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TECHNOLOGY TRANSFER SUPPORT SERVICES

to the

CARBON DIOXIDE RESEARCH DIVISION U.S. DEPARTMENT OF ENERGY

Contract Number DE-AC01-86ER-60446

FINAL REPORT

January 13, 1990

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1.0 Executive Summary

As Congress has directed, the U.S. Department of Energy (DOE) serves as the lead Federal agency with respect to atmospheric carbon dioxide (CO_2) and the "greenhouse effect." Within DOE, the Carbon Dioxide Research Division (CDRD) has been responsible for leading the research effort investigating atmospheric CO_2, global warming, and other aspects of the greenhouse effect.

Critical to CDRD's endeavors is accurate, effective communication of research findings—not only to scientists, but to policymakers and the general public as well. For the past three-and-a-half years, under Contract Number DE-ACO1-86ER-60446, **Walcoff & Associates, Inc.,** (Walcoff) has supported CDRD in meeting this technology transfer challenge. Walcoff has drawn upon management science and information synthesis skills for task assignments totalling $579,147.

Walcoff has helped CDRD conceptualize effective communication of complex, highly specialized research findings—whether from representatives of one scientific discipline to another or to members of Congress or to an educated lay public. To stimulate insights and define the transfer process, for example, **Walcoff** arranged for CDRD to host a colloquium for six communications experts which focused on outreach to journalists and other communicators. The company also designed a model for developing an outreach program and used the model to generate candidate outreach projects.

Besides the communications colloquium, **Walcoff** has provided CDRD with services to design, manage, and support nine meetings. Projects have included seminars to communicate state-of-the-art research findings to scientists and scientific journalists, a meeting with climate researchers from the People's Republic of China to assess findings in joint scientific projects and plan future research, and a workshop sponsored with Sigma Xi, the scientific research society, to design an institute that would bring policymakers and researchers together.

In addition to proceedings for several of these meetings, **Walcoff** has written or edited and produced 27 documents for CDRD. An illustrated question-and-answer booklet for the general public, monthly reports highlighting current research projects for members of Congress, scientists, and program managers, and a publication on superconductivity that appeared as the lead article in the June 1989 issue of *Energy* are among the documents produced.

Walcoff has drawn upon a wide range of technical and professional skills to support the CDRD in its technology transfer services. Underlying all tasks has been the need to communicate highly complex, information across scientific, political and economic disciplines. During the three and a half year contract period, Walcoff has successfully provided support to the CDRD to enhance its technology transfer resources and accomplishments.

2.0 Introduction

Global warming heads the list of environmental issues facing the Administration that took office in January 1989. It is an issue that DOE has been addressing through scientific research since 1978. As designated by Congress, DOE serves as the lead agency for investigating atmospheric CO_2 and the greenhouse effect. DOE exercises this responsibility through the CDRD. Formerly part of the Office of Basic Energy Sciences and now part of the Office of Health and Environmental Research, CDRD stimulates, coordinates, oversees, and evaluates research into global warming and other aspects of the greenhouse effect. As a prime objective, CDRD strives to provide policymakers with the information they need as a basis for shaping public policy decisions.

2.1 Research Sponsored by the Carbon Dioxide Research Division

CDRD-sponsored research addresses all aspects of atmospheric CO_2—and other trace gases like methane—that contribute to the greenhouse effect:

- With respect to the global carbon cycle, CDRD-supported researchers estimate, for example, how much use of fossil fuels may increase future levels of atmospheric CO_2. They likewise attempt to assess how much of this CO_2 might be removed from the atmosphere by natural means, through storage in vegetation and oceans.

- CDRD-sponsored researchers also work to detect past and present climate change and determine whether it results from increasing atmospheric CO_2. These researchers have been instrumental in showing, for example, that average global temperature has risen about 1 °C over the last century. Now, they are investigating whether increasing atmospheric CO_2 can conclusively be identified as the cause of the temperature rise.

- Allied researchers have played key roles in developing the models that project future climate changes resulting from increasing atmospheric CO_2. In addition to strengthening models that make global climate projections, these analysts are focusing their efforts on developing methods to estimate future climate for regions the size of the Midwestern United States.

- Still other researchers are testing the impact of doubled atmospheric CO_2 in fertilizing plants and dramatically increasing harvests. Having demonstrated these effects under controlled conditions, they are now devising ways to assess the effect of increased CO_2 on crops in the field and on natural plant communities.

2.2 Transfer of Knowledge: The Need to Communicate Research Findings Effectively

In keeping with DOE's responsibilities as lead agency in this field, CDRD focused outreach efforts for several years on publication of four state-of-the-art reports and two companion volumes in 1985. The state-of-the-art reports provide a definitive statement of the knowns, unknowns, and uncertainties in each of the areas highlighted above. The companion volumes dealt with the question of sea level rise and with possible greenhouse effects on human health and on forests, water, and other resources. Together, these publications offered scientists an authoritative assessment of atmospheric CO_2 and the greenhouse effect.

Building on these achievements, CDRD sought ways to communicate CO_2 research findings and transfer knowledge of the greenhouse effect to a variety of audiences. Scientists certainly continue to be among the audiences who need this information:

- Scientists working on the unknowns and uncertainties identified in the state-of-the-art reports need both periodic and sustained ways to share findings and define research directions.

- In particular, scientists need to communicate and collaborate internationally. In the future, some of the greatest contributions to increasing atmospheric CO_2 may come from developing and centrally planned economies. Global warming is a challenge that confronts the entire world, not just the United States and other highly industrialized nations.

It is equally important, however, to communicate sound understanding of the greenhouse effect to other audiences:

- Legislators and public officials need this knowledge as a basis for public policy decisions.

- The public, too, needs a broader awareness of this issue because informed citizens are likely to support good public policies. They are likely to understand the need for increased knowledge and further research, rather than falling prey to either complacency or alarmism.

To provide the technical expertise and management support required to meet these needs, CDRD turned to **Walcoff & Associates**. Specifically, the Division asked **Walcoff** to develop models to communicate research findings and their implications to non-technical audiences and to organize the transfer of this information through print media, public presentations, and other means.

2.3 Walcoff & Associates' Capabilities

Walcoff & Associates offered CDRD maturity and breadth of staff, together with experience appropriate to specific CDRD needs.

Senior **Walcoff** Associates are capable of working with senior scientists on a professional level. Senior Associates possess the highest academic or professional degrees, and they provide seasoned judgment on questions of management, communication, organization, and public information. They are sensitive to the need to make communication accurate and scientifically sound, and they can work with senior researchers tactfully and effectively to achieve clarity and coherence. They are equally sensitive to the needs of the audience reading a document or attending a meeting. They can help researchers and program managers focus a paper or a conference so it addresses the audience's interests, knowledge, and needs and thus achieves CDRD's objectives.

Walcoff Associates have developed these skills through experience that matches specific CDRD needs:

- They have researched, written, edited, and prepared for publication an array of documents dealing with environmental issues, technology transfer, and other scientific and technical research. They have prepared these documents for audiences ranging from fellow scientists in the same field and interdisciplinary scientific groups to members of Congress and the general public.
- They likewise have broad experience with scientific and public policy meetings. At one end of the spectrum, they have designed small workshops focused on developing a five-year research plan, for example, or achieving consensus on a given public policy. At the other, they have managed logistics for conferences involving thousands of scientists attending meetings on dozens of topics concurrently.

Table 1 presents a Staff/Skills Matrix, and Figure 1 outlines **Walcoff** facilities and computer and communications resources.

TABLE 1

WALCOFF & ASSOCIATES
PROFESSIONAL SKILLS MATRIX
IN SUPPORT OF CDRD

STAFF	SUPPORT SKILLS																	
	Management	Organizational Development	Research	Public Information	Legislative Affairs	Writing	Editing	Publication Management	Graphic Arts	Graphic Design	Desktop Publication	Publication Production	Bibliographic Research	Cataloguing	Meeting Design	Meeting Logistics	Information Systems Design	Information Systems Management
C. Walcoff	X	X	X	X		X	X							X	X	X	X	
A. Cambel			X			X												
M. Firestine	X		X	X		X	X	X		X								
B. Eiler	X	X												X	X			
M. Hallman	X		X		X	X	X							X	X			
J. Feldman	X													X	X			
M. Heckard	X		X	X		X	X	X	X									
R. Smith				X		X	X											
J. Benton			X			X												
W. Hart				X	X	X												
J. Harrill				X					X	X								
S. Coglin			X			X									X			
I. Gendell											X	X						X
M. Gendell						X					X						X	X
E. Milner			X	X		X	X					X	X	X				
S. Monahan			X			X							X					
D. Allen					X	X	X								X			
P. McKeta				X		X												

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FIGURE 1
WALCOFF & ASSOCIATES RESOURCES

Office Facilities	Meeting Facilities	Library Resources	Communications Capabilities	General Office Resources	Computer Hardware	Software Capabilities
Location off GW Parkway in Old Town, Alexandria	320-square ft. conference room: seats 12 conference-style and 30 theater-style	Library of resource materials on technical and management fields	Lanier Renaissance XX phone system	MITA DC3132 copier with collation, automatic stapling , enlargement and reduction capabilities	Local area Network with IBM workstations	Desktop Publishing: Xerox Ventura Desktop Publishing
10 minutes from downtown Washington, DC	One-way mirror for focus group observation	Sample topics: The greenhouse effect, ozone depletion, acid rain, ac- services quired immune deficiency syndrome, and the management of technological innovation.	Long distance call accounting system	Friden Alcatel postage meter and scale	160 megabytes of hard disk storage	Graphics: Lotus 1-2-3, Lotus Freelance Plus, PC Paintbrush for charts freehand and clip art presentations
Word processing and desktop publishing center	46x48 projection screen		Computer data transfer via 9600 baud modem	GBD and Velobinder binding machines	State-of-the-art Novell NetWare network software, with ARCnet architecture	Database Management: dBase III Plus
Writing and graphic arts workroom	48x48 white board		In-house telefax		Mainframe like security	Word Processing: WordPerfect 4.2, WordPerfect 5.0., MultiMate, ASC II
Reproduction center	Kodak 4400 slide projector		Local and world-wide courier services		Easy expansion to 100 workstations while maintaining performance	
Mail room	20-inch color television	Management and writing areas: organizational leadership and management, strategic planning, financial management, style manuals			Electronic mail system for inter-office communications	Accounting: RealWorld General Ledger, custom-designed, Lotus 1-2-3 spreadsheet applications
Conference room	VHS video cassette recorder				Optical scanner for graphic input, and optical character recognition software (OCR) for text input	Project Management: Harvard Total Project Manager II, Agenda
Library	Lanier dictation and transcription equipment	Federal department and agency directories, Congressional directories			Desktop Publishing Equipment: 300 dots per inch (dpi)	
	Access to larger meeting and conference facilities				Sigma Designs, 19-inch monitors for double-page design and layout	
	Access to state-of-the-art technical equipment				Postscript laser printer	

3.0 Contract Performance

3.1 Expenditures

Walcoff & Associates has provided support services to CDRD under a cost-plus-fixed-fee contract for the last three-and-a-half years. The initial contract was awarded July 23, 1986 for one year, and the most recent extension ends January 13, 1990.

Work performed under these contracts has been divided into four major task areas:

- Task 1--Program Management;
- Task 2--Publications;
- Task 3--Transfer of Knowledge: Process Design;
- Task 4--Management and Administrative Support.

Figure 2 shows money expended for each task, while labor hours expended appear in Figure 3. Figure 4 traces cumulative expenditures each month for the life of the contract.

FIGURE 2
FUNDS EXPENDED ON EACH TASK

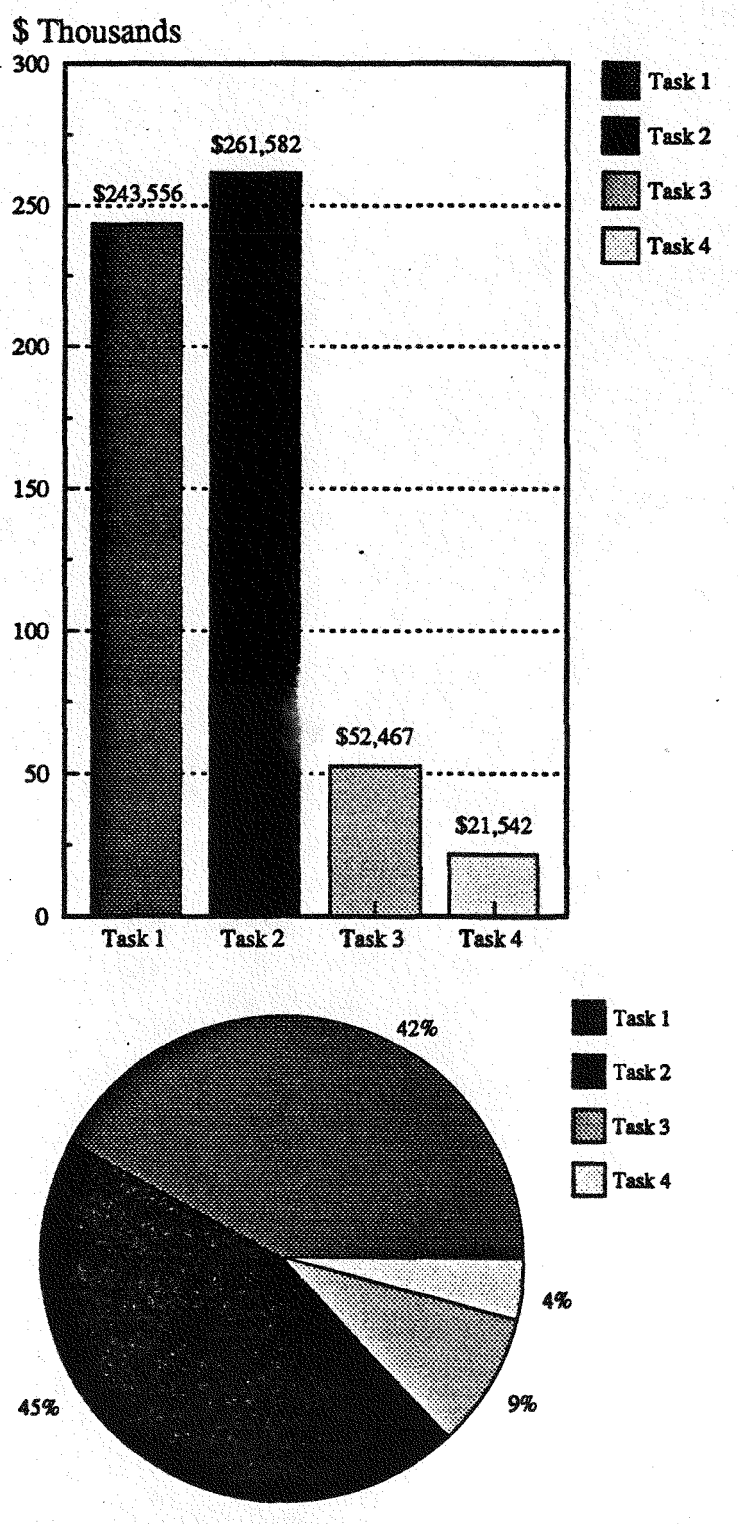


FIGURE 3
LABOR HOURS DEVOTED TO EACH TASK

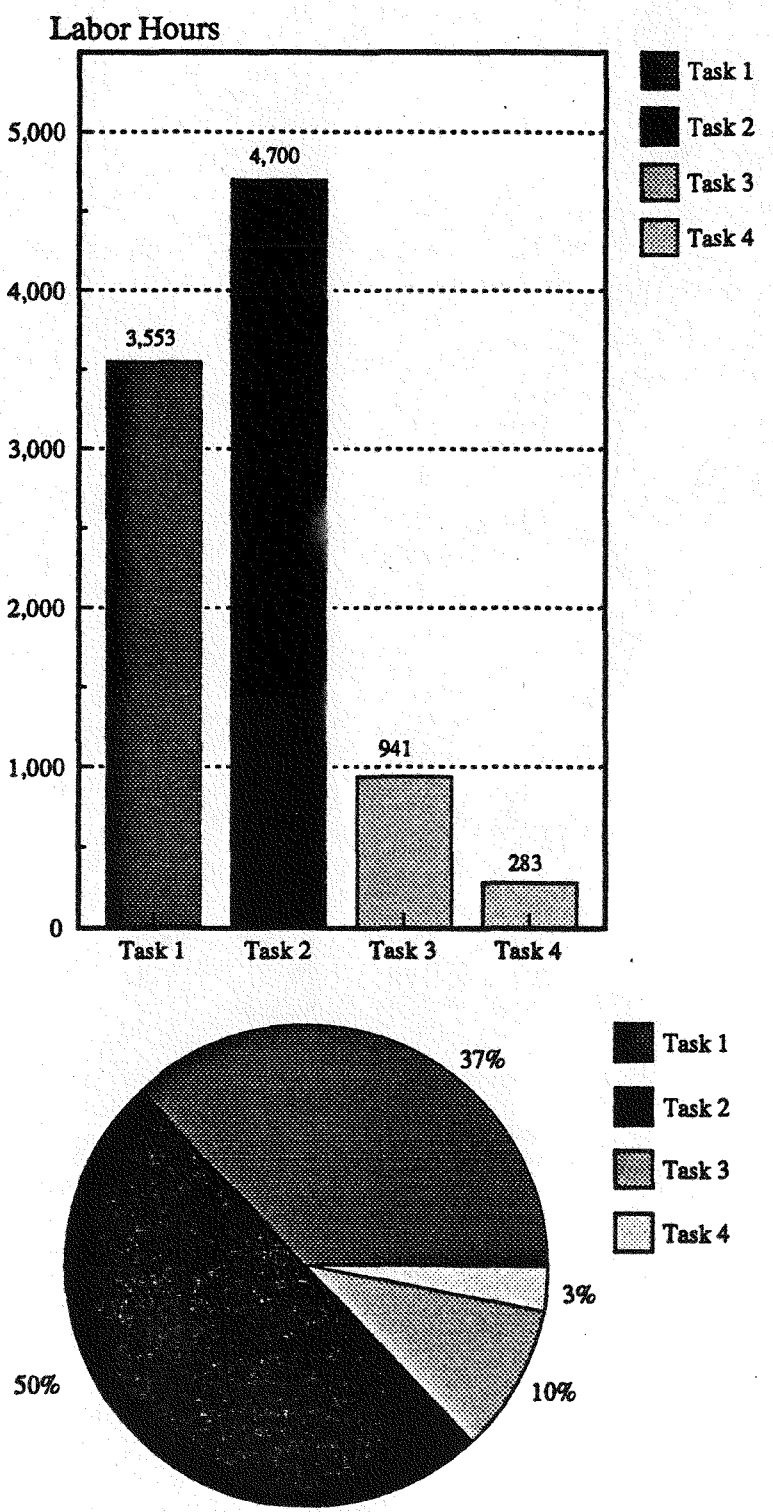
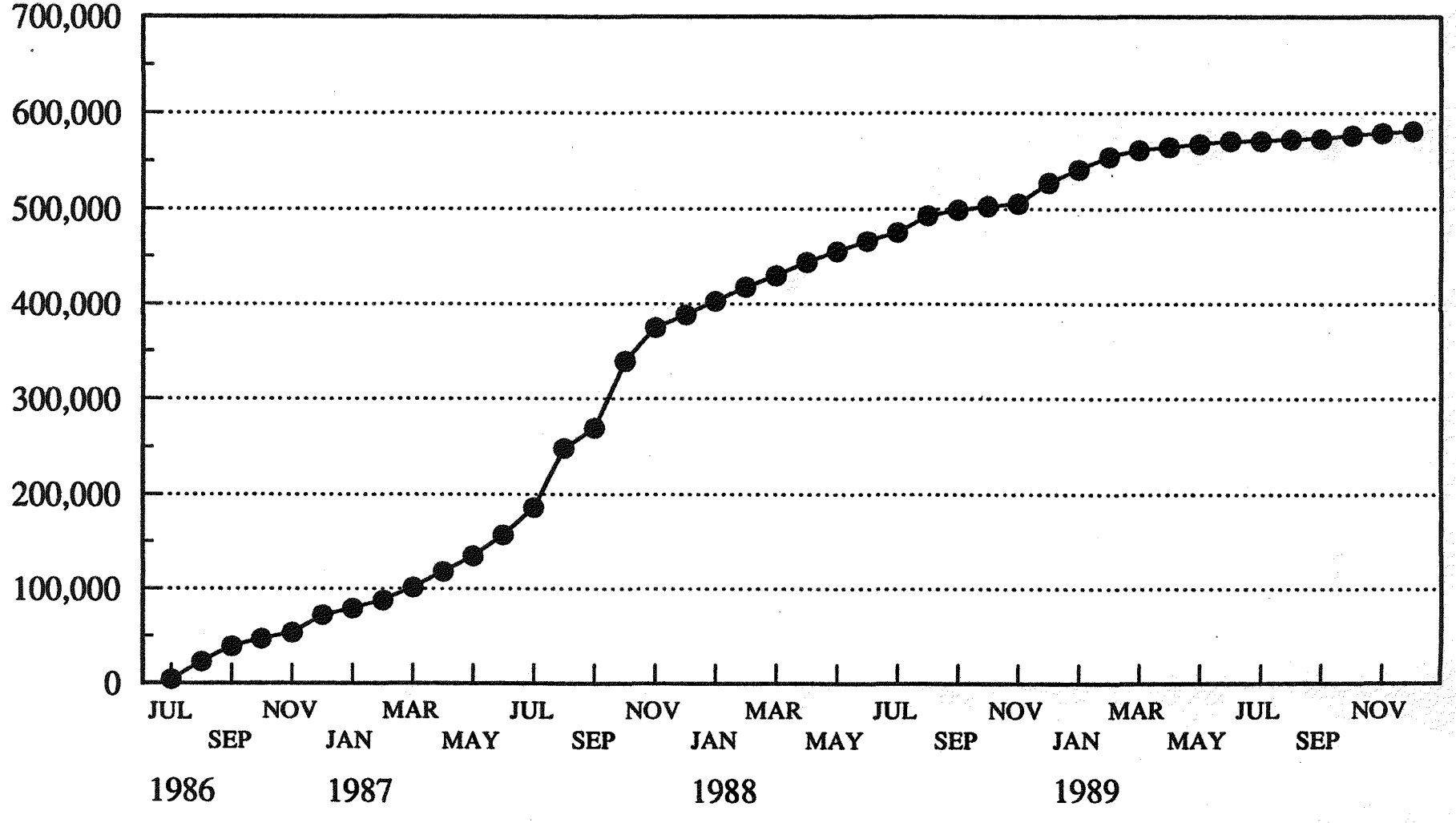


FIGURE 4

CUMULATIVE EXPENDITURES EACH MONTH OF THE CONTRACT



3.2 Major Responsibilities

Walcoff support to CDRD has focused on eight major projects. Highlights of each of these projects appear below. Figure 5 shows funds expended on each of these activities.

3.2.1 State-of-the-Art CO_2 Research Seminar

Subtask Area: Program Management
Subtask Period: September 15, 1986 - January 15, 1987
Walcoff Manager: Jeanne Feldman
CDRD Manager: Thomas Gross

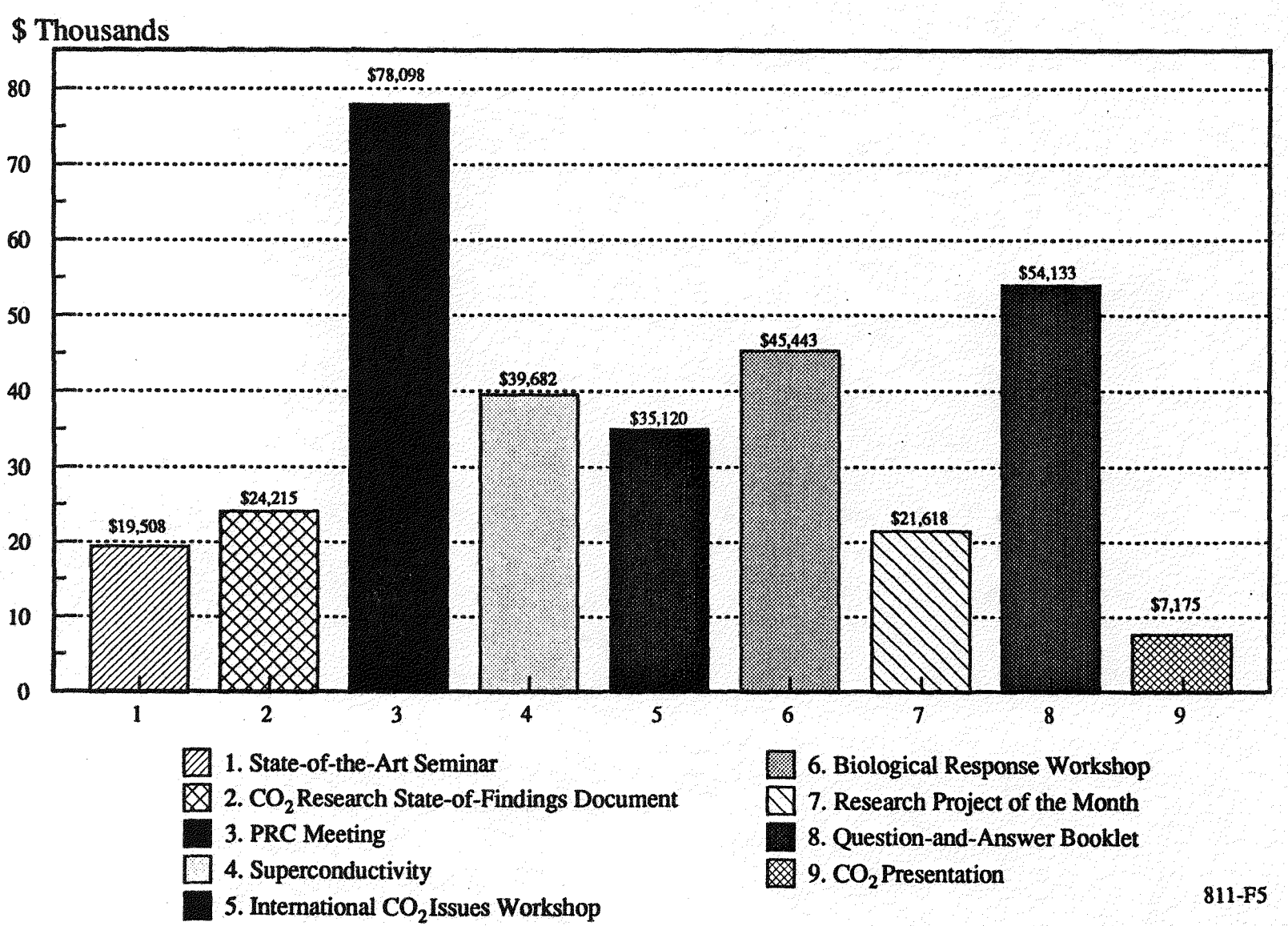
In December 1986, CDRD sponsored a seminar to disseminate information in the state-of-the-art reports and review state-of-the-findings research directions. Participants included a member of Congress, a reporter from *Nature* and other science writers, representatives of the Commission of European Communities and the Tokyo Electric Power Company, and people associated with The World Resources Institute, Resources for the Future, and various public interest groups, as well as government officials and researchers from universities and other research institutions. Approximately 100 people attended the seminar at the National Academy of Sciences. Twenty-eight thousand dollars ($28,000) was budgeted for **Walcoff** support.

Walcoff performed these tasks to facilitate the meeting:

- planned the seminar in conjunction with CDRD staff;
- prepared and distributed invitations, registration materials, agendas, and summaries of the presentations;
- arranged for meeting facilities and audio-visual equipment;
- arranged and managed refreshment breaks, luncheon, and a reception;
- invited and registered participants;
- recorded seminar proceedings and documented discussions;
- provided on-site seminar management;
- reimbursed speakers' expenses; and
- forwarded requests for information produced by the Carbon Dioxide Information and Analysis Center to Oak Ridge National Laboratory.

Deliverables for this project included a list of seminar participants and a summary of the proceedings.

FIGURE 5
FUNDS EXPENDED ON MAJOR SUPPORT ACTIVITIES



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3.2.2 CO_2 Research Statement-of-Findings Document

Subtask Area: Publications
Subtask Period: August 1, 1986 - March 31, 1987
Walcoff Manager: Martha Firestine
CDRD Manager: Frederick A. Koomanoff

The statement-of-findings concerning CO_2 research was designed to supplement the state-of-the-art volumes by providing a general audience with a broad perspective on what is known, unknown, and uncertain about the greenhouse effect. Forty-six thousand dollars ($46,000) was allocated for this task.

Walcoff & Associates' staff performed the following tasks to help prepare the Statement-of-Findings:

- researched the state-of-the-art documents and other research and program reports prepared by CDRD;
- interviewed DOE managers who oversee CDRD-supported projects to identify their understanding of the document's goals and objectives in their research areas;
- worked with the author to define the scope and structure of the document;
- provided substantive editing and major rewriting for two drafts of the document;
- prepared draft and final copies of the document for review; and
- presented the final draft to program staff and scientists for review.

Walcoff & Associates delivered initial, intermediate, and final drafts of the document to CDRD.

3.2.3 PRC/USA Joint Scientific Team Meeting

Task Area: Program Management
Subtask Period: April 1, 1987 - December 31, 1987
Walcoff Manager: Jeanne Feldman
CDRD Manager: Michael Riches

This meeting contributed to international communication and collaborative research on atmospheric CO_2 and other contributors to the greenhouse effect. Held in August 1987 in Harper's Ferry, West Virginia, the meeting coincided with the formal signing in Beijing of a cooperative research agreement between the People's Republic of China (PRC) and the United States.

Both the agreement and the meeting reflect the significance of the PRC's potential role in greenhouse warming and related research. PRC emissions of CO_2 have grown dramatically in the last quarter century, and that trend is likely to continue. Together with the USSR

and the USA, moreover, the PRC can exert broad influence on future emissions. These three countries possess more than 75 percent of global coal resources, the world's most abundant fossil fuel by far.

In addition, PRC climate records extend back more than 500 years, to the 1400's. Such records are invaluable in testing climate models. Using climate records from early in the 15th century, for example, analysts can enter data into the model equations and then see how accurately the model projects climate 50 or 100 years later.

At the Harper's Ferry meeting, 15 scientists from the PRC met with experts from U.S. government agencies, universities, and the private sector to discuss an ongoing joint research program. Participants reviewed recent research progress, set new goals for the cooperative program, and exchanged CO_2 research data.

Working with a budget of $76,000, **Walcoff & Associates** provided extensive support for the meeting and the proceedings document. To fulfill major responsibilities for this task, **Walcoff** staff—

- researched and arranged for meeting facilities, refreshment breaks, and meals;
- designed and prepared agendas and schedules for the participants in Mandarin and English;
- designed, prepared, and mailed meeting invitations and the agenda;
- reviewed protocol documents and observed their provisions in managing the meetings;
- arranged to transport the PRC visitors from airports to Harper's Ferry and then to Washington;
- managed on-site meeting logistics, including audio-visual, word processing, and photocopy services;
- provided a photographer for group pictures;
- arranged and managed a group banquet;
- provided on-site simultaneous interpretation in Mandarin and English during the meetings;
- provided two interpreters for informal meetings;
- prepared meeting summaries in Mandarin and English;
- provided extensive assistance with visas and travel arrangements;
- prepared and managed schedule of special events, lodging, meals, and transportation for PRC visitors in Washington; and
- developed the proceedings document for the meeting.

Walcoff staff edited six papers for the proceedings document. One of these, for example, dealt with agricultural production of methane, which contributes significantly to the greenhouse effect, and with measurements of methane emissions in Sichuan, China. Another documented the first general circulation climate model developed by the Institute of Atmospheric Physics in Beijing. After editing the papers, **Walcoff** coordinated author review, wrote the introduction, and produced camera-ready copy.

In addition to the proceedings document, **Walcoff & Associates** produced letters of invitation, agendas, itineraries, and schedules for the participants. Further, a summary of the meeting was prepared in both English and Mandarin, photographs of the joint team were taken, and a report of the visit was written.

3.2.4 Question-and-Answer Booklet

Task Area: Publications
Subtask Period: March 1, 1987 - July 15, 1989
Walcoff Manager: Martha Firestine
CDRD Manager: Thomas Gross

Entitled *Atmospheric Carbon Dioxide and the Greenhouse Effect*, the question-and-answer booklet presents important points about greenhouse gases, global warming, and other significant issues in an intelligible, interesting fashion for an informed lay public. The text underwent thorough, rigorous review by CDRD program staff and by leading researchers in the field to ensure its scientific soundness and balance. It was also reviewed by public information specialists to ensure clarity, focus, and liveliness. The custom illustrations and the graphic design highlight major points and contribute to the high quality of the finished work.

Using a total of nearly $55,000, **Walcoff & Associates** completed these steps:

- developed a proposal for the booklet identifying the purpose, audience, general format, questions, and main points;
- substantively edited drafts prepared by program staff for half the answers; researched and wrote answers to the remaining questions; delivered the first draft for review by program staff;
- revised the draft in response to reviewers' comments and submitted a second draft for internal review;
- prepared a third draft incorporating further revisions and distributed it to scientists in the field for review;
- collated detailed responses from multiple reviewers and sorted the comments into categories: those that could simply be incorporated into the draft, those that raised scientific questions requiring consultation with program staff, and those that raised policy questions requiring consultation with CDRD's director; prepared extensive documents outlining each set of comments and coordinated review by program staff.
- prepared a fourth draft following these consultations and submitted it to the DOE public affairs office;
- revised the draft to make the changes requested by that office;
- developed sample design and illustrations for CDRD review;
- researched the illustrations and completed illustrations and layout;
- submitted camera-ready copy;
- conducted the press inspection;
- prepared a proposal for distributing the booklet, particularly to journalists and educators who can transmit this knowledge to others;

- prepared cover letters to accompany the booklet, secured mailing lists, and coordinated distribution.

Over the course of this effort, **Walcoff & Associates** submitted the following deliverables: the initial proposal; digests of scientific reviewers' comments; five drafts of the text; camera-ready copy, including desktop published text and captions, boards, and full-size illustrations; a proposal for distribution; cover letters and instructions for distributing the booklet.

3.2.5 International CO_2 Issues Workshop

Task Area: Program Management
Subtask Period: August 1, 1987 - December 31, 1987
Walcoff Manager: Carol Walcoff
CDRD Manager: Frederick A. Koomanoff

As scientists research the greenhouse effect, it is important to communicate the findings and their implications accurately to policy analysts and decision makers. Otherwise, there is no sound basis for shaping public policy.

Effective communication between such diverse groups, however, presents a major challenge. Policymakers must focus their attention on situations of immediate and grave urgency, and they must be attentive to public perceptions of a situation. They need to deal with high levels of certainty and clear cause-effect relationships.

Uncertainty, however, colors most scientific assessments of the greenhouse effect. Climate systems are exceedingly complex, and the interactions between climate systems and the human community in the next 50 to 100 years almost defy projection. While a few outcomes can be predicted with confidence, most potential results remain questionable.

Where policymakers need clarity and certainty, scientists deal with complexity and qualifications. Policymakers are attuned to public perceptions, while researchers try to describe scientific reality. Frequently, scientists may be unaware of the policy considerations raised by their analyses.

In the absence of good communication, public policy can become the product of alarmism—increasing the possibility of wasting money, exaggerating people's fears, disrupting their lives, and yielding little benefit. To counteract this possibility, CDRD sponsored a workshop to explore ways of promoting communication, at an international level, between scientists and public officials. The workshop was held in October 1987 at the Mercy Center in Madison, Connecticut.

Sigma Xi, the scientific research society, convened the workshop and selected participants. The 24-member interdisciplinary group included Jesse Ausable, Lester Lave, Norman Rosenberg, Frederick Thayer, and others of similar stature.

Through the course of the workshop, participants developed guidelines for an international institute. They specified its charge, scope, and framework and defined criteria for selecting scientists and policymakers to participate. Among other goals, they called for the institute to integrate information and provide new insights into greenhouse issues, to provide advice on research agendas, to influence decision making, and to contribute to public education and awareness.

Using a budget of $42,000, **Walcoff & Associates** provided the following management and technical support services for this workshop:

- invited participants;
- made travel, lodging, and meeting arrangements;
- prepared and distributed the agenda, background readings, and other materials;
- documented meeting proceedings;
- served as liaison between meeting participants, CDRD staff, and facilities representatives;
- prepared a meeting synopsis;
- reimbursed travel expenses;
- edited the concluding report;
- and prepared thank you letters for workshop participants.

Walcoff & Associates produced a list of participants, a workshop agenda and materials, a workshop synopsis, and a task report for delivery to CDRD.

3.2.6 Research Project of the Month

Task Area: Publications
Subtask Period: September 1, 1986 - January 13, 1989
Walcoff Manager: Maureen Hallman
CDRD Manager: Thomas Gross

The publications in the *Research Project of the Month* series allow CDRD to communicate current developments in research on the greenhouse effect to policymakers and the scientific community. Each publication describes research and findings in CDRD-supported projects. Topics have included ocean storage of CO_2, plant response to a combination of increasing atmospheric CO_2 and different moisture levels, and assessment of models' ability to project climate through comparison with actual past climate.

Using a total of nearly $22,000, **Walcoff & Associates** published 13 issues in the series. Publication entailed three major steps: substantive editing of the scientific summaries; conversion of the report to desktop format, incorporating computer-generated graphics; and distribution of the finished publication to several hundred recipients. Specifically, Walcoff staff performed the following tasks:

- reviewed candidate research project summaries;
- selected 13 summaries for the series;

- substantively edited draft reports for author review;
- consulted with authors and developed final copy for the reports;
- designed the format for desktop publication;
- converted the text to desktop format;
- generated graphics electronically and integrated them into the publication;
- developed and maintained the mailing list;
- coordinated distribution.

Walcoff delivered 13 issues of *Research Projects of the Month* and the updated mailing list.

3.2.7 Workshop on Biological Response to Environmental Change

Task Area: Program Management
Subtask Period: May 1, 1987 - January 31, 1988
Walcoff Manager: Bette Eiler
CDRD Manager: Roger Dahlman

One promising aspect of increasing atmospheric CO_2 is its impact in fertilizing plants. Jointly supported by CDRD and the U.S. Department of Agriculture, researchers have shown that under laboratory conditions crop harvests increase dramatically with double today's level of atmospheric CO_2. Crops ranging from corn to cotton increase their yield from 10 to more than 80 percent. Under the same conditions, plants may also become more efficient in using water. Plants take in atmospheric CO_2 for photosynthesis through pore-like stomata in their leaves. When atmospheric CO_2 is abundant, the stomata are less open than under current conditions, and plants may lose less water vapor as a result. If similar results occur in the field, there is a possibility crops might need less irrigation than at present.

Investigating these possibilities presents many challenges. Scientists are devising ways to test plant responses to increased atmospheric CO_2 under field conditions, but they must also investigate a host of complex questions. How will plants respond to possible combinations of changes—concurrent changes in atmospheric CO_2, temperature, soil moisture, and rainfall, for example? How will entire plant communities or ecosystems respond to increasing atmospheric CO_2, alone or in combination with other resource changes?

To address these questions, CDRD took the lead in forming the Inter-Agency Planning Committee comprised of representatives from these agencies:

- U.S. Department of Energy
- Smithsonian Institute
- U.S. Department of Agriculture
- U.S. Environmental Protection Agency
- U.S. Department of Agriculture's Forest Service
- National Science Foundation
- National Aeronautics and Space Administration

The committee planned and held a workshop on "Biological Response to Environmental Change" in October 1987 at Woods Hole, Massachusetts. The workshop brought together scientists interested in the effects of CO_2 on agricultural and ecological systems. Participants represented an usually diverse mix—agronomists and environmentalists, researchers conducting field experiments and those developing plant models, scientists examining questions of physiology at the micro level and those dealing with remotely sensed data from satellites, analysts who assess the vegetative canopy worldwide. The resulting discussion was unusually energetic and enthusiastic, both within workshop sessions and outside. Participants explored opportunities for cooperative work within the research community, and the workshop solidified DOE's role as a leader in the field.

Nearly forty-five thousand five hundred dollars ($45,500) was spent on this workshop, including money contributed by the agencies represented on the Inter-Agency Planning Committee. **Walcoff & Associates** provided the following services in support of the workshop:

- prepared participant list;
- helped design the workshop format;
- drafted and mailed invitations and registration materials;
- developed a participant database and managed the flow of information between speakers and planning committee;
- prepared and distributed meeting materials;
- arranged accommodations, facilities, computers, and audiovisual and other equipment;
- managed on-site logistics;
- attended meetings and documented proceedings;
- prepared initial draft of the meeting summary; and
- reimbursed travel expenses.

Deliverables for the project included a participant list, meeting agenda, invitation, and a draft of the meeting summary.

Members of the Inter-Agency Planning Committee were so pleased with their cooperative efforts that they planned to continue meeting as a group to share information and encourage communication among related government projects.

3.2.8 Papers on Superconductivity

Task Area: Program Management
Subtask Period: April 1, 1987 - March 15, 1989
Walcoff Manager: Carol Walcoff
CDRD Manager: Frederick A. Koomanoff

The promise of high-temperature superconductors (HTSCs) may include reduction of CO_2 emissions. If HTSCs can be developed and made practical, they may well cut energy consumption. At present, for example, resistance consumes perhaps 5 to 20 percent of the

electricity sent over transmission and distribution lines. HTSCs could sharply lower these losses. Lower energy consumption, in turn, could reduce emissions of CO_2.

At the request of CDRD, **Walcoff** prepared a series of papers to explore and publicize these possibilities, using a total of nearly forty thousand dollars ($40,000). The **Walcoff** team was headed by Dr. Ali Cambel, Professor Emeritus at George Washington University, with technical, editing, and production support provided by other members of the staff. The series of papers began with "An Exploratory Study of the Potential Impacts of Superconductors on Carbon Dioxide Emissions," delivered to CDRD in July 1987, and culminated with the publication of "High-Temperature Superconductors and CO_2 Emissions" as the lead article in the June 1989 issue of ***Energy***.

The ***Energy*** article was published within three months of its submission for publication. To ensure prompt publication, **Walcoff** submitted camera-ready copy to the publisher, and to secure compatibility between the article and the rest of the journal, **Walcoff** produced the article in a desktop published format designed to match the style and appearance of the journal.

3.3 Additional Tasks

3.3.1 Program Management

The objective of the program management tasks was to facilitate the flow of technical information to scientists and other interested parties through information transfer meetings. **Walcoff & Associates** helped CDRD design conferences and managed logistics for these efforts. **Walcoff** staff also assembled and organized a library of print materials on greenhouse issues and, in addition, catalogued CDRD viewgraph library. In total, 10 subtasks were performed under the Program Management task area in addition to the major activities already highlighted.

3.3.1.1 Subtask Title: Preparation for Colloquium
Subtask Period: August 1, 1986 - October 1, 1986
Walcoff Manager: Deborah Allen
CDRD Manager: Thomas Gross

CDRD planned a colloquium for 100-150 CO_2 researchers for the spring of 1987 in Washington, DC. Eighteen thousand dollars ($18,000) was budgeted for this subtask. **Walcoff & Associates** provided the following services in designing the conference:

- defined the planning parameters;
- defined the goals and objectives of the colloquium;
- defined available resources;
- assessed the availability and suitability of meeting sites;
- developed a "strawman" meeting design;
- selected the colloquium site and made initial site arrangements;
- identified participants;
- mailed colloquium invitations.

Walcoff & Associates provided CDRD with a briefing on meeting site alternatives and the "strawman" meeting design, together with a copy of the meeting announcement.

3.3.1.2 Subtask Title: Visit to Oak Ridge National Laboratory
Subtask Period: August 6, 1986 - August 7, 1986
Walcoff Manager: Carol Walcoff
CDRD Manager: Frederick A. Koomanoff

The Carbon Dioxide Information Analysis Center (CDIAC) at Oak Ridge National Laboratory compiles, evaluates, and distributes CO_2-related information in support of CDRD. With the agreement of CDRD, **Walcoff** took steps to initiate a cooperative relationship with CDIAC and coordinate technology transfer efforts.

In August 1986, a **Walcoff & Associates'** representative traveled to Oak Ridge to meet staff supporting energy research programs at the laboratory. The goal of the visit was to gain a better understanding of the scope of work performed by these offices. The **Walcoff** representative met with—

- the director of the Center to discuss the center's activities, goals, and objectives;
- Charles C. Coutant to discuss energy research projects within CDRD; and
- various Center staff to discuss their individual roles and responsibilities; and to
- identify areas of mutual concern.

The Coordination, Control, and Communication System (C^3), which contains information about each research project, is used to analyze the whole CDRD research program and its individual components. The **Walcoff** representative observed the C^3 system and identified components which could be obtained by **Walcoff & Associates** to ensure compatibility with Oak Ridge.

One thousand dollars ($1,000) was budgeted for this subtask. The **Walcoff** representative delivered an oral briefing on the site visit and discussed it with CDRD personnel in Washington, DC.

3.3.1.3 Subtask Title: Preparation of Committee Hearing
Subtask Period: August 1, 1986 - August 15, 1986
Walcoff Manager: Carol Walcoff
CDRD Manager: Frederick A. Koomanoff

On June 10 and 11, 1986, the Senate Committee on Environment and Public Works held a hearing entitled "Changes in Atmospheric Ozone Levels and the Greenhouse Effect". Four thousand five hundred dollars ($4,500) was budgeted for **Walcoff & Associates** to prepare a memorandum on the hearing.

A **Walcoff** representative attended the committee hearing, obtained and reviewed formal remarks made by the presenters, and prepared a summary of the proceedings, which was delivered to CDRD.

3.3.1.4 Subtask Title: Plan and Document Hydrological Systems Conference
Subtask Period: September 15, 1986 - November 1, 1986
Walcoff Manager: Carol Walcoff
CDRD Manager: Roger Dahlman

CDRD sponsored a two-day advice retreat to review hydrological systems reports. Attended by six scientists, the meeting was held in Washington, DC, in the fall of 1986. Seven thousand five hundred dollars ($7,500) was budgeted for this task.

Walcoff & Associates performed the following tasks in support of the retreat:

- arranged for the meeting site;
- managed travel arrangements and reimbursed travel expenses; and
- documented meeting and provided a summary report.

3.3.1.5 Subtask Title: Design of a Workshop on the Oceans
Subtask Period: August 1, 1987 - December 30, 1987
Walcoff Manager: Jeanne Feldman
CDRD Manager: Michael Riches

The oceans have the potential to play a major role in the greenhouse effect. They are by far the largest natural reservoir for storing CO_2 emissions, and they may also store a great deal of heat, thus delaying global warming. Yet their absorption of heat may eventually warm and hence expand ocean waters, thus contributing to sea level rise.

Despite their importance, these issues are very difficult to study. The complexity of ocean circulation, convection, and currents, the depths of the oceans and their general inaccessibility all make oceans extremely challenging to investigate.

To address both the issues and the constraints, CDRD initiated plans for a meeting at the National Academy of Sciences in January 1988. Working with a budget of $25,000, **Walcoff & Associates** provided the following services in support of the planning phase:

- developed a workshop agenda;
- defined the target audience;
- researched workshop sites and dates.

3.3.1.6 Subtask Title: Updating State-of-the-Art Vegetation Database
Subtask Period: March 15, 1987 - September 1, 1987
Walcoff Manager: Suzanne Monahan
CDRD Manager: Roger Dahlman

CDRD has developed a database on the effects of increasing atmospheric CO_2 and climate change on vegetation. Specifically, the database deals with unknowns in this area and with needs for future research. Because the database was drawn from a draft of the state-of-the-art report on vegetation, page references in the database needed adjustment to reflect the published version of the report. Four thousand dollars ($4,000) was budgeted for **Walcoff & Associates** to revise the database.

A **Walcoff & Associates** staff member reviewed the page references and reference content to check for discrepancies, added new references, and modified the content of the references, where necessary. A revised database file was delivered to CDRD.

3.3.1.7 Subtask Title: Video and Camera Equipment Rental
Subtask Period: June 6, 1987 - July 20, 1987
Walcoff Manager: Suzanne Monahan
CDRD Manager: Roger Dahlman

Roger Dahlman visited a CDRD-supported research site in the Arctic from June 25 through July 10, 1987. Two thousand ($2,000) dollars was budgeted for **Walcoff & Associates** to provide support for this trip.

Walcoff & Associates provided the following equipment for the site visit:

- VHS Camcorder with wide angle and zoom lenses and audio capability;
- two rechargeable batteries and recharger;
- tripod and cables for use with the Camcorder;
- 35mm camera with 80-210 lens;
- carrying cases for both cameras;
- blank videotapes and 35mm film; and
- instruction book for Camcorder.

Before the site visit, a **Walcoff & Associates** staff member also accompanied Dr. Dahlman to a CDRD-sponsored test site within the Washington, DC, area to experiment filming CO_2 related research.

3.3.1.8 Subtask Title: State-of-the-Art CO_2 Research Seminar - 1987
Subtask Period: June 1, 1987 - January 31, 1988
Walcoff Manager: Jeanne Feldman
CDRD Manager: Michael Riches

CDRD anticipated holding a seminar to update scientists and science journalists on current research related to atmospheric CO_2 and the greenhouse effect. Twenty-nine thousand five hundred dollars ($29,500) was budgeted for this task.

The company provided the following services in support of the seminar:

- researched meeting sites;
- defined the target audience; and
- developed workshop agenda.

Walcoff & Associates produced a slate of recommended meeting sites and drafts of both an invitation list and the workshop agenda.

3.3.1.9 Subtask Title: Coordination of Consultant Travel Costs
Subtask Period: July 15, 1987 - March 1, 1988
Walcoff Manager: Jeanne Feldman
CDRD Manager: Michael Riches

Using a budget of $6,000, **Walcoff & Associates** reimbursed travel costs for several CDRD consultants and foreign visitors attending scientific meetings and visiting research institutions. The firm provided travel assistance as requested, including arranging visa renewals.

3.3.1.10 Subtask Title: Document Organization
Subtask Period: November 1, 1987 - May 31, 1988
Walcoff Manager: Elizabeth Milner
CDRD Manager: Frederick A. Koomanoff

CDRD's extensive viewgraph library required an update to catalogue many additions and eliminate outdated items. Using a total of less than two thousand dollars ($2,000), **Walcoff & Associates** sorted the viewgraphs into four subject areas—climate, vegetation, general information and the carbon cycle, and sea level and indirect effects—and prepared a master index for all viewgraphs.

The index provides number, title, and summary information for each slide, as well as cross-references. In addition, **Walcoff** staff matched original artwork to the viewgraphs, numbered the artwork appropriately, and stored it.

3.3.2 Publications

The objective of the publications task was to support CDRD in transferring knowledge concerning CO_2 findings and current research projects to scientists, policymakers, and the general public. **Walcoff & Associates'** services in this area included writing, editing, production of computer graphics, desktop publishing, graphic design and illustration, distribution, and publication management. Seven subtasks were undertaken in this area in addition to those already highlighted.

3.3.2.1 Subtask Title: CO_2 Program Accomplishments and Plans
Subtask Period: September 1, 1986 - June 30, 1987
Walcoff Manager: Martha W. Firestine
CDRD Manager: Thomas Gross

The report entitled "CO_2 Program Accomplishments and Plans" summarizes some of the most significant results of research sponsored by CDRD in 1986. Nearly four thousand dollars ($4,000) was budgeted for editing the draft report on CDRD accomplishments and plans.

Walcoff & Associates provided the following services in preparation of this report:

- collected written reports prepared by CDRD staff;
- edited diverse input to prepare a consistent report; and
- synthesized additional information for report revision.

Walcoff & Associates provided an intermediate draft and a final, camera-ready report to CDRD.

3.3.2.2 Subtask Title: Position Papers
Subtask Period: September 1, 1986 - June 30, 1987
Walcoff Manager: Martha W. Firestine
CDRD Manager: Thomas Gross

CDRD prepares technical and scientific papers for presentation as formal position papers directed to an educated lay audience. Seven thousand five hundred dollars ($7,500) was budgeted for **Walcoff & Associates** to support this objective.

Walcoff & Associates provided the following services to prepare a position paper on sea level rise:

- edited and queried the original draft;
- consulted with the CDRD program manager on substance, organization, and accuracy of expression;
- conferred with a technical reviewer;
- generated a one-page summary;
- prepared camera-ready text and graphics.

Walcoff & Associates prepared three drafts and the finished paper and summary.

3.3.2.3 Subtask Title: Letter to the Editor of **Science**
Subtask Period: September 1, 1986 - June 30, 1986
Walcoff Manager: Martha W. Firestine
CDRD Manager: Roger Dahlman

Roger Dahlman responded to an article by R.P. Neilson in the April 4, 1986, issue of ***Science*** with a letter to the editor arguing that the article ignored the influence of atmospheric CO_2 in determining the historical distribution of certain kinds of plants.

Walcoff & Associates substantively edited the letter to improve its organization, clarity, coherence, and succinctness. Five hundred dollars ($500) was budgeted for this task.

During the editing process, **Walcoff** staff prepared two drafts of the letter and discussed each with Dr. Dahlman before sending the finished letter to the editor of ***Science***.

3.3.2.4 Subtask Title: Informal Paper on Illiteracy
Subtask Period: July 1986 - September 1986
Walcoff Manager: Carol Walcoff
CDRD Manager: Frederick A. Koomanoff

Professor Ali Bulent Cambel prepared a paper entitled "Informal White Paper on Illiteracy." The paper explored definitions of the terms "literate" and "illiterate" and attempted to ascribe a "quality factor" to the meaning of illiteracy.

The paper was delivered to CDRD in September 1986.

3.3.2.5 Subtask Title: Article for *Challenge Magazine*
Task Period: April 1, 1987 - April 30, 1988
Walcoff Manager: Carol Walcoff
CDRD Manager: Frederick A. Koomanoff

Walcoff & Associates helped the Director of CDRD write an article entitled "The Greenhouse Effect and the Coming of Bio-Economics" which was submitted to *Challenge Magazine* for publication. Nearly sixteen thousand dollars ($16,000) was devoted to this project and the next article described.

Walcoff staff drafted and revised the article in concert with the CDRD Director before submitting the article to *Challenge*.

3.3.2.6 Subtask Title: Article on Climate and Animal Boundaries in China
Subtask Period: November 1987 - May 1988
Walcoff Manager: Ralph Lee Smith
CDRD Manager: Michael Riches

Following the joint PRC/USA Scientific Team Meeting in August 1987, **Walcoff & Associates** helped three Chinese researchers prepare an article entitled "The Shift of Climate Zones and the Boundaries of Animals in China During Historical Times" for publication.
Walcoff & Associates analyzed the draft and defined extensive information needed to strengthen the argument. Having obtained this material from the researchers, the **Walcoff** editor thoroughly restructured and revised the article for submission.

3.3.2.7 Subtask Title: CO_2 Presentation
Task Period: December 1988 - February 1989
Walcoff Manager: Martha W. Firestine
CDRD Manager: Frederick A. Koomanoff

CDRD staff must be prepared to take advantage of opportunities to communicate information about atmospheric CO_2 and the implications of the greenhouse effect. To enable CDRD personnel to respond quickly to these opportunities, **Walcoff & Associates** helped develop a succinct, polished presentation.

Noting the relationship between increasing atmospheric CO_2 and fossil fuel consumption, the presentation emphasizes energy's critical role in achieving a desirable standard of living in the developing, as well as the developed, world. It points out, as well, that alternate energy sources like nuclear and hydroelectric power are not replacing fossil fuels at all rapidly. Thus, to focus simply on replacing fossil fuels with other sources of energy is unlikely to be successful. Instead, the presentation stresses the need to learn more about how increases in atmospheric CO_2 and other trace gases—methane, nitrous oxide, and chlorofluorocarbons—may affect climate, vegetation, and sea level. In each of these areas, the discussion outlines what is known about possible consequences of the greenhouse effect and what research is needed to enable society to respond effectively.

Walcoff & Associates edited the text to increase clarity, coherence, and succinctness. Company staff also generated the graphics electronically, scanning and enhancing freehand illustrations and creating flow charts, graphs, and tables. Using just over seven thousand dollars ($7,000), **Walcoff** delivered three drafts and the final, camera-ready copy.

3.3.3 Transfer of Knowledge: Process Design

The objective of the transfer of knowledge task was to design processes that would facilitate the dissemination of information about CO_2 research and findings to policymakers, the scientific community, and the general public.

Walcoff & Associates accomplished the following subtasks in support of CDRD.

3.3.3.1 Subtask Title: Transfer of Knowledge Task
Subtask Period: August 1, 1986 - July 31, 1987
Walcoff Manager: Carol Walcoff
CDRD Manager: Frederick A. Koomanoff

Good communication between scientists and policymakers about the greenhouse effect is extremely important. To shape legislation, allocate budgets, and define policy, members of Congress and government officials need a broad grasp of what is known—and what is not known—about the greenhouse effect and the implications that can--and cannot--be drawn from these findings. Scientists, on the other hand, may need to become more sensitive to the political implications of their research.

To facilitate this communication, CDRD directed **Walcoff & Associates** to help the Division define and develop ways to transmit knowledge about CO_2 and its effects from scientists to policymakers in a timely manner. Thirty-five thousand dollars ($35,000) was budgeted for this project.

Walcoff & Associates developed conceptual designs for various processes to enhance the dialogue between scientists and policymakers. Staff performed the following tasks:

- developed a thought paper to stimulate the consideration of different knowledge transfer methods and patterns;
- solicited input regarding the thought paper from selected individuals involved in related fields or concerns;
- identified and categorized alternative approaches and strategies for transferring knowledge; and
- defined the pros and cons of the approaches and strategies.

Walcoff & Associates delivered an oral briefing and a written report recommending a strategy for designing and implementing a transfer of knowledge dialogue.

3.3.3.2 Subtask Title: Transfer of Knowledge Discussion
Subtask Period: September 15, 1986 - February 15, 1987
Walcoff Manager: William Hart
CDRD Manager: Frederick A. Koomanoff

CDRD sponsored a Transfer of Knowledge Seminar at George Washington University in February 1987. Its goals were to assess the suitability of a one-day seminar to communicating CO_2 research issues and to seek specific recommendations from the eight participants regarding changes that might affect the transfer of knowledge from scientists to policymakers. Twenty-five thousand dollars ($25,000) was budgeted for this task.

Walcoff & Associates performed the following services in support of the seminar:

- selected and arranged the meeting site;
- prepared orientation materials;
- identified candidate participants;
- invited and oriented selected participants;
- attended and documented the discussion; and
- prepared a summary of meeting and recommendations for next research step.

3.3.3.3 Subtask Title: Transfer of Knowledge—Outreach Program Design
Subtask Period: May 1, 1987 - June 15, 1987
Walcoff Manager: Carol Walcoff
CDRD Manager: Frederick A. Koomanoff

In exploring the transfer of knowledge from scientists to policymakers, CDRD developed an increased appreciation for the importance of a group characterized as communicators and their role as information gatekeepers. Using a budget of fifteen thousand dollars

($15,000), **Walcoff** was charged by CDRD to identify outreach programs that could be developed to support and enhance the transfer of knowledge to communicators in both the short and the long term.

Walcoff staff realized the need to classify different communications outreach approaches to address the varying interests of different communication groups. With this need in mind, **Walcoff** designed an evaluation model that applied a series of filters to proposals for candidate communication outreach program. As a first step, the model entailed continuously generating diverse ideas from a wide resource base. These program ideas were then evaluated to define target audiences. Next, projects were screened according to priorities established by CDRD, relationships among programs, and funds available for implementation.

Using the model, **Walcoff** staff generated proposals for the following candidate projects:

- clearinghouse of non-technical information on the greenhouse effect and CO_2 issues;
- regional speakers' bureaus;
- videotape entitled "The Greenhouse Effect, a Global Research Effort";
- industry brochures;
- "Global Energy Use" breakfasts;
- CDRD staff presentations;
- case studies for law student; and
- "Greenhouse Effects Notes--A Quarterly Publication."

4.0 Annotated Bibliography of Deliverables

Question-and-Answer Booklet: Highlights what researchers know about atmospheric CO_2 and the greenhouse effect for an educated lay public. Presents a balanced, scientifically sound account of the issue in an intelligible, lively fashion. Desktop published text with custom illustrations; 36-page booklet (May 1989).

Research Project of the Month: Summarizes CDRD-supported research and findings for Congressional staff members, researchers in the scientific community, and program managers at sister agencies. Desktop published, with computer-generated graphics. Thirteen issues were published in the series:

Research Project Issues of the Month

Title	Date
The Role of the Ocean in Climate Change Resulting from Increased CO_2	October 1987
The Flux of Methane from Rice Paddies and Biogas Generators in China	November 1987
Oak Seedling Response to CO_2 Enrichment	December 1987
Lessons from the Past—Model Validation Research: Comparison of Simulated and Observed Climate Patterns over the Last 1800 Years	January 1988
Effects of Carbon Dioxide Enhancement of Wheat Under Two Moisture Levels	February 1988
The Prospect of Solving the CO_2 Problem through Global Reforestation	March 1988
Ocean Models in the Global Carbon Cycle	April 1988
Controlling CO_2 Concentrations in Free Air Experiments	May 1988
Comparison of Model Simulations from Four Circulation Models	June 1988
Climate in China After the Tambora Eruption of 1815	July 1988
Greenhouse Warming Could Magnify Positive Effects of CO_2 Enrichment on Plant Growth	August 1988
Circulation Model of the Oceanic Carbon Cycle	November 1988
Regional and Seasonal Analysis of the 130-year Northern Hemisphere Temperature Record	January 1989

Superconductivity Papers: Exploratory study of potential impacts (July 1987); article entitled "High Temperature Superconductors and CO_2 Emissions" published as the lead article in *Energy* (June 1989).

CO_2 Research Statement-of-Findings Document: Explains and sums up the knowns, unknowns, and uncertainties discussed in the state-of-the-art reports and companion volumes. Presents this information in language intelligible to the general public. Eighty pages with graphics (January 1987).

CO_2 Presentation: Text and graphics for a presentation on fossil fuel consumption, CO_2 emissions, and their implications; three drafts and final copy (January 1989).

State-of-the-Art CO_2 Research Seminar: Invitations, registration materials, agenda, presentation abstracts, list of participants, and summary of proceedings (December 1987).

PRC/USA Joint Scientific Team Meeting: Invitations, agenda in Mandarin and English; participant itineraries and schedules in Mandarin and English; meeting summaries in Mandarin and English; group photographs; introduction, edited papers, and camera-ready copy for proceedings document; visit report (August 1988).

International CO_2 Issues Workshop: Letters of invitation, meeting information, agenda, workshop synopsis, thank you letters, and meeting report (October 1987).

Workshop on Biological Response to Environmental Charge: Participant list, agenda, invitation, registration materials, and meeting report (October 1987).

Colloquium: Briefing on meeting sites and "strawman" meeting design, participant list, invitation, and meeting announcement (August 1986).

Visit to Oak Ridge National Laboratory: Briefing (August 1986).

Committee Hearing: Summary of hearing on "Atmospheric Ozone Levels and the Greenhouse Effect" held by the Senate Committee on Environment and Public Works (August 1986).

Hydrological Systems Conference: Summary (November 1986).

Oceans Workshop: Agenda (September 1987).

State-of-the-Art Vegetation Database: Updated database (September 1987).

Video and Camera Equipment: Rental of VHS Camcorder with wide angle and zoom lenses and audio capability, two rechargeable batteries and recharger, tripod and cables for use with the Camcorder, 35mm camera with 80-210 lens, carrying cases for both cameras, blank videotapes and 35mm film, and instruction book for Camcorder (June-July 1987).

1987 State-of-the-Art CO_2 Research Seminar: Slate of possible meeting sites, participant list, agenda (July 1988).

Viewgraph Library: Updated library and master index (May 1988).

1986 Research Accomplishments and Plans: Draft and final, camera-ready report (November 1986).

Sea Level Rise: Position paper endorsing a balanced, scientifically sound assessment of sea level rise in the last century and over the next 100 years; draft, final paper, and one-page summary (November 1986).

***Science* Letter:** Two drafts and final letter (November 1986).

Illiteracy: Informal paper (September 1986).

***Challenge Magazine* Article:** Article on the greenhouse effect (January 1988).

Climate and Animal Boundaries in China: Two substantively revised drafts of a scholarly article (May 1988).

Transfer of Knowledge: Thought paper to stimulate contributions to designing the transfer of knowledge process, oral briefing, and written report (December,1986).

Transfer of Knowledge Colloquium: Candidate participant list, invitation, orientation materials, and summary of the meeting and its recommendations (February 1987).

Outreach Program: Proposal documenting a model for outreach design and presenting eight candidate outreach projects (June 1987).