

REPORT TO
BIOLOGICAL AND ENVIRONMENTAL RESEARCH
ADVISORY COMMITTEE (BERAC)

COMMITTEE OF VISITORS

FOR
OFFICE OF SCIENCE
OFFICE OF BIOLOGICAL & ENVIRONMENTAL RESEARCH
CLIMATE CHANGE RESEARCH DIVISION

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PREFACE

The National Science Foundation (NSF) has used Committees Of Visitors (COVs) successfully for years to evaluate their research programs as to quality and effectiveness of program administration. The reports of these committees have been very valuable to NSF by providing feedback on procedures and personnel. In addition and perhaps of even greater importance, COVs provide an opportunity for the community not only to observe internal processes, but to understand those processes and issues with which staff has to deal on a daily basis.

The Office Of Management and Budget (OMB) has found COVs to be quite valuable in evaluating programs and in particular science programs where it is difficult to quantify expectations and sometimes even results. COVs provide useful information for the Congressionally mandated Government Performance and Results Act (GPRA) that requires all Federal agencies to evaluate and report on the results of their activities annually. In addition, OMB has begun a new program for evaluating Federal programs called PART (Program Assessment Rating Tool). PART asks questions on relevance (why?), quality (how?), and performance (how well?). COVs can help answer some of these questions.

The mission of the Department of Energy's Office of Science (SC) is to deliver the remarkable discoveries and scientific tools that transform our understanding of energy and matter as well as advance the national, economic, and energy security of the United State. This is accomplished through research supported at universities, national laboratories, and user facilities. There have been regular external reviews of programs at national laboratories and user facilities. There have not been external reviews of Headquarters programs. Committees of Visitors (COVs) will fill that gap.

COVs are a new element in the management of programs within the Department of Energy's Office of Science. The first COV was carried out in March 2002 when the Basic Energy Sciences Chemistry Programs were reviewed. A second COV in 2003 reviewed the Basic Energy Sciences Materials Program. The review of the Climate Change Research Division (CCRD) is the first COV within the Office of Biological and Environmental Research (OBER) and the subject of this report.

ACKNOWLEDGEMENTS

The COV would like to acknowledge the work done by the staff of the Office of Biological and Environmental Research (BER) to prepare for the COV. A COV is a joint effort that can only be successful with sufficient and adequate input from management officials and program officers that are being visited. Interaction with program officers was very useful in helping to understand individual programs and how they are managed. Dr. Jerry Elwood served as the primary contact within BER. He was always available to answer questions. His guidance and suggestions were very helpful in preparing for the COV meeting and in response to the COV's report.

Dr. Ari Patrinos provided the COV with basic information about BER and specifically the CCRD. His comments set the stage for a successful visit. At the completion of the review, he entertained all comments from the COV and seriously responded to those issues that were brought before him.

Without support from Ms. Leslie Runion and Ms. Karen Carlson from the BER staff, the task would have been much more difficult.

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EXECUTIVE SUMMARY

This report is the first of what will be a continuing series of program reviews and evaluations within the Office of Biological and Environmental Research (BER), one of the components of the Department of Energy's (DOE) Office of Science (SC). The Committee of Visitors (COV) reports will be a major factor used in managing the SC's science programs and in addition will contribute to the Office of Management and Budget's (OMB) responsibility to assess how well these programs are performing.

The COV was charged by the Director of the Office of Science to review and evaluate the Climate Change Research Division (CCRD) of the Office of Biological and Environmental Research (BER). The COV was asked to consider and provide an evaluation of two major elements for both DOE laboratory projects and university grants: (1) An assessment of the efficacy, fairness, and quality of the processes used to solicit, review, recommend, and document proposal funding actions and to monitor active projects and programs for progress and outcomes and (2) An assessment of the efficacy and quality of processes used to manage ongoing programs by raising the following questions. Does the process:

- consider the depth and balance in a research portfolio,
- solicit and encourage some exploratory, high-risk research,
- link the research to mission needs of DOE,
- enable the support of coherent suites of projects that are integrated and collectively of added scientific value to programs,
- ensure a reasonable and appropriate turnover of funded investigators to enable and foster the support of new projects and scientists by programs, and
- result in a portfolio of elements and programs that have national and international scientific standing?

The report concludes that processes presently in place that are used to solicit, review, and recommend funding actions for both DOE laboratory projects and university grants are adequate on average. Processes in place to document funding actions for university grants are also adequate; however, those for DOE laboratory projects are inadequate. Processes need to be put in place to document the basis for funding actions of projects at DOE labs. Further, changes can and should be made to modify and standardize documentation of funding actions so that such material in program jackets can be found more easily. Processes used to monitor active programs for progress and outcomes do exist. Since there are several methods used for monitoring programs, it would be useful to standardize that activity. It also should be noted that because of inadequate staffing, program results often are not publicized to the extent that they should be. In summary, the various programs are operating at a level that gets the job done, but through reviews such as this COV, a better and more efficient operation can be had.

The BER/CCRD is a credit to the DOE and an example of the way that Executive agencies should operate. Many of the programs within the CCRD are unique. For example, the Atmospheric Radiation Measurement (ARM) Program is the only program within the US Climate Change Science Program (CCSP) that is observing the atmospheric radiation effects of and on clouds in an effort to develop model parameterizations. It is a program designed and initiated by the DOE. The present Atmospheric Science Program (ASP) is being terminated and

replaced by a much needed aerosol program in response to a need pointed out by OMB. The ability of BER to undertake initiatives and terminate programs makes them a vital player in the interagency climate program. The observational programs, Ameriflux and FACE, are two other programs initiated by DOE and essentially were pioneer climate programs that have now been undertaken by other countries. The terrestrial ecology program is another example of a very well known program. Thus the leadership and initiative of BER in developing and implementing climate research programs makes the DOE a major contributor to the President's climate initiatives and the ongoing US Global Change Research Program.

Each of the nine programs that constitute the Climate Change Research Division (CCRD) was examined by a subset of the COV. Approximately 45% of the awards made in FY 2003 were reviewed. Approximately 9% of the declinations made in FY 2003 were reviewed. Actions that were reviewed came only from FY 2003. A set of templates raising questions about each program was used so all programs would be evaluated in the same way. The questions addressed the following subjects: (1) quality and effectiveness of the program's use of merit review procedures; (2) selection of reviewers; (3) the resulting portfolio of awards; and (4) management of the program. Detailed findings for each program make up a major part of the report. The COV response to each question for each program is included in the report. Suggestions for improvement and change are imbedded within the findings. These need to be addressed by the Program Manager (PM) and the CCRD and BER management.

Common issues that cut across programs were raised during the review. These issues should be discussed by CCRD and BER management with PMs and implemented when and where appropriate. They are summarized as follows: Documentation of materials that should be in the grant and declination jackets needs to be specified and implemented. Integration of CCRD mission programs into the interagency Climate Change Science Program (CCSP) should be continued and expanded since these programs are vital to DOE as well as to the nation. Peer review procedures need to be better articulated and standardized. Reviewers need to be better informed about what is expected from them. Reviewer pools need to be expanded and updated. Program announcements and solicitations need to be more focused and better reflect program goals. National Laboratory and university investigators should be treated equally with regard to what is required from the initiation of a proposal to the completion of a research project. A documented philosophy regarding the role of National Laboratories needs to be stated. Staffing of the CCRD is at a critical point necessitating that a single PM in some cases, must handle several programs to the detriment of the PM, CCRD, BER, DOE, and the science. Nevertheless, the program staff has made the programs operate successfully and provided leadership to the CCSP and to several international endeavors. The report's recommendations focus on improving the COV process for the future. This can be accomplished through the following suggestions: (1) providing responses were made to the first COV findings and recommendations, (2) retaining a few previous COV members on the new COV, and (3) presenting more program material compiled by the staff from results and standardized data sets from several years of proposal jackets. These data need to be made available prior to the meeting of the COV. Information is needed not only from grants, but also from all activities such as declinations, withdrawals, etc. that come to the attention of the PM.

INTRODUCTION

The Director of DOE's Office of Science requested that the Biological and Environmental Research Advisory Committee (BERAC) undertake a review of the Climate Change Research Division (CCRD). The CCRD is a component of the Office of Biological and Environmental Research (BER). BERAC appointed a chair to gather and organize a Committee of Visitors (COV) to undertake the task.

This is the first Committee of Visitors (COV) meeting that has been held within BER and was assembled because the Office of Management and Budget (OMB) requested that the DOE's Office of Science begin to institute COVs as a part of their ongoing response to the Program Assessment Rating Tool (PART). Several other COVs already have been held within the Office of Basic Energy Science (BES) on the chemistry and materials science programs.

The Director of the Office of Science charged the BERAC with the task of assessing some of the research program management processes in the CCRD. These are the processes used to solicit, review, and recommend proposal funding actions. In addition the processes used to manage ongoing research programs, especially the decision-making processes, also were to be assessed.

An expert team was assembled. This team covered the spectrum of scientific disciplines that is supported by the CCRD. A sufficient number of team members were selected so more than one member of the COV would look at each action being reviewed. The team was composed of a majority of members who were not receiving research support from DOE. Research managers as well as individual university Principal Investigators representing a balance of institutions, geographic regions, and gender were included in the team. Members of the COV are listed in Appendix A.

Although the charge to the COV emphasized an assessment of processes, it is difficult not to include a review of the actions of personnel involved in the processes. Therefore, the team emphasized neither process nor personnel, but considered each individual program as a seamless entity that they were asked to review and upon which they commented.

**CHARGE TO THE
BIOLOGICAL AND ENVIRONMENTAL RESEARCH
ADVISORY COMMITTEE (BERAC)**

The Director of the Office of Science charged BERAC with assembling a Committee of Visitors (COV) to assess processes used to solicit, review, and recommend proposal funding processes in the Climate Change Research Division (CCRD) of BER. BERAC also was charged with assessing processes used to manage ongoing research programs, especially decision-making processes.

Specifically, the COV was asked to consider and provide evaluation of two major elements: (1) For both DOE laboratory projects and university grants, assess the efficacy, fairness, and quality of the processes used to (a) solicit, review, recommend, and document proposal funding actions and (b) monitor active projects and programs for progress and outcomes; and (2) Assess the efficacy and quality of processes used to manage ongoing programs by raising the following questions. Does the process:

- consider the depth and balance in a research portfolio,
- solicit and encourage some exploratory, high-risk research,
- link the research to mission needs of DOE,
- enable the support of coherent suites of projects that are integrated and collectively of added scientific value to programs,
- ensure a reasonable and appropriate turnover of funded investigators to enable and foster the support of new projects and scientists by programs, and
- show result in a portfolio of elements and programs that have national and international scientific standing?

The COV was instructed to report its findings to the BERAC. Upon acceptance by BERAC, the COV's report with findings and recommendations will be presented to the Director of the Office of Science.

A copy of the charge letter to BERAC may be found in Appendix B.

RESPONDING TO THE CHARGE

The COV was divided into groups to evaluate the nine (9) separate programs comprising the Climate Change Research Division (CCRD). Each group consisted of at least two members of the COV. Although nine programs are called out as separate entities, four of the programs essentially cover just two disciplines. The Ocean Carbon Cycle Program and the Ocean Carbon Sequestration Research Program were considered as a single discipline by the COV for review purposes. In a similar manner, the Terrestrial Carbon Processes Program and the Terrestrial Carbon Sequestration Research Program were considered together. The major reason for two carbon oriented programs within the oceans and terrestrial disciplines is because the sequestration programs are regarded as components of the Climate Change Technology Program (CCTP) and therefore are funded from a different source than the other programs within the CCRD.

All members of the COV were sent a list of grants in their area of expertise. The list included grants made to universities, other government agencies, and DOE National Laboratories. The National Labs compete for funds as do the universities, but the Labs do not compete against the universities since the funding sources within DOE are separate. Each review group had two lists of grants, one for the National Labs and one for other grant actions. Grants from both sets were numbered randomly so the reviewing group would see a variety of grant actions. The first ten grant actions were distributed to each group to begin the review. COV members were allowed to request specific grant jackets if there were a subject or issue that the team felt they needed to pursue, in addition to reviewing jackets from the randomized lists.

The COV had been told initially that jackets only from FY 2003 would be available for review. Although there were reasons for having only one FY available, this practice should not be continued for future COVs. One year is not sufficient for a representative sample. It is unfair and possibly an error to make judgments based on a single year's activities. A period of three years gives a better representation of a program and the way it is managed. This ground rule should be adopted for future COVs. Having stressed the need for more than a single year's actions to be available for a COV, it also needs to be acknowledged that the CCRD does make funding decisions that embrace more than one year. Should a grant that was looked at be in the second or third year of funding, material and information concerning support for the previous years also was included in the jacket.

PMs during any year have to deal not only with grants awarded, but also with declinations; withdrawals; solicitation responses, both exploratory and real; and proposals returned due to lack of mission relevance. Unless a COV sees what passes over a PM's desk during the year, it is difficult to assess how a program is being managed. The lack of availability of declinations in FY 2003 had been raised in early discussions with BER management. Due to some very good work by BER staff, some declinations were made available for review by the COV.

A program summary written by the PM was sent to each team member prior to the actual review of the program(s) for which the team member was responsible. A plenary session was held initially on the first day of the COV. A historical perspective of DOE and an overview of BER

were presented to set the stage for the review. A number of COV members had had little contact with the DOE, so it was necessary for them to understand why the DOE would be supporting programs such as those found in the CCRD and why those programs were an integral part of the interagency U.S. Climate Change Science Program (CCSP).

Executive sessions were held at the end of each day and at other times when appropriate. It was felt that the entire team should identify and discuss issues of common interest. BER/CCRD management was apprised of progress, needs of the COV, and findings.

The agenda for the COV meeting may be found in Appendix C.

To create and provide a level playing field for all programs, it was decided to use a standard template with a set of questions that addressed the following subjects:

- Quality and effectiveness of the program's use of merit review procedures.
- Selection of reviewers.
- The resulting portfolio of awards.
- Management of the program.

All the questions were to be answered for each of the nine programs being reviewed. Detailed data for each program are presented in the Program Findings section. It was decided to provide all the data collected, editing only where necessary for improved legibility, in order that PMs and BER management would be made aware of the COV's complete evaluation of each program and the findings would be transparent. Program recommendations are embedded in the findings. Only if the same finding were found in other programs would it be highlighted and included among the cross-cutting issues.

The Executive session on March 2nd highlighted issues that were thought to be worthy of discussion by the entire COV. Those issues were brought forward and discussed with Drs. Patrinos and Elwood. And are included in the section on Cross-Cutting Issues Raised by the COV. Perhaps they could be considered as recommendations, since they bear on the way programs are operated and managed.

The section on recommendations contains suggestions for future COVs.

PROGRAM FINDINGS

In a review such as this, there are issues that arise that are not specifically called out in the charge to the COV. Nevertheless, the COV felt it would be prudent to highlight one issue that was felt to be important. It was NIGEC (The National Institute for Global Environmental Change). NIGEC is an academically based institute funded through a cooperative agreement by the CCRD with a national office and six regional centers. Research funded through NIGEC must be relevant to one or more of the core climate change research programs in the CCRD. The COV is concerned about the high overhead costs of NIGEC operations associated with funding a national office and six regional centers. The COV recommends that options be explored to reduce the overhead costs of operating NIGEC without compromising the quality of the research it funds at academic institutions

The program findings section presents material gathered during the reviews of the seven separate programs areas. The findings begin with a summary of the program written by the COV. It is followed by data collected by the COV team responsible for the review using responses to all the questions on the templates. Recommendations and suggestions are embedded throughout the section. Thus the material collected by the COV is presented in its entirety..

Atmospheric Radiation Measurement Program (ARM)

Program Summary - The ARM PM handles a very heavy load of projects. Given the number of proposals the Program Manger handles, the timeliness of the review process for grants is impressive. Some excellent proposals are funded through this important program. Also, Principal Investigators had approximately the same funding success no matter what type of institution they represented (university, DOE laboratory, other). The research sponsored by this program should be a highlight of the *U.S. Climate Change Science Program's Strategic Plan*.

Even though there are many excellent research projects funded by the ARM program, some parts of the ARM funding process need to be improved. Communication between the PM and the ARM science team is vital, but the COV did not see evidence of the science team's input into the proposal selection process. ARM is a very goal-oriented program, but it is not clear how the proposal process meets the goals of the program. The broad RFPs for ARM do not demonstrate the goal-oriented needs of the program. Also, because the infrastructure proposals for ARM are not peer-reviewed, approximately 75% of this program is not evaluated by outsiders. ARM is a program that should be coordinated with other programs within CCRD, but the COV saw no evidence of connections with other programs such as the Atmospheric Science Program. For example, it is not clear how ARM's mission to develop model parameterizations for climate models is related to the U.S. Climate Change Science Program's climate modeling objective that focuses on models at NCAR and GFDL.

The COV reviewed 13% of all the actions that were completed by the Program for FY 2003, 14 grant actions (18%) and 12 declinations (9%).

Program Data -

A. Questions about the quality and effectiveness of the program's use of merit review procedures.

1. **Is the review mechanism appropriate?** No. It seems inappropriate that ~75% of the budget is for infrastructure and was not reviewed by the COV. We did not see the reports that the infrastructure was reviewed so the COV could consider the program balance. Such balance could be achieved by a review panel for the proposals or by a steering committee to overview the entire program in addition to the mail review. A future COV should look at both the proposals as well as the support for the infrastructure.
2. **Is the review process efficient and effective?** Yes. The review process seems timely; however, it isn't clear to what extent the process focuses on achieving the goals of ARM.
3. **Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines?** Yes. Some reviewers mention the proposal's importance to ARM, some do not. We suggest adding a question about relevance to ARM goals for reviewers. The COV did not see the instructions to reviewers. We suggest that these instructions be provided to future COVs.
4. **Is the documentation for recommendations complete and does the program officer provide sufficient information and justification for her/his recommendation?** No. Only for the university awards does the PM supply comments to justify the decision. No justification for university declines or National Laboratory awards or declines is given.
5. **Is the time to decision appropriate?** Yes. As far as can be determined from the documentation provided, the time seems appropriate.
6. **Issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures.** Much of the program is not reviewed. It is not clear if there are well-defined goals that are being met by the research. It is not clear how the program is coordinated with other programs within CCRD.

B. Questions concerning the selection of reviewers.

1. **Did the program make use of an adequate number of reviewers for a balanced review?** Yes. Usually there are three reviewers. This is generally adequate for most proposals, but not for proposals with large budgets or multi-institutional collaborative proposals.
2. **Did the program make use of reviewers having appropriate expertise and/or qualifications?** Generally yes, with some notable exceptions. There were some reviewers whose affiliations were not known to COV. Only names were given. When the name was not recognized and there was no affiliation, it was difficult to assess the qualifications or expertise of the reviewer.

3. **Did the program make appropriate use of reviewers to reflect balance?** Data were not available.
4. **Did the program recognize and resolve conflicts of interest when appropriate?** Data were not available. CCRD does have guidelines for COI that are commonly used by granting agencies. These guidelines apply to reviewers and to Principal Investigators (PI). Usually documentation occurs only if there is a panel review or a mail reviewer is identified after a proposal has been sent out for review. The COV did not notice any conflicts of interest and no conflicts of interest were highlighted by program officer.
5. **Concerns identified that are relevant to selection of reviewers.** None.

C. Questions concerning the resulting portfolio of awards under review.

1. **Overall quality of the research projects supported by the program.** Appropriate. The overall quality of projects is good, but the COV is not sure if the projects are focused on the goals of ARM.
2. **Are awards appropriate in size and duration for the scope of the projects?** Yes. The budgets and scope were adjusted in response to reviewers' comments. It is not clear why some of the projects were so much bigger than others and why some of the biggest projects went to other government research labs such as those funded by NASA.
3. **Does the program portfolio have an appropriate balance of high-risk proposals?** No. No conspicuous high-risk proposals were funded among the proposals that were reviewed. Instead, most were conservative proposals likely to succeed in achieving their objectives. High risk proposals are those that push the envelope and in many cases do fail, but they are thought to be worth the risk to see if they are able to do what is proposed. One or two such proposals that get funded would indicate that the PM is willing to take a risk rather than support only proposals that are most certain to succeed.
4. **Does the program portfolio have an appropriate balance of multidisciplinary proposals?** No. The program and RFPs are very focused. Therefore, there are not many multidisciplinary proposals.
5. **Does the program portfolio have an appropriate balance of innovative proposals?** No. Most of the proposals build on previous work rather than making a jump or even a transition into a new area of research.
6. **Does the program portfolio have an appropriate balance of funding for awards to individuals and the national laboratories?** Yes. For the grant part of the program the funding success rate is approximately the same as for DOE laboratories, universities and others (non-DOE government labs and foreign government labs). The funding success rates are 42%, 35% and 36%, respectively.
7. **Does the program portfolio have an appropriate balance of awards to new investigators?** Data are not available. New investigators can be of two types,

those who have not had support from the program previously or young investigators who are proposing for the first time. Keeping statistics on this issue at the division level or even the program level would be helpful.

8. **Does the program portfolio have an appropriate balance of geographical distribution of Principal Investigators?** Adequate.
9. **Does the program portfolio have an appropriate balance across disciplines and sub-disciplines of the activity and of emerging opportunities?** Not appropriate. There seemed to be an inequity between modeling and measurement proposals. It is not clear that the program is taking advantage of the measurement community to make the measurements needed for the program to be successful.
10. **Does the program portfolio have appropriate participation of under represented groups?** No data were available. This is a sensitive area, yet it is one on which questions are asked continuously. Some agencies do provide a set of questions that address this issue as a part of their grant application form. Answers to the questions are optional. In DOE apparently, any such questions are not allowed to be asked, so no data are available.
11. **Is the program relevant to national priorities, agency mission, relevant fields and other customer needs?** Yes. The program is relevant to the *Strategic Plan for the U.S. Climate Change Science Program* though it was not highlighted in that report.
12. **Concerns identified that are relevant to the quality of the projects or the balance of the portfolio.** It is not clear how ARM's mission to develop model parameterizations for climate models is related to the U.S. Climate Change Science Program's climate modeling objective that focuses on models at NCAR and GFDL. Neither is it clear how the PM is assessing the proposals' relevance to ARM's goals. It is not clear if the ARM science team has any input into these decisions. The RFPs are very broad and it is not clear whether the proposals solicited by the RFPs do meet the ARM goals.

D. Management of the program under review.

1. **Management of the program.** It is a large program so the PM has a very heavy load, but still makes timely decisions. The PM is funding well-known researchers with proven track records. The COV did not see the infrastructure reviews. It is not clear how the science team's input is being included in the program management. It also is not clear how gaps in the program are being recognized and addressed.
2. **Responsiveness of the program to emerging research.** It appears that 75% of the program is not evolving. It is encouraging the further development of models, but it is not driving new instrumentation and measurements.
3. **Program planning and prioritization process (internal and external) that guided the development of the portfolio under review.** The COV is not sure what the planning process is. It seems unusual that a very goal-driven program

like ARM would have such a broad RFP. We cannot determine if the PM is prioritizing the proposal selection to meet ARM goals. For a program with a budget this size, the amount available for grants is very small, so we expect prioritization to be important but do not know how it is achieved in the selection process.

4. **Concerns identified that are relevant to the management of the program.** For the next COV, the PM could help by providing the planning documents and methods of determining whether investigators are moving towards ARM goals. Statistics should be kept on funding, new investigators, young investigators, minority investigators, etc. Future COVs need to have more complete and consistent documentation on both accepted and declined proposals. Information on the PM's decision process should be included. It is not clear if the funded investigators see the reviews. The PM should provide funded investigators with copies of their reviews so they can benefit from authoritative criticism. It would be useful to know specifically what is needed to meet the ARM goals listed in the RFP. Is there some document outlining why each topic listed in the RFP request is needed? For example, "climatological properties of aerosols using ARM data" is listed in the RFP. What properties need to be measured? Why should this be done with ARM data as opposed to with a new measurement? Are the data sufficient for what you are trying to determine, etc? Another example: "development of new cloud and radiation parameterizations". What kind of parameterizations those that are computationally faster or those that are more accurate? What ARM goal is being met by parameterization?

Atmospheric Science Program (ASP)

Program Summary - The Atmospheric Sciences Program (ASP) historically focused on atmospheric chemistry and meteorology of energy-related pollutants. Existing files of accepted proposals and associated information about specific solicitations all stem from this role. Funding for these programs will be reconfigured in FY 2005 into a program on the role of tropospheric aerosols in the climate system. This is being done in response to research needs identified in the CCSP strategic plan. The reconfiguration is appropriate and more importantly is exactly the type of paradigm shift that federal agencies should take in response to interagency program needs. DOE is to be commended for committing to this new focus.

It was found that the ASP Program was well directed by the PM and that documentation was in accordance with existing directives. Information on declinations and negotiations/discussions with selected investigators was not available except from the PM. This limited responses to some of the questions on the report template. One of the documents provided was the ASP Strategic Plan, which is a well-prepared and well-thought out plan on how the ASP program would evolve. It was apparent from the proposal files that proposers had been made well aware of the content of the strategic plan. This is to be commended. The development of strategic plans and the use of the plans to guide proposal preparation and ultimate selections should be common practice in the division. Conclusions drawn from these files and discussions indicate that the reconfigured aerosol program will be well managed.

It was, however, the absence of information and/or documentation of the rationale on declined proposals and a general sparseness of decision documentation (e.g., funding decision rationale, discussions with PIs, funding changes, scope adjustments), in the jackets for funded proposals that was most problematic. As a general rule, existing documentation was marginal for the purposes of the COV and, to COV members, insufficient for documentation of programmatic decisions. The lack of documentation for declined proposals was perceived to be a major shortfall. The PM willingly explained the circumstances of the “reconfiguration” and how it affected some decisions involving highly ranked proposals. This rationale was not contained in any documentation file and as a result leaves room for speculation and doubt. The COV reviewers recommend that the rationale for all funding decisions, especially those involving highly ranked proposals that are not funded, be maintained and contain a thorough rationale for the decision.

The direction to develop a new program, nearly from scratch, affords the PM a rare opportunity. The division is strongly encouraged to take full advantage of the opportunity and to ensure that the observations and recommendations of the COV be seriously considered in the implementation and execution of the aerosol program. This would include recommendations to: take full advantage of the expertise extant in the National Laboratories, form a science leadership panel to assist the PM extend his expertise and thought processes, include expertise from the full spectrum of research expected to be supported from molecular scale research to global aerosol distributions and models, develop a science team involving both national laboratory and non-DOE scientists as appropriate to the goals and needs of the program, and evolve the program in time to more fully address the scope provided by the CCSP.

The COV reviewed 18% of all the actions that were completed by the Program for FY 2003, 20 grant actions (53%) and 10 declinations (8%).

Program Data –

A. Questions about the quality and effectiveness of the program’s use of merit review procedures.

1. **Is the review mechanism appropriate?** Yes. The individual proposals are reviewed first by mail and then by a relevance review panel. More complete documentation is needed, especially for laboratory proposals, declined proposals, and relevancy review.
2. **Is the review process efficient and effective?** Partially. It is difficult to assess and difficult to tell how efficiently the process was completed. The dates of when reviews were sent out, when received, and when awards were made were not recorded or not easily determined. Likewise, limited documentation inhibited an assessment of the effectiveness. Review comments for funded proposals were available but only for non-lab proposals. For effective review, documentation for the funding cycle process, declinations, scoring summaries, and resolutions for scoring disagreements need to be available. PM working files contained much of

the needed information and were made available. The files were maintained in accordance with DOE directives, but were not sufficient for review purposes.

3. **Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines?** Partially. Reviews are in accordance with the DOE evaluation form, but the form questions are intended for general application and do not help reviewers focus on the specific solicitation. There is particular concern about the determination of the numerical score due to its importance in the evaluation results. Reviewers should be given guidelines as to how to weigh criteria to determine the numerical score. While the solicitation states that the current criteria are listed in priority order the lack of specific guidelines does not promote consistency between reviewers in assigning numerical scores. The absence of specific guidelines extends a similar concern to reviewer's comments and possibly to a frequently observed inconsistency between reviewers' comments and numerical scores.
4. **Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation?** Partially only for non-DOE laboratory accepted proposals. There is a lack of documentation on how decisions were made for grants to the DOE national laboratory PIs as this was not required in the past. The program has not had a call since 2000. It is now refocusing its major efforts. Documentation for non-lab proposals is generally not sufficient. Issues used to determine criteria beyond numerical ranking, such as balance and relevancy, were not documented in any formal sense.
5. **Is the time to decision appropriate?** Yes, apparently. There was insufficient data available to address this unequivocally, but the typical time to award was found to be about 6 months in the few cases examined. This is considered an adequate response time and faster than comparable agencies.
6. **Issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures.** Major issues that could contribute to a more effective COV in future are listed below:
 - Maintain lab proposal review documentation.
 - Maintain summary documentation of review results for all proposals received in response to solicitation. This should include reviewers, all scores, award amounts, duration, proposal title, PI, Institution, and decisions.
 - Maintain declination documentation and reasoning.
 - Maintain documentation of resolution of scoring disparities in files.
 - Maintain documentation of efforts to resolve scores and comments within a given proposal when scores do not reflect apparent intent of written comments.
 - The records should be maintained electronically which would facilitate use by COV.
 - The evaluation form should be revised to reflect DOE criteria and more effectively guide reviewers in assigning numerical scores in agreement with stated DOE priorities.
 - It does not appear that peer review is the only driver used in making funding decisions. Other drivers, however, do not appear to be

documented.

B. Questions concerning the selection of reviewers.

1. **Did the program make use of an adequate number of reviewers for a balanced review?** No. The reviewer pool needs to be broadened. We recommend that the PM work with other people in the SC and other Federal Agencies to develop a broader list of possible reviewers. It is recommended that a science panel be established for each solicitation to confirm appropriate assignment of reviewers. Three is the absolute minimum of reviewers for each proposal. If the reviewers do not agree, additional reviews are required. In no case should DOE staff serve as reviewers, nor should awards be made with fewer than three reviews.
2. **Did the program make use of reviewers having appropriate expertise and/or qualifications?** Generally yes for non-lab proposals. While in many cases reviewers were assigned appropriately, some reviewers were asked to review proposals outside their area of expertise. There is conceivable rationale for this – specific aspects of the proposal or specific applications of the research results - however, no rationale appeared in the files to document if this were the case. In general, a majority of reviewers should be knowledgeable in the area of the proposal.
3. **Did the program make appropriate use of reviewers to reflect balance?** No. Proposals appeared to be preferentially assigned such that most DOE lab proposals were reviewed by non-DOE reviewers and vice versa. This raises questions about the match between reviewer expertise and proposal focus.
4. **Did the program recognize and resolve conflicts of interest when appropriate?** No comments in any file reflected identification of conflicts-of-interest or resolution thereof. CCRD does have guidelines that weed out conflicts, but documents only those that come from panel reviews or are identified in a mail review after the proposal has been sent to the reviewer.
5. **Concerns identified that are relevant to selection of reviewers.** Some significant issues arose out of the effort to look at the assignment of reviewers as discussed above.

C. Questions concerning the resulting portfolio of awards under review.

1. **Overall quality of the research projects supported by the program.** Funded projects examined appeared to be of high quality. A limited cross-section of files was available to be examined due to dramatic changes in the direction of the Atmospheric Sciences Program. This redirection is specifically to focus an effort of critical mass on the CCSP identification of a need to improve understanding and model representation of climate-aerosol connections. This redirection terminated one or more solicitation award sequences, limiting the number of completed awards to be examined stemming from award actions in the last year.
2. **Are awards appropriate in size and duration for the scope of the projects?**

Yes. There are no issues. This was appropriately addressed in the peer review process.

3. **Does the program portfolio have an appropriate balance of high-risk proposals?** It is in reality unknown, but evidence would suggest there are not many high-risk projects. An insufficient number of funded/declined projects were examined to evaluate the issue. For the next COV, the PM should provide summary information on what are considered to be high-risk projects.
4. **Does the program portfolio have an appropriate balance of multidisciplinary proposals?** Sufficient data were not available so the issue is unknown. As above, an insufficient number of funded proposals were available to be examined to permit a useful response. The next COV should be given information from the PM about multi-disciplinary proposals. Where appropriate, solicitations should encourage multi-disciplinary collaboration to address large-scale problems.
5. **Does the program portfolio have an appropriate balance of innovative proposals?** This is a complicated question to answer because it is very subjective and dependent on individual perceptions. We could not conclude that there is or is not an appropriate balance.
6. **Does the program portfolio have an appropriate balance of funding for awards to individuals and the national laboratories?** This is unknown because of lack of a documented strategic intent for the research program and the particular solicitation. It is apparent that there is a difference between how laboratory and non-laboratory proposals were treated. This is inconsistent with the stated intent for equal treatment; however, we do not believe that lab and non-lab proposals can be treated equally in all respects. DOE supports the existence of National Laboratory research programs for a myriad of reasons. That implies there could be a difference in what research will be supported and to what national lab that support might be given.
7. **Does the program portfolio have an appropriate balance of awards to new investigators?** This also is unknown because there is no documentation on young/new investigators. There probably is a better future support path for National Laboratory young investigators who come in as part of a large proposal than for a new young investigator sending in a first proposal from a university.
8. **Does the program portfolio have an appropriate balance of geographical distribution of Principal Investigators?** Not apparent. No awards were noted to regions of low Federal funding.
9. **Does the program portfolio have an appropriate balance across disciplines and sub-disciplines of the activity and of emerging opportunities?** A large amount of overlap was noted among those proposals that were supported, especially among the University proposals. Emerging opportunities appear to be under-represented, for example in chemistry and nanoscience. The program is undergoing dramatic redirection to address specific issues identified in the CCSP Strategic Plan dealing with aerosol-climate connections. This will require new databases and modeling approaches and may involve the need for cutting edge measurement technologies. The PM needs to be aware of the impact of currently under-funded disciplines and have resources to invest in appropriate high-risk and

innovative research efforts.

10. **Does the program portfolio have appropriate participation of under represented groups?** There was no documentation provided to address this question due to restrictions on asking for such information. As a result, there may have been some missed opportunities.
11. **Is the program relevant to national priorities, agency mission, relevant fields and other customer needs?** Yes, based on COV knowledge. The redirection of the program to tropospheric aerosols is strongly supported. The issue is critical to resolving uncertainties about the relationship between energy use and climate and the affect of aerosol on direct and indirect radiative forcing. Chemistry will play a key role in understanding how aerosols are formed and processed. We commend DOE in their mission to find important gaps related to energy-impacts on the environment and support these efforts.
12. **Concerns identified that are relevant to the quality of the projects or the balance of the portfolio.**
 - Due to redirection of the program, the PM requires broader community input. We recommend a scientific advisory board to assist a new chief scientist. The PM needs to consult with this board in selection of reviewers and establishment of balance across the program relative to laboratory versus non-laboratory funding, risk, evolving scientific opportunities, and other balance issues.
 - Complete documentation concerning award decisions needs to be available. Documentation needs to be actively managed. Requirements for continuity of PI participation should be documented as a part of the proposal selection process. Consideration of balance and duplication need to be applied in a consistent manner.
 - With the new CCSP document, it is important to assure that the portfolio decisions are clearly connected to the overall mission of the division and the objectives of the CCSP.
 - The balance of the portfolio obviously must include laboratory efforts, either for facility support or research. There is no documented philosophy about the differences expected between laboratory roles and the roles filled by non-lab research efforts. The absence of a documented philosophy leaves the impression that the division apparently uses an *ad hoc* process.
 - Improvement of the application process is necessary not only to minimize duplication and expenditure of effort on the part of the proposers, but also to assure that pre-applications are not used to preempt the peer review process.

D. Management of the program under review.

1. **Management of the program.** In general the PM is doing a very good job, especially in light of the limited resources that are available.

All of the proposals funded were encompassed within the solicitation; however, the balance of selected proposals was not consistent with breadth and balance put forth in the call. This is likely due to limitations of available funds.

For the new aerosol program a chief scientist has been appointed and there are

plans to establish a science leadership group. This is commendable. It is recommended that this group include representation from areas of expertise including aerosol chemistry, but broader than traditional atmospheric chemistry (e.g. molecular-scale and/or laboratory research).

It is apparent that the PM maintains working files at a level of documentation that far exceeds the formal requirements of the organization. The PM's efforts to develop a strategic vision and an apparent insistence that proposals respond to that vision is commendable and should be expanded upon. Organization management requirements for documentation need to be improved.

2. **Responsiveness of the program to emerging research.** We felt this question should be expanded to address "emerging research and needs."

Concerning "needs," DOE is responding to the need to aggressively address aerosol impacts on climate with the establishment of a new aerosol-climate research program. This is to be commended.

Concerning "research," the breadth of the research that will be proposed will challenge the PM. He will require scientific input and advice as has been addressed above. The chief scientist needs to be centrally involved in articulating the research needs of the new program, but his expertise requires augmentation in areas such as new instrumentation possibilities or development and new computational approaches.

The Atmospheric Sciences Program is being redirected by DOE to address directly aerosol-climate issues as identified in the *CCSP Strategic Plan*. That plan identifies aerosol impacts on climate as a significant area requiring new research effort to address "climate-relevant chemical, microphysical, and optical properties, and spatial and temporal distributions, of human-caused and naturally occurring aerosols."

3. **Program planning and prioritization process (internal and external) that guided the development of the portfolio under review.** Documentation that this was being done was not made available. Having such information would be necessary to be able to respond to this question.
4. **Concerns identified that are relevant to the management of the program.** With rapidly evolving and emerging technologies and capabilities, DOE management needs to address actively the requirement for the PM to be able to keep up with changes. We recommend that the PM be offered periodically the opportunity to attend germane meetings and conferences and perhaps spend an extended period of time in a scientific institution. We perceive that current practices do not allow this to occur easily.

The NARSTO (North American Research Strategy for Tropospheric Ozone) activity was documented in a sparsely documented jacket. Participation in NARSTO is considered to be important to DOE, but the file content did not permit substantive comments about how this program is being managed.

Like NARSTO, management of facilities is not articulated in any documentation. Support for the G-1 aircraft, the subject of one jacket provided for review, is

considered highly significant, especially to the new aerosol program. At \$1 million of funding, it would appear to be an underfunded resource that could be heavily leveraged with modest increases in funding (i.e. significant increases of usage with modest increases in funding since the fundamental support costs have already been invested).

The redirection of the ASP to address objectives of the CCSP Strategic Plan (questions 3.1 and 4.1 in part, plus others) will likely require a broadly-based aerosol research program involving fundamental research extending from the molecular level (aerosol sources and life cycle processes) to the global distribution of aerosols and their resulting climatic impact. This will require a mix of research and technical expertise not represented in classical atmospheric sciences research. Similarly, technologies may be required that are usually outside the scope of typical atmospheric aerosol research efforts. These considerations suggest that the PM will need to ensure that his scientific leadership team for the DOE aerosol research initiative includes expertise appropriate to understanding innovative research efforts and instruments that may be proposed to the new program in order to address physical and chemical processes at very small scales.

Climate Change Prediction Program (CCPP)

Program Summary – The Panel reviewed the Climate Change Prediction Program. We reviewed the contents of the jackets for nine proposals that received awards, 5 from Universities and 4 from National Laboratories, as well as 6 proposals that were declined, all from Universities. Our Panel found that the review procedures used by the CCPP in recent years had been satisfactory. The reviewers used were well qualified (although rather limited in number) and generally provided thoughtful reviews. The acceptances we reviewed all were worthy of funding and the declinations we saw did not review strongly enough to be funded. Good justifications were prepared by the PM for University proposals that were selected for funding. Nevertheless, like other Panels, we were disappointed to learn that the PM was not required to write justifications for declined University proposals. We also were surprised to see that proposals submitted from National Laboratories were not required to be as well developed as ones from Universities and that the jackets for these proposals included little justification even for proposals selected for funding.

The introductory presentations by Ari Patrinos and Jerry Elwood, together with our subsequent discussions, seemed to stress that the BER/CCRD developed "niche" or "segment" programs. The funded proposals we reviewed seemed to support this view. Four of these proposals were for climate model development work from the computing science and numerical procedure standpoints (at LBNL, LANL, NPGS, and a partnership of CSU/UCLA/NPGS). Two of the proposals received funding to enhance computer facilities (LBNL, LLNL). Two proposals were confined to analysis of archived model output (SIO) and paleoclimate data (SUNYA). The other proposal was for a financial transfer to support NOAA participation on an interagency panel. The LLNL computing facility funding request included additional funding to bring a University of Michigan faculty member to LLNL for a sabbatical. Thus, the emphasis of the CCPP seems to be on developing the capacity for climate modeling. It probably is unlikely that any of these nine proposals would have received NSF support. In contrast, the six declined proposals we saw were more like standard NSF proposals focused on specific scientific problems.

The COV reviewed 28% of all the actions that were completed by the Program for FY 2003, 9 grant actions (17%) and 6 declinations. The total number of declinations made during the year was not determined.

Program Data –

A. Questions about the quality and effectiveness of the program’s use of merit review procedures.

1. **Is the review mechanism appropriate?** Yes. Reviews are of high quality (depth & breadth). Mail review (ad hoc) process seems appropriate. For large multi-institutional proposals, we recommend using more than 3 reviewers.
2. **Is the review process efficient and effective?** Yes.
3. **Are reviews consistent with priorities and criteria stated in the program’s solicitations, announcements, and guidelines?** Yes. For the cadre of experienced reviewers that seems to be used, reviews seem appropriate in this regard. Nevertheless, use of focused guidance to reviewers should be emphasized, especially when younger reviewers are used.
4. **Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation?** Yes for awards made, but no for declinations. For declinations, we suggest (1) justification statements in jackets should be as well developed as those for awards and (2) more explicit letters need to be sent to PIs indicating the reason(s) for declination (e.g. lack of funds, off-target, poor science, etc.)
5. **Is the time to decision appropriate?** Yes. The time cannot be shortened without possibly compromising the quality of reviews and the review process.
6. **Issues identified by the COV concerning the quality and effectiveness of the program’s use of merit review procedures.** See above and below.

B. Questions concerning the selection of reviewers

1. **Did the program make use of an adequate number of reviewers for a balanced review?** Yes, as noted above, it may be desirable to have more than 3 reviewers for large, multi-faceted, multi-institutional proposals.
2. **Did the program make use of reviewers having appropriate expertise and/or qualifications?** Yes, reviewers were well qualified and furnished insightful reviews.
3. **Did the program make appropriate use of reviewers to reflect balance?** Guidelines concerning “balance” were insufficiently defined by the COV to allow

us to address this issue.

4. **Did the program recognize and resolve conflicts of interest when appropriate?** Jackets did not contain information on this issue. Although guidelines do exist, documentation occurs only from panel reviews or if a mail reviewer is found to be in conflict after a proposal has been sent out for review.
5. **Concerns identified that are relevant to selection of reviewers.** We encourage the development of a strategy to enlarge the reviewer pool through selective addition of younger reviewers.

C. Questions concerning the resulting portfolio of awards under review.

1. **Overall quality of the research projects supported by the program.** Generally very high.
2. **Are awards appropriate in size and duration for the scope of the projects?** Yes, quite appropriate.
3. **Does the program portfolio have an appropriate balance of high-risk proposals?** We recognize that some high-risk proposals are being supported.
4. **Does the program portfolio have an appropriate balance of multidisciplinary proposals?** Portfolio of projects reflects adequately the inherently multidisciplinary nature of climate modeling and dynamics of climate system.
5. **Does the program portfolio have an appropriate balance of innovative proposals?** This clearly is the case for an appropriate fraction of the proposals we saw.
6. **Does the program portfolio have an appropriate balance of funding for awards to individuals and the national laboratories?** The COV did not feel that they could determine this issue without a great deal of discussion for which there was insufficient time available. Also, this issue is beyond the scope of the COV review.
7. **Does the program portfolio have an appropriate balance of awards to new investigators?** Data are not available. New investigators are those that are seeking support for the first time and have not been supported by the program previously. Such information should be retained by the PM for future COVs.
8. **Does the program portfolio have an appropriate balance of geographical distribution of Principal Investigators?** Data are not available.
9. **Does the program portfolio have an appropriate balance across disciplines and sub-disciplines of the activity and of emerging opportunities?** Data are not available and this is beyond the scope of our charge. This information should be tracked and retained for future COVs.
10. **Does the program portfolio have appropriate participation of under represented groups?** The small sample to which we were exposed did not have

strong diversity. Obtaining such information is difficult due to restrictions imposed within the DOE.

11. **Is the program relevant to national priorities, agency mission, relevant fields and other customer needs?** Yes, it is. It needs to be more strongly related to the CCSP Strategic Plan. The DOE is a very important member of the CCSP interagency team through its contribution to several programs that would not exist without the DOE. This relationship needs to be reinforced and vocalized continually by the DOE.
12. **Concerns identified that are relevant to the quality of the projects or the balance of the portfolio.** There is a need for increased emphasis on regional-scale modeling. This area (a) has many scientific challenges and (b) provides the link with impacts work that will become increasingly important. DOE has an important opportunity to be a leader in this area

D. Management of the program under review.

1. **Management of the program.** The program seems to have been quite well managed.
2. **Responsiveness of the program to emerging research.** We strongly encourage the transformation of the present “niche-type” climate program into a more proactive program that reflects the DOE mission from the energy-climate perspective. Such a program would be at the forefront of developing national climate initiatives (e.g., CCSP). We also urge that the programs seek access to the highest-power DOE computational facilities.
3. **Program planning and prioritization process (internal and external) that guided the development of the portfolio under review.** See comment immediately above.
4. **Concerns identified that are relevant to the management of the program.** An important management aspect requiring improvement is the maintenance of the proposal jackets. These will need to be better organized and made more complete. Most importantly, the files for declined proposals should contain the same materials (including justification of decisions) as those for funded proposals. We encouraged strongly the transformation of the present “niche-type” climate program into a more proactive program that reflects the DOE mission from the energy-climate perspective and is at the forefront of developing national climate initiatives (e.g., CCSP).

Ecosystems Program

Program Summary - The Ecosystems Program is a very focused set of activities that revolve around a small number of large ecosystem manipulations. The program has funded several FACE experiments, soil warming experiments, and the Walker Branch watershed manipulations at Oak Ridge National Laboratory. Since DOE made the programmatic decision to focus the Ecosystems Program in this way, it has become the national leader in sponsoring such research studies of the responses of ecosystems to warming and increases in atmospheric CO₂. Associated research studies are funded primarily to explore other ecosystem parameters that are not fully covered in the main experimental manipulations. The Ecosystems Program has been very productive scientifically over the years.

The COV reviewed 31% of all the actions that were completed by the Program for FY 2003, 16 grant actions (100%) and 0 declinations (100%).

Program Data -

A. Questions about the quality and the effectiveness of the program's use of merit review procedures

1. **Is the review mechanism appropriate?** Yes. Panels and mail reviews were used. We had information on only one solicitation. The panel was reasonably large, 17 people. Proposals had a minimum of three and a maximum of five reviewers.
2. **Is the review process efficient and effective?** Yes. The reviews themselves seemed for the most part to be fine. There were generally good comments provided on the scientific and technical merit. Issues identified were clearly specified so the PI and PM could respond.
3. **Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines?** Yes, in that the reviews themselves cover the criteria, but the criteria as stated are extremely general. No, they are not consistent in that the proposals funded are far more narrow and more focused than the solicitations. The funded program is essentially a few large-scale ecosystem manipulations plus process studies that support them. The actual solicitation is much broader than this.
4. **Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation?** Sometimes. Selection memos to DOE management only exist for university and other government agency PI's. They do not exist for National Lab proposals. Award letters to PI's are pro forma. Selection memos generally have some sort of record of a phone conversation between the PM and the PI, although this is variable. There is no documentation of a letter or e-mail from the PM to the PI requesting responses to reviews. There are only a couple of exceptions (one of these is for a lab proposal). There are only a couple of records where the PI has written something back to the PM responding to reviews. This puts a big burden on the PM, as he has essentially no documentation from the PI's themselves on how they would respond to the reviews.

5. **Is the time to decision appropriate?** There were no summary statistics provided on this issue. There is a general Office of Science solicitation every year, but not a specific program solicitation. Since there seems to have been no complaints in the community on the time taken from submission to award, the time seems to be appropriate.
6. **Issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures.** While the panel for this solicitation seemed fine, was reasonably large, and certainly was technically and scientifically competent, the ecology community is rather small. There is a systematic and disturbing difference between the documentation of the review process for National Lab proposals and outside proposals. Documentation for the former is lacking important documentation. Often there are no responses to reviews, no selection memos, and in two cases, no actual proposals. In one case, reviews of a substantial lab proposal were quite lukewarm, but the proposal was funded essentially without comment with no documentation of any discussions that might have been had with lab management or the PI's on how to respond.

B. Questions concerning the selection of reviewers.

1. **Did the program make use of an adequate number of reviewers for a balanced review?** Yes, from a technical perspective. Enough reviewers were used for scientific adequacy from a technical standpoint.
2. **Did the program make use of reviewers having appropriate expertise and/or qualifications?** Yes.
3. **Did the program make appropriate use of reviewers to reflect balance?** There were only a few women (3/17) in the review panel or mail reviews.
4. **Did the program recognize and resolve conflicts of interest when appropriate?** There is a form that must be signed by all reviewers indicating that they do not have a conflict of interest. If the reviewer does not sign the form his/her review is not considered. There was no documentation of what constitutes a significant potential conflict in DOE's determination, nor an indication that there is a common procedure for how reviewers have to address it.
5. **Concerns identified that are relevant to selection of reviewers.** We are somewhat concerned that women scientists are under-represented both as reviewers and funded investigators.

C. Questions concerning the resulting portfolio of awards under review.

1. **Overall quality of the research projects supported by the program.** The general quality of the research is high. PI's generally are very productive and the scientific output is good. The list of publications over the last few years was very impressive.
2. **Are awards appropriate in size and duration for the scope of the projects?** They are appropriate. There do not seem to be any issues here, for the most part.

There are some experiments that have been funded for many years for which this could become an issue, but the reviewers seem to be sensitive to this concern.

3. **Does the program portfolio have an appropriate balance of high-risk proposals?** It is hard to judge. Once the programmatic decision to focus on large-scale manipulations was made, the consequence is that additional research projects are supportive of particular components of ecosystem responses to those manipulations. For the most part, those are not high-risk, methodologically novel efforts.
4. **Does the program portfolio have an appropriate balance of multidisciplinary proposals?** Again, this is difficult to judge because of the very focused nature of the program. Over the entire program, there are many different kinds of measurement methods used, but this is not for the most part an interdisciplinary program, nor should it necessarily be.
5. **Does the program portfolio have an appropriate balance of innovative proposals?** Hard to judge. Many of the proposals are very reasonable extensions of current research, etc. This seems entirely appropriate given the focus of the program. Reviewers have addressed this issue on occasion.
6. **Does the program portfolio have an appropriate balance of funding for awards to individuals and the national laboratories?** Maybe. Given the great difference in documentation in the packages between these communities, this is hard to say. At least two of the lab jackets had no proposals, no reviews, no selection letter, but clearly had received funds. On the other hand, the emphasis on major ecosystem manipulations does seem to favor the National Labs, as they have much infrastructure available to them. Interestingly, the FACE arrays are not at the National Labs, but in university settings. Thus for this program, this question essentially revolves around the program at Oak Ridge. There is some indication that ORNL proposals are not being as fully responsive to reviews as those from other institutions, but this is difficult to respond to in any detail. One award to ORNL is as well documented as any other project, but others are not.
7. **Does the program portfolio have an appropriate balance of awards to new investigators?** It is difficult to tell since sufficient information is not readily available to determine this. New investigators are the proposers who are seeking DOE support for the first time. Information of this type should be retained by the PM and made available specifically to COVs in the future.
8. **Does the program portfolio have an appropriate balance of geographical distribution of Principal Investigators?** Maybe. There appeared to be no bias in this respect, but with only one solicitation represented, this is difficult to judge.
9. **Does the program portfolio have an appropriate balance across disciplines and sub-disciplines of the activity and of emerging opportunities?** Maybe. This is covered above.
10. **Does the program portfolio have appropriate participation of under represented groups?** No. Concern has been raised that women may be underrepresented in the funded portfolio, but a later analysis indicates that the percentage of female investigators funded by the Ecosystem Program (~27%) is

essentially the same as the percentage of female members of the Ecological Society of America (~26%). It also is recognized that there are DOE restrictions that make it difficult if not impossible to obtain such data.

11. **Is the program relevant to national priorities, agency mission, relevant fields and other customer needs?** Yes
12. **Concerns identified that are relevant to the quality of the projects or the balance of the portfolio.** None.

D. Management of the program under review.

1. **Management of the program.** Documentation of the jackets for universities was reasonably clear. Documentation for National Lab proposals was significantly less so and often lacking key documents. This needs to be remedied. When selection memos do exist, they only document phone conversations on responses to reviews. There should be correspondence from PI's to the PM documenting how they are going to respond in response to a letter/e-mail from the PM. This would shift the responsibility from the PM to the PI who after all is the person who really must respond to the reviews.
2. **Responsiveness of the program to emerging research.** This program has defined a lot of the emerging research in the fields of ecosystem response to increasing CO₂, temperature increases, and/or soil warming.
3. **Program planning and prioritization process (internal and external) that guided the development of the portfolio under review.** There is no indication of how this was done.
4. **Concerns identified that are relevant to the management of the program.** Three issues are important here that need to be raised in addition to those identified above. One is the lack of documentation of overall program balance and responses to solicitations. This lack of documentation is especially true for proposal declinations. Evidently, no summary data on numbers of proposals, requested funds, number of proposals funded and declined, gender balance, etc. are either asked for or kept. Consequently, there is no way for BER management to assess whether the program could be better constructed or even if it is truly responsive to proposals that have been received.

The second is the difference between the described breadth of the program and the actual breadth. Solicitations are very broadly phrased as was the two page program description that was received prior to the COV meeting. In fact, the funded program focuses almost completely on major ecosystem manipulations and supporting studies. It is not entirely a closed shop, but the opportunities for breaking into this system are relatively few and inexperienced investigators would not be able to recognize them.

The third issue is the need to be very clear about what the program has accomplished and how its direction will be set for the future. We have no information on how this is to be done or how the community is expected to participate or respond.

Integrated Assessments Program (IA)

Program Summary – The COV believes that the Integrated Assessment (IA) Program plays a very important role within the overarching, interagency U.S. CCSP. The IA Program is a critical component of the CCSP’s efforts to (1) understand the sensitivity and adaptability of different natural and managed ecosystems and human systems to climate and related global changes (CCSP Goal 4) and (2) explore the uses and identify the limits of evolving knowledge to manage risks and opportunities related to climate variability and change (CCSP Goal 5). The IA Program is to be applauded for the high-quality research it has funded and the valuable payoffs to the research and policy communities that already have come from its research investments. The investments the program has made are yielding significant results that will help meet the President’s charge to “provide the best possible scientific information to support public discussion and decision making on climate-related issues.”

The COV identified opportunities to further enhance the IA Program and increase its already excellent performance. Particular suggested areas for future improvement include: (1) strengthening linkages to the new *Strategic Plan* for the federal CCSP, (2) being explicit about any programmatic choices that have been made to focus on the two major modeling groups at Battelle/PNNL and MIT, (3) improving the process for selecting peer reviewers for grant proposals, and (4) ensuring consistency and effectiveness of the review process and procedures.

The COV reviewed 100% of all the actions that were completed by the Program for FY 2003, 11 grant actions (100%) and 5 declinations (100%).

Program Data –

A. Questions about the quality and effectiveness of the program’s use of merit review procedures.

1. **Is the review mechanism appropriate?** It is unclear. There is no indication that site visits have been done or are even necessary. There is incomplete documentation in the packets of annual progress reviews.
2. **Is the review process efficient and effective?** Not always. The process by which comments from reviewers were dealt with was inconsistent and sometimes inadequate. For example, in some cases, reviewers noted that insufficient information had been provided on a topic for which they were asked for reviews. In these cases, the PM obtained the information from the grantee, but there is no evidence that the information was sent back to the reviewers. Rather, the PM evaluated the adequacy of the information himself.

The Program needs to ensure that when a grantee responds to significant reviewer questions or concerns, there is thorough documentation that the PM appropriately dealt with all of the responses and in some cases, where appropriate, sent the responses back to the reviewers for further evaluation.

In some cases, the PM dismissed negative reviews, even when only a small number of reviews (*e.g.*, three) were obtained. When significantly negative reviews are received and the size of the review panel is small, the PM should be required to solicit additional reviews and ask the new reviewers to focus on the specific issues of concern raised in the negative reviews.

- 3. Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines?** Yes. BER's IA Program plays a very important role within the overarching, interagency U.S. Climate Change Science Program (CCSP). Yet, no reviewers tied their reviews back to these CCSP responsibilities or to the mission of the BER Climate Change Research Division. They were not asked to do this in the questions posed to them by DOE. (This is understandable since the COV reviewed packets that were written prior to the completion of the CCSP *Strategic Plan*.)

Reviewers should be provided copies of the CCSP's *Strategic Plan*, summaries of the Integrated Assessment Program's responsibilities as articulated in the *Plan*, and guidelines for evaluating grant proposals in the context of those responsibilities.

The Program should do a better job of insisting that proposals better articulate: (1) the specific incremental improvements in scientific understanding or model development that will be made by their research and (2) how these specific improvements will enhance the ability of the Program to meet DOE's mission and national needs as articulated in the CCSP *Strategic Plan*. The failure of most "winning" proposals to do this was best articulated by one of the reviewers: "...it is not evident that the project team has performed an evaluation to identify the margin at which additional work should be pursued. Consequently, the proposal appears to catch-up a variety of extensions that the investigators find most exciting, most promising and most practical, without a method providing a justification for these priorities."

- 4. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation?** Not always. The packets varied in their completeness. For example, some omitted the names and affiliations of reviewers. Others failed to provide numeric scores along with the written reviews.

For the purpose of future COVs, the program should ensure: (1) that all jackets are required to contain the same set of information and (2) that jackets are complete, *e.g.*, all reviews contain numeric scores as well as responses from reviewers.

- 5. Is the time to decision appropriate?** Yes. The time to decision appears appropriate; however, the Program needs to ensure that this is maintained even as other recommendations presented by the COV are addressed.

6. **Issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures.** BER should ensure that it has formal, written procedures for what constitutes a scientifically sound peer review process. The CCRD also should have procedures that ensure that peer reviews in all its programs have been appropriately managed before awards from particular solicitations are approved.

There was no evidence of any negotiations over budgets having taken place between the PM and grantees prior to award. This may be symptomatic of the fact that most, though not all, reviewers simply invoked that budgets were appropriate. The PM should more carefully scrutinize appropriateness of budgets prior to award.

B. Questions concerning the selection of reviewers.

1. **Did the program make use of an adequate number of reviewers for a balanced review?** No. Many of the reviews appeared inadequate, suggesting that a request from the PM for more and more detailed reviews would have been appropriate. For example, most reviewers did not indicate how they evaluated the appropriateness of budget proposals. They simply invoked that budget proposals were appropriate. More detailed review questions containing guidelines for evaluating proposals, (*e.g.*, budgets), should be provided to reviewers.

Looking across all awards, the pool of reviewers was too small. The same small group of individuals was often approached to do reviews. The size of the pool of reviewers actually used should be increased. Also new "young talent", needs to be brought into the pool.

2. **Did the program make use of reviewers having appropriate expertise and/or qualifications?** Not always. Much of the work in this program area is multidisciplinary in nature and effective proposals should reflect how expertise from the relevant diverse disciplines would be used. The composition of review panels must therefore also represent the diversity of disciplines relevant to the various components and users of integrated assessment models. Nevertheless, review panels usually were too small and members drawn from the same limited number of disciplines (*e.g.*, economics; public policy; energy modeling). More reviews should be solicited for each proposal and a wider range of disciplines reflected.
3. **Did the program make appropriate use of reviewers to reflect balance?** No. Most reviewers appear to be drawn from the same community of modelers as the investigators submitting "winning" proposals. It does not appear that reviewers familiar with, or proponents of alternative modeling approaches are being engaged. The pool of reviewers actually used on panels should be enlarged to include proponents of alternative modeling approaches. This would ensure that proposed projects with fresh viewpoints and proposals to explore alternative modeling approaches are given fair consideration.
4. **Did the program recognize and resolve conflicts of interest when appropriate?**

Not Applicable.

5. **Concerns identified that are relevant to selection of reviewers.** Recipients of awards from the IA Program too often are also used (repeatedly) as reviewers. In the worst cases, the grant recipients are those who have received funding on a long-term basis. Not only has this reinforced a tendency to maintain a small pool of reviewers, but it also appears to have limited the overall breadth of viewpoints and modeling approaches funded by the program. Recipients of funding from the program should only be approached to be reviewers on a limited basis.

C. Questions concerning the resulting portfolio of awards under review.

1. **Overall quality of the research projects supported by the program.** The overall quality of the research projects supported by the program is extremely high. The Program has very important responsibilities to the U.S. Climate Change Science Program, as articulated in the new CCSP *Strategic Plan* (Goal 4). The investments the program has made are already yielding significant results that will help meet the President's charge to "provide the best possible scientific information to support public discussion and decision making on climate-related issues.
2. **Are awards appropriate in size and duration for the scope of the projects?** They are appropriate.
3. **Does the program portfolio have an appropriate balance of high-risk proposals?** Not appropriate. Greater investment in high-risk proposals might enable the Program to better explore alternative modeling approaches that would help it better meet some of the nation's "decision-support" needs. Its heavy reliance on the ongoing development of only two major integrated assessment models/efforts (specifically, the Battelle/PNNL model and the MIT model) may ultimately limit the types of policy questions on which it is able to provide information.
4. **Does the program portfolio have an appropriate balance of multidisciplinary proposals?** It is appropriate. Integrated Assessment modeling is inherently a multidisciplinary effort.
5. **Does the program portfolio have an appropriate balance of innovative proposals?** It does not have an appropriate balance. Although many innovative proposals were received, most were declined. See response to the subsequent question about awards to new investigators.
6. **Does the program portfolio have an appropriate balance of funding for awards to individuals and the national laboratories?** It is appropriate. The Program's resources appear to be split between two major integrated assessment modeling efforts; specifically, the Battelle/PNNL model (a national lab) and the MIT model (a university). Although this funding distribution appears balanced,

there are concerns (articulated below) about the restricted focus of the Program on these two efforts.

7. **Does the program portfolio have an appropriate balance of awards to new investigators?** No. The Program has apparently made an implicit choice to focus its resources on the ongoing development of only two major integrated assessment models/efforts (specifically, the Battelle/PNNL model and the MIT model). This represents a major ongoing investment. Almost all of the awards we reviewed were somehow tied to the two major modeling efforts (e.g., Battelle/PNNL investigators also appeared as co-investigators on other awards to universities). This raises a couple of concerns:

(1) It isn't clear that the Program has, at any point, stepped back to evaluate whether this limited focus allows it to satisfy its responsibilities as articulated in the Climate Change Science Program's *Strategic Plan*. Put differently, does this approach enable the Program to meet the nation's "decision-support" needs and to provide the best possible scientific information to support public discussion and decision making on climate-related issues at any point in time?

(2) Over time, the ongoing significant investment in the development of the two models has limited the amount of investment in innovative proposals and alternative modeling approaches that may be better suited to answer certain types of policy questions.

To the extent that a programmatic choice has been made to focus on the two major modeling groups at Battelle/PNL and MIT, future RFAs should be explicit about this choice and therefore more narrowly focused.

8. **Does the program portfolio have an appropriate balance of geographical distribution of Principal Investigators?** It is appropriate.
9. **Does the program portfolio have an appropriate balance across disciplines and sub-disciplines of the activity and of emerging opportunities?** Appropriate, but the majority of funding (though not all) tends to go to the two major modeling efforts (i.e., the Battelle/PNNL model and the MIT model). They, in turn, then make investments in many of the sub-disciplines. In some cases, much smaller awards are made to other institutions that conduct research in the sub-disciplines. Many of the proposals from these smaller grantees also include co-investigators from the Battelle/PNNL or MIT teams.
10. **Does the program portfolio have appropriate participation of under represented groups?** Data are not available to respond to this question.
11. **Is the program relevant to national priorities, agency mission, relevant fields and other customer needs?** Unequivocally, yes. The Program has very important responsibilities to the U.S. Climate Change Science Program, as articulated in the new CCSP *Strategic Plan* (Goal 4). The Program is uniquely qualified to fulfill these modeling responsibilities. The investments the program has made already

are yielding significant results that will help meet the President’s charge to “provide the best possible scientific information to support public discussion and decision making on climate-related issues.” The Program has nicely leveraged its integrated modeling activities with the research programs of other CCSP agencies (e.g., EPA, NOAA). As noted above, opportunities exist to broaden the portfolio of modeling activities in which the Program invests which would have the benefit of increasing the array of national and international climate-related policy questions on which it can help to inform at any point in time. Nevertheless, this opportunity does not detract from the relevance the Program already has to national priorities.

12. **Concerns identified that are relevant to the quality of the projects or the balance of the portfolio.** The Program should explore opportunities to link its activities, which fall under the purview of the Climate Change Science Program, with the activities of the Climate Change Technology Program (CCTI). For example, the scenario development activities being undertaken by Battelle/PNNL could be better informed by, and leveraged with, DOE programs engaged in CCTP.

D. Management of the program under review.

1. **Management of the program.** The DOE Office of Science has a *Strategic Plan*. Nevertheless, BER and the CCRD do not have strategic plans. We recommend that such plans be developed. These plans would help: (1) prospective grant applicants evaluate whether the work they propose to do is consistent with the Program’s goals and responsibilities to the CCSP; (2) PMs evaluate whether proposed work would be consistent with the Division’s long-term vision; (3) PMs determine whether important research gaps still exist; and (4) peer reviewers evaluate grant proposals.
2. **Responsiveness of the program to emerging research.** As noted in earlier comments, the Program is focusing its major investments on the development of two major integrated assessment models (Battelle/PNNL and MIT). Most of the other awards leverage with the efforts of Battelle/PNNL and MIT. It isn’t clear to what extent this is coincidental or to what extent it is by design (*i.e.*, through explicit requirements of the RFAs). If a goal of the Program is to foster cross-institution collaboration by leveraging multiple proposals, then it is succeeding. Nevertheless, if a goal is to encourage new ideas, innovative proposals and modeling approaches, as well as to foster new talent, then the Program has had only moderate success.
3. **Program planning and prioritization process (internal and external) that guided the development of the portfolio under review.** It remains unclear what the strategic goal of the program is: (1) *fundamental* advances in the field of integrated assessment; (2) “exploratory” modeling improvements and methodological developments (e.g., uncertainty analysis) for their own sake or; (3) modeling improvements in areas where scientific and policy interest are most keen. The goal needs to be clarified.

Recognizing that the Program is part of the larger U.S. CCSP, it is recommended

that the Division ensure that there has been consultation with other federal agencies in the development of RFAs. This will help the Program: (1) identify key scientific questions, research priorities, and user needs; (2) confirm that the work is best undertaken by DOE; (3) identify opportunities for other CCSP agencies to leverage resources and co-fund particular projects; and (4) identify opportunities for DOE-supported researchers to collaborate with other researchers.

It is unclear how the program ensures that its investments in integrated assessment model development will yield advances and information where policy interest is most keen. The Program should establish a formal and ongoing mechanism for interacting with relevant scientific communities (*e.g.*, the climate impacts research community) and user communities (*e.g.*, national policymakers and decision makers), to guarantee that its investments and priorities are properly focused.

The Program should consider developing RFAs that encourage “human dimensions” research that would foster significant advances (“breakthroughs”) in integrated assessment modeling.

4. **Concerns identified that are relevant to the management of the program.**
There are none.

Ocean Carbon Cycle and Ocean Carbon Sequestration Programs

Summaries - Ocean Carbon Cycle - The COV finds that although the technical aspects of proposal processing of the awards made under the “Ocean Carbon Cycle” program were correct, the subject matter covered shows evidence of being static and not now closely related to important science themes. The greater part of the funding is being applied to biogeochemical cycling of nitrogen in continental shelf sediments. The positive aspect is that the PIs being supported are indeed productive, as evidenced by numerous publications. The question is how relevant is the research? Results are not likely to be applicable to modern concerns over the relationship of ocean processes to national energy/climate policy needs. This program has roots that are decades old with the need to constrain the man-made radionuclide signals accumulating in the ocean. In the recent past it has defined important trends in the oceans and sediments touching our coasts and in the citizenry who live there. The program has now shrunk below critical mass. It needs refocusing and refunding. The program should take on the important challenge of defining impacts or benefits of the extraordinary rise in ocean fossil fuel CO₂ levels now occurring in the surface layers of the ocean that bathe our continental shelves. In this way the program would be returning to its roots with the fossil fuel artifact of mankind replacing the nuclear artifacts as the object of study.

Ocean Carbon Sequestration Program - The COV finds that, in contrast to the traditional carbon cycle program, this vital DOE program is at the cutting edge of important innovations in marine science with energetic and productive PIs who are at the forefront of their fields. All nations, whether land locked or maritime, already indirectly dispose of CO₂ in the ocean in very large quantities. The question of whether direct deep-ocean disposal would be useful or harmful on balance cannot be addressed by a system of beliefs. This program is providing absolutely

essential knowledge of the processes involved. Nevertheless, the technology innovations required also need to be addressed. DOE has created important techniques for establishing the FACE experiments on land where controlled CO₂ enrichment of ecosystems to simulate the atmosphere of the late 21st century. We recommend that it take the lead in transferring such technologies to the ocean. This would be a true challenge, but we find no technical impediment to doing so. As has happened on land these techniques would be adopted around the world and bring great credit to the agency as it openly addressed the issues of continued fossil fuel use as a primary energy strategy for the nation.

The COV reviewed 100% of all the actions that were completed by the Program for FY 2003, 29 grant actions (100%) and 2 declinations (100%).

Program Data –

A. Questions about the quality and effectiveness of the program's use of merit review procedures.

- 1. Is the review mechanism appropriate?** Yes. The COV looked at data for a subset selection of successful and unsuccessful proposals submitted 2000-2003 timeframe. Data included the names of the Principal Investigator and the home institution from which the proposal was submitted, the mail reviews, and the PM's selection statement for awards. The proposals we were asked to review were selected randomly. In all cases there was a clear explanation of the review material and an adequate justification in the record for the action taken. Nevertheless, the COV noted that information and review materials for the declined proposals were not maintained over the 2000-2003 period. This made it impossible for the COV to evaluate the appropriateness of the declined proposals. No other reviews were conducted for this program. The COV recommends maintaining all records of the declined proposals for the COV review process.
- 2. Is the review process efficient and effective?** Yes. The proposal review process for this research program element takes approximately 6 months from the date of proposal submission to the date of the sending of the award letter. The processing of proposals, the organization of the review, and the subsequent recommendation for declination or funding, is working efficiently and effectively for this program element.
- 3. Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines?** Yes. This review team was asked to review two ocean carbon programs. The reviews are consistent with the goals, objectives, and guidelines of the Ocean Carbon Sequestration Research Program. For the Ocean Carbon Cycle Research Program, we found the reviews to be narrowly focused. Nevertheless, the COV could not identify any statements in the solicitations and/or review documents regarding research priorities that would help the COV evaluate the overall program balance. We recommend that the PMs provide future COVs with a summary input on program priorities, major research

accomplishments, and future research directions in support of the DOE's contribution to the CCSP *Strategic Plan*.

4. **Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation?** No. The COV reports that the proposal jackets were, in some cases, inconsistent in the kinds of information that was supplied by the PM. While the reviewer's comments were available for each of the proposals, the selection statement was not available to the COV with respect to proposal from the National Laboratories. A uniform review policy should be established for all of proposals.
5. **Is the time to decision appropriate?** Yes. The proposal review process for this research program element takes approximately 6 months from the date of proposal submission to the date of the award letter sent. This is appropriate.
6. **Issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures.** The COV found it difficult to evaluate how the PM's made their decisions regarding program balance and, in particular, the rationale for the declination of some highly rated proposals. In some instances the declined proposals were as highly rated as the accepted proposals. Since no decision documents were kept for these declined proposals, it is impossible for the COV to evaluate how the merit review procedures for the declined proposals were applied. PMs should maintain all records of declined proposals for the COV review process. The mail/panel reviews were heavily focused on technical details. Relevance to the overarching climate change and carbon cycle strategic goals were not clearly evident in this review process.

B. Questions concerning the selection of reviewers.

1. **Did the program make use of an adequate number of reviewers for a balanced review?** Yes. The number of written reviews for each proposal averaged about 3. In some cases there were as many as 5 reviews and in some cases, as few as 2. The COV recommends that the PMs work towards a goal of increasing the number of reviews. It was noted that the same individuals were used both for the written reviews and the panel discussions. This small number of reviewers has had a strong influence on the overall direction and scope of the program. The COV recommends a separation of mail and panel reviewers.
2. **Did the program make use of reviewers having appropriate expertise and/or qualifications?** For the Carbon Cycle Program, the reviewers had appropriate technical expertise., Since the FY 2003 actions were taken, a CCSP *Strategic Plan* has been completed. Thus it would not be possible to hold up that Plan as a metric for the FY 2003 proposal actions.

For the Carbon Sequestration Program, the reviewers had both technical expertise and the broad experience to address the relevance to the climate change programs.

3. **Did the program recognize and resolve conflicts of interest when appropriate?** Yes. The COV felt that the PM adequately addressed these issues.
4. **Concerns identified that are relevant to selection of reviewers.** The COV was concerned that the same individuals were used both for written reviews and panel discussions. This small number of reviewers has had a strong influence on the overall direction and scope of the program. The COV recommends a separation of mail and panel reviewers.

For the Carbon Cycle Program, the reviewers had appropriate technical expertise, but inadequate expertise for addressing the relevance to the *Strategic Plan*.

For the Carbon Sequestration Program, the reviewers had both technical expertise and the broad experience to address the relevance to the climate change programs..

C. Questions concerning the resulting portfolio of awards under review.

1. **Overall quality of the research projects supported by the program.** For the Carbon Cycle Program, the overall quality of the scientific research has been excellent, but in a narrow area. Its relevance to the CCSP is unclear. It is suggested that this program be coordinated with Fossil Energy, thus linking biogeochemical processes with fossil fuel expertise and technology to create important new capabilities that address climate impact issues in the *Strategic Plan*.

For the Carbon Sequestration Program, the scientific thinking and advances are rapidly changing and BER is well poised to build on the outstanding technical and scientific accomplishments it has developed in this field.

2. **Are awards appropriate in size and duration for the scope of the projects?** Yes. Many of the awards are coordinated with other agency programs, such as NSF. The overall size and duration of the stand-alone carbon cycle projects in CCRD are adequate for the style of research presently conducted.
3. **Does the program portfolio have an appropriate balance of high-risk proposals?** No. The Carbon Program should consider an investment in new and innovative attacks on this problem, possibly through coordinated ventures with scientists and engineers such as those in the Fossil Energy and Terrestrial Carbon communities.
4. **Does the program portfolio have an appropriate balance of multidisciplinary proposals?** No. For the Carbon Cycle Program, the COV did not find evidence for significant multidisciplinary proposals. For the Carbon Sequestration Program, the COV finds evidence for promise in this area that could be further developed.
5. **Does the program portfolio have an appropriate balance of innovative proposals?** No, see comments to 3 and 4 above.

6. **Does the program portfolio have an appropriate balance of funding for awards to individuals and the national laboratories?** Yes.
7. **Does the program portfolio have an appropriate balance of awards to new investigators?** Yes.
8. **Does the program portfolio have an appropriate balance of geographical distribution of Principal Investigators?** Yes.
9. **Does the program portfolio have an appropriate balance across disciplines and sub-disciplines of the activity and of emerging opportunities?** No, see comments to 3 and 4 above.
10. **Does the program portfolio have appropriate participation of under represented groups?** Yes. Nevertheless, the COV recommends that PMs provide basic statistics on these issues for future COV reviews.
11. **Is the program relevant to national priorities, agency mission, relevant fields and other customer needs?** No. The COV recommends that a review of program direction and relevance, in the context of rapidly changing ocean chemistry and climate, could result in powerful new and unique initiatives that would address BER's mission in Climate Change.
12. **Concerns identified that are relevant to the quality of the projects or the balance of the portfolio.** We emphasize the points addressed earlier.

D. Management of the program under review.

1. **Management of the program.** It is the COV finding that both Ocean Carbon Cycle and Carbon Sequestration Programs have been managed well at the technical level of grant execution. Nevertheless, we feel that program direction and balance with other components of CCRD, as well as with the broader interagency programs of the CCSP, could be greatly improved by a comprehensive review of program direction in the context of rapidly changing ocean chemistry and climate. This could result in powerful new and unique initiatives that would address BER/CCRD's mission in Climate Change.
2. **Responsiveness of the program to emerging research.** The Carbon Cycle Program shows evidence of being static and could benefit greatly from engagement in new emerging research themes. The Carbon Sequestration Program has responded well to emerging new science in the past several years. It is anticipated that it will continue to respond to emerging research opportunities in the future.
3. **Program planning and prioritization process (internal and external) that guided the development of the portfolio under review.** For the Carbon Cycle Program, detailed planning and prioritization documents that provided the

scientific underpinnings for this program could not be found. For the Carbon Sequestration Program, the DOE Carbon Sequestration "Roadmap" appears to have provided useful guidance. Where possible, it is desirable to align future carbon cycle research planning to the *Strategic Plan*.

4. **Concerns identified that are relevant to the management of the program.** Recommendations are interdispersed throughout the report that may be of use in these programs as well as in other programs within the CCRD.

Terrestrial Carbon Process and Terrestrial Carbon Sequestration Programs

Summary - These research programs focus on terrestrial components of the global carbon cycle, with emphasis primarily on field and experimental studies in the U.S. The Terrestrial Carbon Process (TCP) Program emphasizes efforts to understand the processes and mechanisms that control carbon exchange among plants, soils, and the atmosphere, particularly at the ecosystem level. The focus of the Terrestrial Carbon Sequestration (TCS) Program is the capture and long-term storage of CO₂ in plants and soils. The research domains of these programs inherently intersect, and one PM administers both programs. The Committee reviewed the TCP and TCS Programs together.

These programs have had a profound impact on the development of national research priorities relevant to interactions between climate and the carbon cycle. This impact has resulted from the PM's decisions a number of years ago to emphasize long-term field research, leading ultimately to the development and expansion of the AmeriFlux and Free-Air CO₂ Enrichment (FACE) programs. AmeriFlux has become a cornerstone of the North American Carbon Program and other efforts to constrain the terrestrial carbon budget of the U.S. and North America. FACE experiments have become the most successful and fruitful experiments to examine ecosystem response to high ambient CO₂ concentrations. The influence of these programs is reflected explicitly in planning documents for the North American Carbon Program and the U.S. Carbon Cycle Science Plan, as well as the CCSP. Program results are also well represented in international assessments such as those conducted by the IPCC. These programs have become a model for continent-scale research programs throughout the world.

The overall research portfolio is well balanced. For the period reviewed, approximately 29% of funds were allocated to AmeriFlux studies, 26% to FACE experiments, 23% to carbon sequestration studies, and 22% to other field-oriented research efforts. The number of high-risk awards was relatively small but not unreasonable given the importance and cost of maintaining long-term field measurements and experiments. The emphasis on long-term studies has yielded many unexpected results, leading to innovative methods and research directions. The balance of the AmeriFlux and FACE studies still reflects earlier program emphasis on relatively undisturbed sites. Recent site additions and funding of additional research shows increasing attention to human disturbance, and this direction should be continued as funds permit.

Approximately 75% of the funds for carbon sequestration research are allocated to DOE laboratories. The DOE has unique opportunities to lead in this important area of national need, but there is little or no interaction between the programs reviewed here and the substantial carbon sequestration technology programs in other parts of the DOE. Institutional barriers to

coordination should be addressed by a concerted effort involving PMs, the national laboratories, outside consultants, and upper-level management.

The COV reviewed 14% of all the actions that were completed by the Program for FY 2003, 22 grant actions (50%) and 5 declinations (3%).

Program Data –

A. Questions about the quality and effectiveness of the program's use of merit review procedures.

- 1. Is the review mechanism appropriate?** Yes. The program uses a combination of mail and panel reviews. For some larger, longer projects, site visits have been made after the initial funding.
- 2. Is the review process efficient and effective?** Yes. The process has produced a coherent and balanced portfolio of quality research projects. The strategic decision to support long term, "big science" carbon cycle research has been extremely effective both in answering research questions and also in leveraging other research (often non-DOE) to the site or project. The process has also been effective by making quick funding decisions, generally less than 5 months from submission, followed by prompt establishment of funding, generally less than 8 months from submission.
- 3. Are reviews consistent with priorities and criteria stated in the program's solicitations, announcements, and guidelines?** Yes. Generally, reviewers address the relevance of a proposal to program solicitations, announcements, and guidelines.
- 4. Is the documentation for recommendations complete, and does the program officer provide sufficient information and justification for her/his recommendation?** Yes, for university proposals. Yes, for National Lab proposals after 2002. The PM's recommendations are transparent and clearly argued. They draw upon reviewers' recommendations, relevance of the proposal to the goals and needs as stated in the RFP, program balance, and other factors. The documentation of recent National Lab proposals follows the same procedures as for University proposal, but the earlier laboratory proposals that were examined were insufficiently documented.
- 5. Is the time to decision appropriate?** Yes. It is relatively quick. Program proposals generally are due in the January-March period with decisions made by early summer and funding in place to awardees by end of fiscal year. Total time is less than 9 months.
- 6. Issues identified by the COV concerning the quality and effectiveness of the program's use of merit review procedures.** Better documentation of reasons for

declining proposals would be useful. Merit reviews supported award decisions, but a specific statement of reasons from the PM would assist assessment of the review process.

B. Questions concerning the selection of reviewers.

- 1. Did the program make use of an adequate number of reviewers for a balanced review? Yes.** The program uses 3-5 reviewers for each project. For larger projects and/or when there was some concern about project integration or management, the program employed site visits by 5 reviewers.
- 2. Did the program make use of reviewers having appropriate expertise and/or qualifications? Yes.** Reviewers were generally of a very high caliber, often leaders in their specific fields. Review comments were generally well considered. When disparities of reviews were received, there was evidence of additional review(s) being solicited.
- 3. Did the program make appropriate use of reviewers to reflect balance? Yes.** The thoughtful and balanced selection of reviewers was impressive. Balance was demonstrated by the variety of reviewer expertise and affiliation with a good mix of academic and government reviewers. Examples: ecosystem carbon flux proposals were reviewed both by meteorologists and ecologists; an instrumentation proposal for measurement of soil carbon by nuclear methods was reviewed by soil scientists and nuclear physicists.
- 4. Did the program recognize and resolve conflicts of interest when appropriate? No instances of COI were identified in the review, but no data were available.**
- 5. Concerns identified that are relevant to selection of reviewers.** There was a good connection between reviewer comments/ranking and proposal success. PM's decisions were clearly stated and drew on the reviews. Reviewers concerns and weaknesses identified in otherwise favorable proposals were brought to the attention of PI's.

C. Questions concerning the resulting portfolio of awards under review.

- 1. Overall quality of the research projects supported by the program.** Scientific quality of the programs is quite high. This high quality is a direct result of program management decisions initiated during the last decade to emphasize field research and experiments with less emphasis on modeling and remote sensing activities that are funded elsewhere. The emphasis is roughly balanced among 4 programmatic areas. About 29% of the funding under these programs is directed toward AmeriFlux studies, 26% to FACE, 23% towards sequestration, and the remaining 22% to other field-oriented studies. The supported researchers include top scientists in the areas of program focus. The overall effort has contributed

fundamentally to advancing the field. The impact of these programs is multiplied by substantial leveraged support from other sources.

2. **Are awards appropriate in size and duration for the scope of the projects?** They are appropriate. These programs include a substantial number of long-term awards and renewals for research at AmeriFlux and FACE sites. The size and duration of awards reflects the need to balance long-term observations with addition of new field sites and new measurements as funds are available.
3. **Does the program portfolio have an appropriate balance of high-risk proposals?** Yes. There are relatively few high-risk awards due to limited funds and the program emphasis on established field programs. Some high-risk efforts are evident in the development of new methods for measuring soil carbon content. These awards are appropriate given the importance of improving soil carbon measurement capabilities. See comments on areas of concern, below.
4. **Does the program portfolio have an appropriate balance of multidisciplinary proposals?** Yes. Carbon research is inherently interdisciplinary. These programs support biologists, ecologists, geologists, chemists, and physicists, and others. Human dimensions, especially effects of land use change, are perhaps underrepresented, but the balance of research in this area reflects an appropriate emphasis on field research.
5. **Does the program portfolio have an appropriate balance of innovative proposals?** Yes. Innovative methods and research directions are applied as new directions are suggested by the measurements at many sites. These programs have yielded an unusually high rate of unexpected results.
6. **Does the program portfolio have an appropriate balance of funding for awards to individuals and the national laboratories?** It may be appropriate. Combined TCP and TCS Program funds are approximately evenly split between individuals and the National Laboratories. Within the TCS Program, about 75% of the funds are directed towards the National Laboratories while TCP funds are more heavily directed towards individuals. Documentation of awards to National Laboratories was not of same quality as for other awards. See areas of concern.
7. **Does the program portfolio have an appropriate balance of awards to new investigators?** Yes. New investigators are entrained into the program through extensive involvement of graduate students in the research.
8. **Does the program portfolio have an appropriate balance of geographical distribution of Principal Investigators?** Yes. Geographic distribution is an inherent outcome of the programs' emphasis on distributing sites among important ecosystems and land management regimes in the U.S.
9. **Does the program portfolio have an appropriate balance across disciplines and sub-disciplines of the activity and of emerging opportunities?** See comments above.
10. **Does the program portfolio have appropriate participation of under represented groups?** Data are not available to make any comments.

11. **Is the program relevant to national priorities, agency mission, relevant fields and other customer needs?** Yes. These programs have had a profound impact on the development of national research priorities relevant to interactions between climate and the carbon cycle. This impact has resulted from the PM's decisions a number of years ago to emphasize field research, leading ultimately to the development and expansion of the AmeriFlux and FACE programs. AmeriFlux has become a cornerstone of the North American Carbon Program and other efforts to constrain the terrestrial carbon budget of the U.S. and North America. FACE experiments have become the most successful and fruitful experiments to examine ecosystem response to high ambient CO₂ concentrations. The influence of these programs is reflected explicitly in planning documents for the North American Carbon Program and the U.S. Carbon Cycle Science Plan, as well as the CCSP. Program results are also well represented in international assessments such as those conducted by the IPCC. These programs have become a model for continent-scale research programs throughout the world.

The PM's contributions also include leadership of the Carbon Cycle Interagency Working Group, which has served as a model for the development of interagency coordination of global change research.

12. **Concerns identified that are relevant to the quality of the projects or the balance of the portfolio.** Documentation of proposals and reviews for National Laboratory research was not of the same quality as documentation for other proposals. This appears to reflect more general management policies that have recently been improved. There was no evidence that National Laboratory proposals received preferential treatment. In fact the PM conducts site reviews that yield very constructive suggestions for National Laboratory research. Documentation of technical reviews and follow-up to reviews of National Laboratory research should be improved.

An area of scientific investigation that may be underrepresented is the effects of land management on carbon cycling. Effects of land use are increasingly understood as a predominant control on U.S. and global land surface carbon exchange, but the balance of the AmeriFlux program still reflects earlier program emphasis on relatively undisturbed sites. The FACE program on the other hand is carried out on relatively disturbed sites, except for the site at the Nevada Test site. Recent site additions and funding of additional research shows increasing attention to human disturbances. This direction should be continued as funds permit. Nevertheless, because long-term measurements at several sites are yielding very important information about interannual variability, shifting program emphasis should not be accomplished at the expense of abandoning successful long-term sites.

The *Strategic Plan of the Climate Change Science Program* emphasizes the need for coordination with the Climate Change Technology Program (CCTP). The need for better integration of science and technology is particularly evident in the area of carbon sequestration. The DOE has unique opportunities to lead in this important area of national need, but the lack of integration across bureaucratic boundaries within the DOE is conspicuous. There is little or no interaction between the programs reviewed here and the substantial carbon sequestration programs in other parts of the DOE. Institutional barriers to coordination appear to be worsening in recent years and are so pronounced that they can only be

addressed by a concerted effort involving PMs, the National Laboratories, outside consultants, and upper-level management.

D. Management of the program under review.

1. **Management of the program.** Management of the TCP program has been capable and adept. The program shows evidence of a coherent and balanced portfolio of research. Expected documentation has been present, reviewers have been selected with insight, and the decision making process has been transparent.
2. **Responsiveness of the program to emerging research.** The program has been exceptional at identifying and promoting important emerging research. Two important examples are the long-term support for FACE (Free Air CO₂ Enrichment) experiments and the AmeriFlux network. Both are key components of efforts to address a FY04 Climate Change Research Initiative (CCRI) Priority of addressing North America's carbon balance as described in chapter 7 of the *Strategic Plan for the U.S. Climate Change Science Program*.
3. **Program planning and prioritization process (internal and external) that guided the development of the portfolio under review.** The PM maintains close contact with the scientific community by attending and hosting meetings, site reviews, and professional contacts. The PM also has been active in interagency discussions and coordination related to the program area.
4. **Concerns identified that are relevant to the management of the program.** None have been identified.

CROSS-CUTTING ISSUES RAISED BY THE COV

During the course of the COV, some issues were raised that deserve discussion since they were common to more than one program. Embedded in these discussions are recommendations that apply specifically to the issue being discussed. It is recognized by the COV that, in all probability, some of these recommendations will be implemented, although it will take time, perhaps as long as several years. Nevertheless, the BER and the CCRD will be stronger and less vulnerable to criticism if many of these recommendations are taken seriously.

It is difficult to prioritize these cross-cutting issues. They are all important. Nevertheless, it is important to the BER management that some idea be given regarding the importance of these issues. Staffing is the most important one. If the staff is inadequate for whatever reason, then none of the other issues can be accomplished. Good staff will enable some of the other issues to take place.

Documentation of the necessary material in the program files is very important for internal and external reasons as iterated in the section below. The needed changes to improve documentation can be accomplished quickly, and over time the files will contain the information needed.

How the National Laboratories are treated is a very important issue that probably can not be resolved by BER/CCRD. Nevertheless, the playing field can be leveled and lab proposals considered in the same manner as proposals from universities. That will mean more

documentation from the labs and for PMs who deal with lab proposals. The payoff of using the expertise available in the National Laboratories and encouraging the labs to work more closely with universities would be tremendous and well worth the effort.

Good reviewers and understandable guidelines for them are indispensable in support of any grant program. It is important that they exist once staff is in place, documentation is proceeding as needed, and the “playing field” for universities and the National Labs has been leveled.

Getting the word out to the scientific community so high quality proposals are received follows from the above priorities. Specifics are often necessary so time is not wasted by either proposers or PMs who have to deal with them.

Finally, although of extreme importance, the last priority is to be sure that the high quality research that has been supported is used by national and international programs. It is imperative that the research supported by CCRD plays an integral role as a part of the Climate Change Science Program.

STAFFING

Staffing in the CCRD has been an issue for some years. Naturally, the optimum situation would be to have the ability to hire staff as Federal employees on a full-time basis. That apparently is not an option at this time. Bringing staff in under the Intergovernmental Personnel Act (IPA) would seem to be feasible since it would allow personnel to handle program areas where they have expertise. There has been some resistance to this idea based on the perception that IPAs from the National Laboratories would have an automatic conflict-of-interest. Other agencies in the Executive Branch do use IPAs to handle details concerned with solicitations, proposals, grants, etc. If a proposal comes from the same organization as the IPA, then that IPA is recused and another staff member handles the action. To make such an operation run smoothly, rules and operating procedures for such situations have to be worked out ahead of time and all staff members have to be sensitized to conflicts-of-interest.

At present within CCRD, individual PMs are handling two, three, and sometimes four separate programs. The discipline diversity within CCRD is quite large so there is concern that any PM handling such a load probably is unable to do an adequate job. That is a disservice to the PM as well as to proposers, investigators, and the DOE. If many of the recommendations from this COV are accepted, then the work load for Program Managers will increase thus making a bad situation even worse. Hopefully, BER management will be able to address the staffing issue so there are adequate and credible staff available to do what is required to operate a high quality and extremely important scientific grants program.

DOCUMENTATION

Documentation is important from several points of view. It gives the DOE management at all levels information needed to help defend programs whether it be to the Congress, OMB, or higher levels of DOE management. It also is important for the COV process since COV members need complete information to assess program management and the effectiveness of a program in achieving its goals. If the information is provided in a clear and consistent format, it will increase the efficiency and the effectiveness of the COV.

Program files (grants, proposals, declinations, etc.) should contain complete information so reasons for any funding decision will be clear to anyone examining the file. Information that may be needed about a Principal Investigator or a grant should be accessible easily from the files. This is also important for continuity within DOE as PMs do move to different positions and the presence of such documentation will enable new PMs to do a better job.

A program summary should be provided containing a short description of the program including goals, budgets, activities supported, and a few examples of outcomes including some from grants regarded as high-risk. Program solicitations or any other basis for requesting proposals also need to be a part of the program documentation.

A table for each program listing all proposals with their PI, title, amount requested, duration, institution, reviewers' scores, decision, award amount, and whether a new or renewal proposal is essential. This is a very important input for the COV. Summary program statistics are needed on the number of proposals received since the last COV; the number of awards, declines, and withdrawals by university, DOE laboratory, or others; and statistics on diversity (gender, age, geographic location, type of institution, and new investigator). The summary also should include the number of awards to underrepresented groups and the number of first time awardees.

Individual file documentation should contain the following information:

- PM's justification for decision (acceptance, decline, withdrawal, etc.),
- A record of all communications (summaries of phone conversations and copies of all significant e-mails and correspondence) between PM and PIs or reviewers,
- A note on how disparate scores from a minimum number of reviewers was resolved,
- A timeline for processing of proposal and contacts with PM,
- Indication of whether the PI is a new investigator, young investigator, member of an underrepresented group, etc.,
- An example of a request for review,
- Copies of all the reviews including reviewers' affiliations,
- Notification of decision, and
- Consistent documentation both for university and national laboratory proposal files

Appropriate documentation for the user facility aspects also must be kept.

NATIONAL LABORATORIES

Since WWII, the national laboratory system has been the major provider of research and development support for the DOE and its predecessor agencies. In recent decades laboratory support has broadened beyond the original focus on nuclear energy generation for civilian use and weapons and now spans a wide range of scientific issues related to energy production, use, and sustainability. This evolution has included a broadening of National Laboratory activities into environmental sciences. As part of this process, the CCRD, and its predecessors in DOE's

Office of Biological and Environmental Research, has depended to varying degrees on support from most of the National laboratories. At the same time CCRD has sought and received research support from the university community.

The evolution noted above raises the following issues/questions about the relative roles of National Laboratories versus universities in providing research supported by CCRD:

- DOE Laboratories are a vital part of DOE's structure and mission. These facilities provide needed long-term continuity and expertise for the furthering of the research needed to fulfill DOE's mission.
- It is not apparent that there exists an articulated philosophy on how CCRD will take advantage of the resources within the National Laboratories. For example, CCRD PM should extend the scope of their personnel expertise by aggressively exploiting the expertise found in the National Labs.
- The Laboratories should work with personnel from universities and other agencies when the expertise inside the DOE system is not sufficient to achieve DOE's goals (e.g., high excellence in particular research areas and involvement of graduate students, post-docs and visiting scientists.)
- The merit-review process and documentation should be the same for National Laboratory and university proposals.
- While the outside perception is that scientists in National Laboratories receive preferential treatment in the CCRD proposal process, this may not be true. For example, funding success for ARM program proposals is approximately the same from each type of institution (DOE Laboratories, universities, and others). Nevertheless, proposal jackets provide an almost total lack of information on how Laboratory proposals are reviewed and processed, so it is difficult to dispel this perception. Therefore, documentation must be improved before this perception truly can be evaluated and changed, if need be.

QUALITY AND EFFECTIVENESS OF MERIT/PEER REVIEW PROCEDURES

PMs need to ensure that when a grantee responds to significant reviewer questions or concerns, there is thorough documentation showing that the PM appropriately dealt with all of the responses and, in some cases, sent the responses back to the reviewers for further evaluation.

We strongly recommend that reviewers be provided copies of the CCSP's *Strategic Plan* or, at least, a summary of the Program's responsibilities as articulated in the *Plan*, where applicable, and guidelines for evaluating grant proposals in the context of those responsibilities.

Programs could do a better job of insisting that proposals better articulate: (1) the specific incremental improvements in scientific understanding or model development that will be made by their research and (2) how these specific improvements will enhance the ability of the Program to meet DOE's mission and national needs as articulated in the CCSP *Strategic Plan*. The failure of most "winning" proposals to do this was best articulated by one of the reviewers:

“ . . . it is not evident that the project team has performed an evaluation to identify the margin at which additional work should be pursued. Consequently, the proposal appears to catch-up a variety of extensions that the investigators find most exciting, most promising and most practical, without a method providing a justification for these priorities.”

For the purpose of future COVs, we recommend that the PM ensure: (1) that all jackets contain the same set of information and (2) that jackets are complete, *i.e.*, all reviews contain numeric scores as well as responses from reviewers. In addition, information should be retained and documented on the resolution of scoring disparities, declinations, reasoning for support or non-support of proposals, under-represented groups, young investigators, and under-represented areas of the country.

DOE/BER should ensure that it has formal, written procedures for what constitutes a scientifically sound peer review process. The CCRD also should have procedures that ensure that peer reviews in all its programs have been appropriately managed before awards, particularly from solicitations, are approved.

PMs should scrutinize more carefully appropriateness of budgets prior to award.

REVIEWERS AND SELECTION OF REVIEWERS

Recognizing that the review processing is central to the operation and success of a program, it is important that reviewers be carefully selected and be given a clear description of what is expected of them. More detailed guidelines for evaluating proposals, especially budgets, should be provided to reviewers. In addition to rating a proposal with respect to formal and/or mandatory criteria, reviewers should be given supplemental evaluation instructions that are specific to the program and should be required to provide detailed grounds for a recommendation of declination. Such supplemental instructions also must be available to proposal writers. Reviewers should understand the need and value of a punctual response and should ensure the compatibility of their comments with the overall score given. Reviewers also should describe any personal and/or professional relationships with the proposer in terms of conflicts-of-interest and should indicate clearly any revisions of the proposal that they feel are necessary or desirable. DOE should develop a conflict-of-interest policy such as that used by NIH or NSF if such a policy does not exist. Reviewers should state if they are prepared to examine a revised submission.

To ensure the continued vitality and objectivity of the pool of qualified reviewers, it is important that efforts routinely be made to involve younger scientists who are identified, for example, by senior investigators or by review of recent peer-reviewed publications. More reviews should be solicited for each proposal using a wider range of disciplines where necessary. The pool of reviewers actually used on panels should be enlarged to include proponents of alternative approaches. This is especially true in modeling proposals. Such action would ensure that proposed projects with fresh viewpoints and proposals to explore alternative modeling approaches are given fair consideration. A minimum of three written reviews should be used before any decision is made.

Recipients of funding support from the program should be approached to be a reviewer only on a limited basis. It must be acknowledged that there are some solicitations germane to a small

community that may receive a very large response requiring a number of reviewers that exceed the number of “unaffiliated” reviewers that are available.

SOLICITATIONS/RFPs/RFAs

Several of the programs reviewed by the COV are noted for relatively low success rates. In some cases 10% or less of the submitted proposals were funded. This is particularly true for new proposals. There is a desire, of course, to minimize the number of rejected proposals in an effort to reduce wasted effort by the scientific community and PMs. Program announcements are the critical tool in communicating the focus of a program opportunity to the community at large. The precise wording in an announcement has a large influence on both the number and slant of proposals that may result. Many program announcements were found to be written more broadly than necessary. This resulted in a number of proposals being rejected because they were outside the scope of the program goals. PMs should be cognizant of opportunities for potential applicants to misinterpret even well written announcements. Therefore, they should make every effort to articulate the intent of the program as specifically and clearly as possible. This is an instance where brevity is not necessarily the most valuable ingredient. A few examples noted by the COV included statements indicating that proposals focused on field campaigns would be welcome when, in fact, contributions only to certain field campaigns were funded.

The COV recommends that the PMs rely on the expertise of their program Chief Scientist and other members of the community to hone the program announcement so it better reflects and carefully communicates program goals.

Numerous federally funded scientific research programs have well defined goals as opposed to being broadly based basic research requests. Generally, these programs have calls for proposals in a given year that are well focused on a particular set of calculations, model developments, instrument developments, or measurements that systematically address the goals of the program. Over several years one often sees calls for proposals focusing on models or measurements that were missing in previous years, yet are needed to meet the goal. In the ARM RFP these characteristics are not present in the call for proposals. Instead the call is very general. Not only are many areas covered, but individual areas are not specified in great enough detail to allow goals to be achieved.

Here are two examples. The ARM RFP calls for parameterizations for clouds and radiation. This call is too vague. What is wrong with the current parameterizations? Are they too slow computationally? Are they not accurate enough? Do they fail to include some capability? ARM is a mature program and developing these parameterizations is one of its major goals. Surely the ARM science team has a good idea of what is needed to take the next step forward. Nevertheless, the RFP does not reflect a goal driven, carefully considered, sequence of steps needed to advance this issue.

Another example is the call for creating a climatology of aerosol properties using ARM data. There are two problems. First, the call is limited to using ARM data. It is almost certainly the case that ARM instruments are not capable of measuring all the needed variables. Yet, there is no call to build measurement capability. Just creating a climatology, especially when all the data are being archived already, is not advancing the science. Second, calling for aerosol properties is

too vague. In order to advance the field one needs to measure a complete set of parameters. For example, the radiative transfer equations need the optical depth, single scattering albedo, and scattering phase function as a function of space, time, and wavelength. Without all three of these, the radiation field cannot be determined. Alternatively, one can use the optical properties and size distribution to calculate the radiative properties. To understand the indirect effect of aerosols on clouds requires another set of parameters. A well posed ARM RFP would ask for sets of quantities such as these. It would describe which of these quantities are being measured at the present time and call for proposals to investigate the ones that are not being measured.

The lack of specificity in RFPs for goal-oriented projects suggests programs that are drifting and not moving systematically toward their goals. It also reflects a management style that is not making use of its advisory committees and the expertise in the National Labs to plan carefully the program and its future.

In a somewhat similar way, since a programmatic choice has been made in the Integrated Assessment Program to focus on the two major modeling groups at Battelle/PNL and MIT, future RFAs should be explicit about this choice and therefore more narrowly focused.

INTEGRATION OF CLIMATE AND CO₂ PROGRAMS INTO THE CCSP

The U.S. Global Change Research Program (USGCRP), initiated some considerable time ago, has now been folded into the *Strategic Plan for the U.S. Climate Change Science Program* (CCSP) which integrates research on climate and global change. This is the mechanism for integration of individual agency programs into U.S. national objectives and, if done well down to the individual program level, it can lead to increased recognition and support. Therefore, interfacing CCRD mission oriented research activities with the *CCSP Strategic Plan* is in the best interests both of DOE and the nation. The COV recommends that DOE use this review as an opportunity to define the substantial, unique, and positive contributions that the CCRD program elements can and do make to the integrated, interagency CCSP.

DOE uniquely occupies substantial segments of the CCSP and has made distinguished and creative fundamental science and technology contributions without which U.S. science would be lacking essential knowledge. These contributions are well founded in DOE's mission and are seen by the COV as interactive and evolving both with other DOE programs and divisions and in an interagency context. Nevertheless, the COV finds that these successes are not adequately highlighted nor recognized. This is true from the Office of the Secretary through the SC down to the level of individual program elements.

There are some themes to which DOE brings advanced technical skills, integration of science and technology, and ambitious scale that make the agency uniquely qualified to contribute to the CCSP. The following are examples of current successes and future possibilities:

- The creation of the ARM technologies for advanced study of complex radiative processes. One of the major goals of ARM is to develop parameterizations for clouds and radiation for climate models. Goal 3 of the CCSP is directly relevant to ARM, "Reduce uncertainty in projections of how the Earth's climate and related systems may change in the future". Goal 3 contains three elements directly related to ARM. These are: "include

understanding of key “feedbacks” including changes in the amount and distribution of water vapor ..., cloud properties ...”; accelerate incorporation of improved knowledge of climate processes and feedbacks into climate models...”; and “improve national capacity to develop and apply climate models”. The first two goals of CCSP are also relevant to ARM. Goal 1 is related to the ARM CART sites, “Improve knowledge of the Earth’s ...present climate...”. Goal 2 is related to the science thrust of ARM, “Improve quantification of the forces bringing about changes in the Earth’s climate”. Although the CCSP defines specific goals only over the next few years while ARM goals are of a longer period of time, ARM should consider establishing well-defined near-term goals that it can achieve.

- The SciDAC contribution to computer science that is enabling the success of the Community Climate Model. The *CCSP Strategic Plan* calls for the climate models at NCAR and at GFDL to be the major tools in the national climate program, but it does not mention how DOE supported climate models fit into this program. ARM needs to specify how its activities will be used to influence and help with the major national models. The CCSP also calls for a global network of ground sites and satellites to measure climate parameters, but again there is no mention of the value of the basic ARM program or its CART sites in the document. The CART sites offer both a GCM grid size test bed and a local area where a large data set is collected. These concepts should be incorporated into the *CCSP Strategic Plan* and its implementation.
- The creation of large-scale land ecosystem perturbation experiments such as the FACE program.
- The early and successful efforts to support sophisticated integrated assessments.
- DOE’s substantial contributions to quantifying the global carbon cycle of land, atmosphere, and oceans. The Terrestrial Carbon Process (TCP) Program exemplifies the mutually beneficial interagency coordination envisioned by the CCSP. The DOE TCP program has had a profound impact on the development of CCSP priorities relevant to interactions between climate and the carbon cycle. The PM is co-chair of the Carbon Cycle Interagency Working Group that has served as a model for the development of interagency coordination of global change research. Program announcements and requests for proposals are coordinated to address priorities identified by the Interagency Working Group and the Carbon Cycle Scientific Steering Group, a diverse group of experts who are consulted regularly. The resulting coordination maximizes overall contributions to the CCSP and strengthens the programs of all participating agencies by eliminating duplication and reducing gaps that might otherwise occur in a research portfolio. The effectiveness of these mechanisms is reflected in national planning documents such as the *U.S. Carbon Cycle Science Plan* and in implementation activities such as the North American Carbon Program. These efforts have become a model for continent-scale research programs throughout the world.
- Advances in carbon sequestration research, both geotechnical and biotechnical, which may provide a buffer against rising atmospheric CO₂ levels.

The COV sees these as evolving opportunities within which programs can change and create important new thrusts. One example is the extension of FACE-type ecosystem perturbation experiments to ocean ecosystems in order to simulate, probe, and predict the lower pH ocean of a CO₂ rich world. Another example deals with the ARM program instruments and models. These are extensible and can provide international capabilities and knowledge essential to climate science agreements. The reconfigured ASP also will provide needed support for aerosol research that is crucial to the understanding of clouds and their role in computer modeling of climate. DOE's CCRD environmental science programs are essential in providing the basic knowledge necessary for evaluating the environmental footprint and consequences of carbon sequestration options.

Programs within the CCRD that fall under the purview of the CCSP should explore opportunities to link their activities with those of the Climate Change Technology Program (CCTP). For example, the scenario development activities being undertaken by Battelle/PNNL in the Integrated Assessment Program could be better informed by and leveraged with DOE programs engaged in CCTP. More interaction with other programs in the sequestration programs supported as a part of the CCTP also should be explored.

CONCLUSIONS

A response to the charge is not a trivial task because there is so much variability in the system especially in the way in which the nine programs are managed. Nevertheless, it is necessary to address and respond to the charge. Details on specific programs will be found in the Program Findings. Details pertaining to issues found in several programs will be found in the section on Cross-Cutting Issues Raised by the COV.

In general the programs are carrying out their responsibilities through the processes now in place. Many of the programs have adequate depth and balance. Some are quite focused and need to broaden their perspectives. Pertinent comments regarding this issue are made in the Program Findings where needed. Although there are weaknesses in some of the processes in vogue today, the scientific staff has made the CCRD a productive and high quality research entity that plays an important role in the DOE and especially in the CCSP.

Whether there is an adequate amount of high-risk research is a question raised in the questions to be answered for each program. How much is an adequate amount? There is no answer. Rather the question should be, is there any? If there is, then the PM is willing to invest in high-risk research and that is a good sign. Some programs have funded some high-risk proposals, but there could be much more. When budgets are declining or increasing only at the rate of inflation, PMs seem not to take many risks. All PMs should be encouraged to fund more high-risk proposals and be prepared to defend such decisions.

The needs of DOE are being met in the programs. Fortunately, DOE has been involved in many program areas over many years that may seem not to be relevant to DOE's present mission. Upon review it becomes apparent that DOE has been a leader in many of the climate areas and has undertaken programs that no other agency has been able to support.

Fortunately, all of the CCRD programs have healthy relations with programs in other agencies. In addition these programs have interactions both with national and international programs. Part of that reason is because all of the programs are climate related. Several of the DOE programs play a seminal role in the CCRI. The best example of that is the ARM program. In reviewing the CCRD programs, the COV has concluded that DOE is playing a very important role in climate activities. In particular without the DOE supported climate programs, there would be obvious weaknesses in the US climate programs.

The CCRD has shown that it can and has terminated programs when those programs no longer serve as useful a purpose as they had in the past. The most recent case has been the reconfiguration of the Atmospheric Science Program (ASP) at the end of FY04. A Reconfigured ASP that focuses on two specific aerosol issues has replaced the previous ASP. These aerosol issues have been called out as extremely important for a number of years, but there was still a need to fill in some major gaps. DOE stands as a unique agency with the courage to make changes that are needed. With regard to bringing in new scientists into CCRD programs, there is quite a bit of variability. There is no question that new blood in a program is very useful. That is recognized by the COV. Nevertheless, reiteration of this need will keep this goal before PMs so they do not continue to fund the same PIs for years on end.

The CCRD by the very nature of the subject matter of its programs is national and international. Climate is a universal subject that interacts with many other scientific disciplines. It also has many impacts on humankind. As a result the entire scientific endeavor of CCRD has national and international scientific standing and in several programs scientific leadership is provided nationally and internationally.

RECOMMENDATIONS

Since this was the first opportunity for the COV to interact with the BER staff, the COV considers this to be a highly interactive process that will continue to evolve over time. With this in mind the COV offers the following recommendations for enhancing the exchange of information between the BER and CCRD staff and for insuring that the next COV can meet its duties as fully and effectively as possible.

Recommendation 1: The COV recommends that CCRD staff compile a list of recommendations given in this COV report and document the subsequent response to each recommendation for review by the next COV.

Recommendation 2: There would be real value in having one or two members from the previous COV included in the membership of its successor to bring some history and continuity to the process.

Recommendation 3: The CCRD staff will need to provide more material on aspects of the performance of their programs if future COV meetings are to evaluate fully programs against DOE Performance Goals. We recommend that CCRD staff take a proactive role in developing information on successes of both the program and the management/leadership of the program. A 1 to 2-page self-assessment white paper of the performance of each CCRD program should be prepared from a management perspective and briefly described to the COV. Preparation for a COV does not require large amounts of materials, but some careful synopses along the following lines are strongly recommended: These synopses should be made available to the COV before they meet.

- Several paragraphs on primary results of the past 3 years that, in the view of the BER/CCRD staff and management, have demonstrated the greatest impact on DOE's mission. This summary should include description of emerging trends that are likely to produce major breakthroughs in future years. A short description of critical science and/or management challenges faced by the CCSP, if applicable, and the CCRD should be included.
- A partial list of significant recognition accorded to CCRD funded grantees, staff and DOE programs since the previous COV. This should include major accolades; publication of articles in *Nature*, *Science*, *Scientific American*, and other scientific publications; major pieces in the popular media; etc. This will require reporting by grantees on such matters on an annual basis, but it is well worth the effort and probably should be done anyway.

Recommendation 4: Data sets developed by the CCRD staff were reviewed by the COV. It is recommended that the CCRD staff prepare a standard data set of information based on proposal jackets, both accepted and declined, in advance of the visit and that it be provided to the COV before they arrive. The data sets that are recommended are listed below, together with a suggestion of whether the data are most helpful in tabular or graphic form or both.

- Budget history of BER divisions and their programs in current and constant dollars (table and graphs).
- Budget history of CCRD's total budget and the nine research programs in current and constant dollars (table and graphs).
- Awards history data: number of awards by program, mean annual award size by program in current and constant dollars, number of proposals by program, mean duration of award by program, and success rate (table and graphs).
- Table of mean panel review scores and mean mail review scores by program for awards and declines.
- Success rates for all CCRD programs, for women, for recent PhD's, and for multidisciplinary programs; average length of awards, average amount of awards; and percent of proposals funded.

With these materials and the preparation inherent in them on the part of the next COV and the CCRD staff, the COV can spend its time on very productive, interesting discussions with BER management and CCRD staff as well as on the more traditional, but essential, duties of evaluating the programs, processes, and records.

Recommendation 5: The COV recommends that three years of data be made available to the COV. A single year does not give an adequate representation of the activity in a program, the complexities that must be faced, and the real interaction of a program with other programs within and outside the DOE.

Recommendation 6: Items pertaining to funding actions and decisions that pass over a PM's desk should be made available to the COV. That includes grants, declinations, withdrawals, solicitations. Only through receipt of such information can the COV determine the pressures on a given program.

APPENDICES

APPENDIX A

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APPENDIX B



Department of Energy
Office of Science
Washington, DC 20585

Office of the Director

July 23, 2003

Dr. Keith Hodgson
Director, Stanford Synchrotron Radiation Laboratory
Department of Chemistry
Stanford University
Stanford, California 94305

Dear Dr. *Keith* Hodgson:

By this letter, I am charging the Biological and Environmental Research Advisory Committee (BERAC) to assemble a Committee of Visitors (COV) to assess some of the research program management processes in the Climate Change Research Division (CCRD) in BER. The panel should provide an assessment of the processes used to solicit, review, and recommend proposal funding actions. It should also assess the processes used to manage ongoing research programs in the CCRD, especially the decision-making processes. I would like the panel to consider and provide evaluation of the following two major elements.

- 1 For both the DOE laboratory projects and university grants, assess the efficacy, fairness, and quality of the processes used to: (a) solicit, review, recommend, and document proposal funding actions, and (b) monitor active projects and programs for progress and outcomes. For example, is the proposal review process rigorous and fair, are funding decisions adequately documented and justified, does the solicitation process for proposals provide sufficient and useful guidance to prospective applicants, and are the progress and outcomes of multi-year projects adequately monitored and evaluated to justify decisions about continued funding?
2. Assess the efficacy and quality of processes used to manage ongoing programs. For example, does the process (a) consider the depth and balance in a research portfolio, (b) solicit and encourage some exploratory, high-risk research, (b) link the research to mission needs of DOE, (b) enable the support of coherent suites of projects that are integrated and collectively of added scientific value to programs, (c) ensure a reasonable and appropriate turnover of funded investigators to enable and foster the support of new projects and scientists by programs, and (d) result in a portfolio of elements and programs that have national and international scientific standing?



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The panel should assess the processes and operations used for proposal funding actions and program implementation decisions in the CCRD during FY 2003 and provide comments on how they can be improved. It may examine any files of both DOE laboratory projects and university projects funded in FY 2003. It may also examine any documents related to CCRD program implementation. The panel is asked to review the aforementioned processes used by all CCRD programs and elements. The COV panel will be provided with background material on the processes prior to its first meeting.

A primary requirement is that the COV should have significant expertise across all covered areas, and that this expertise should not rely upon one person alone. A second requirement is that a significant fraction of the committee receives no direct research support from the DOE. A guideline is that approximately 25% of the members, including the Committee Chair, receive no support from DOE. It is also important to have representation on the COV from individuals with experience in managing research programs, either at DOE or NSF. There should be an attempt to balance between university principal investigators and national laboratory investigators. A final overlay should also consider a number of other balance factors, including institution, geographic region, etc. In the end, the COV should constitute an exceptional group of internationally recognized researchers, with broad research expertise in the program areas in BER's CCRD, as well as a deep familiarity with DOE programs.

The COV should take place early this fall at the BER/DOE Germantown location at 19901 Germantown Road, Germantown, Maryland. A presentation on the status and progress of the COV to BERAC is requested at its November 2003 meeting. Following acceptance of the full BERAC committee, the COV report with findings and recommendations is to be presented to me, as the Director of the Office of Science.

If you have any questions regarding this charge, please contact Jerry Elwood, 301-903-3281, or by email at jerry.elwood@science.doe.gov.

Sincerely,



Raymond L. Orbach
Director

cc: Ari Patrinos
Jerry Elwood

APPENDIX C

COV AGENDA

CLIMATE CHANGE RESEARCH PROGRAM OFFICE OF BIOLOGICAL AND ENVIRONMENTAL RESEARCH U.S. DEPARTMENT OF ENERGY

March 1 – 3, 2004

March 1

(Rm. # G-207, Continental Breakfast available)

8:30	Welcome and Introductions Signing of COI Forms	Jerry Elwood
8:50	A Historical Perspective	Ari Patrinos
9:00	An Overview of BER	Ari Patrinos
9:15	Why a COV? Charge to the Committee	Jerry Elwood Jerry Elwood
9:30	Discussion of Procedures for the COV	Gene Bierly
10:00	Breakout Sessions	Review Groups Appropriate Staff
	<i>Brief staff presentations on program & important issues Select jackets so each one will have two readers Read until lunch</i>	
12:00	Lunch in Rm. # G-207	
1:00	Breakout Sessions Continued	COV
	<i>Continue reading and discussion of jackets Begin drafting using templates as a guide Smaller programs can draft final comments</i>	
2:00	Refreshments available in Rm. #G-207	
4:15	COV Meets with BER Staff	COV
	<i>Raise any issues that need addressing Discuss any changes that should be made in the process</i>	

4:45 Depart for Hotel/Motel/Home

March 2

(Rm. # G-207, Continental Breakfast available)

8:30 COV Executive Session COV

9:00 Breakout Sessions Continued COV

*Continue reading and discussing jackets
Make recommendations on any or all aspects of review
How can the review be improved?*

12:00 Lunch in Rm. # G-207

1:00 Breakout Sessions Continued COV

*Continue reading and discussing jackets
Make recommendations on any or all aspects of review
How can the review be improved?*

2:00 Refreshments available in Rm. #G-207

4:00 COV Meets with BER

4:15 COV Executive Session

4:45 Depart for Hotel/Motel/Home

March 3

(Rm. # G-207, Continental Breakfast available)

8:30 Prepare Report COV

*Write necessary comments
Address questions on the templates
Consult as necessary*

10:30 Executive Session COV

*Discuss final conclusions and recommendations
Prepare for discussion with BER leadership*

11:30 Report to BER Leadership

*Summary of conclusions and recommendations
Prepare for report to BERAC*

12:00 Adjourn