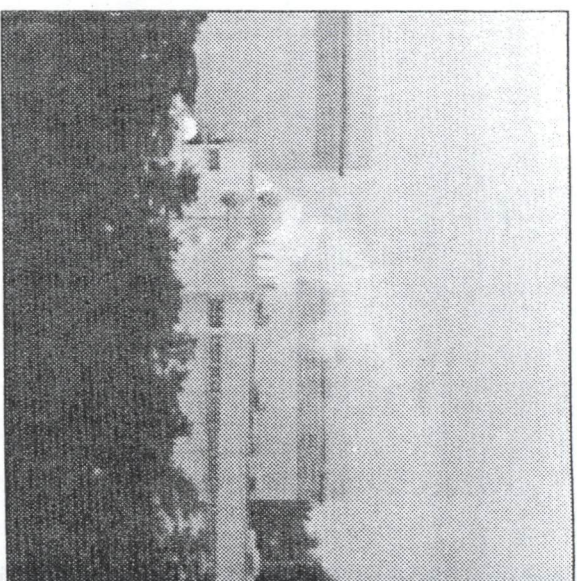
TOKYO

AS Japan has rapidly grown more dependent on nuclear power over the last two decades, it has also grown more confident, perhaps even a bit smug, about its prowess at running nuclear reactors. Eager to beat back a growing anti-nuclear movement, the Japanese Government constantly reminds people that this country's reactors suffer far fewer glitches and emergency shutdowns than plants in the United States or Europe. Workers are trained more intensively. Facilities are inspected more rigorously. Much like making computer chips and defect-free cars, the argument goes, nuclear safety is a matter of discipline and controlling the process.

Those reassurances lost a bit of their persuasive power in 60 panicked minutes last weekend in Mihama, a small town on the Japan Sea. Just after lunch, meters in the control room of a 19-year-old plant showed a sudden jump in radioactivity, often a warning sign of a leak in one of the small tubes carrying superheated radioactive water into the plant's steam generator.

While workers spent 50 minutes trying to determine if the meter was providing false readings — a common occurrence — the plant was heading toward potential disaster. When the workers finally realized that a burst tube was pouring tons of mildly radioactive water into the steam generator, where the water supply is supposed to be pure, they activated a critical emergency pressure valve. It failed. Moments later alarms rang and an emergency system flooded the reactor to prevent a meltdown. No one was hurt in what Japanese officials said was the country's worst nuclear "incident" — they refused to call it an accident — but a small amount of radiation was released into the atmosphere.

Just how narrowly Japan skirted nuclear disaster is still an unanswered question. But if there is never a good time for a nuclear accident, this was a particularly bad one. Seizing on the clear message of the gulf crisis, the Government's legions of industrial planners have been pushing hard in recent months to convince the country that it must double the number of nuclear reactors in the next two decades. Japan's 40 nuclear power plants already generate more than a quarter of the country's electricity, making the Japanese more dependent on nuclear technology than anyone except the French. But as one senior government official put it not long ago,



Agence France-Presse

Radiation was released last week from the nuclear power plant in Mihama, Japan.

"When you've got no oil, you've got no choice."

What is slowing these plans is a phenomenon the Japanese usually only read about: a growing, grassroots movement to reverse national policy. A population that silently endures outrageous prices and shrugs its shoulders at revelations of political corruption seems increasingly nervous about nuclear power.

Losing Faith

A 1984 government poll showed that 70 percent of the public thought that nuclear power was reliable. In 1987 the figure fell to 52 percent. After two major nuclear "incidents" in the last two years — a plant in Fukushima was shut down in 1989 when chunks of metal broke free and clogged a critical pump — no one in power is likely to ask the question again anytime soon.

For four decades Japan has taught its schoolchildren about the horrors of radiation sickness from the bombings of Hiroshima and Nagasaki. But now those

teachings are rewording on the nuclear power industry, especially as it becomes clear that in a country this small it is impossible to put plants far from major population centers.

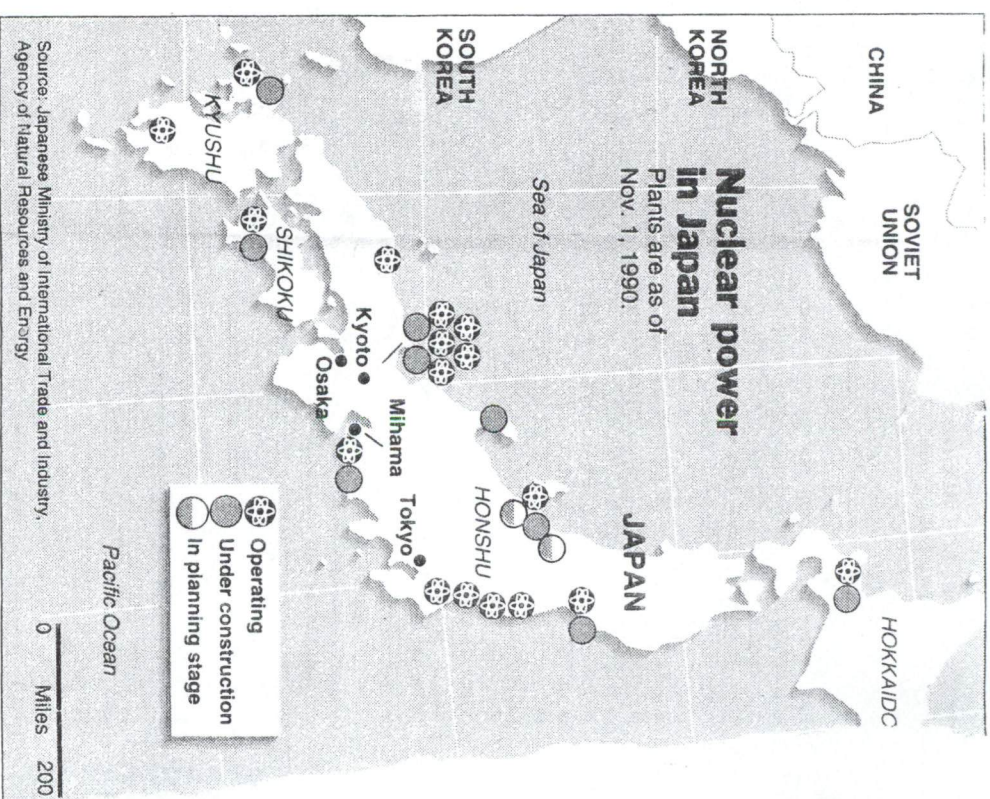
"People are beginning to realize that nuclear technology is not as mature as they were led to believe," said Atsushi Tsuchida, a researcher at Japan's Institute of Physical and Chemical Research and a leading critic of the industry. It does not help, he said, that the Government institution responsible for acting as a watchdog over nuclear safety is also the one in charge of convincing the public that it needs a rapid-fire buildup of new nuclear projects.

That institution is Japan's Ministry of International Trade and Industry. A major part of the ministry's job is securing energy supplies, from coordinating the purchase of oil around the world to spending millions on experimental projects like the fast breeder reactor, which generates nuclear fuel faster than it consumes it. Other projects are under way to design reactors that extend the life of nuclear fuel and to build Japan's first spent-fuel reprocessing center, at a site in northern Honshu that has become a lightning rod for the anti-nuclear movement. In a local election two weeks ago, the ruling Liberal Democratic Party beat back challengers to the plant, but only after enormous expenditures by both party leaders and utility companies.

To Japan's credit, its record so far is impressive. In 1988 the average number of unplanned shutdowns per reactor — that is, problems so severe that the plug must be pulled — was only 0.4, compared with 4.0 in the United States and 5.3 in France. But Japanese often become prisoners of their own statistics. There is strong if unspoken pressure not to shut a plant down and ruin the numbers. That pressure seemed to be at play in the Fukushima accident, when a pump was allowed to rattle and shake for 14 hours before it was shut down.

Just as in the Fukushima case, the Japanese public only learned the more chilling details of last week's Mihama accident days later, after government and utility officials were finished with their no-problem, everything-under-control patter.

"On the whole, we are very happy with the way the system worked," Ryuko Fujii, an official of MITI's Agency of Natural Resources and Energy, told reporters. But for Japan, he conceded, "this is not a scientific issue. It depends on how the public changes its mind."



Talk, But Just That, About Global Warming

ALMOST two years ago, when President Bush invited delegates for the first international conference to negotiate a treaty to curb global warming, it was a gesture to convince allies and foes that the United States considered the threat to be real.

Last week, the 10-day conference ended with a pact that carved the first blazes on a path toward a treaty, but also caused puzzlement over just how committed the United States is.

Some of the biggest doubters are members of the American delegation, who privately believe the United States should be far more aggressive in combating global warming but were overruled by John. H. Sununu, the White House Chief of Staff.

Mr. Sununu maintains that without more conclusive scientific evidence the United States should not commit itself to reducing emissions of carbon dioxide, the principal gas linked to warming temperatures, because that would be tantamount to reducing



Andrea Mohlin/The New York Times

John H. Sununu

the use of oil and other fossil fuels and could lead to economic stagnation.

Some delegates said Mr. Sununu directed American negotiators only to establish the framework for negotiating a treaty before pursuing substantive discussions. As a result,

the conference agreed to form two primary groups to write the final treaty, but left unfinished which countries would form the groups.

The narrow objectives and limited gains appeared to delight the Administration. "The meeting was a substantial step forward in that 100 countries agreed to establish a framework by which to deal with the question of global climate change over the course of the next 16 months," said Michael R. De-land, chairman of the White House Council on Environmental Quality.

But critics feared that much of the next meeting in Kenya in June also could be taken with arguments on procedural issues.

"I'm really aggravated at my Government," said Pamela Wexler, a policy analyst at the Center for Global Change, a research group. "They spent almost two weeks deciding to decide and all they came up with is an agreement to keep talking. Everyone's going home empty-handed."

KEITH SCHNEIDER

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9120537

FROM: LANGDON, George D.: AMERICAN MUSEUM OF NATURAL HISTORY

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 02/15/91

SUBJECT: THE EXHIBITION ON GLOBAL WARMING ^{Amcl} ~~NAD~~ CLIMATE CHANGE
SPONSORED BY BY THE AMERICAN MUSEUM OF NATURAL
HISTORY AND THE ENVIRONMENTAL DEFENSE FUND.

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: D. Allan Bromley
Nancy Maynard

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 02/26/91

FILE: ENVIRONMENT-GLOBAL WARMING

American Museum of Natural History

The President

Dear Allan,

We are quite excited
about the exhibition. I
hope we will see you at
the museum again on one
of your trips to New York.

Ye

9120537

AMERICAN MUSEUM OF NATURAL HISTORY

RECEIVED
CENTRAL PARK WEST AT 79TH STREET

NEW YORK, N.Y. 10024-5192

91 FEB 26 AIO: 08

OFFICE OF THE PRESIDENT

OFFICE OF THE
DIRECTOR

February 15, 1991

Dr. D. Allan Bromley
Assistant to the President
for Science & Technology
Executive Office of the President
Washington, DC 20506

Dear Allan:

We would like to bring to your attention the exhibition on global warming and climate change sponsored by the American Museum of Natural History and the Environmental Defense Fund. The exhibition will open at the American Museum in New York in May of 1992 and, after a showing of eight months, will travel to other leading science and natural history museums. If funding is available, we will also produce foreign language versions for travel to other countries.

The key goal of the exhibition is education of the general public on the basis for predicting climate change, potential impacts of global warming on our environment and society, and the choices that lie ahead. The exhibition clearly separates what is known from what is predicted and presents a range of individual and collective choices, both to mitigate climate change and adapt to its potential consequences. While there is no unanimity of opinion among scientists as to what the future may hold, it is important that the issues that could affect our future are understood by an informed public.

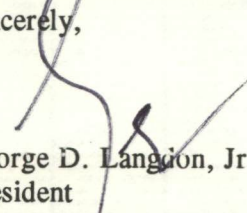
Museum exhibitions allow people to become directly involved and browse through information that they decide to learn more about. The exhibition will be highly interactive, increasing the effectiveness of learning through hands-on experiences. Publications, lectures, a symposium, demonstrations, workshops, field trips and other events will further extend the exhibition's reach.

This exhibition on global warming represents the first collaboration between the American Museum of Natural History and a national environmental organization to educate the public on a significant issue of our time. In the past, natural history museums focused on looking back in time to understand development of the natural world; these museums are now looking to the future toward the preservation of the natural world. The global warming project combines the American Museum of Natural History's scientific strength in biological diversity and evolutionary history with the Environmental Defense Fund's concentration on climatic change research and policy analysis.

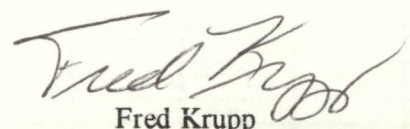
Page Two
Dr. D. Allan Bromley
February 15, 1991

To ensure the accuracy, balance, and timeliness of the exhibition's content, we have gathered together specialists in climatic change and related disciplines from leading educational and research institutions to form a scientific advisory panel (see attached for a list of panel members). We will keep you informed of future developments as planning for the exhibition and its public programs continues.

Sincerely,



George D. Langdon, Jr.
President
American Museum of Natural History



Fred Krupp
Executive Director
Environmental Defense Fund

**American Museum of Natural History/Environmental Defense Fund
Global Warming Exhibition**

Scientific Advisory Panel

Panel Chairman:

Dr. Michael Oppenheimer
Senior Scientist
Environmental Defense Fund

Atmospheric Physics

Dr. Fahkri Bazzaz
H. H. Timken Professor of Science
Department of Organismic and Evolutionary Biology
Harvard University

Plant Ecology

Dr. Wallace S. Broecker
Newberry Professor of Geological Sciences
Lamont-Doherty Geological
Observatory of Columbia University

Paleoclimatology/Marine
Geochemistry

Dr. William Clark
Assistant Director
Center for Science and International Affairs
John F. Kennedy School of Government
Harvard University

Ecology/Policy/Adaptation

Dr. John W. Firor
Director
Advanced Study Program
National Center for Atmospheric Research

Atmospheric Physics

Dr. William A. Gutsch, Jr.
Chairman/Associate Astronomer
American Museum-Hayden Planetarium

Astronomy

Dr. James H. Hansen
Director
Goddard Institute for Space Studies

Climatology

Dr. George Harlow
Chairman and Curator
Department of Mineral Sciences
American Museum of Natural History

Geology

Dr. Stephen P. Leatherman
Director
Laboratory for Coastal Research
University of Maryland

Sea Level Rise/Beach Response

Dr. Thomas E. Lovejoy
Assistant Secretary for External Affairs
Smithsonian Institution

Ecological Effects/Tropical Forests

Dr. Malcolm McKenna
Frick Curator
Department of Vertebrate Paleontology
American Museum of Natural History

Paleontology

Dr. Scott Mori
Associate Curator
New York Botanical Garden

Plant Taxonomy/Tropical Forests

Dr. E. Fred Roots
Science Advisor
Department of the Environment
Canada

Arctic Impacts

Dr. Stephen Schneider
Head of Interdisciplinary Climate Systems
National Center for Atmospheric Research

Atmospheric Physics/Chemistry

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9120451

FROM: MECKLER, DAVID C.

TO: JOHN SUNUNU

DATE OF
CORRESPONDENCE: 02/08/91

SUBJECT: U.S. SHOULD TAKE A MORE AGGRESSIVE APPROACH TO
REGULATING GREENHOUSE GASSES TO PREVENT EXCESSIVE
GLOBAL WARMING.

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: Nancy Maynard
D. Allan Bromley

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 02/20/91

FILE: ENVIRONMENT-GLOBAL WARMING

912045 1

RECEIVED

1991 Feb 8
91 FEB 20 AIO: 46

OFFICE OF THE
DIRECTOR

Gov. John Sununu
White House Chief of Staff
Washington DC

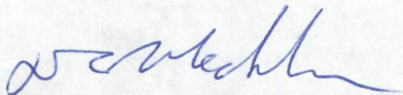
Bromley

Governor Sununu:

After reading several articles on the Greenhouse Effect debate in *Science*, *Science News*, *Nature*, and *Scientific American*, I conclude that the US should take a more aggressive approach to regulating greenhouse gasses, including carbon dioxide. While I am no more of an expert on the subject than you are (I have only a BS degree in physics), I feel that the predominant opinion in the scientific community supports strong actions. Furthermore, if measures are designed properly, environmental regulation and carbon taxes could enhance America's long term economic and energy prospects.

Please urge President Bush to live up to his campaign slogans of an "Environmental President," and to join the international community, not retard its progress, in the matter of the prevention of excessive global warming.

Sincerely,



David C Meckler
8725 Dolomite Dr
El Paso TX 79904

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9120335

FROM: MCMASTER, DR. BELLE MILLER

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 02/01/91

SUBJECT: LETTER TO PRESIDENT GEORGE BUSH CONCERNING GLOBAL
WARMING

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: Nancy Maynard
D. Allan Bromley

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 02/05/91

FILE: ENVIRONMENT-GLOBAL WARMING

RECEIVED



SOCIAL JUSTICE AND PEACEMAKING

91 FEB 5 P 5:12 PRESBYTERIAN CHURCH (USA)

February 1, 1991

OFFICE OF THE
DIRECTOR

President George Bush
The White House
1600 Pennsylvania Avenue
Washington DC 20500

Dear Mr. President:

I understand that negotiations will take place in Washington, D.C., in February on a framework convention for reducing the "greenhouse gas" emissions that lead to the gradual warming of the earth's climate. I wish to call your attention to a recent action of the General Assembly of the Presbyterian Church (U.S.A.) and to an international ecumenical event that took place this month.

The 202nd General Assembly (1990) of the Presbyterian Church (U.S.A.) approved a report entitled "Restoring Creation for Ecology and Justice." It includes a strong statement, with policy recommendations, on global warming. I enclose a copy of this section of the report.

The International Ecumenical Consultation on the Responsibility of the Churches for the Protection of the Earth's Atmosphere took place at Gwatt, Switzerland, January 13-18. Delegates came from the churches of eighteen European and North American countries. The nine-member U.S. delegation included two Presbyterians.

The Presbyterian Church (U.S.A.) and the Ecumenical Consultation both take the position that the global atmospheric warming trend constitutes a very serious danger. The Presbyterian report calls for the United States to lead the way by reducing its own combustion of fossil fuels and shifting to renewable sources of energy. The Ecumenical Consultation calls upon the industrialized nations to adopt a three percent annual reduction of carbon dioxide emissions as a specific target.

These developments represent an increasingly firm and widespread conviction in the churches that the time has come for strong measures to address global warming. I urge you to take full advantage of the opportunity now at hand to work for an international convention to be signed at the United Nations Conference on Environment and Development in 1992. This treaty should reflect the special responsibility of industrialized countries and should set specific targets for greenhouse gas reductions.

We would be pleased to provide you with additional information on the churches' policies if you wish, and look forward to hearing from you.

Respectfully yours,

Dr. Belle Miller McMaster, Director
Social Justice & Peacemaking Ministry Unit

Enclosure: 1990 General Assembly policy statement on global warming

cc: Daniel Riefsnyder
Director, Global Climate Change Office
U.S. Department of State

Buff Bohlen
Assistant Secretary for Oceans, Environment and Science
U.S. Department of State

John Knauss
National Oceanic and Atmospheric Administrator
Department of Commerce

Allen Bromley
Science Advisor to the President

Michael R. DeLand
Chairman, Council on Environmental Quality

William Reilly
Administrator, Environmental Protection Agency

Admiral James Watkins
Secretary, Department of Energy

Fred Bernthal
Acting President, National Science Foundation

John Sununu
Chief of Staff, Executive Office of the President

Richard G. Darman
Director, Office of Management and Budget

Dallas Peck
Director, U.S. Geological Survey

Samuel Skinner
Secretary, Department of Transportation

"RESTORING CREATION FOR ECOLOGY AND JUSTICE": Adopted by the 202nd General Assembly (1990) of the Presbyterian Church (U.S.A.)

Area Five. OVERCOMING ATMOSPHERIC INSTABILITY: GLOBAL WARMING AND OZONE DEPLETION

Background information on ozone depletion and global warming may be found in Part I of this report, in Keeping and Healing the Creation, pp. 21-25, and in Church and Society (March-April, 1990).

We note that the phenomena determining climate are very complex and that scientific opinion varies with respect to the reliability of models projecting temperature increases. The weight of evidence, however, justifies a serious response to the threat of global warming.

Ozone depletion and global warming have risen rapidly to head the list of concerns about the future of creation. They are significantly different from other problems in several respects. They have to do with global problems that lie ahead and cannot now be measured. No place on earth will be unaffected, however. Without united action worldwide, no nation can do much about global warming and ozone depletion. They represent the unintended consequences of proud industrial achievements. The gases released were not toxic. Chlorofluorocarbons (CFC's) have had all sorts of beneficial uses, and we breathe air with CO₂ in it. Now in the upper atmosphere these gases are doing enormous damage. But we cannot get them down again. We can only stop sending them up and thereby limit the damage.

In the case of CO₂, substantial reduction of emissions means changing the energy basis of our whole civilization. We knew that fossil fuels would not last indefinitely; but suddenly the danger is that they will last too long, that the world will not make the transition soon enough to simpler, more efficient, and renewable energy sources and technologies.

In 1989 the United Church of Canada and eight European churches came to a "Covenantal Agreement Regarding the Threat of Global Warming." They did this in connection with the meeting in Basel, Switzerland, of Protestant and Catholic Christians from East and West Europe on the "Justice, Peace, and Integrity of Creation" theme of the World Council of Churches. They agreed to work together on the problem of global warming and to give particular attention to the role of energy. They have already made an important approach to governments by advocating cooperation on reduction in the use of fossil fuels by means of energy-saving technologies and the development of renewable (solar) energy supplies. They presented comments and policy statements to the October 1989 environmental meeting in Sofia, Bulgaria, of governments belonging to the Conference on Security and Cooperation in Europe.

These are significant developments. An invitation has come to U.S. churches, through their representatives on the NCC Eco-Justice Working Group and through their delegates to the 1990 World Convocation on JPIC in Seoul, Korea, to participate in this international cooperative effort of churches on global warming.

THE 202nd GENERAL ASSEMBLY (1990) RECOMMENDS:

A. ECUMENICAL PARTICIPATION AND INTERNATIONAL PARTICIPATION

1. The Presbyterian Church (U.S.A.) declares its serious concern, in concert with ecumenical partners, that the global atmospheric warming trend (the greenhouse effect) represents one of the most serious global environmental challenges to the health, security, and stability of human life and natural ecosystems; and

2. The church affirms its intention to participate in ecumenical efforts to address this challenge cooperatively with Canadian and European churches and the conciliar movement.

3. The General Assembly affirms its intention to participate in the United Nations International Conference on Environment and Development, to be held in 1992, and requests a report to a subsequent General Assembly as appropriate.

B. POLICIES ON GLOBAL WARMING

1. The United States, as consumer of nearly a quarter of the world's energy, must take the lead in reducing its own combustion of fossil fuels and shifting to renewable sources of energy which do not contribute to the atmospheric buildup of carbon dioxide.

2. Appropriate response to the warnings of impending climate change requires an extended frame of reference for decision-making by governments, international agencies, industries, educational institutions, churches, and community organizations. The U.S. government, other governments, the United Nations, and appropriate scientific organizations should increase their capability to monitor and project trends in atmospheric temperature and to make broad environmental and social assessments.

3. The United States should work through the United Nations and appropriate diplomatic channels to reach firm international agreements for steady and substantial reduction of the gases causing climate change, and for halting deforestation and promoting reforestation. Some programs already in place should be given an enlarged role and increased funding—the U.N. Environment Programme, for example, and the U.N.'s programs on development and population.

4. The United States government should adopt legislation and administrative policies, with adequate funding, for vigorously stepped-up research and development of energy efficient technologies.

5. The U.S. government should promote the introduction and use of energy-efficient technologies by applying carefully targeted incentives and disincentives.

6. Similarly, the U.S. government should adopt legislation and administrative policies, with adequate funding, to step up research and development on the various sources and technologies for solar energy. Appropriate incentives and disincentives to accelerate the transition to an economy based on renewable, safe, nonpolluting, affordable energy should be developed and implemented.

7. The United States and the other industrialized nations should assist developing countries to achieve the energy sufficiency necessary for the general improvement of living standards that these countries desperately need. This assistance should include appropriate technology transfers for pollution control and energy efficiency. In particular, assistance will be necessary to enable developing countries to find equitable solutions to the problems of debt and land use that figure heavily in the destruction of their forests.

8. The U.S. Environmental Protection Agency should act promptly to strengthen fuel economy and emission standards for automobiles, buses and trucks by mandating and consistently enforcing a schedule of energy efficiency improvements, leading to a substantially higher standard of efficiency within a few years. Incentives and disincentives to encourage consumers to choose fuel-efficient vehicles will also be in order.

9. Comparable standard-setting and incentive-generating measures should be advanced by the U.S. Bureau of Standards with respect to efficiency improvements in lighting, heating, air-conditioning, appliances, building construction, the weatherization of existing buildings, and the cogeneration of heat and electricity (with legislation as necessary where the Bureau's powers do not apply). As more efficient technologies become available, public policy should encourage and facilitate their adoption and use by individuals and businesses.

10. Public policy should encourage alternatives to private automobiles. Alternatives include municipal mass transit, railroads, bicycles, and walking.

C. POLICIES ON OZONE DEPLETION

To a large extent the kinds of policies needed for reducing the emissions of chlorofluorocarbons (CFC's) and other ozone-destroying gases parallel the policies required for reducing the buildup of the greenhouse gases. The CFC's, which are the leading cause of ozone depletion, also add significantly to the greenhouse effect. To protect the ozone shield, there clearly is need for international action through:

1. Leadership by the United States, which is the largest contributor to the problem.

2. A longer-term and global frame of reference, with improved foresight capability by governments and international agencies.

3. Strong international agreements and cooperative arrangements; specifically, firm adherence to the Montreal and Helsinki agreements on phasing out the production of CFC's by the end of the century and discontinuing the other ozone-destroying chemicals as soon as possible, with continuing efforts to bring additional nations into the pact.

4. Improved technologies and development of acceptable substitutes for the chemicals that must be phased out; rapid shifts in production processes.

5. Assistance to developing countries by providing them with information, training, funding mechanisms, and technology transfers that will enable them to participate in the Montreal-Helsinki pact and have access to the improved technologies and substitute chemicals.

6. Strict standards, in line with international agreements but enforced by governments.

7. Incentives and disincentives that lead actors in a market economy to make environmentally rational decisions.

CHURCH SUPPORT THROUGH PERSONAL AND INSTITUTIONAL PRACTICE

1. The American people, beginning with members of our churches, must be challenged to form personal habits consistent with the need to cut back on the emissions of the gases that are causing the greenhouse effect and the depletion of the ozone layer. This means energy conservation and cutting back on the use of fossil fuel energy. It means avoiding foams made with CFC's, and making sure that CFC-based coolant is not released when air conditioners are serviced.

2. The greenhouse and ozone problems reinforce the call to a less materialistic and wasteful style of life. It is unrealistic and self-serving to think that efficient and renewable energy technologies, now in the early stage of the transition, will take effect fast enough to provide sufficient insurance against the potentially disastrous consequences of global warming — unless there is also a move away from unnecessary and wasteful production and consumption.

3. The church in its own life must teach, exemplify, and advocate the values and principles, policies and practices that foster energy efficiency, the transition to renewable sources, and the avoidance of products that break the ozone down. Obviously the church must be responsible in the construction and maintenance of its own buildings. If habits of conservation and responsible consuming are cultivated consistently, we shall discover many practical applications of our values.

As this report has repeatedly made clear, the affliction of the creation will not be healed unless the human part of creation undergoes significant personal and institutional transformation. Our recommendations suggest something of what the transformation may entail, but they fall far short of prescribing all that is needed. That will be the agenda for the coming years.

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9120259

FROM: SEITZ, FREDERICK

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 01/30/91

SUBJECT: RESULTS OF THE LATEST STUDY OF THE GREENHOUSE
PROBLEM

ASSIGNED TO: Nancy Maynard

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO:

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 01/31/91

FILE: ENVIRONMENT-~~GLOBAL WARMING~~

Global Δ
Greenhouse



THE ROCKEFELLER UNIVERSITY

1230 YORK AVENUE • NEW YORK, NEW YORK 10021-6399

January 30, 1991

Dr. D. Allan Bromley
Science Advisor to the President
Office of Science and Technology
Policy
Old Executive Office Building
Washington, DC 20506

Dear Allan:

I thought you would be interested in the results of our latest study of the greenhouse problem. Advance copies of the report and Executive Summary are enclosed, with a summary sheet outlining the principal findings.

Sincerely,

Frederick Seitz

Encls: 1) *Global Warming: What Does the Science Tell Us?*
2) *Executive Summary*

RECEIVED
91 JAN 31 AID: 24
OFFICE OF THE
DIRECTOR

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9120286

FROM: SAVITT, CHARLES C. (ISLAND PRESS)

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 01/29/91

SUBJECT: CLIMATE CHANGE: THE IPCC RESPONSE STRATEGIES

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

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COPIES TO: Nancy Maynard
D. Allan Bromley

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REMARKS: ENCLOSURE TO NM

DATE RECEIVED: 01/30/91

FILE: ENVIRONMENT-CLIMATE CHANGE

9120 286

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91 JAN 30 P 2: 51

OFFICE OF THE
DIRECTOR

January 29, 1991

Dr. D. Allan Bromle
Assistant to the President
for Science & Technology
725 17th Street, NW
Washington, D.C. 20506

Dear Dr. Bromle:

Thought you would be interested in our just
published CLIMATE CHANGE: The IPCC Response
Strategies.

Best regards,

Charles C. Savitt
Charles C. Savitt
President

Enclosure

A Division of
The Center For
Resource Economics

ISLAND PRESSES

Washington Office
1718 Connecticut Avenue, N.W.
Suite 300
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JANUARY 30, 1991
FOR IMMEDIATE RELEASE

CONTACT: Charles Savitt
(202) 232-7933

A Division of
The Center For
Resource Economics

U.N. PANEL OUTLINES POLICY OPTIONS ON GLOBAL WARMING
Report To Be Debated at February Conference

Washington, D.C., Jan. 30--The United States and other industrialized nations will have to alter their economies to limit emissions of carbon dioxide and other gases that cause global warming, and must provide aid to developing nations so they can cope with the problem without impeding their economic growth, according to an international report on climate change released today. Energy conservation, use of cleaner energy sources, and a phase out of chlorofluorocarbons (CFCs) are among the short term measures recommended in the final report of the Response Strategies Working Group of the Intergovernmental Panel on Climate Change (IPCC). The IPCC was established by the United Nations Environment Program and the World Meteorological Organization.

The report's recommendations will be debated intensively at the upcoming Convention on Climate Change, sponsored by the United Nations, which begins Feb. 4 in Chantilly, Virginia.

The working group that prepared the report, **Climate Change: The IPCC Response Strategies**, was charged "to lay out as fully and fairly as possible a set of response policy options and the factual basis for those options," according to Frederick M. Bernthal of the National

--more--

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GLOBAL WARMING--Page 2

Science Foundation. Bernthal represented the U.S. Government, which chaired the group. The report identifies and evaluates a wide range of possible response strategies for limiting or adapting to potential climate change, and reviews mechanisms for implementing the strategies.

Hundreds of researchers and analysts from over 50 countries participated in the preparation of the 272-page report. It was published and released today by Island Press in anticipation of the upcoming U.N. Convention.

"This report should be a critical tool for delegates to this Convention as they begin the negotiating session for an international Framework Convention on Climate Change next week," said Charles Savitt, Publisher of Island Press.

Island Press is a nonprofit environmental publishing organization based in Washington, D.C. **Copies of the book are available for \$34.95 (plus \$3.00 postage and handling) by calling toll free: 1-800-828-1302.**

"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9120240

FROM: KNAUSS, JOHN A.

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 01/29/91

SUBJECT: DYNAMICAL LIMITATIONS ON THE ANTARCTIC IRON
FERTILIZATION STRATEGY

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: D. Allan Bromley
Nancy Maynard

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 01/31/91

FILE: ENVIRONMENT-GLOBAL WARMING



1120290
UNITED STATES DEPARTMENT OF COMMERCE
The Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

RECEIVED

JAN 31 10:26

OFFICE OF THE
DIRECTOR

Honorable D. Allan Bromley
Assistant to the President for
Science and Technology
Old Executive Office Building
Washington, D.C. 20506

Dear Allan,

As part of my continuing volunteer effort to keep you informed about the "science of global warming," I call your attention to the enclosed from last week's Nature about the sequestering of carbon dioxide in Antarctica by fertilizing that part of the ocean with iron, [an idea about which I believe you are informed]. The point made by Peng and Broecker is that after an original decrease in atmospheric CO₂, a new atmosphere-surface Antarctic Ocean equilibrium will be established in a few years, and any further decrease in atmospheric CO₂ will be dependent upon the rate at which the surface layer is mixed downwards and is replaced by water from below.

The mixing model is crude and the available data on which it is based is limited, but the model results are apparently robust for fairly wide ranges of input. Their conclusion is that adding iron to the Antarctic Ocean will have little effect on lowering atmospheric carbon dioxide concentrations. The mixing rate is simply too slow.

Sincerely,

John A. Knauss

Enclosure



THE ADMINISTRATOR

possible source for the two-level systems would be tipping of the central phenyl ring of *p*-terphenyl between various allowed orientations that are made accessible by disorder in the crystal structure¹⁷. Validation of this model requires detailed temperature-dependent measurements of the jump rate for a single centre over a wide range of temperature in hope of observing the characteristic $\coth(E/2kT)$ dependence, where E is the energy splitting in an asymmetric two-level model and k is Boltzmann's constant.

As the spectral jump rates and sizes that we observe are different for different defects, direct observation of this spectral diffusion effect would not be possible in any spectroscopy that averages over many defects. Direct measurement of the behaviour of individual guest molecules in a glass would lead to a clearer understanding of the origins of dynamics in amorphous solids^{18,19} than is available from ensemble-averaged measurements. Much more intriguing is the fact that we have seen spectral jumping in a crystalline environment, where such an effect is not expected. □

Received 1 November; accepted 7 December 1990.

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ACKNOWLEDGEMENTS. We thank M. Orrit for providing a copy of his manuscript prior to publication. This work was supported in part by the US Office of Naval Research.

Dynamical limitations on the Antarctic iron fertilization strategy

T.-H. Peng* & W. S. Broecker†

* Environmental Sciences Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831, USA

† Lamont-Doherty Geological Observatory, Columbia University, Palisades, New York 10964, USA

MARTIN *et al.* have proposed an ingenious means by which the rise in atmospheric CO₂ content generated by the burning of fossil fuels and deforestation might be partially compensated¹. The idea is that plant production in the nutrient-rich surface waters of the Antarctic could be stimulated by the addition of dissolved iron, thereby reducing the CO₂ partial pressure in these waters and allowing CO₂ to flow from the atmosphere into the Antarctic Ocean. We have used a box model calibrated with transient tracer data to examine the dynamical aspects of this proposal, and conclude that after 100 years of totally successful fertilization the CO₂ content of the atmosphere would be lowered by only 10±5% below what it would have been in the absence of fertilization. So if after 100 years the CO₂ content of the atmosphere were 500 μatm without fertilization, it would be between 425 and 475 μatm with full fertilization. In other words, if our model calibration is correct, even if iron fertilization worked perfectly it would not significantly reduce the atmospheric CO₂ content.

The CO₂ partial pressure in surface ocean water is influenced by the extent to which plant growth reduces the total CO₂ content, ΣCO₂, of surface water. The magnitude of this reduction depends on the efficiency with which the limiting nutrients phosphate and nitrate are utilized. In today's temperate and tropical ocean the utilization efficiency is high and therefore the reduction of the CO₂ partial pressure, p_{CO_2} , is near maximum. By contrast, the utilization efficiency is low in the polar oceans. Hence, were a means to be found to increase the efficiency of nutrient utilization in these waters, their CO₂ partial pressure and in turn that for the atmosphere, could be reduced. Martin and his co-workers²⁻⁶ have shown in incubation experiments that plant growth rates in waters from polar regions can be greatly accelerated by adding trace amounts of dissolved iron. Iron is an essential micronutrient required for the metabolism of all forms of life, its primary function being cytochrome formation. Because iron is one of the most particle-reactive elements, its concentration in the sea is very low, with the lowest values occurring in regions like the Antarctic that are most removed from the continents.

To date, most of the attention regarding the Martin proposal has been focused on its biological aspects¹ and little attention has been given to the dynamical aspects. Even though successful iron fertilization would initially produce up to a twofold decrease in the CO₂ partial pressure in Antarctic surface waters, this reduction might be short-lived. In the absence of water circulation, only an amount of CO₂ equal to that removed as a result of the initial iron fertilization would be sequestered from the atmosphere. In this case, the atmosphere, the Antarctic surface ocean and the non-Antarctic surface ocean would

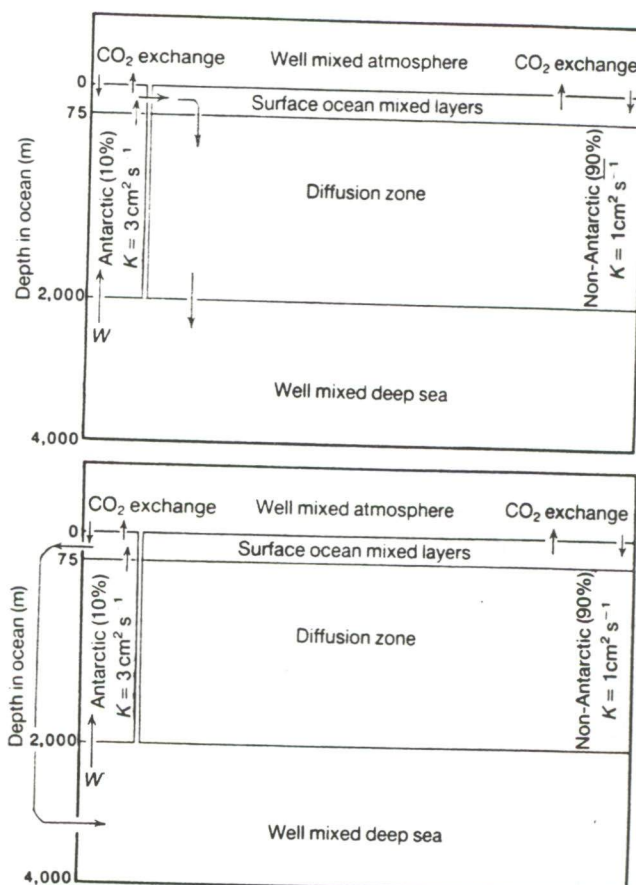


FIG. 1 Linked vertical advection and diffusion model used to evaluate the response to iron fertilization of Antarctic surface waters. The upper panel shows the case where the water upwelled in the Antarctic is transferred laterally to the non-Antarctic surface ocean. The lower panel shows the case where this upwelled water is converted to deep water and transferred directly to the model's deep reservoir.

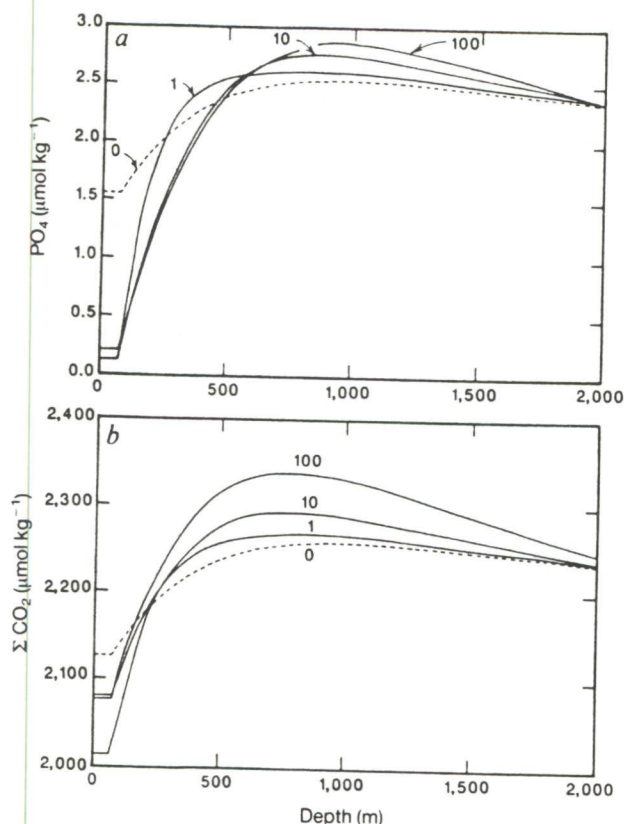


FIG. 2 Vertical distribution of *a*, PO_4 and *b*, ΣCO_2 in the Antarctic column before the onset of fertilization (dashed line) and 1, 10 and 100 years after the onset of fertilization for the scenario where water is upwelled at the rate of 17.4 Sv and transferred to the deep sea.

rapidly reach a new equilibrium, leaving the atmosphere with a CO_2 content only slightly lower than it had before fertilization. To achieve a significant reduction of the atmosphere's CO_2 content the surface waters of the Antarctic must be replaced frequently from below.

Thus the critical issue is the rate of vertical mixing in the Antarctic Ocean. Traditional thinking is that deep ocean water upwells in this region⁷. A portion of this upwelled water moves beneath the Antarctic's sea-ice fringe where it is densified by brine release causing it to sink back into the deep sea. The remainder moves to the north. Part is converted to intermediate water which penetrates northward into the Atlantic, Pacific and Indian oceans at a depth of $\sim 1,000$ m. The remainder is mixed into the temperate surface water.

Confirmation of the upwelling hypothesis comes from the inventories of bomb-produced radiocarbon in the Antarctic

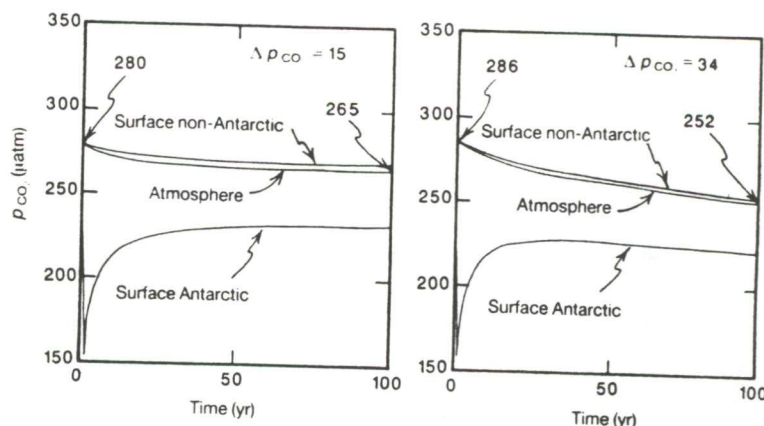
Ocean as measured during the GEOSECS surveys of the world ocean⁸⁻¹⁰. These results show that the Antarctic waters contain far less bomb-produced radiocarbon than invaded this region from the atmosphere¹¹. By contrast, the temperate region of the Southern Hemisphere ocean has an inventory exceeding the amount received by invasion. This excess roughly balances the deficiency in the Antarctic. This pattern can only be explained by upwelling in the Antarctic coupled with lateral transport to the adjacent temperate regions¹¹. The upwelling rate required to explain the Antarctic deficiency is 15 m yr^{-1} (ref. 11). As the low bomb-radiocarbon water in the Antarctic Ocean covers $\sim 10\%$ of the total ocean area, this corresponds to a flux of 17 Sv ($17 \times 10^6 \text{ m}^3 \text{ s}^{-1}$).

In addition to upwelling, account must be taken of the extent of vertical mixing. The mean penetration depth of the bomb radiocarbon for the fifteen GEOSECS radiocarbon profiles for latitudes south of 49°S is 260 m (ref. 11). This extent of penetration into the upwelling plume can be explained¹¹ using a vertical eddy diffusivity of $\sim 3 \text{ cm}^2 \text{ s}^{-1}$ (the steady-state tracer penetration depth into such a plume would be 630 m). Hence, if this interpretation of the bomb-radiocarbon data is correct, the volume of water immediately beneath the Antarctic surface available for CO_2 storage is only $2.2 \times 10^{16} \text{ m}^3$ ($630 \text{ m} \times 3.5 \times 10^{13} \text{ m}^2$) or 1.8% of the ocean's volume, a volume too small to house a significant amount of excess CO_2 . Thus it is the fate of the upwelled water that matters. Additional storage capacity will be provided by that portion of the upwelling water that is converted to bottom water along the southern fringe of the Antarctic or to intermediate waters along the northern fringe of the Antarctic.

We devised a simple model to test our ideas. Two box-diffusion columns¹² are linked by an overlying atmosphere and an underlying deep sea (see Fig. 1). One column represents the Antarctic and the other the non-Antarctic region of the ocean. Each column is capped by a mixed layer 75 m deep. These mixed layers are underlain by diffusion zones 2,000 m thick. Beneath the diffusion zone is a single well mixed deep reservoir. The area of the Antarctic column was taken to be 10% of the ocean total. The actual effective area of nutrient-rich water in the Antarctic is 16% of the ocean area (out to 45°S). We adopted a somewhat lower area to compensate for the fact that iron fertilization cannot work during the lightless winter months. During these periods vertical mixing will return the CO_2 partial pressure to its pre-fertilization value.

We set the vertical eddy diffusivity in the Antarctic column at $3 \text{ cm}^2 \text{ s}^{-1}$ and that in the non-Antarctic column at $1 \text{ cm}^2 \text{ s}^{-1}$. The upwelling rate in the Antarctic column was set at 17 Sv (15 m yr^{-1}). Because we do not have information with which to apportion the fate of the upwelled water, we studied two limiting cases. In the first the water is transferred entirely to the surface of the non-Antarctic column. In the second it is transferred

FIG. 3 Model runs for an Antarctic upwelling flux of 17.4 Sv. Left-hand panel shows the case where the upwelled water is transferred to the surface of the non-Antarctic Ocean and the right-hand panel shows the case where the upwelled water is transferred to the deep sea. In each case totally successful iron fertilization is conducted for 100 years. For the steady-state conditions before fertilization, the p_{CO_2} for Antarctic surface waters is nearly identical to that for the atmosphere.



We started our calculation with the carbon cycle in a steady state. The residence times for PO_4 with respect to biological removal from the surface reservoirs were set to yield $1.6 \mu\text{mol per kg PO}_4$ in the surface water above the Antarctic column and no PO_4 in the surface waters of the non-Antarctic column. The regeneration function for falling organic debris was set to yield PO_4 depth profiles similar to those observed (the choice of this regeneration function has no influence on the result of the calculation of the atmospheric CO_2 response to iron fertilization). The atom ratio of carbon to phosphorus in the organic matter falling from the surface mixed layer was 130. We then adjusted the $\Sigma\text{CO}_2/\text{alkalinity}$ ratio in the model ocean to yield an atmospheric p_{CO_2} of $280 \mu\text{atm}$.

We simulated a totally successful iron fertilization by greatly decreasing the residence time (with respect to biological removal) of PO_4 in Antarctic surface water, bringing its PO_4 content to near zero, and continued the iron fertilization for 100 years. Figure 2 shows the evolution of the vertical distributions of PO_4 and ΣCO_2 in the Antarctic column for the deep-transport case. The total PO_4 in the water column remains unchanged but a bulge of excess ΣCO_2 appears, representing the CO_2 transferred from the atmosphere to the Antarctic water column. In the lateral-transfer scenario (see Fig. 3), the atmospheric CO_2 content drops ever more slowly, reaching an asymptote $\sim 15 \mu\text{atm}$ lower than the initial value. In the deep-transfer scenario the decrease continues, reaching $\sim 34 \mu\text{atm}$ after 100 years. The reason for the difference is that in one case the surface water from the Antarctic is transferred to the surface of the non-Antarctic region, allowing the excess CO_2 to re-enter the atmosphere, whereas in the other this water is removed to the deep sea, isolating it from the atmosphere.

As a sensitivity test we have changed the upwelling rate for the deep-transfer case. A rate of 8.7 Sv yields a drop in atmospheric p_{CO_2} of $28 \mu\text{atm}$ and that of 34.8 Sv a drop of $47 \mu\text{atm}$. The question naturally arises as to what would happen if iron fertilization were terminated. Our model shows that any reduction in atmospheric CO_2 content accomplished by the fertilization would be lost, on more or less the same timescale as it was gained.

Clearly, the key to the evaluation of the iron-fertilization scheme is the rate of vertical overturn in the Antarctic. If our interpretation of the bomb-radiocarbon record is correct, then this process is too slow to create a significant decrease in the CO_2 content of the atmosphere. The distribution of freons in the Antarctic water column offers further evidence in this regard. The single published freon section¹³, a meridional traverse across the Atlantic sector of the Antarctic, shows that the freon concentration for the entire water column between 500 m below the surface and 500 m above the bottom is $<6\%$ of the surface concentration. Although we have not formally modelled freons, this result is broadly consistent with the dynamics adopted here. In any case, such surveys offer constraints on the rates of both deep- and intermediate-water formation. As such information is critical to the evaluation of temperature buffering of the greenhouse warming by the Antarctic Ocean¹⁴, as well as to evaluation of the iron fertilization scheme, its procurement should be placed high on the list of environmental research priorities. □

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ACKNOWLEDGEMENTS. Discussions with J. Sarmiento prompted this study. He also pointed out an important mistake in our paper. We had assumed that the reductions obtained for a steady-state atmosphere with 280 p.p.m. CO_2 applied directly to the anthropogenically perturbed atmosphere. Sarmiento pointed out that this is not correct. We have carried out CO_2 -increase models and found that the percentage change in CO_2 partial pressure and not the absolute change that remains approximately the same. We have done the perturbation calculations and find that this is indeed correct. This work was supported by the Lawrence Livermore National Laboratory, Exxon Corporation and the Carbon Dioxide Research Program (W.S.B.) and by the U.S. Department of Energy (T.-H.P.) through a joint contract Martin Marietta Energy Systems Inc.

Control of pore-water chemistry at the base of the Florida escarpment by processes within the platform

Jeffrey P. Chanton*, Christopher S. Martens & Charles K. Paul

Marine Science Program and Department of Geology,
University of North Carolina, Chapel Hill, North Carolina 27599, USA

PORE waters collected from seep sediments hosting active chemosynthetic communities^{1,2} tend to be rich in sulphide, chloride and ammonium and depleted in sulphate relative to the concentrations in sea water. To investigate the source of the energy-rich compounds and the processes causing low sulphate concentrations in seep-sediment pore waters, we have measured the sulphur isotope composition, $\delta^{34}\text{S}$, of pore waters from seep sediments at the base of the West Florida escarpment. The isotopic composition of pore-water sulphate remains approximately constant as its concentration is depleted, indicating that processes within the Florida platform, rather than microbial processes at seep sites, control pore-water chemistry in these sediments. The composition of the seep brines, deduced from a linear mixing model, provides information on processes deep within the platform.

Dense biological communities living on highly sulphidized sediments found at the 3,280-m-deep base of the Florida escarpment are supported by chemosynthetic processes^{1,3,4} that use reduced substrates seeping from the highly jointed limestone cliff forming the edge of the Florida platform^{2,5} (Fig. 1). These seeps occur along at least 10% of the escarpment base⁶. Sedimentary pore waters beneath the large populations of mussels and tube worms are enriched in ammonium (up to 2 mM)⁷, radiocarbon-depleted biogenic methane (up to 10 mM)^{5,8} and sulphide (up to 5.7 mM). Sediments consisting of $>30\%$ sulphide minerals have been reported⁹. The acidity generated by sea-floor oxidation of dissolved sulphide has been suggested as one mechanism for undercutting and eroding the edge of the carbonate continental margin².

We collected sediment cores in these chemosynthetic communities with the submersible *Alvin*. The pore waters were expressed from sediments by pressure filtration. Depth profiles of pore-water concentrations show chloride and ammonium enrichment and corresponding sulphate depletion relative to overlying sea water (Fig. 2). Both pore-water sulphate and ammonium are linearly correlated with pore-water chloride concentrations (Fig. 3), indicating conservative mixing between sea water and a sulphate-depleted, ammonium-rich brine. The chloride-sulphate trend yields a value of 27.5% for a sulphate concentration of zero, suggesting that this is the chlorinity of the brine exiting the platform at the sea floor. The equation fitting the chloride-ammonium data yields a value of 2.2 mM for the concentration of ammonium in the sulphate-depleted brine.

* Present address: Department of Oceanography, Florida State University, Tallahassee, Florida 32306, USA.

Received 4 September; accepted 16 November 1990.

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2. Martin, J. H. & Fitzwater, S. E. *Nature* **331**, 341–343 (1988).
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"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9120445

FROM: MARTIN, JAMES G.

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 01/28/91

SUBJECT: RE:THE LETTER OF INVITATION FROM THE TRIANGLE
UNIVERSITIES CENTER FOR ADVANCED STUDIES, INC. TO
HOST A CONFERENCE CONCERNING GLOBAL CHANGE RESEARCH.

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: Thomas Ratchford
D. Allan Bromley
Nancy Maynard

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 02/05/91

FILE: ~~GLOBAL CHANGE RESEARCH~~

Environment - Global Δ



RECEIVED

STATE OF NORTH CAROLINA
OFFICE OF THE GOVERNOR
RALEIGH 27603-8001

FILED 5 A10: 58

OFFICE OF THE
DIRECTOR

JAMES G. MARTIN
GOVERNOR

January 28, 1991

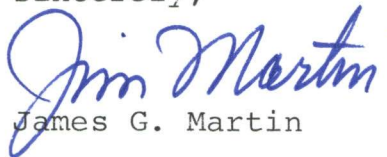
Dr. D. Allan Bromley
Science Advisor to the President
The White House
Washington, DC 20500

Dear Allan:

Mr. Sherwood H. Smith, Jr., has shared with me the enclosed letter of invitation from the Triangle Universities Center for Advanced Studies, Inc., to host in the Research Triangle Park a spring planning conference concerning global change research.

Please be assured that this invitation has my warm support. Should it turn out that North Carolina is the most desirable site for the meeting, we would be pleased to assist you and President Bush in every appropriate manner.

Sincerely,


James G. Martin

JGM/jy

Enclosure

9120204

Triangle Universities

Center
For
Advanced
Studies

Incorporated
Research Triangle Park
Box 12074
North Carolina 27709
(919) 549-8181

January 4, 1991

Dr. D. Allan Bromley
Science Adviser to the President
The White House
Washington, DC 20500

Dear Dr. Bromley:

The deep interest of the scientific community in the Research Triangle Park in Global Change Research has drawn our attention to the concept advanced by President Bush last spring of a Western Hemisphere Network of Institutions to promote regional cooperation among the natural and social sciences and engineering. Through the good offices of Dr. Thomas Malone, Distinguished University Professor of North Carolina State University, we have learned of the recent Bellagio Conference which provided further support to the idea of global change research networks.

We understand that consideration is being given to an initial regional meeting to define and plan the Western Hemisphere initiative. On behalf of the Triangle Universities Center for Advanced Studies, Inc. (TUCASI), may I extend a warm invitation to our government, and the other nations involved, to consider the Research Triangle Park as the site for this regional meeting.

TUCASI was incorporated by Duke University, North Carolina State University and the University of North Carolina (the Triangle Universities) to foster collaborative studies that transcend the scope of a single university. We presently host on our special campus the National Humanities Center, and have arranged for Sigma Xi, the National Institute of Statistical Sciences, the North Carolina Supercomputing Center, and the Biotechnology Center of North Carolina to establish residence on our campus.

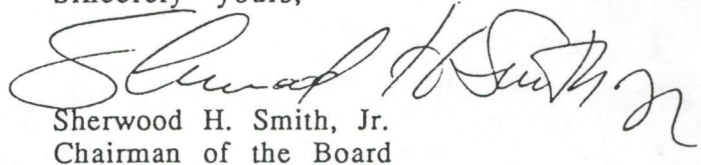
The Research Triangle Park would seem to be an especially appropriate location for the regional meeting. In addition to our three universities, it is the home of the Center for the National Institute of Environmental Health Sciences, a Regional EPA Center, the Research Triangle Institute (a nonprofit organization also incorporated by the Triangle Universities which houses more than 1400 researchers, many of whom are involved in environmental or social sciences research), and several major corporate research laboratories. Interest is keen in environmental matters and the social sciences.

Dr. D. Allan Bromley
Page 2
January 4, 1991

TUCASI would be pleased to work with your office on the meeting. We have been assured of the participation by Dr. Malone on a local arrangement committee since he will be in residence here in early 1991.

We would be pleased to explore this matter further with you. In any case, rest assured of our best wishes for the success of this important initiative.

Sincerely yours,



Sherwood H. Smith, Jr.
Chairman of the Board

SHSjr:pb
cc: TUCASI Board of Trustees
Dr. Thomas F. Malone

"CORRESPONDENCE TRACKING"

TYPE: ACTION

DOCUMENT NUMBER: 9120204

FROM: SMITH, SHERWOOD H.

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 01/04/91

SUBJECT: GLOBAL CHANGE RESEARCH NETWORKS...PLANNING A
REGIONAL MEETING TO DEFINE & PLAN THE WESTERN
HEMISPHERE INITIATIVE

ASSIGNED TO: Thomas Ratchford

ACTION REQUIRED: DIRECT REPLY

SENDER'S DUE DATE: OSTP DUE DATE: 02/23/91

DATE COMPLETED: -----

COPIES TO: D. Allan Bromley
Nancy Maynard

WHITE HOUSE TRACKING #: CONTACT PERSON:

REMARKS: PLEASE NOTE: This has been reassigned to Dr. Ratchford.

DATE RECEIVED: 01/19/91

FILE: GLOBAL CHANGE

THE WHITE HOUSE
WASHINGTON

March 28, 1991

Dear Jim:

Thanks very much for your support of the offer by the Research Triangle Park as a potential site to host a regional planning workshop on the establishment of a Western Hemisphere Institute on Global Change Research.

The concept of a regional global change institute was proposed during the White House Conference on the Science and Economics of Global Change last April. As you may know, I accompanied President Bush on his very successful Latin American trip last December when I had the opportunity to discuss science, technology and environmental issues with senior officials in Brazil, Uruguay, Argentina, Chile, and Venezuela. The meetings resulted in a good exchange of views and enthusiastic support for the regional global change institute concept in each of the five countries visited.

Armed with this enthusiastic response, we are currently planning a workshop to provide a wider forum for discussion of the concept of a regional global change institute by all the countries in the Western Hemisphere. We are currently in the process of planning the workshop and will make a decision very soon about the location.

In closing, let me say how much I admire the job you have done as Governor of North Carolina and, before that, as a Member of Congress. We need more leaders at the national and state levels with a scientific background like yours. I understand from Tom Ratchford, who keeps track of North Carolina happenings better than I, that you have threatened to leave the public scene. I hope that you will not. The nation needs your talent and experience, a fact that you should fully understand.

Best wishes. I look forward to seeing you again soon.

Sincerely,



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

The Honorable James G. Martin
Governor
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"CORRESPONDENCE TRACKING"

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FROM: HAJOST, SCOTT A.

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 01/11/91

SUBJECT: GREENHOUSE GAS TRADING: REDUCING THE COST OF ACTION

ASSIGNED TO: Nancy Maynard

ACTION REQUIRED:

SENDER'S DUE DATE:

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CONTACT PERSON:

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DATE RECEIVED: 01/19/91

FILE: ENVIRONMENT-~~GREENHOUSE GAS~~

Global Δ
~~Greenhouse~~

51

ENVIRONMENTAL DEFENSE FUND

1616 P Street, NW
Washington, DC 20036
(202) 387-3500

January 11, 1991

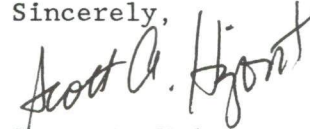
D. Allen Bromley
Assistant to the President
for Science and Technology
Office of Science and Technology Policy
Old Executive Office Building
Washington, DC 20506

Dear Dr. Bromley:

The enclosed is a paper on Greenhouse Gas Trading:
Reducing the Cost of Action that our senior economist Dan
Dudek prepared for the Second World Climate Conference.

We thought your staff might find it useful in
preparing for the first round of climate change convention
negotiations in February.

Sincerely,



Scott A. Hajost
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Enclosure

GREENHOUSE GAS TRADING:
REDUCING THE COST OF ACTION

Daniel J. Dudek

Environmental Defense Fund
New York, New York

Prepared for the

Second World Climate Conference
29 October - 7 November 1990
Geneva

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1 Introduction¹

Economists have long believed that the internalization of environmental externalities is a positive and effective policy prescription for managing these problems. Although internalization can be accomplished through a wide array of policy instruments,² economists have preferred the use of economic incentives. Most frequently these prescriptions have taken the form of charges or fees for emissions, in essence a special form of corrective tax.

While convenient in theory, effluent fees have not met with success in the U.S. The fee concept has not been able to overcome the daunting practical problems of political acceptability and implementation. In many cases the problem is typified by the ethical concern that the effluent fee policy would allow companies to "pay to pollute". In addition, the fee imposes an information burden upon regulatory agencies similar to the requirements of the traditional command approach. The fee setting authority must know the shape and location of the aggregate marginal treatment cost curve and either the marginal benefit function or a socially accepted emissions reduction target. Alternatively, it must be able to experiment with different fee levels to trace out polluters' responses. For industries, like electric power, characterized by high fixed costs of pollution control, uncertainty in the fee level compounds the difficulty of the investment problem.

An alternative, based upon transferable permits denominated in physical quantities of pollutants has flourished in the U.S. however. Transferable permits have been applied to everything from land development rights to atmospheric discharges (Tripp and Dudek, 1989). Marketable permit programs require the regulatory authority or the political process to explicitly define the goals of the pollution control policy in terms of allowable emissions. Once total levels are defined, emissions are parcelled out to individual emitters. In contrast to fee or charge systems, the market in these transferable permits performs the valuation function, not the regulator. The regulatory authority records transfers of title and monitors compliance.

The tremendous political appeal of these systems is based upon the policy's focus on environmental objectives. At their root is a solid regulatory program which prescribes emissions reductions to each source. Sources are free to determine their individual control strategy, including purchasing extra reductions from more distant sources, but they are not free to avoid their control obligations.

1 The author gratefully acknowledges the support of the Joyce Foundation.

2 In fact, any policy which requires the emitter to take account of emissions would produce internalization. Command-and-control regulations requiring the use of specific control technologies is one extreme form of internalization.

The electric power sector has been the source of significant and persistent environmental externalities. This paper will focus on those externalities associated with the discharge of transboundary atmospheric pollutants. In particular, the design and operation of a marketable permit system for SO₂ emissions in the U.S. developed by the Environmental Defense Fund will be discussed. This policy approach will then be extended to CO₂, perhaps the greatest environmental challenge confronting the electric power industry.

2 Short History of Emissions Trading

Emissions trading is actually a generic term for a collection of flexible air pollution policies created to overcome the conflicts produced by the failure to meet air quality goals in urban areas in the U.S. in the late 70's. The EPA's final emissions trading policy includes provisions for bubbling, offsetting, and netting. Tietenberg (1985) provides an excellent overview of the development of these policy reforms for the management of air emissions. Over time, these basic concepts have been applied to a wider number of pollutants and circumstances. Emissions trading is ideally suited for the management of transboundary pollutants such as acid rain.

The concept of emissions trading is based on the premise that pollution reductions can be accelerated if polluters are allowed to optimize pollution control investments. The evidence from the experience with trading clearly shows significant cost savings for emitters (Dudek and Palmisano, 1988). The environmental account has been more hotly disputed however. Both Hahn and Hester (1986) and Liroff (1986) in their reviews of the performance of netting and bubbling respectively observed no significant deterioration in air quality. However, these analyses focused on narrow local air quality problems and on the directly regulated individual pollutants. For large markets, such as acid rain, early reductions to create banked credits and the stimulus to innovation in emissions reduction are expected to produce significant environmental benefits. Flexible control policies also create the opportunity to reduce cost-effectively more than one pollutant at a time. For example, Dudek, *et al* (1990) identified significant CO₂ reduction benefits from an acid rain emissions trading program. Cost-effective SO₂ control investments could eliminate between 5.4-6.0% of expected utility CO₂ emissions over the decade 1995-2005.

The emissions trading system operates quite simply. Polluters are assigned a baseline for each emissions source which establishes the initial conditions from which reductions can be assessed. Baselines are established by regulation by the appropriate air quality management authority. The polluter must meet the minimum standards in force for each pollutant at each source. However, these regulatory obligations can be met by over-controlling at another emissions point and transferring the over-control. The flexibility provided by the ability to transfer over-control is the heart of emissions trading. It encourages firms to search for cost-effective

reductions. When coupled with the prospect of trade outside the firm the incentive of revenues for emissions reductions is added. Institutional innovations such as emission reduction banking and recordation functions reduce the transactions costs of extra-firm transactions.

It is important to point out that a tradeable permit system is a particular policy tool built upon a regulatory program that establishes overall limits on emissions of CO₂ or, as a surrogate, limits on combustion of fossil fuel or deforestation. The trading system is designed to introduce flexibility in economic decisionmaking by allowing regulated sources to increase emissions above regulatory limits through the purchase of emission credits or to acquire income from the sale of such credits when they emit regulated pollutants below prescribed limits while encouraging investment in pollution reductions beyond minimum requirements. This is the essence of "harnessing the power of the market".

3 Acid Rain Emissions Trading

The U.S. Congress stands on the verge of enacting a sweeping reauthorization of the Clean Air Act. The most innovative aspect of this new legislation is the acid rain provisions. These provisions would require a 10 million ton reduction in SO₂ emissions from 1980 levels (see Figure 1.), 8.9 million of which would be required from electric utilities. The reductions would be accomplished in 2 roughly equal 5 year steps.³

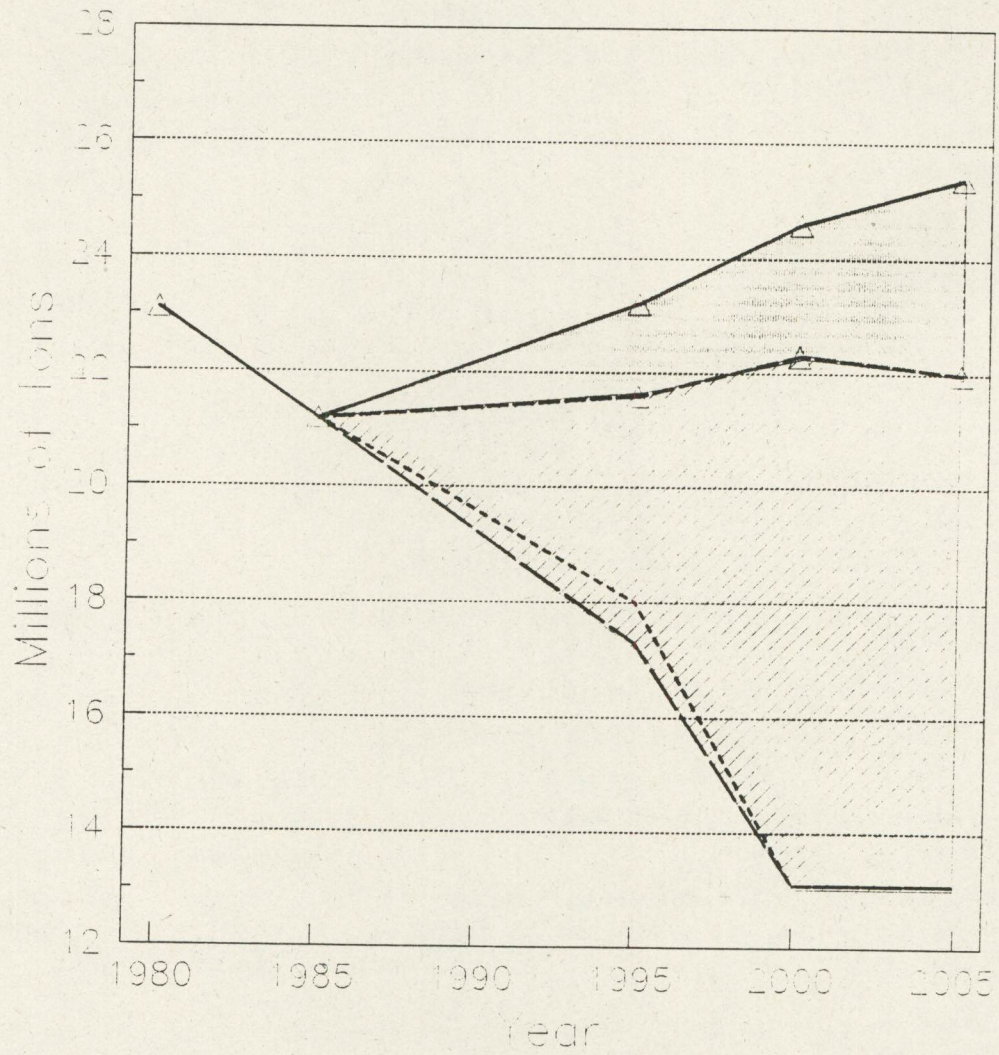
While there are differences between the House and Senate versions, both would use emissions trading as the main policy vehicle. Each would create virtually a national market for SO₂ emission allowances. The essential ingredients of the policy are represented in the schematic in Figure 2. The first step is to determine a baseline for each source. In this case, historic fuel use in btu's was used. The baseline is multiplied by an allowable emissions rate per Btu to yield an annual SO₂ tonnage allowance which is assigned to each utility plant by permit. In effect, this can be thought of as the initial deposit into a checking account which the plant draws upon as it discharges pollutants. Discharges are monitored in real time through continuous emissions monitoring systems (CEMS) which are required for all sources within the system.

The regulatory agency, in this case the Environmental Protection Agency, assures compliance by comparing each plant's actual emissions as tracked by CEMS with the annually permitted emissions. Plant emissions beyond annual allowances that are not compensated by reductions at other plants are subject to a \$2000/ton fine⁴. In addition, the offending source must produce additional reductions in order to compensate the environmental account. The combined financial implication of these penalties is 2-3 times the highest marginal cost of control. These penalties also depart from previous practice in that they are designed like income

3 Since the precise form of the legislation is not known currently, the reduction paths shown in Figure 1 are only approximate.

4 The level of the fine is automatically adjusted over time according to changes in the consumers' price index in order to maintain its economic force.

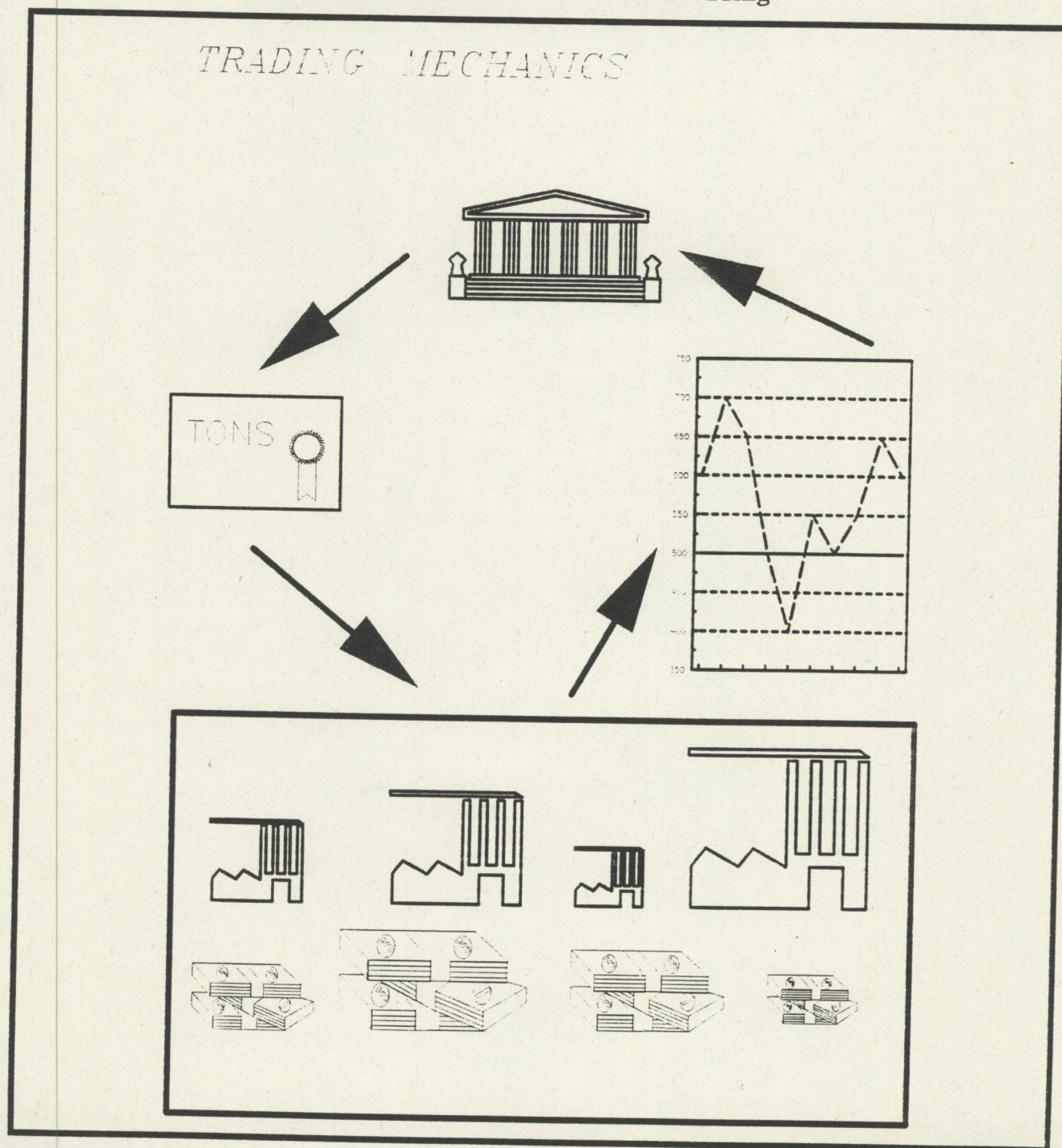
Figure 1. SO₂ Emissions in the U.S.



High Emissions Track Low Emissions Track
 High Track Reductions Low Track Reductions

tax bills which are due and payable upon receipt. In the past, polluters were able to defer fines pending adjudication before an administrative law judge. Frequently this was a protracted process with time and inflation eroding the economic force of any penalty. In addition, penalties were based upon a judicial interpretation of any profits made as a result of the violation.

Figure 2. Elements of Emissions Trading



The relatively draconian penalties in the system are feasible due to the incredible flexibility granted to SO₂ sources. For example, the ability to over-control at one plant and do nothing at another means that utilities will be able to optimize pollution control investments on a system-wide basis. In effect, SO₂ emissions characteristics by plant will be another criteria under which plants are dispatched. The first form that trading can be expected to take then is intra-utility reallocation of allowances. Research indicates that even if no interregional trading occurs, the cost savings from intra-utility trading will be roughly 25 % (Elman, *et al*, 1989). Inter-system trades will reduce overall program compliance costs by at least 50 %.⁵

One of the other unique features of the program's design is a nationwide cap on total SO₂ emissions. The cap is designed to insure that once the required aggregate emissions reductions are achieved that they are maintained. This is accomplished through the requirement that all new plants must offset completely their proposed emissions. In effect, new plants must buy into the system. Concern has been expressed that existing sources would hoard allowances and prevent the competition that new entrants would bring by denying them access to allowances. As a stopgap against such possibilities, there are precedent setting auction provisions. Between 2-5 % of the annual allowance entitlements will be withheld from existing sources and auctioned. Auction revenues are cycled back to the sources from which the allowances were tapped. The annual auctions are open to anyone.⁶

Clearly, the combined force of these provisions is to generate strong incentives for the development and use of low or non-polluting generating technologies and fuels. In particular, the offset provisions are likely to pressure new sources to construct that exactly optimize between the value of SO₂ emission credits available in the market and the marginal costs of control technology. Since new plants will likely need to demonstrate access to offsetting emissions reductions for several years of operation in order to receive debt financing if not permitting from the air pollution control authority, this will be a powerful internalizing force for new generating capacity.

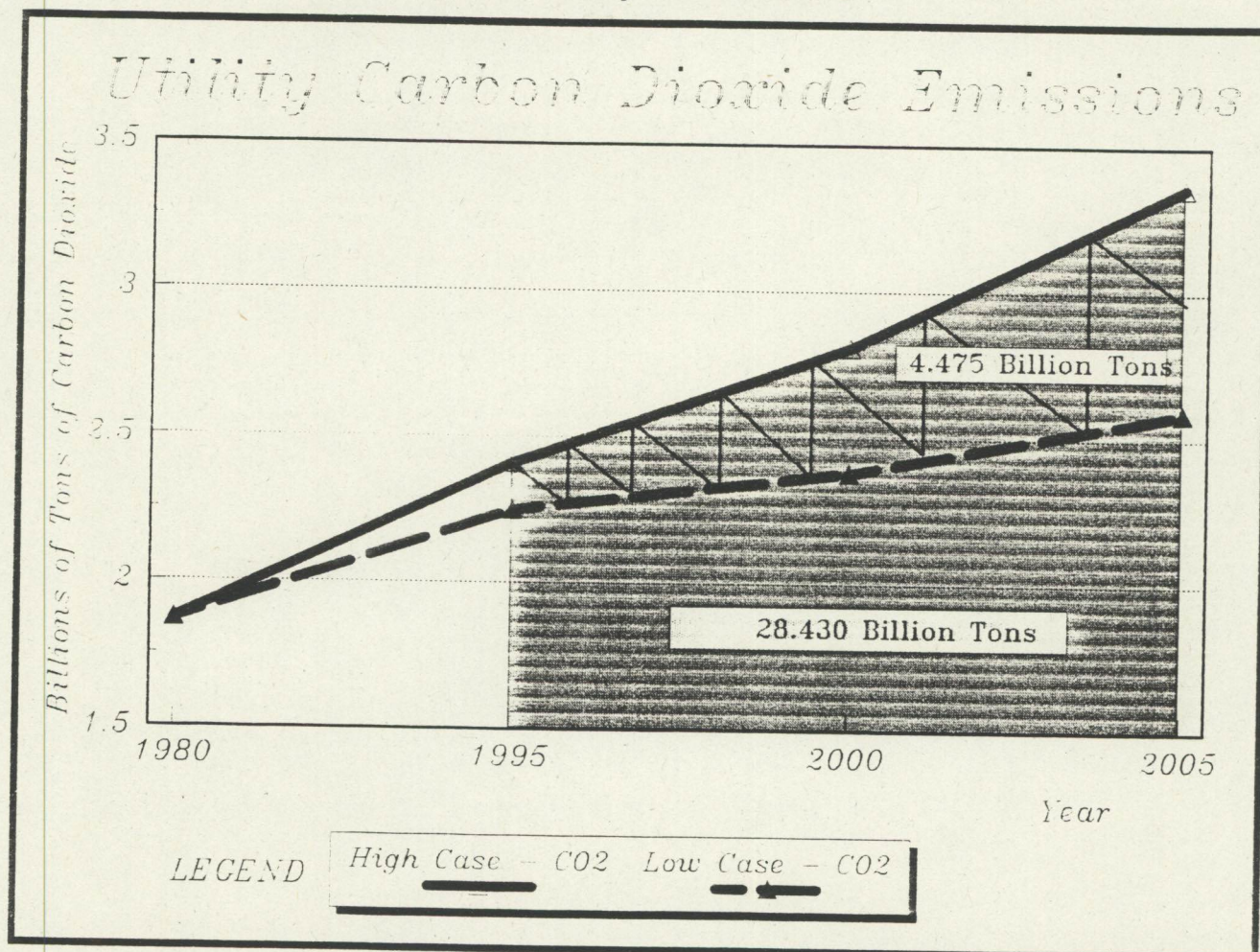
The emissions reductions potential of this program reaches beyond the precursors of acid rain however. Figure 3 depicts projected increases in utility CO₂ emissions over the next decade. Both a high and low emissions scenario were developed from EPA data (EPA, 1989). The scenarios differ not in overall economic activity but in assumptions concerning energy fun-

5 Because the acid rain emissions trading program will create a market, precise estimates of compliance costs are difficult. The market responses of individuals to the opportunities provided by the program will undoubtedly drive costs lower over time.

6 One of the proposed auctions would create in effect a futures market. Utilities making SO₂ control investments could offer for sale in a Department of Treasury sponsored auction future emissions reductions. The Treasury would pass the results to EPA which would debit and credit the allowance accounts of the buyer and seller. This institutional arrangement would reduce the risk of non-performance on two party contracts.

damentals such as the relative price of oil and natural gas and the rate of energy demand growth. In addition, energy efficient technologies such as cogeneration are much more aggressively exploited in the low base case.

Figure 3. Utility CO₂ Emissions



Since the CO₂ profiles of these two scenarios are so radically different, the question naturally arises as to what policies can help society achieve the low base case? One way would be for emitters to be required to take account of all of their emissions and optimize their operations over all costs. Unfortunately, no policy is so systematically rational. Pollution control policies tend to be focused on a pollutant-by-pollutant basis without concern for any synergy or antagonism. Nonetheless, policies do differ in their effects on several pollutants despite the ostensible focus on a single pollutant. For example, in the case of acid rain controls, requiring the use of flue gas desulphurization devices will likely add to CO₂ emissions. However, if utilities were left to determine their own control strategy, cost-effective SO₂ controls that also reduced CO₂ could be undertaken. Table 1 summarizes the expected results for CO₂ if utilities are free to choose control strategies as under emissions trading (Dudek, *et al.*, 1990).

TABLE 1. The CO₂ Balance Sheet

SOURCE of REDUCTIONS	CUMULATIVE AMOUNT (mm tons)	SOURCE of INCREASES	CUMULATIVE AMOUNT (mm tons)
Resid to Natural Gas	411.440- 459.600	Added Scrubbing	30.480- 124.700
Cogeneration	423.920	Sub-Bituminous Coal	10.010- 19.200
Demand Response	128.850		
Conservation	728.620		
TOTAL	1,692.78- 1,740.99		40.580- 143.900

Cumulative CO₂ Reductions 1995-2005 --
1,548.88 - 1,700.41 Million Tons

More flexible policies such as emissions trading can produce reductions in several pollutants simultaneously because sources are not prevented from optimizing over several pollutants as is the case with the normal command-and-control policy prescription. In this sense, flexible policies are inclusive rather than exclusive. However, if we are not left to rely solely upon the powers of strategic positioning to elicit such investments, opportunities to grant regulatory credit for simultaneous reductions must be created. Unfortunately, this approach also cuts across the normal regulatory grain of expropriating any serendipitous reductions for the environmental account.

4 Alternative CO₂ Trading Systems Designs

Before describing a trading program at either a national or international level, the regulatory framework must be described. Initially, as a simplifying assumption, this paper considers only one greenhouse gas - carbon dioxide. If, through an international convention/protocol or even a series of bilateral conventions, nations want to achieve controls on emissions of CO₂ one approach, based on the Montreal Protocol experience, would be for those countries to establish goals and then allocate the total loadings authorized by the goals among the cooperating nations. The goals could be developed on the basis of historic data as in the case of the U.S. acid rain trading program or they could be arbitrary based upon factors such as GNP and population. These goals and allocation system must take into account environmental objectives, economic efficiency needs and international equity concerns.

For an international agreement to achieve limits on global CO₂ emissions, it must establish overall emission and/or fossil fuel use reduction goals, reduction schedules or formulae, allocation formulae, monitoring, reporting and enforcement provisions and mechanisms for financing and technology transfer. Such an agreement must do all of these things whether or not it provides a mechanism for trading of CO₂ emission credits among sources in different nation states. Of course, CO₂ trading could be implemented on a separate national basis irrespective of whether any international convention/protocol authorized international trading. One of the most likely and useful examples for allocating national environmental performance responsibilities is given by the Montreal Protocol. By stating national requirements in terms of consumption requirements, all nations would have a role within the framework of the agreement irrespective of whether they produced significant fossil fuels or not. In addition, the market power that the main fossil fuel producers might otherwise wield would be diluted.

There are a large number of alternative designs for a greenhouse gas trading program. Only two specific alternatives are described in this short discussion paper. Two polar extremes are discussed. One option would allocate permits to fossil fuel producers while the other would distribute permits to end users. In both cases the limiting, but simplifying assumption of CO₂ trading is introduced. This discussion pertains both to national as well as international trading systems.

The first case involves allocating permits to fossil fuel producers. The second would assign permits to fossil fuel end users. The designs differ largely in effect, extent of trading, and administrative ease.

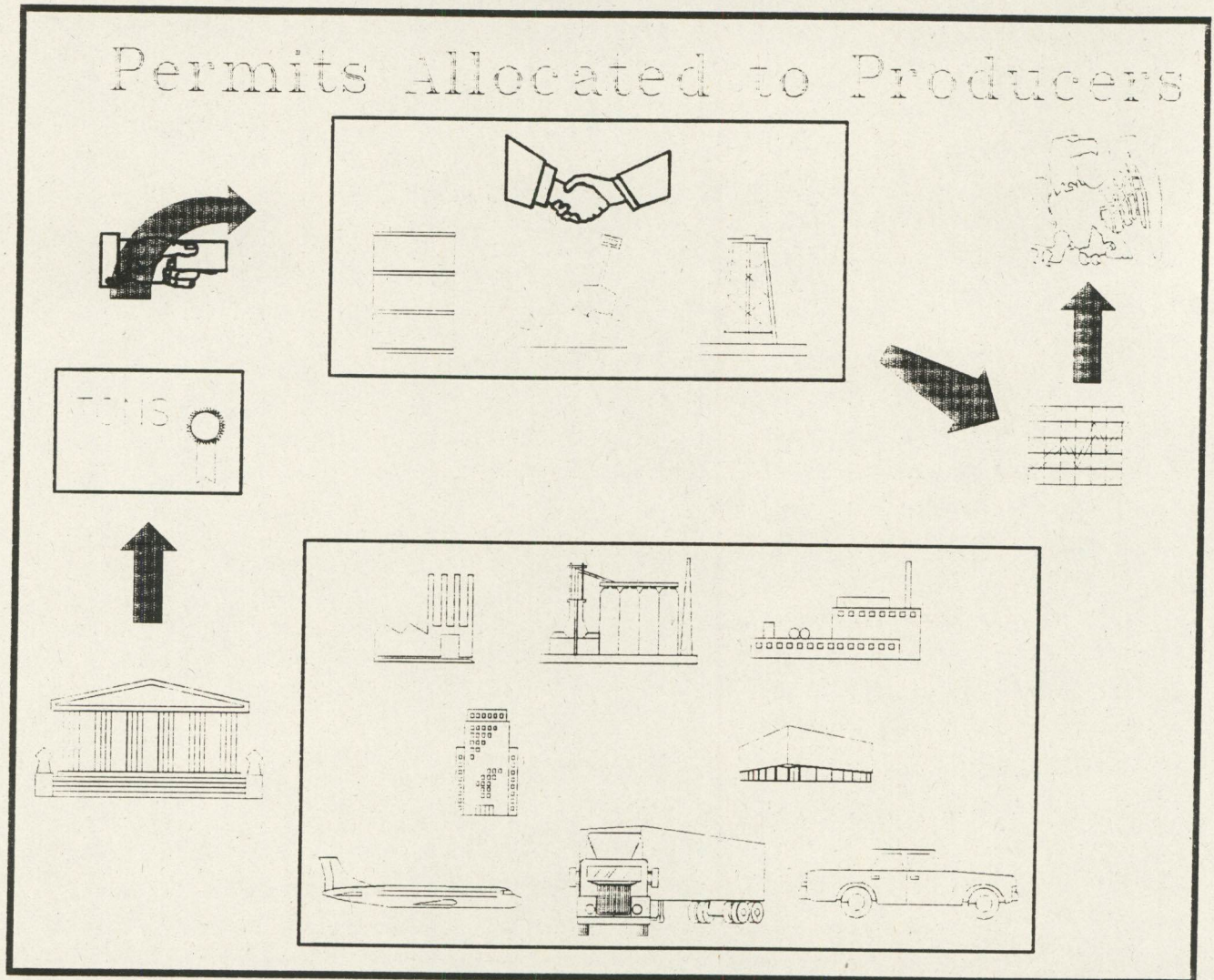
4.1 Allocation to Fossil Fuel Producers

Allocating permits to fossil fuel producers as indicated in the diagram below, would restrict the bulk of trading activities to energy producers and sink managers. In the case of greenhouse gas trading, the capture and destruction of banked CFCs and halons would also be a valuable source of reductions as would the recovery of coal-bed methane. In both designs the control point for compliance is the fossil fuel producer who would be required to turn in a sufficient quantity of permits to cover annual production.

End users would perceive the program in economic terms much as a tax on carbon, i.e. they would face higher energy prices. In fact, users would be offered energy at two prices -- one price with the permit bundled in and another with the permit to be supplied by the fuel purchaser. Buyers would evaluate the costs of generating new permits versus the price differentials charged by the energy producers.

As indicated above, the permit program, although behaving somewhat as a tax policy in effect, would nonetheless differ in at least two critical aspects. First, the "tax" would be determined by the market in permits, i.e. by the decisions of private actors rather than through legislative or bureaucratic means. Second, sinks are encouraged.

Figure 4. CO₂ Permits to Producers



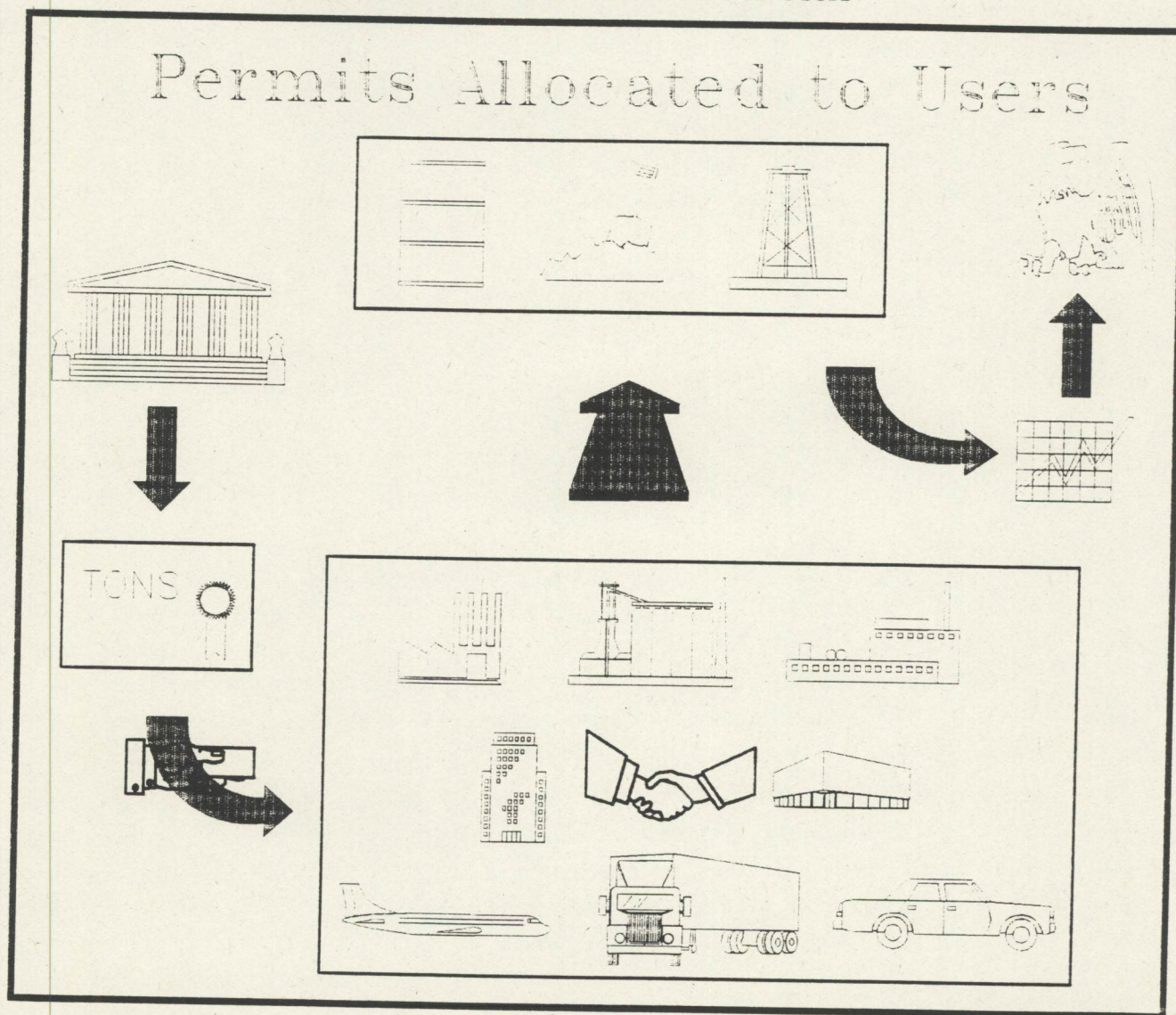
4.2 Allocation to End Users

An alternative design for a CO₂ trading program would allocate permits to end users of fossil fuels as depicted in the figure below. The big liability of this approach is the creation of baselines for all of the sources involved. Even if a line were drawn at major commercial and industrial consumers, literally thousands of firms' records would have to be evaluated. In effect, the baselines would be consumption entitlements denominated in CO₂ equivalents. The

big asset to this approach is the direct stimulus to energy efficiency. Any energy use reduction below the individual baseline is by definition a credit that can be transferred. This direct revenue mechanism would be a dramatic boost to fossil fuel conservation efforts.

This design would still encourage sinks and reductions in other greenhouse gases for the purposes of trading. Fossil fuel producers could still offer two tiered prices, but the main permit supplies would come from end users who would pass permits covering their purchases to producers. Compliance would still be measured at the point of production of fossil fuels.

Figure 5. CO₂ Permits Allocated to Users



5 Application to CO₂

The primary advantages of using marketable permits were distilled recently in the process of the IPCC discussions concerning response policies. Those identified included:

- flexibility

- direct control of emission levels

- efficiency in pollution control

- mechanism for trading among different greenhouse gases

- incentives for development of non- or low polluting technologies.

(Working paper by Bertram et al. For IPCC/WG3-II/Doc 3)

In addition, permits would decentralize pollution control decision-making commensurate with the numbers of sources involved. An international CO₂ (or greenhouse gas) trading program also can accommodate a variety of separate national implementation strategies and policies. No nation would be compelled to achieve its control obligations through trading. Lastly, by linking sources and sinks in one comprehensive strategy, an explicit mechanism of self-interest is established between along the often divisive North and South axis.

5.1 Sink Stimulus

CO₂ trading is likely to produce the same proliferation in supply options as generated in the deregulation of the financial services industry. The huge variety of precisely tailored investment vehicles available in the current market are likely to be mirrored in the CO₂ (or greenhouse gas) permit markets. After all, a CO₂ trading program would create a new form of environmental currency. One direct effect would be the stimulus to develop sinks as well as source reductions.

Since tropical forests are a major sink for carbon and their burning or destruction at current rates constitutes some 15 % of global CO₂ loadings, the question is how an international greenhouse agreement can promote the retardation of the destruction or the re-establishment of any forests and whether a trading program can facilitate attainment of those goals. Melding these objectives may be complicated by the development of a separate Forest Agreement.⁷

The destruction and burning of tropical forests in countries such as Brazil and Indonesia contribute a significant fraction of their CO₂ budgets. While a framework convention which established CO₂ reduction targets would not necessarily prescribe sector specific reductions, if countries allocated their CO₂ emissions targets proportionately to the forest sector and fossil fuel sectors, they would have to take steps to prevent increases in the destruction of its forests as well as reduce fossil fuel combustion.

⁷ The Houston Summit meeting of the G7 countries in July of 1990 ended with a commitment to develop such an agreement.

If tropical forest acres can be converted into CO₂ and energy efficiency equivalents, countries like Brazil and Indonesia might find it economically attractive, as well as environmentally sound, to retard the destruction of their forests even faster or to implement restoration programs where, in the process, they can earn CO₂ credits which their own industry could use or which they could sell to foreign firms or governments. Those countries in turn could use the revenues from the sale of such credits to finance programs to retard forest loss. A trading program authorized under an international convention/protocol could therefore provide such countries with substantial economic incentives to protect their forests over and above the regulatory mandates of such a convention/protocol.

While a convention/protocol should encourage the creation and protection of carbon sinks, such as forests, defining quantitatively the magnitude, size and rates of loss of those sinks is an enormous undertaking. Satellite monitoring is a critical tool. But this effort must be made whether or not international trading of credits involving sinks is authorized so long as CO₂ emissions from destruction or creation of such sinks is incorporated into a convention/protocol.

One of the primary advantages of greenhouse gas trading is the fact that it is quantity denominated. Everyone can readily determine what is required and what has been accomplished. The program is denominated in environmental terms. There are no conflicts over revenue and its distribution internationally. It is completely consistent with any underlying national implementation policy. It is voluntary, no one is compelled to trade. Depending upon the initial distribution of CO₂ permits (reduction responsibilities), it also contains an explicit mechanism for North-South flows of funds. Tropical forests in less developed nations would be linked to fossil fuel combustion in developed nations through the opportunities provided by greenhouse gas trading.

6 Implementation Issues

International trading in greenhouse gas permits can be established in a limited number of coordinated phases. The first phase would build the infrastructure necessary to facilitate such a global market. This phase would be devoted to the creation of international monitoring systems, tracking and recording systems, and market clearinghouse. The second phase could be a limited permit system more narrowly focused as an offset program targeting new sources. The final phase would be the development of full scale trading perhaps only for CO₂ initially with other gases included as the capacity of the trading system is expanded. The phased sequence above could be easily pursued by individual nations irrespective of any international greenhouse gas control agreement. In the event of an agreement with significant reduction schedules, the second and third phases would be collapsed into one. In any event, the administrative

apparatus required to facilitate international greenhouse gas trading is no more complex than that required for any other effective control system and would impose no time delays in implementation.

For an international convention/protocol that imposes limits on emissions of CO₂ from burning of fossil fuels and destruction of forests to function effectively, the participating nation states must be willing to and be able to obtain and report reliable information about fuel use and forest loss. The convention/protocol must also provide for a credible enforcement mechanism and the establishment or strengthening of an international agency to receive and assimilate data and to help assure compliance.

If the convention/protocol authorizes bilateral or multinational trading of CO₂ emission credits, that international agency or some international body would have an additional role to play. More specifically, at the national level, any country with a domestic trading program would have to have in place an administrative mechanism for certifying that individual firms were entitled to credits or had to acquire credits to comply with standards. The credit certification process would have to comply with international norms if those credits were to be tradeable to a source in another country. In addition, some international agency should have the authority to record those credits and to assure that the national credit certification program was viable and accurate. Since a country might have an incentive to inflate its eligibility for credits, this international agency would need additional resources to assure reliable national reporting of information and valid credit issuance programs.

A trading system can also help to assure the integrity of any system of emissions limits. As industrial enterprises -- or even governments -- attempt to comply with CO₂ limits, technical or economic factors will inevitably prevent some from complying at some times. Without a trading system, a variance or exemption system (formal or simply by non-enforcement) will inevitably develop. A formal system will in turn require technical or economic criteria for evaluating variance requests and bureaucracies to apply those criteria. Inevitably also, those bureaucracies may not discipline needed economic enterprises for the sake of what may appear "temporary" violations of CO₂ limits. The problem could lead to distrust between nations and diminishing willingness to make needed sacrifices. By allowing dischargers the flexibility of choice in reduction decisions and the ability to bank extra reductions, there is no credible justification for violation of emissions limits.

A trading system should eliminate the need for variances, exemptions or special exclusions by allowing industries and nations that cannot comply with limits to purchase credits. No criteria would be necessary to evaluate exception requests, and the sole task for bureaucracies would be the registration and verification of the transfer. Enforcement officials would not need to negotiate complex compliance orders, but simply to order the purchase of credits. Enforcement could also be more credible because the purchase of credits should often be less draconian than shutdown of enterprises. In addition, the failure of some enterprises to comply

with initially set limits should always be matched by compensating reductions. And because a market mechanism will replace bureaucratic judgment, those enterprises that do not comply with initial limits should do so because of real economic needs not political influence.

6.1 The Offset Program

One of the first direct implementation steps for CO₂ trading is an offset requirement for new CO₂ sources. This is a program which the major industrialized nations should undertake unilaterally as a first rational step toward the significant reductions required. It is a minimalist step which can be established now without any regulatory lag or lead-in. Major new sources would include new fossil fueled electric generating stations, new industrial boilers, and cogeneration facilities selling power into regional electricity grids. Such a program would:

- * begin reduction of accumulation of greenhouse gases in the atmosphere
- * establish administrative mechanisms to facilitate trading
- * stimulate private market development of CO₂ reducing technologies.

The heart of the program is the ability to create and transfer CO₂ credits. Any CO₂ reduction meeting the certification requirement would constitute a legitimate CO₂ credit available for offset. The program would create explicit procedures for the certification of several identified offset credit sources. In addition, these procedures would allow any source to receive credit for CO₂ reductions for any such reductions that can be demonstrated to have been explicitly created for this program and which constitute CO₂ reductions that would have normally been emissions.

Examples of sources of CO₂ offsets include energy efficiency investments, vehicle fuel efficiency improvements beyond the Corporate Average Fuel Economy (CAFE) baseline, appliance efficiency improvements beyond the mandated standards, fuel switching to less CO₂ intensive fuels, and the planting of trees (see Dudek and LeBlanc (1990) for offset costs). Putting the burden of proof of new reductions upon the potential offset supplier allows the program to be open-ended and to encourage the widest diversity of offset sources to be developed, demonstrated, and engaged. These sources should include other greenhouse gases, e.g. methane, and N₂O. The greenhouse trading ratios to represent radiative differences between gases could be established in consultation with WMO or any other internationally recognized atmospheric scientific authority.

Certification for some sources will require the development of specialized rules and methods. For example, in the case of automobiles, reductions beyond the CAFE standard would be translated into a quantity of CO₂ through a statutory assumption concerning the actuarial life of a vehicle. In the case of trees, the uptake rates of individual species by location and soil type would need to be specified. Improved uptake rates could be prospectively established through demonstration projects. For example, new more intensive management procedures could improve uptake rates and should not be precluded from being developed.

In order to insure that a sufficient supply of offset credits is available, an offset bank could be created and maintained at the appropriate environmental authority. Sources generating reductions can be certified for credit as soon as the reductions are produced. These reductions can then be maintained as an available supply. This bank can function like an information exchange identifying the owners of certified reductions. Information maintained would be contact, quantity and minimum bid price.

For some offset supplies such as trees, it will be critical to assure that the CO₂ sequestering value of the offset is maintained. For example, for trees, it is critical that the stored carbon credited as an offset is maintained as stored carbon. For example, if a forest used for an offset is subsequently harvested, only those amounts of wood transferred into a relatively permanent use like housing stock should be credited with maintaining the stored carbon.

Each year, each source subject to the offset provisions would be required to deposit with the environmental authority sufficient CO₂ offsets to fully compensate for its CO₂ emissions in that year. Each year all sources regulated by the program would submit a report of CO₂ emissions. Each source would be required to adopt CO₂ emissions monitoring or a monitoring method of equivalent accuracy. Each year, the environmental authority would publish a report of such emissions.

Sources failing to comply would be subject to a penalty per ton of CO₂ not covered by an offset. The penalty should be adjusted by the producer price index in order to assure its continued economic force over time. In addition, the emitter would be required to submit a plan for the production of offsets to compensate for the uncompensated emissions.

7 Conclusions

In the debate about greenhouse gas policy much energy has been expended in the prices versus quantities issue. In actual implementation, the distinction is likely to blur. For example, if the penalty for failing to hold sufficient CO₂ permits is a fine levied per unit of excess CO₂ discharged as in the acid rain case, then that fine becomes the upper limit of the price for CO₂ permits. On the other hand, if not only a fine is levied but a requirement to produce a compensating CO₂ reduction, then there is no price ceiling and the systems do not necessarily diverge. As indicated in the discussion on alternative designs, when permits are issued to fossil fuel producers, the tradeable permit program would appear to fossil fuel users in the form of increased energy prices. In this sense, the transferrable permit program behaves exactly like the carbon tax except for one crucial difference. Under the permit system, the level of the tax is set by the market and varies continually depending upon market conditions and not upon political or bureaucratic whim.

International greenhouse gas permit trading has several critical advantages unmatched by alternative policy options. First, marketable permits would provide the greatest spur to innovation in both low polluting technologies, emission control options, and pollutant sinks. This substantial economic incentive for forest protection is an important and often overlooked

feature of any greenhouse policy. Providing the option of producing additional permits over time through forest management changes lessens the impact of greenhouse gas control on economic performance. Permits also provide an explicit mechanism for reallocating scarce resources, namely CO₂ permits, over time and space. Certainly fixed international obligations could be periodically renegotiated, but it difficult to imagine that such a process could even begin to approach the efficiency of a genuine global market. Lastly, a system of marketable permits provides all parties with a relatively simple means of determining performance. The sum of permits transferred to control authorities at any one point in time measures total emissions.

In the international context, the primary gains from trading include:

- 1) powerful incentives for extra reductions
- 2) stimulus to technical change and innovation
- 3) creation of a mechanism for international transfer of reductions reducing the burden of any individual emissions limit
- 4) consistency with any national control program

International trading in greenhouse gases would build directly upon the successful model of the Montreal Protocol. The administrative apparatus required to implement trading is no different than that required to track CFC production for example. The administrative requirements to track and monitor any greenhouse gas protocol will be very similar. The definition of control obligations within the Montreal Protocol include the tracking of exports and imports as well as conversion factors between different CFCs to account for differences in ozone depletion potential. The Montreal Protocol allows has provisions which allow for the economic rationalization of production which by any other name is trading. International greenhouse gas trading would function in a like manner.

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"CORRESPONDENCE TRACKING"

TYPE: INFORMATION

DOCUMENT NUMBER: 9120047

FROM: THOMAS F. MALONE

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 01/04/91

SUBJECT: FORUM: GLOBAL CHANGE AND THE HUMAN PROSPECT: ISSUES
IN SCIENCE, TECH, AND EQUITY

ASSIGNED TO:

ACTION REQUIRED:

SENDER'S DUE DATE:

OSTP DUE DATE:

DATE COMPLETED:

COPIES TO: D. Allan Bromley
Nancy Maynard

WHITE HOUSE TRACKING #:

CONTACT PERSON: THOMAS F. MALONE

REMARKS:

DATE RECEIVED: 01/08/91

FILE: ENVIRONMENT - GLOBAL CHANGE

THE WHITE HOUSE

WASHINGTON

January 23, 1991

Dear Tom:

First of all, congratulations on your new appointment as Distinguished University Professor at North Carolina State.

I am indeed interested in learning about the forum that you have scheduled for Washington on November 16-18, 1991. This sounds like a very interesting session and I would look forward to continuing information concerning it as it becomes available.

At the moment, we are of course very much involved with Desert Storm, but also working to prepare our participants for the first negotiation session for the Framework Convention on Climate Change that will take place February 4-14 just outside of Washington. We will certainly urge that this first session be largely devoted to formal structural matters to establish the framework in the literal sense with more substantive discussions coming in the many further negotiating sessions that are planned.

As you know, the U.S. Federal support for activities directed toward better understanding and prediction of global climate phenomena has increased from roughly \$500 million in fiscal year 1990 to about a billion dollars in fiscal year 1991. At the same time the EPA has estimated that the policies that we have put in place during the Bush Administration are such that our net greenhouse gas emissions in the year 2000 will be identical to what they were in 1987. To the best of my knowledge, no other nation can make that claim. I enclose herewith for your possible amusement a copy of a talk I gave recently to the diplomatic corps assembled in Blair House.

With warmest best wishes,

Sincerely yours,



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

Professor Thomas F. Malone
North Carolina State University
Box 8208
Raleigh, North Carolina 27697



North Carolina State University

Department of Marine, Earth and
Atmospheric Sciences
College of Physical and Mathematical Sciences

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Raleigh, NC 27695-8208
(919) 737-3711
FAX No. (919) 737-7802

January 4, 1990

RECEIVED
91 JAN 8 P12:57
OFFICE OF THE
DIRECTOR

9120047 chf

Dr. D. Allan Bromley
Office of Science and Technology Policy
The White House
Washington, DC 20500

Dear Allan:

To confirm my telephone conversation with your secretary, Marian, I am serving as Chairman of the Program Committee for a FORUM on Global Change and the Human Prospect: Issues in Science, Technology Economics and Equity to be held in Washington, DC, November 16-18, 1991.

The FORUM is sponsored by Sigma Xi, AAAS, the Council of Scientific Society Presidents, the Social Science Research Council, the American Association of Engineering Societies, and COSSA. It is germane to the topics we explored in Ottawa in 1984 and relevant to the UN Conference on Environment and Development in June 1992.

In consultation with Sir Chrispin Tickell and the British Embassy in Washington, we are extending an invitation to Mrs. Margaret Thatcher to deliver a closing address on something like 'Rethinking the World'.

I knew you would want to be informed on this initiative. I will keep you abreast of developments.

With every good wish for the 'New Year',

Sincerely yours,

Thomas F. Malone
Distinguished University Professor

TFM:dh
cc: Dr. J. Ahearne

Logged

"CORRESPONDENCE TRACKING"

TYPE: ACTION

DOCUMENT NUMBER: 9120204

FROM: SMITH, SHERWOOD H.

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 01/04/91

SUBJECT: GLOBAL CHANGE RESEARCH NETWORKS...PLANNING A
REGIONAL MEETING TO DEFINE & PLAN THE WESTERN
HEMISPHERE INITIATIVE

ASSIGNED TO: Thomas Ratchford SB

ACTION REQUIRED: DIRECT REPLY

SENDER'S DUE DATE: 2/21/91

OSTP DUE DATE: 02/23/91

DATE COMPLETED: -----

COPIES TO: D. Allan Bromley
Nancy Maynard

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS: PLEASE NOTE: This has been reassigned to Dr. Ratchford.

DATE RECEIVED: 01/19/91

FILE: ~~GLOBAL CHANGE~~
P- Environment-global change

"CORRESPONDENCE TRACKING"

TYPE: ACTION

DOCUMENT NUMBER: 9120204

FROM: SMITH, SHERWOOD H.

TO: DR. BROMLEY

DATE OF
CORRESPONDENCE: 01/04/91

SUBJECT: GLOBAL CHANGE RESEARCH NETWORKS...PLANNING A
REGIONAL MEETING TO DEFINE & PLAN THE WESTERN
HEMISPHERE INITIATIVE

ASSIGNED TO: Nancy Maynard

*Please follow
up the people
before it goes
out. DAB.*

ACTION REQUIRED: DIRECT REPLY

SENDER'S DUE DATE:

OSTP DUE DATE:

02/11/91

DATE COMPLETED: -----

COPIES TO: D. Allan Bromley

WHITE HOUSE TRACKING #:

CONTACT PERSON:

REMARKS:

DATE RECEIVED: 01/19/91

FILE: GLOBAL CHANGE

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20506

April 1, 1991

Dear Dr. Smith:

Dr. Bromley has asked me to express to you his gratitude for your kind offer to host the forthcoming regional planning workshop for the establishment of a Western Hemisphere Institute on Global Change Research. We are currently in the process of planning the workshop and will make a decision very soon about the location.

Thank you for your interest in the success of this important initiative.

Sincerely,

A handwritten signature in cursive script that reads "J. Thomas Ratchford". The signature is written in dark ink and is positioned above the printed name and title.

J. Thomas Ratchford
Associate Director

Dr. Sherwood H. Smith, Jr.
Chairman of the Board
Center for Advanced Studies Inc.
Box 12074
Research Triangle Park
North Carolina 27709

9120204

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January 4, 1991

Dr. D. Allan Bromley
Science Adviser to the President
The White House
Washington, DC 20500

Dear Dr. Bromley:

The deep interest of the scientific community in the Research Triangle Park in Global Change Research has drawn our attention to the concept advanced by President Bush last spring of a Western Hemisphere Network of Institutions to promote regional cooperation among the natural and social sciences and engineering. Through the good offices of Dr. Thomas Malone, Distinguished University Professor of North Carolina State University, we have learned of the recent Bellagio Conference which provided further support to the idea of global change research networks.

We understand that consideration is being given to an initial regional meeting to define and plan the Western Hemisphere initiative. On behalf of the Triangle Universities Center for Advanced Studies, Inc. (TUCASI), may I extend a warm invitation to our government, and the other nations involved, to consider the Research Triangle Park as the site for this regional meeting.

TUCASI was incorporated by Duke University, North Carolina State University and the University of North Carolina (the Triangle Universities) to foster collaborative studies that transcend the scope of a single university. We presently host on our special campus the National Humanities Center, and have arranged for Sigma Xi, the National Institute of Statistical Sciences, the North Carolina Supercomputing Center, and the Biotechnology Center of North Carolina to establish residence on our campus.

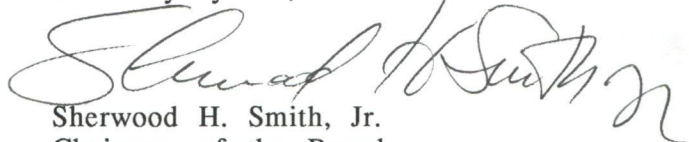
The Research Triangle Park would seem to be an especially appropriate location for the regional meeting. In addition to our three universities, it is the home of the Center for the National Institute of Environmental Health Sciences, a Regional EPA Center, the Research Triangle Institute (a nonprofit organization also incorporated by the Triangle Universities which houses more than 1400 researchers, many of whom are involved in environmental or social sciences research), and several major corporate research laboratories. Interest is keen in environmental matters and the social sciences.

Dr. D. Allan Bromley
Page 2
January 4, 1991

TUCASI would be pleased to work with your office on the meeting. We have been assured of the participation by Dr. Malone on a local arrangement committee since he will be in residence here in early 1991.

We would be pleased to explore this matter further with you. In any case, rest assured of our best wishes for the success of this important initiative.

Sincerely yours,

A handwritten signature in cursive script, appearing to read "Sherwood H. Smith, Jr.", written in dark ink.

Sherwood H. Smith, Jr.
Chairman of the Board

SHSjr:pb
cc: TUCASI Board of Trustees
Dr. Thomas F. Malone