Review of DOE Climate and Environmental Sciences Division

Committee of Visitors

July 20-22, 2010

A Report of Findings and Recommendations

Review of fiscal years 2007-2009

Submission to the
Biological and Environmental Research Advisory Committee
(BERAC)

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Acronyms and Abbreviations

AAF	ARM Aerial Facility
AAVP	ARM Airborne Vehicle Program
ACRF	ARM Climate Research Facility
AMF	ARM Mobile Facility
ARM	Atmospheric Radiation Measurement
ARPA	Advanced Research Project Agency
ARRA	American Recovery and Reinvestment Act
ASCR	Advanced Scientific Computing Research
ASP	Atmospheric Science Program
ASR	Atmospheric System Research
BER	Biological and Environmental Research
BERAC	Biological and Environmental Research Advisory Committee
CCSP	Climate Change Science Program
CESD	Climate and Environmental Science Division
CMIP	Coupled Model Intercomparison Project
COV	Committee of Visitors
DOE	U.S. Department of Energy
EMSL	Environmental Molecular Sciences Laboratory
ERSD	Environmental Remediation Sciences Division
FOA	Funding Opportunity Announcement
FY	Fiscal Year
IFRC	Integrated Field Research Center
IOP	Intensive Operational Period
IPCC	Intergovernmental Panel on Climate Change
JGI	Joint Genome Institute
MAOS	Mobile Aerosol Observing System
NCAR	National Center for Atmospheric Research
NEON	National Ecological Observatory Network
PART	Performance Assessment Rating Tool

PCMDI	Program for Climate Model Diagnosis and Intercomparison
PI	Principal Investigator
PM	Program Manager
PNNL	Pacific Northwest National Laboratory
RGCM	Regional and Global Climate Modeling
SBR	Subsurface Biogeochemical Research
SC	Office of Science
SciDAC	Science Discovery through Advanced Computing
SFA	Science Focus Area
SPRUCE	Special PRiority and Urgent Computing Environment (NSF)
TES	Terrestrial Ecosystem Science
UAV	Unmanned Aerospace Vehicle
UCAR	University Corporation for Atmospheric Research
USGCRP	U.S. Global Change Research Program

I. Executive Summary

On August 27, 2009, Dr. W. F. Brinkman, Director of the Office of Science, charged the Biological and Environmental Research Advisory Committee (BERAC) to assemble a Committee of Visitors (COV) to assess the processes used by the Climate and Environmental Sciences Division (CESD) within the Office of Biological and Environmental Research (BER) to manage their research programs and two of their user facilities. The CESD portfolio of scientific programs, divisions and facilities to be reviewed in the 2007 to 2009 period included: (1) Atmospheric Radiation Measurement Science; (2) Atmospheric Science Program; (3) Terrestrial Carbon Processes; (4) Ecosystem Function and Response; (5) Regional and Global Climate Modeling; (6) Earth System Modeling; (7) Integrated Assessment; the separate division of Environmental Remediation Sciences Division that encompassed both the (8) Environmental Remediation Sciences Program (ERSP) and (9) the Environmental Molecular Science Laboratory facility (EMSL); and (10) the Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF).

In response to this charge, Ray Wildung, a BERAC member, was asked to Chair the COV. Unfortunately, Dr. Wildung was unable to attend the CESD review and resigned as Chair. Judy Wall, another BERAC member was asked to accept this responsibility and, on January 13, 2010, accepted the invitation to Chair the 2010 COV for CESD. BER Program Managers (PM) Todd Anderson and Mike Kuperberg were appointed as liaisons to the COV and Eileen Knox, CESD Administrative Assistant, provided administrative/logistical support. A COV was established that consisted of 19 scientists -- nine from academia, five from the Federal Government, three from the private sector and two from National Laboratories. The Chair and an additional COV member were BERAC members. Two of the COV had served on former such committees and two more had reviewed the EMSL facility in the recent past.

The COV met on July 20-22, 2010, at the DOE headquarters in Germantown, MD. To perform a meaningful review, COV members were assigned to programs according to their scientific expertise resulting in six subcommittees of three members each. A consequence of this assignment was that several subcommittees reviewed more than one program. One COV member was unexpectedly not able to attend; thus, one committee had only two members. The entire COV had the opportunity to comment on the high level summary of recommendations and to provide specific responses to the questions iterated in the Charge. Written responses to the Charge were obtained from each subcommittee. A draft of this report was made available to all COV members prior to submission and COV comments were incorporated appropriately. All errors are the responsibility of the Chair of the COV.

Overview and General Recommendations:

- The COV found the PMs of the CESD to be knowledgeable, dedicated and energetic. Their commitment to seeking solutions of global problems such as climate change,

climate prediction and remediation of contaminated environments is palpable. As a result, the PMs work tirelessly to obtain the best ideas and scientists for this critical research.

- The portfolio of scientific programs developed and supported is the operational mechanism for contributing to solutions of global problems. These CESD programs are nationally respected with high profiles and many are unique. One example, data obtained from the Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) are used worldwide for climate modeling efforts. The outcomes of these models then are reported at the Intergovernmental Panel on Climate Change (IPCC) and become the basis for policy decisions in many countries.

- **The CESD is to be commended for efforts to differentiate the research capabilities of the National Laboratories from those of universities.** At the National Labs, interdisciplinary teams are more readily assembled and multiuser equipment can be obtained more efficiently. Thus the questions addressed can be more complex than is possible by the necessarily more narrowly focused science carried out in individual faculty laboratories in universities. Funding the National Labs through the Science Focus Areas (SFAs) is a step in fostering the capabilities of those entities.

- The PMs are asked to solicit proposals, identify appropriate reviewers, make funding decisions, monitor funded projects, keep abreast of current research pertinent to their program and do every task exceptionally. The prior COV stated, "We find that insufficient resources, both in terms of personnel and budgetary support, collectively place at risk the ability of the Program Managers to effectively manage and oversee the programs for which they have responsibility." Since that time, the renewed recognition that research efforts at National Laboratories can and must be planned and executed on a different scale from those at universities has resulted in the transition to Science Focus Areas (SFAs). Thus additional duties will accompany the installation and functioning of this new system but no new administrative resources have been provided. The former COV concern remains and has become more acute. **The COV recommends that more support staff be made available for, for example, workshop and review planning and reviewer database maintenance. Additional PMs are needed as well as increased assistance for financial guidance document preparation for successful proposals.**

- The peer review process is working well for both the proposals submitted in response to solicitations and for the SFA efforts at National Labs. These have been thorough, performed by qualified reviewers and accomplished in a timely manner. The PMs are to be commended for their efforts to obtain versatility among the reviewers while avoiding

conflicts of interest and biases. Feedback to successful awardees was considered comprehensive. In several instances the PMs talked personally with proposal PIs to resolve questions raised by reviewers before funding decisions were finalized. **PMs are to be commended for these efforts.**

- Feedback to unsuccessful proposals PIs tended to be generic without substantive information about the specific reasons for declination. The lack of information makes it difficult for the proposers to improve research plans so that they can be successful. **The COV recommends that more informative statements be included in declination letters.** Clearly to respond informatively will require more effort from the already overcommitted PMs, thus underscoring the need for additional support personnel.

- Experience of other agencies, in particular NSF, suggests that the productivity of PMs and support staff can be enhanced by a well designed and maintained electronic grants information system. **There appears to be room for improvement in the system in place at DOE.**

- Because the SFA is a large program of research, its size may inhibit a nimble response of the National Lab to current and changing needs for information. Accountability of all scientists associated with a SFA must be carefully monitored. Because this structure is in its infancy, discreet deadlines and mechanisms for reapplication will prevent complacency. **The COV recommends a plan for recompeting SFAs be put in place as soon as conveniently possible.**

- In the past, the DOE has had difficulties with its public image. However, the work at the National Laboratories and DOE supported university PIs is of very high quality with positive impacts in many areas of which the public is unaware. **The COV would encourage more effort to showcase the contributions of DOE to the public.**

- The problems addressed by scientific inquiry and research programs continually evolve necessitating reorganization and creation of new programs. **Care should be taken in this evolution to be clear in informing each constituency of the relationship of new programs to old.** Program name changes that are minor provide the opportunity for confusion, *e.g.*, consider these various names: Terrestrial Carbon Cycle Program, Carbon Sequestration Program, Terrestrial Carbon Sequestration Research, and Terrestrial Carbon Processes.

- To assess the quality and standing of the research supported through the solicitation process in the Atmospheric System Research (ASR) program**, it is suggested that**

quantitative metrics of the output publications be considered. These metrics could also contribute to the identification of future research areas in the program.

- **The COV supports the plans of the ASR program to utilize panels to review proposals instead of the pure mail-in reviews that were used in the past.** Virtual meetings could supplement traditional panel meetings to allow more participation by reviewers.

- The COV lauds the enthusiasm of the PM for the newly consolidated program for terrestrial systems research. **To strengthen the new program, the COV would encourage the PM to reduce the number of non-reviewed renewals so that awards would be guided by competitive processes that are transparent, rigorous and well documented.**

- **The COV recommends that the Terrestrial Ecosystem Science (TES) program consider bringing the state-of-the-art ecosystem models and modelers together to determine how ecosystem models can be better interfaced with climate models.** This activity could uncover sensitive voids in our understanding that could be used to prioritize the direction of future funding of programs in TES.

- The transition of the Environmental Remediation Sciences Program (ERSP) to the Subsurface Biogeochemistry Research (SBR) Program has been smooth. A major effort of the SBR has been the strategic change in support of the National Laboratories by funding through SFAs, now complete for SBR. The initial SFAs are now starting their third year of the five awarded. **The COV recommends that plans for year six and beyond be drafted, articulated and communicated.**

- Annual reports for both university grants and Laboratory SFAs need additional definition. Their purpose and use should be clearly iterated. **The PMs should consider the format and content of these reports to ensure that these documents are useful to all stakeholders.**

- Given the high importance and national and international prominence of the activities of the Climate Modeling Program and the extensive responsibilities of its PMs, **a program of mentoring for new PMs would be appropriate.**

- The allocation of high-performance computing resources is decoupled from Climate Modeling projects. This procedure has been successful to date because of the expansion of available resources and the good will of the participants. However, as demands

increase, **it would be prudent to install a more systematic method for the allocation of high-performance computer resources coupled to the funding of the project**.

- The Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF) management was proactive in the development of the "best estimate" cloud/aerosol data sets. **The COV applauds this approach to data product development and encourages the PMs to apply this approach to other areas of earth science research.**

- The ACRF supplies chemical and aerosol data as basic information about sites where information is gathered. Concern was expressed regarding the sufficiency of this information to support the newer model land-atmosphere parameterizations, the aerosol-cloud precipitation process characterizations and the air quality products. **The COV recommends that assessment be made to determine whether the ACRF measurement suites deliver sufficient chemical and biochemical data to support the "basic development of climate model components, with an emphasis on incorporating missing physical and biogeochemical processes in Earth System Models."**

- ACRF is now managed separately from the science that uses data generated by the Facility. **A reliable mechanism for frequent communication exchanges with the modeling scientists needs to be established.**

- The users of the Environmental Molecular Sciences Laboratory (EMSL) facilities write short proposals to obtain access to the sophisticated instrumentation and expert guidance of EMSL personnel. Proposals are three pages single spaced; however, among the proposals considered and supported, some were much longer. **The COV strongly recommends that proposal guidelines be firmly enforced to prevent the perception of, or actual, inequitable treatment.**

- EMSL is a unique and highly valuable national facility. Users have included a number of distinguished investigators and the Facility has outstanding international recognition. **The COV encourages the PM to keep in mind that the instrumentation at EMSL must be continually upgraded for the Facility to maintain its position at the forefront of science.**

II. Introduction

A. COV Operation

The Climate and Environmental Sciences Division (CESD) in Biological and Environmental Research (BER) supports the key missions of DOE through its research to obtain a predictive, systems-level understanding of climate change and the environmental challenges of DOE. The portfolio of research provides for investigations at hugely different scales ranging from regional to global predictions, from molecular to field studies and from modeling current conditions to centuries in the future. As a division that recommends and awards funds, the CESD is subject to review by a Committee of Visitors (COV) every three years. This committee reports to the appropriate Federal Advisory Committee, in this case the Biological and Environmental Research Advisory Committee (BERAC).

On August 27, 2009, the BERAC was charged by W. F. Brinkman, Director of the Office of Science (SC), with forming a COV to evaluate the efficacy and quality of the processes used to solicit, review, recommend, monitor and document funding actions and to assess the quality of the resulting portfolio of CESD. The Charge letter issued by Dr. Brinkman is found in Appendix A. In the spring of 2010, a committee of 19 experts agreed to perform the evaluation of CESD activities from 2007-2009. Four of the COV were women and the members were derived from academia (9), the Federal Government (5), the private sector (3), and National Laboratories (2). The complete roster of the COV is found in Appendix B. Robert (Todd) Anderson and Michael Kuperberg, Program Managers (PMs) in CESD, were assigned liaisons to the COV and Eileen Knox provided administrative assistance. The review was scheduled for July 20-22, 2010, at DOE headquarters in Germantown, MD, and the agenda for the meeting is found in Appendix C. In early July, the COV received a packet of materials that included the Charge letter, SC guidance document for COVs, merit review procedures, National Laboratory Science Focus Area (SFA) program structure and review processes, brief descriptions of CESD programs/facilities and the relevant solicitations/activities, and previous COV reports on CESD programs with responses.

In FY10, substantive reorganization of several CESD programs took place. The programs were to be reviewed as extant during the period under review. First, Climate Modeling - the Climate Response program, Integrated Assessment and Climate Mitigation became administered under the umbrella of Climate and Earth System Modeling as the Regional and Global Climate Modeling, Earth System Modeling and Integrated Assessment programs. Second, terrestrial systems research programs that were spread under Climate Forcing and Climate Response became consolidated under the title Environmental System Science and were named Terrestrial Ecosystem Research and Terrestrial Carbon Sequestration Research, respectively. Third, Atmospheric Systems Research now includes the programs Atmospheric Radiation Measurement

(ARM) Science and Atmospheric Science. Fourth, Environmental Remediation Sciences (ERSP) along with the Environmental Molecular Science Laboratory (EMSL) facility previously formed a separate division. The ERSP is now folded into CESD as the Subsurface Biogeochemical Research (SBR) program. Fifth, the two major user facilities in CESD, ARM Climate Research Facility (ACRF) and EMSL became separate entities within the Division. Finally, to capitalize on the unique scientific capabilities of the National Laboratories, BER is transitioning to solicitation and funding of research portfolios, SFAs, rather than individual or small groups of investigators at the Laboratories. This transition is complete for SBR but is not for other programs in CESD.

These 11 programs and two facilities were evaluated by six subgroups of three COV members, and one of each subgroup was asked to chair the review team considerations. The six program/facility assignments were Climate Modeling, Terrestrial Ecosystem/Carbon Mitigation, Atmospheric System Research, SBR, EMSL and ACRF. Breakout rooms for the six subcommittees were available in the DOE headquarters. In each room, the relevant PMs had made available copies of the Funding Opportunity Announcements (FOAs) and Program Announcements, review summaries and funding decisions, and all files relevant to the programs and timeframe under evaluation. In addition, the PMs presented an overview of the pertinent activities, answered questions and were available for additional consultation throughout the COV visit.

B. Charge to COV

The COV was charged with providing an evaluation of the following:

1. For both the DOE national laboratory projects and university grants, assess the efficacy and quality of the processes used by CESD programs during the past three years to:

a) solicit, review, recommend and document application and proposal actions, and

b) monitor active awards, projects and programs.

2. Within the boundaries defined by DOE mission and available funding, comment on how the award process has affected:

a) the breadth and depth of the portfolio elements and,

b) the national and international standing of the portfolio elements.

3. For the EMSL and ACRF user facilities, assess the management and oversight of these facilities, including facility operations tracking and review, user proposal solicitation, review and recommendation procedures.

C. CESD Program Administration

In 2008 Jerry Elwood, Director of CESD, retired from Federal service and Wanda Ferrell and Mike Kuperberg alternated as Acting Director of the Division. Shortly before the COV met, it was announced that Gary Geernaert, Director of the Institute of Geophysics and Planetary

Physics at LANL, will assume the position of Director of CESD on August 11, 2010. Dr. Geernaert is certainly a fine choice and a permanent Director will bring more continuity to CESD. However, it is clear that Drs. Ferrell and Kuperberg have handled the leadership position with great skill at a time that major transitions and reorganizations have taken place.

The CESD Program Managers and Staff are to be lauded for their remarkable professionalism and dedication to the ideals exhibited in pursuing the DOE missions relevant to climate and environmental sciences. For research projects, the PMs are expected to 1) prepare solicitations for proposals, 2) review preproposals, 3) solicit external review of full proposals, 4) arrange for panel meetings (if employed), 5) make award decisions based on reviewer evaluations and program priorities, 6) communicate decisions to PIs, 7) prepare budget requests, 8) monitor funded projects, 9) document all substantive communication with PIs, and 10) review annual and final reports. In the meantime, the PMs must arrange for the annual PI and Contractors' Meetings, hold workshops that will help guide future research directions, coordinate efforts with other Federal agencies, prepare for and respond to COV evaluations, attend as many research meetings as possible and keep abreast of relevant cutting-edge science.

With this huge docket of expectations, it is clear that creation of a second system for research program administration at the National Laboratories, the SFAs, differing substantially from the recent past, will add significantly to the PM duties. While the number of PI proposals from National Labs will apparently decrease, the complexity of each SFA proposal will be much greater. Thus PMs will need to identify reviewers who are able to cross discipline boundaries and come face-to-face to offer meaningful evaluations. More PMs should be seriously considered as well as additional support staff and travel funds.

III. CESD Program Overviews and Recommendations

A. Atmospheric System Research (ASR)

1. Program Summary

The ASR program was formed in FY2010 by the merger of two related DOE Climate programs, the Atmospheric Science Program (ASP) and the Atmospheric Radiation Measurement (ARM) program. During the period covered by this COV review, the activities of these programs were tracked separately. The missions and priorities of the earlier programs are retained in the current ASR configuration. Briefly, the mission of the ASR is "to quantify the interactions among aerosols, clouds, precipitation, radiation, dynamics, and thermodynamics to improve fundamental process-level understanding, with the ultimate goal to reduce the uncertainty in global and regional climate simulations and projections."

2. Efficacy and Quality of Funding Processes

Findings

- Three university solicitations were processed in the past three years by the ASP and ARM programs, which have recently been merged together to form the ASR program. During this period, no solicitations were issued for the National Laboratory due to the ongoing transition to Science Focus Area (SFA) funding mechanism that will be used in the future instead of individual PI solicitations for the National Laboratories.

- The key processes for the university solicitations that were reviewed by the COV were the pre-applications process, the external scientific review, the programmatic review, and award action. All three solicitations were reviewed using mail reviews, but the PMs have indicated that future reviews would be performed with panels and will include one mail review per proposal.

- To PIs who submitted pre-applications, the PMs provided feedback that was largely focused on how the proposed project would fit within the scope of the call and how the project would fit within the Program priorities. The PM's responses to the pre-application notices are viewed as a good process.

- The timing of the pre-applications and the deadline for the PM to reply led to some inconsistencies in the reply to the PIs but it is expected that this will become more uniform as the PMs gain additional experience with the process. The pre-application process was not formally documented but one PM was able to provide an example of the pre-application responses upon request.

- Overall the reviews were conducted by high quality reviewers and typically three or four reviews were conducted for each proposal, and most reviewers provided detailed assessments of the proposals. The mail review process was effective and fair and no major flaws were found.

- The definition of conflict of interest did not seem to be clearly presented, but no major problems with the appropriateness of reviewers were identified.

- After the scientific review, the final decisions for funding were conducted within the context of the scientific review and a programmatic assessment. The programmatic assessment of Notice 07-26 (DE-PS02-07ER07-26) was well defined and reasonable based on detailed documentation provided by the PM upon request. The details of the programmatic assessments for the other two solicitations were not as well documented but did seem consistent with the overall Program mission.

- Although Program balance is considered an important factor in funding decisions, mapping the specific funded proposals against strategic research goals was not documented, and detailed documentation of the rationale supporting declination of well-reviewed proposals against less well reviewed proposals is lacking. Declination letters to the PIs could be more informative, although it is our understanding that personal phone calls were made. Overall funded PI teams are very strong with scientists of very high caliber.

- The COV reviewed one SFA proposal and the scientific review of the SFA. The scientific reviews were rigorous, are being addressed by the National Laboratory submitting the proposal and are consistent with assuring high quality science and research. However, it is important to note that the SFA review is not a competitive review in the standard sense, which has some potential implications for the scope and quality of the research activities.

Comments

- The documentation for recording which projects are renewals and/or continued funding to a university PI is not complete. In one of the FOAs (07-24), only new proposals were declined, and in another, only two renewals were not funded. This suggests that FOAs might be more useful to prospective PIs by including more specific information as to the importance of linking new proposed research to ongoing efforts and guidance to prospective PIs as to where/how such information can be found.

- Likewise, the requirement for PIs to document the accomplishments from prior funding from the Program with a new proposal, and for these accomplishments to be considered in the review process, has not been formalized. In some cases, these accomplishments were documented in the proposal and considered in the review process, but in many other cases prior accomplishments were not documented, and assessment's made in general terms not considered in the scientific review.

- The COV notes the progress made toward the award of SFAs in the ASR program. The COV suggests that a plan for continuing review and assessment of SFAs be established from the beginning. It is the COV's understanding that the future management of the SFA will be directed at managing overall efforts with potentially limited or nonexistent full competitive assessment. It is unclear how the Program will ensure that proposed efforts will achieve maximum advancement of science and the most effective use of National Laboratory resources. Care must be taken in designing an ongoing review program that assures long-term excellence and agility to adapt to the evolution of science.

Recommendations

- A requirement to include accomplishments from prior support from the Program (including ARM and ASP) as part of the proposal process should be formalized and these accomplishments should be considered in the scientific review.

- For proposals that rated good scientific reviews but were not funded for programmatic considerations, the programmatic issues used in funding decisions should be fully documented and suitably articulated.

- Increasing attention to PI diversity and balance across career development is strongly encouraged.

- The definitions of conflict of interest should be more formally defined.

3. Processes to Monitor Active Awards, Projects and Programs

Findings

- The processes for monitoring active awards and projects within ASR are based on annual reports and annual PI meetings. These activities are probably sufficient for project management but are really insufficient to effectively assess the effectiveness of the overall program and the value added by individual solicitations. Although the Program does keep a running tabulation of publications associated with activities funded by the

Program, there is no additional assessment or use of metrics to assess the effectiveness of the awards, projects, and programs.

Comments:

- The oversight of projects from a project management perspective is adequate but additional assessment is important to identify the impact of the program.

Recommendations:

- Additional quantitative assessment should be conducted to determine the contributions of the program and to provide guidance for future solicitations and programmatic reviews.

- It seems monitoring of ongoing research projects as well as overall program assessment could strongly benefit from better staff support.

4. Effect of the Award Process on Portfolios

Findings

- Very little evaluation of the ASR portfolio is conducted by the Program. Clearly, the funded PI and activities are making important contributions to the mission of the DOE, the Office of Science and the Division, but the Program should use more quantitative metrics to assess the impact and to use such assessment to help guide future solicitation and funding decisions. With this said, it is very clear that the program is funding critical science within the missions of ASR and the quality of science is extremely high.

Comments

- A qualitative assessment of ASR clearly shows that important contributions are being made to the understanding to the aerosol-cloud-radiation continuum within the context of climate. The Program is funding leading scientists in this area and is on the forefront of improving fundamental scientific understanding of aerosol, clouds, and their interactions, within the context of climate.

Recommendations

- ASR should direct efforts at determining the impacts of the program's portfolio on science using quantitative metrics.

5. The National and International Standing of the Portfolio Elements

Findings

- The quality of work and the PIs leading ASR projects are well regarded, nationally and internationally, for their contributions to understanding aerosols, clouds and their interactions within the context of climate. The publications record of ASR is very good in terms of the numbers and the quality of journals in which they are published.

6. Other Review Criteria

- Are an adequate number of qualified reviewers (free from bias and/or conflicts of interest) selected for review of projects and grants? The proposal reviewers are qualified and are free of bias and conflicts of interest but as noted above, the Program should more formally define the definitions of conflict of interest. The COV has not identified any major issues and this recommendation is largely being provided as a safeguard for the future.

- Are the Office of Science (SC) merit review criteria applied appropriately in the evaluations? Yes

- Is documentation of the review process adequate and complete? Yes, but the rationale for programmatic decisions concerning funding should be better documented.

- What are the characteristics of the award portfolio?

- Are progress reports on previously funded research useful in the evaluation of proposed research? The progress reports are useful and sufficient for project management.

- What is the quality of overall technical management of the program? Very good

- What are the relationships between award decisions, program goals and DOE mission? Very well aligned but full evaluation is difficult without the recommended programmatic assessment above.

- Are there significant impacts and advances that have developed since the previous COV review that are demonstrably linked to DOE investment? Difficult to fully quantify without the recommended programmatic assessment recommended above.

- Were the responses of the program to the recommendations of the previous COV review appropriate? The program has been responsive to the previous COV comments by additional progress should be directed at additional documentation and communication to PIs that were not selected for funding.

B. Climate Modeling Programs

1. Program Summary

The Climate and Earth System Modeling components of CESD were formed in FY2010 by the merger of three related programs, the Climate Modeling program, the Integrated Assessment program and a new program (for FY2010), Regional and Global Climate Modeling. During the period covered by this COV review, the activities of these programs are tracked separately here. The missions and priorities of the earlier programs are retained in the current Climate and Earth System Modeling configuration.

Regional and Global Climate Modeling (RGCM) Program mission "is to undertake scientific studies using state-of-the-science coupled climate and earth system models, with a focus on analyzing regional and global climate change projections. The temporal scales of interest range from decadal to centennial."

Earth System Modeling (ESM) Program mission is "to *develop* improved coupled climate and Earth system models for climate change projections on time scales from decadal to centennial and spatial scales from global to regional. The ESM program focuses on the incorporation of improved representations in specific model components e.g., atmosphere, ocean, land, sea-ice and ice-sheet, as well as coupling mechanisms, thus providing the research results and modeling tools that underpin the Regional and Global Modeling Program activities."

Integrated Assessment of Global Climate Change program goal "is to reveal climate change insights into the complex interactions of human and natural systems and develop the integrated models and tools that will underpin future national and regional decision-making on options for mitigation and adaptation."

The Climate Modeling Program is currently supported by two program managers and in 2009 had a budget of approximately $50 million. Over the period covered (2007-2009) it was comprised of a separate Climate Modeling Program and the Integrated Assessment Program. The two program managers provided a very thorough and excellent review of their past and current programs. We appreciate their enthusiastic support and their frank and forthcoming discussions. The Climate Modeling projects consist of four major types: multi-lab consortium projects; single and multi-university projects; single lab projects; and its University Corporation for Atmospheric Research (UCAR) cooperative agreement. The COV had access to and examined successful and declined proposals for all of these entities.

2. Efficacy and Quality of Funding Processes

Findings:

- The committee found that the program solicitations were entirely consistent with the objectives of the Climate Modeling Program.

- The review process was done primarily by panels with some mail review supplementation. All the proposals we looked at had three to five reviews. A rating of very good (7 or higher) was regarded as the minimum requirement for funding. Proposals receiving at or close to 7 were regarded as marginal and selected according to program relevance, when funding was inadequate to support them all. We found that this process of review, recommendation, and documentation of the review process was generally well done.

- We examined a sample of awarded and declined proposals from DOE labs and from outside DOE. We were impressed by the quality of the review panels and the reviews, and we found in essentially all cases that the proposal evaluation was fair and appropriate and that appropriate procedures were adhered to. The UCAR cooperative agreement, which is a significant fraction (~5%) of the total funds, has been successful in thorough peer reviews.

- The COV evaluated statistics for five solicitations, four for university investigators and one for lab Field Work Projects. Success rates varied from 37 awards for 72 proposals submitted in the 2007 Abrupt Climate Change solicitation to 18 awards for 79 proposals submitted in the 2009 Regional Climate Modeling competition. For all 5 outside-DOE solicitations, the success rates for women PIs were the same or higher than for the competition overall. Proportions of female reviewers were roughly similar to the proportion of female PIs submitting proposals. We note, however, that all of the PIs for the National Lab solicitation were men, possibly reflecting the demographics of senior scientific staff at those labs.

3. Processes to Monitor Active Awards, Projects and Programs

Findings:

- The active awards, projects, programs, and cooperative agreement are effectively managed through a number of mechanisms: annual progress reports, annual PI meetings, workshop and working group meetings, and regular reviews/updates of major program elements.
- All the Climate Modeling PI's met together for the first time in 2010. This meeting will continue and should become increasing valuable as a way to promote synergism between the different program elements.

- Workshops have proved to be effective means of obtaining community input for the evolution of program priorities.
- We saw only limited documentation of progress; annual progress reports are typically limited in length and scope, and we did not see formal comments on them from the program managers.
- Program managers indicated that they rely, to a significant extent, on PI meetings to assess research progress, with the resulting slides summarizing the posters made available on a website.

4. Effect of the Award Process on Portfolios

- We found that the award process has promoted a program of increasingly high quality.

5. The National and International Standing of the Portfolio Elements

- Some elements have become critical components of the overall US and international global climate change programs. In particular, by working with DOE Office of Advanced Scientific Computing Research (ASCR), the Climate Modeling program is facilitating the provision of DOE's most advanced computational capabilities for the support of international assessment programs, specifically, the next Intergovernmental Panel on Climate Change (IPCC) assessment.
- Furthermore, the work of the Program for Climate Model Diagnosis and Intercomparison (PCMDI) and the Earth System Grid now provide a major capability for the international community to be able to access output for many of the world's climate models; 20,000 users have already obtained results and more than 600 papers have been written using these results.
- The DOE Climate Modeling program has become an equal partner with NSF/NCAR in the development of the Coupled Climate System Model (CCSM) which is a major US model.
- Besides these large activities, the Climate Modeling program has developed three very important SFA's at national labs, and a wide range of excellent PI research at universities and labs.

Recommendations:

Human resources:

- Program managers for Climate Modeling: There are too few PMs for the size and complexity of the program element. With addition of third PM, the number of PMs will possibly be sufficient, but we suggest that one-to-two additional (4-5 total) managers would allow for PMs to have more time to interact with PIs. In addition, PMs would

have a better opportunity to stay up to date in the science through activities such as scientific meeting attendance and reading. This additional time would facilitate effective communication up the hierarchy and allow engagement in long-range planning activities. The normal work schedules of program managers should allow for their important participation in interagency activities.

- Given the high importance and national and international prominence of the activities of the Climate Modeling Program, and the extensive responsibilities of its program managers, a program of mentoring for new program managers would be appropriate and is recommended.
- Support personnel: Number of support staff is extremely limited overall. The number should be increased, and there is a particular need for staff to work on financial matters.

Support systems:

- Experience of other agencies (namely NSF) suggests that the productivity of program managers and support staff can be significantly enhanced by a well designed and maintained electronic grants information system. There appear to room for improvement in the system in place at DOE.

Computing resources:

- The allocation of high-performance computing resources is decoupled from Climate Modeling projects. It has functioned successfully to date, drawing on the expansion of available resources and the good will of participants, but as demands increase, a more systematic approach would be appropriate.

- Long-term support for vital high-profile activities is needed but lacking.
  - PCMDI: Serving of climate model results and the maintenance and development of associated software are crucial activities, vital for national and international climate research. Support for this project is moving from SciDAC to the Climate Modeling Program, which reduces funds available for other program activities and has the potential to reduce the stability of PCMDI support. International partners are seeking a decadal commitment to support for the availability of climate model output.
  - Computing for IPCC and Coupled Model Intercomparison Project (CMIP): The development and integration of climate models takes several years. In order to plan effectively, climate modelers must know what computing resources will be available. For example, planning for CMIP6/IPCC AR6 should be underway now.

C. Subsurface Biogeochemical Research (SBR)

1. Program Summary

The mission of the program is to "advance our understanding of the fundamental physical, chemical and biological processes that control contaminant behavior in the environment in ways that help solve DOE's intractable problems in environmental remediation and stewardship."

2. University proposals – 07-17 and 08-09

a. Efficacy and Quality of the Program's Processes

1) Solicitation

There is consistency between the program goals, the solicitation and the follow-through with the funded awards. For borderline proposals, decisions are based on which proposal most closely fits program goals and enhances the portfolio of funded awards. The solicitation contains detailed information that describes the specific needs of the program with very clear statements on topics that would not fit with program goals. **The language dealing with the linkage between existing DOE field sites and DOE collaborators could be strengthened to emphasize the importance of this connection in the decision process.** In the 2007 solicitation (07-18), guidelines were given for the PIs had to self-identify the proposal into one of the four listed science elements, this was not the case in 2008 solicitation (08-09).

2) Pre-application handling

The pre-application process has been very well handled with a great deal of effort and thought given by the PMs. The pre-application decisions were completed in a very timely manner, within two to three weeks, which is commendable given the number of pre-applications. The comments to the PI were clear, substantive, and constructive for both the encouraged and discouraged pre-applications.

3) Proposal Review

The solicitations were primarily reviewed by panels with occasional mail reviews to bring in specific expertise. In almost all cases, at least three reviewers, who were panelists, reviewed each proposal. The reviews were generally thorough, thoughtful and insightful. We reviewed several specific proposals and, in all cases, the reviews addressed each of the DOE Office of Science criteria. The chosen panelists were highly qualified and appropriate to the topical area. We found no evidence of bias or conflict of interest. Most of the panelists were not funded by the program, which indicates to us that the program managers are looking for broad input to the portfolio. Hopefully, this does not limit the level of expertise that those funded by the program could add to the review process.

The panel reviews proceeded as a two-step voting process. First each reviewer discussed the proposal and gave their initial scores. This was followed by a discussion and comments on the proposal from other panelists. The chosen reviewers could adjust their scores based on this input, if they chose to do so. At the end of the discussion, the entire panel was encouraged to vote. This second round of scoring could bias results by including recommendations from those who did not read proposals. However, we found in reading summary analyses that the program managers seem to use this information appropriately. The second scores were used for decisions on borderline proposals.

4) Award Decisions

Subsequent to the panel reviews, the program managers met to integrate input across several panels. We noticed that different panels had different success rates. This may reflect differences in quality or programmatic considerations. Some highly rated proposals were not funded as a result of this process, but there was careful consideration of all decisions. The internal documentation summarizing the reason behind the decision was concise but substantive. **However, for the declined proposals, this reasoning was not passed on in the PI letter with the exception of subtle statements indicating that the proposal would not be funded or that the proposal was not funded due to limited resources. It would be helpful to those with declined proposals to have more substantive information on the review process, including general statistics or information about the competition so they can more easily decide if they should revise and resubmit.** We should note that all PI's received the comments from all of the reviewers. For accepted awards, the internal documentation was excellent with very detailed information. In some cases, responses to reviewer comments were solicited from the proposer where critical concerns were raised. In these cases, the response was documented and considered by the PM before the final decision was made.

5) Post Award Handling and Relationship with the PI Community

Award files contained annual reports from the PI and a synopsis and analysis of the progress by the PM before the next round of funding was approved.

3. Science Focus Areas (SFAs)

SFAs have been implemented since the last COV. This is a major strategic change in the way BER funds research at the National Laboratories. Environmental Remediation Sciences Division (ERSD) (now SBR) was the first program to implement SFAs within BER. They have run two competitions; their first cohort has just submitted their second annual report. SBR has initiated the post-award triennial review process with two SFAs and established a rolling schedule to better manage this important responsibility.

The materials provided to the COV included significant planning documents for these SFAs, including how the initial budgets and science foci were derived, plans for the competitions, reporting and triennial reviews. These documents substantiate thorough planning and extensive

communication for the "start up" of the SFAs. There is not a similar level of planning and documentation for the *continuation* of the SFAs in BER. **With the original SBR SFAs just starting their third year of the original five, it is imperative that the plans for year six and beyond be articulated and communicated.**

a. Efficacy and Quality of the Program's Processes

1) Solicitation

The SBR SFA solicitations are consistent with program goals and the SFA approach. The resulting awards are likewise consistent with program goals and the SFA solicitation –there was evidence that proposals lacking the synergy desired in SFAs were not competitive.

2) Pre-application handling

The pre-applications used a different format from that requested in university solicitations to determine the appropriate scope and funding level. A PowerPoint presentation with a template provided by SBR was requested. It is evident that these were carefully reviewed by several SBR program managers. The feedback provided was timely, clear and extensive. The next stage of pre-application documents was an 8-page project summary, again with feedback from program staff.

3) Proposal Review

These proposals were reviewed in panel, with competent panelists representing a wide range of expertise and backgrounds. These proposals received four to eight reviews (depending on scope) from reviewers with complementary expertise. The review included presentations and Q & A from the SFA leads. The 2008 panel was more homogeneous because all the proposals were focused on one topical area. The reviews in general were thoughtful and thorough, addressing the SC merit review criteria and the detailed additional SFA criteria. In both panels, the entire panel participated in the second-round scoring process and provided a useful "big picture" gauge of relative quality.

4) Funding Decisions

The funding decisions generally followed the panel recommendations. In all cases, SBR program managers identified concerns that needed to be addressed before proceeding with an award, as appropriate for these large and complex actions. The proposers clearly took these seriously and the responses were constructive and on-point. The internal documentation is entirely adequate.

5) Post Award Handling and Relationship with the PI Community

The SFA files included abstracts from the annual ERSP PI meeting as well as annual reports. The annual meetings are clearly important events for the SFA researchers. Several ERSP SFAs have already started the post-award triennial review process, giving feedback to projects where significant concerns needed to be addressed early in the award lifetime.

Each SFA seems to have interpreted the SBR guidance on the annual report differently – with two annual reviews in hand for most of the SBR SFAs. **It is timely to look at the format and content of the reports and ensure that the reports are useful to all stakeholders.**

There is evidence from the files and conversation with SBR program managers that they know their SFAs well and have effective communication with the researchers, SFA leads, and upper Laboratory management.

The COV believes that the annual reports, PI meetings and triennial reviews provide adequate oversight on the SFAs. **If additional presentations are requested, the COV urges DOE and the PIs to consider videoconferencing or similar virtual technology.**

SBR has done a commendable job in its implementation of SFAs to date. This significant change has been implemented with careful planning and a lot of hard work. It is particularly noteworthy that this happened in the absence of a permanent ERSD division director – you could track the rotating acting division director by the correspondence. That it went so smoothly is a testament to the skill, professionalism and collegiality of the SBR program staff.

b. Outcomes and award portfolio (combined for university, SFA and IFRCs)

The SBR portfolio includes top researchers in subsurface biogeochemical research, with a good blend of diverse disciplines and interdisciplinary projects. The Highlights on the SBR webpage include recent publications in high-impact journals. Modeling plays a key role in linking the molecular and ecosystem scales, new measurement tools and methods have also been essential in characterizing rates of subsurface processes.

The portfolio includes individual PI and small team research projects, Science Focus Areas at the National Labs and field research sites. The ability to test hypotheses at the IFRCs has moved the subsurface field forward in important ways. **There is synergy and collaboration among these three components of the portfolio, but there is room for additional interaction.**

The SBR portfolio includes a significant investment in Exploratory Projects (universities and through SFAs). This is an important element of the program and brings new people, new insights and new tools to the field.

The historical ERSD portfolio focused on fundamental science that supports DOE's remediation and long-term stewardship missions. The new SBR strategic plan has the potential to broaden the scope of the portfolio and link to the climate change and carbon-cycling efforts in CESD. This would allow SBR to contribute to additional DOE goals and critical societal needs**. Effective implementation of the strategic plan will require significant additional resources.**

4. Integrated Field Research Challenge (IFRC)

These facilities provide advanced understanding and predictive capability of coupled hydrological, geochemical and microbiological processes that control in situ transport, remediation and natural attenuation of metals, radionuclides and co-contaminants across multiple scales ranging from molecular to watershed levels.

The COV reviewed the post-award processes for all three active IFRCs. All appear to be very productive in terms of publications (number and quality). These centers offer a venue for collaboration between National Lab and university researchers. SBR management of these IFRCs is appropriate.

The reporting is more than adequate – quarterly reports that could be shortened into brief management summaries (management, staffing, budget) with extensive scientific reporting annually.

There is a need for development of a comprehensive data management plan for all IFRCs. Apparently, a workshop is scheduled where this issue will be discussed. **Any plan should include arrangements for data-sharing outside the IFRC-funded team within a reasonable time.**

Plans for recompeting IFRCs should be developed soon.

5. Science Discovery through Advanced Computing (SciDAC)

This program offers large modeling awards in partnership with ASCR. There are no competitions. Two National Lab projects are funded. These are breaking new ground in computational subsurface science and are an important part of the portfolio. Outcomes have been strong. Reporting is adequate. SBR management of the SciDAC awards has been good.

D. Terrestrial Ecosystem Science/Terrestrial Carbon Sequestration Research

1. Program Summary

The Terrestrial Ecosystem Science (TES) program was formed in FY2010 by the merger of two related DOE programs, the Terrestrial Carbon Processes and Ecosystem Function and Response. The Climate Mitigation program also transitioned into the Terrestrial Carbon Sequestration Research. The program for ecosystem research and the terrestrial carbon sequestration activities were consolidated with the environmental remediation science program (now subsurface biogeochemical research) within the Environmental Systems Science element of the CESD budget.

During the period covered by this COV review, the activities of these programs are tracked separately here. The missions and priorities of the earlier programs are retained in the current configuration. The **Terrestrial Ecosystem Science** program uses competitive, peer-reviewed research to deliver improved scientific data and models about the potential effects of increasing greenhouse gas concentrations on the Earth's terrestrial biosphere and the role that terrestrial ecosystems play in the global carbon cycle.

In the previous COV report of Climate Change and Research Division programs, 2007, the correlative programs included the **Terrestrial Carbon Cycle Program** focused on terrestrial components of the global carbon cycle, with emphasis primarily on observational and experimental studies in the U.S. The supported research sought to understand processes and mechanisms that control carbon exchange among plants, soils, and the atmosphere, particularly at the ecosystem level. Also included, the **Carbon Sequestration Program** was sharply focused on identifying processes and controls which impact carbon sequestration in soils and biota. Finally, the DOE **Program for Ecosystem Research** (PER) was aimed at producing scientific knowledge about potential effects of climatic change on ecosystems so that decision makers (including the public) could determine if fossil-based energy production were 'safe'.

2. Overall Comments about the Program

- Merging the programs is both worthwhile and appropriate. This reorganization promotes better coordination within the program and is also recognized as an important step forward.

- We appreciate the program manager's enthusiasm for the past, present and potential of the program, and appreciate the breadth of strategic thought about the program. Specifically the move to reduce and eventually eliminate renewals and have awards be guided by competitive processes that are transparent, rigorous and well documented is notable.

- We applaud plans to think about the future of Ameriflux, the network of micrometeorological tower sites providing continuous observations of ecosystem level parameters across North, Central and South America, and what it will become. The decision to formalize monitoring Ameriflux as separate from standard research proposals is useful, but should be carefully considered given that this decision will have a potential impact on the TES program's ability to fund the large-scale experimental science that no one else can or will fund. What do you want to get out of Ameriflux and where do you see it 5-15 years from now? What is the value of a long-term commitment to fund some subset of currently DOE-funded sites? How will the network integrate with the National Ecological Observatory Network (NEON)?

Suggestions: since funding is proposed to be handled with something like the SFA mechanism for the National Laboratories, perhaps selected sites should write a proposal that addresses (1) What the science value is for a long-term record? (2) What questions would be addressed by the long-term network that could not be addressed by standard proposals? (3) How will the network address the well-known problems with the technique, especially for determining carbon balance (advective fluxes and the problems of accurately estimating carbon loss in respiration)?

- The program is internationally recognized for innovative, large-scale ecosystem experiments, and we applaud the vision and leadership that made these possible.
- The program might become more visible and make a greater impact if accomplishments were better tracked and promoted.

3. Efficacy and Quality of the Program's Processes

Findings:

- Within the COV period, there was only one formal solicitation (07-11), but proposals for programmatic funding were also solicited from the National Labs for SFAs. For both the formal and National Lab solicitations, the process followed was very consistent with the program's solicitations, announcements, and guidelines.

- For 07-11, the solicitation was very clear, specific and enhanced by succinctly documented literature sources as additional guidance to the community for what was being sought and for what purpose. The documentation for making the decisions was very complete and understandable. We judged the program to be very efficient in handling this solicitation in three ways. First, the solicitation required a pre-proposal, which is efficient in assessing basic research ideas. Second, these pre-proposals were heavily screened so that the final success rate for full proposals was ~50%--not wasting researcher's valuable time writing proposals for a typical 10-15% success rate. Finally, comments of reviewers were addressed before funds were awarded, allowing methodological concerns to be formally addressed prior to the start of research. For the 07-11 solicitation to the universities, there were six reviewers, all competent in our judgment without conflicts of interest. However, two were from the same research group, and while both were competent, it seems likely that they may share some biases, and choosing reviewers from the same location should be avoided. With regard to gender, one of the proposals was from a female researcher, and it received high marks and was selected for funding. Within the six reviewers, one was female, which is low but reflects the ratio of researchers working in terrestrial ecosystems.

- For the National Lab solicitation, the documentation for making the decisions was very complete and understandable. The reviewers were qualified and sufficiently broad with few conflicts of interest, but not very diverse (only 1 of 15 was female, and most were senior researchers). Substantive review comments were identified and followed with specific questions that were thoroughly, thoughtfully and professionally addressed by formal written answers from the PIs. The new approach should produce more integrated science that addresses questions of the highest priority. The TES and the National Labs both did a fantastic job. The independent review every three years is a good mechanism to evaluate the program.

Comments: Very well run solicitations. The expectations were very clear and met.

Recommendations:

- The 07-11 solicitation and the National Lab solicitation provide excellent models for the future and we recommend that the program continue to follow these processes.

- We recognize that the program will change with the merger and with the addition of a new program officer. However, it is important for the program and process to be transparent and follow the processes discussed above in 'findings.'

- We recommend that the program rapidly transition to a system of solicitations for non-National Laboratory science that includes (1) an annual solicitation, (2) for the proposals that clearly have a term longer than three years, there should be fewer renewal proposals and more longer-term awards, and (3) funding for synthesis activities. We believe that such a system would better engage a broader research community in the program and improve the quality of the science. Additionally, funding synthesis activities is extremely worthwhile, especially in ecosystem science, and is very cost-effective research.

- We recommend that the SFA funding for the National Labs be reevaluated every 6 years (at the end of the second triennial review), aligned with research priorities that have changed with time, and a new proposal solicited at this time.

- We recommend the program consider a solicitation to fund collaborative work with **S**pecial **PR**iority and **U**rgent **C**omputing **E**nvironment (SPRUCE) and NGEE.

- The program should consider an emphasis on model needs or deficiencies as a selection criterion for proposals. This emphasis is an excellent tool for discrimination among proposals and for steering the program.

- The program should consider soliciting shorter, lower cost proposals for high risk-high reward ideas for proof of concept.

4. Processes to Monitor Active Awards, Projects and Programs

Findings:

- Progress reports were consistently well documented and informative. The funding to university projects and to national labs has resulted in high quality science and that productivity was summarized adequately in the reports.

- Workshops and annual PI meetings have been used as means of effective monitoring of progress and potentially could be expanded within the program. If this is done it should be done with clear articulation of how progress will be documented.

- Past COV progress reports suggested greater travel funds be allocated for site visits and science meetings. This has been successful and appears to be adequate at the present time. However, the new emphasis on SFA big science may alter the need and value for travel to specific sites for evaluation of progress.

- Present management of the program is dynamic, with recent flux in personnel and a PM position currently being advertised. The competent and thoughtful management of the terrestrial program is conspicuous and worth noting. New hires should build upon the strength that has grown through time. People matter, and the new hire that is advertised will have a strong impact on the future of the program. We encourage the program to search until it is comfortable that a good fit is identified.

Comments: (See general comments p. 23.)

Recommendations:

- Progress (publication and particularly syntheses) often occurs after final progress reports have been submitted. To keep the program informed on publications, a system such as electronic search capacity (Web of Science) or providing some incentive for funded scientists to contribute information should be considered.

- The development of web pages that document the program and continue to update its impact should be considered a high priority. However, the capacity of the staff and the degree that they are presently stretched needs to be balanced with this need and others.

- Workshops and synthesis products from those workshops can be helpful to the program. One such activity that we recommend is that the program consider bringing the state-of

the-art ecosystem models and modelers together to determine how ecosystem models can be better interfaced into climate models. This exchange has the potential to uncover sensitive voids in our understanding and could be useful in prioritizing the program's future funding.

- The program is growing in stature and impact. That trajectory will be encouraged by continuing the transition from projects that are renewed with little review, to funding based on periodic solicitations for proposals and rigorous transparent reviews that are carefully organized to minimize bias and conflicts. The TES has made tremendous progress in this regard and should be encouraged to continue strides in this direction.

5. Effect of the Award Process on Portfolios

Findings:

- The program is internationally recognized for innovative, large-scale ecosystem experiments, a broad scientifically interesting and very useful research portfolio. The COV applauds the vision and leadership that made these possible.

- The program has a strong history of funding important research on climate change and terrestrial research that fills needs because no one else is funding it. Some of the historical accomplishments are: a suite of free-air CO_2 experiments, the CO_2 – ozone interaction experiment, the precipitation manipulation experiments, temperature manipulation experiments, the establishment of many long-term flux measuring sites, the establishment of the Ameriflux network, important work in belowground and decomposition research. The program leads the world in many of these research areas.

- The two solicitations here are closely aligned with the goals and missions of the program, division, Office of Science, and DOE.

- The two solicitations increased the research portfolio in three important areas – 1) increased temperature and changes in plant and animal community structure and function, 2) an extremely important ecosystem warming experiment in boreal forested wetlands with deep organic soil, and 3) better integration of processes across scales and between models and experiments.

- Many of the funded University proposals have been sustained by repeated renewals without external review. The effectiveness of the portfolio may have decreased over time because of this practice.

Comments: (See general comments p. 23)

Recommendations: (in addition to above)

- We recommend the program continue to solicit research on important topics in ecosystem response to global change that cannot be accomplished outside of the program.

6. The National and International Standing of the Portfolio Elements

Findings:

- The program has produced many highly significant and unique scientific outputs. Free-Air CO_2 Enrichment **(**FACE**)** technology was initially developed with DOE funding and then spread to several locations around the world.
- The Ameriflux network is very well organized with good cross calibrations, and it is an important tool for helping to assess the carbon balance of the Earth in collaboration with Euroflux and many other flux-tower sites around the globe. Such programs plus the excellent scientific reputations of the individual scientists funded by DOE assure that the international standing of the DOE-funded terrestrial research program is high.

Comments:

It was stated that reviewers from foreign countries are sought, and this is a good idea, both because it diversifies the review pool and because it provides an additional mechanism to educate scientists in foreign countries about the generally high level of research being done in this country. However, we note that of the six reviewers of the 07-11 solicitation to the universities no reviewer was from a foreign country, and for the Climate Change Science Focus Areas (SFAs) for the national labs, only one in sixteen was foreign.

Recommendations:

- Therefore, we recommend that a greater effort be made to recruit more highly qualified reviewers from outside the U.S., perhaps 20%.

7. Other Review Criteria and Questions

- Are an adequate number of qualified reviewers (free from bias and/or conflicts of interest) selected for review of projects and grants? *Generally yes, although we note that two reviewers for the 07-11 solicitation to the universities were from the same research group which could contribute to some shared biases.*

- Are the Office of Science (SC) merit review criteria applied appropriately in the evaluations? *Yes.*

- Is documentation of the review process adequate and complete? *Yes, and we are particularly impressed with how well the 07-11 solicitation is documented and we would recommend that this is good model for future solicitations.*

- What are the characteristics of the award portfolio? *Funding is roughly divided half and half between "universities" and National Labs, and it appears to meet the objectives of DOE's Terrestrial Ecosystem Global Change research program.*

- Are progress reports on previously funded research useful in the evaluation of proposed research? *Somewhat.*

- What is the quality of overall technical management of the program? *Good.*

- What are the relationships between award decisions, program goals and DOE mission? *They appear to be consistent.*

- Are there significant impacts and advances that have developed since the previous COV review that are demonstrably linked to DOE investment? *Yes. While this is difficult to address comprehensively, a cursory review of the 2008 publications list on the web for only the PER program shows substantive advances in science. In 2008 forty publications in high quality journals were listed with an additional 12 manuscripts in press. This list included several in the* Proceedings of the National Academy of Sciences *and one review on extreme precipitation events and their impacts on ecosystems. A more thorough documentation of the progress of the program with an accessible presentation on the web would be useful.*

- Were the responses of the program to the recommendations of the previous COV review appropriate? *Generally "yes." However, we note the following:*
    - *The response statement states about 40% of the reviewers from the prior solicitations were foreign, whereas in the more recent solicitations, there was only one.*
    - *Responses with regard to decreasing role of "Chief Scientists" and increasing use of screening with Letters of Intent appear to have been implemented. Documentation of funded (and reasons for declines to funding) appears to have improved.*
    - *Increased budget for travel to sites and meetings by the program manager has been implemented. The use of annual meetings/workshops of the PIs to review projects seems to be partially implemented, but the documentation of results and project performance revealed at the meetings needs to be recorded.*

E. Atmospheric Radiation Measurement (ARM) Climate Research Facility (ACRF)

1. Project Summary

The ARM Climate Research Facility (ACRF) is a multiplatform national scientific user facility, with instruments at fixed and varying locations around the globe for obtaining continuous field measurements of climate data. The ACRF was the first climate change field research facility to operate cutting-edge instrumentation on a long-term continuous basis. There are three components to the facility, fixed sites in diverse climate regions (*i.e.*, the southern Great Plains of the US, the North Slope of Alaska, and the Tropical Western Pacific), a mobile facility (AMF) with instrumentation and data systems similar to the fixed sites, and an aerial facility (AAF) providing airborne measurements in response to scientific questions posed by the research community. The data obtained are used as a resource for over 100 journal articles per year.

The COV subgroup was asked to evaluate the ACRF program management processes associated specifically with ACRF infrastructure for fixed sites, the two AMFs, and the AAF. This COV subgroup did not review any program management processes associated with the ARM science, ACRF user requests, and ACRF mobile facility deployment proposals. These were evaluated by the ASR subgroup. The charge for evaluating the ACRF is also specifically mentioned in the letter of 27 August 2009 from Director Brinkman to Dr. Gary Stacey directing BERAC to assemble the Committee of Visitors:

For the EMSL and ACRF user facilities, assess the management and oversight of these facilities, including facility operations tracking and review, user proposal solicitation, review and recommendation procedures.

However, the ACRF subgroup interpreted this charge to apply to ARM science and was therefore the purview of the ASR subgroup.

2. Efficacy and Quality of the ACRF Infrastructure Program's Processes

There were two major ACRF Infrastructure funding opportunity announcements relevant for the COV 2007-2009 review period.

LAB 06-20

Notice LAB 06-20 *Atmospheric Radiation Measurement (ARM) Aerial Vehicles Program (AAVP)* solicited proposals for re-competing the AAVP [formerly the Atmospheric Radiation Measurement-Unmanned Aerospace Vehicle (ARM UAV) Program]. Only DOE National Laboratories were eligible to respond to this announcement.

Five (5) proposals submitted to LAB 06-20 with funding available to support one (1) selection. Proposals were evaluated by two different panels: one which considered technical merit and one which considered program relevance, balance and flight safety. There was no indication of the relative weighting of evaluations from the two panels. The PM made the final selection.

The technical review panel consisted of six (6) experts, who each reviewed all of the proposals (a total of 30 reviews submitted). The entire technical merit review was accomplished via mail review; there was no panel meeting. The reviewers had expertise ranging from fundamental cloud/aerosol physics to flight program management. There were no obvious conflicts of interest.

The program relevance, balance and flight safety review consisted of two ARM Science Team members and a DOE Office of Aviation Management representative. No additional information was provided on the panel members or their expertise. This panel independently reviewed all 5 proposals. Critical comments on safety were a significant negative factor in the evaluation of one proposal that was highly rated based on technical merit.

The LAB 06-20 program announcement was posted on 30 June 2006. The closing date for proposals was 31 July 2006. Decision letters were sent in November 2006.

A summary of the proposal selection process was contained in the materials presented to the COV by the PM. All reviewer inputs for each proposal were also provided. Copies of the proposals along with their decision letters and reviewer comments were also in the package. The supporting materials were well organized and complete.

The PM's justification for the selection was well articulated. In particular, the PM and PI of the selected proposal held a post-selection discussion of concerns raised during the technical and programmatic relevance reviews. The PI addressed these concerns to the satisfaction of the PM prior to the finalization of the selection process. The COV supports this course of action.

Findings:

- The use of six (6) technical reviewers for each of the proposal represents an adequate number of reviewers for a balanced review. It also provides an appropriate pool of reviewer expertise and qualifications.

- Declination letters were generic and provided little if any detailed feedback to the proposers. This hinders the ability of PIs and their Laboratory management to improve future submissions.

Comments:

- Consider convening a face-to-face meeting or telecon for the technical merit review panel to discuss disparate proposal evaluations. There are advantages and disadvantages to this approach.

Recommendations:

- The PM should provide the proposers more detailed justification for the select/decline decision in the notification letter.

LAB 08-14

Notice LAB 08-14 ARM Climate Research Facility solicited proposals to design, assemble, and operate an AMF for marine science. The open announcement solicited proposals only from Federal Laboratories; the solicitation was not open to universities.

Six (6) proposals were submitted in response to LAB 08-14 with funding available to support one (1) selection. Proposals were evaluated by a single panel that considered technical merit and program relevance. The PM made the final selection.

The technical review panel consisted of six (6) experts, who each reviewed all of the proposals (a total of 35 reviews with one recusal). The entire technical merit review was accomplished via mail review; there was no panel meeting. The reviewers were all from universities or university laboratories and only one was an ARM Science Team member. Several members of the review panel were known to the COV and appeared to have the appropriate range of technical expertise. There were no major conflicts of interest, although there was one proposal that required a reviewer recusal.

The closing date for proposals for the LAB 08-14 solicitation was listed as 30 April 2008, although paperwork given the COV showed that the proposals were submitted between 7 and 13 May 2008. Decision letters were sent in 5 August 2008 (although the final documentation of the selection process was prepared by the PM in October 2009).

A summary of the selection process was contained in the materials presented to the COV by the PM. All reviewer inputs for each proposal were also provided. Copies of the proposals along with their decision letters and reviewer comments were also in the package. The supporting materials were well organized and complete. The PM's justification for the selection was well articulated in the Selection Statement for DOE Laboratory Funding.

Findings:

- The use of six (6) technical reviewers for each of the proposal represents an adequate number of reviewers for a balanced review. It also provides an appropriate pool of reviewer expertise and qualifications.

- All proposals were submitted after the closing date listed in the solicitation. It appears that an undocumented extension was given to all proposers. It is unclear if any proposer realized an unfair advantage from having more time to prepare their proposal. The selected proposal was not the last submitted.

- The period of time from proposal submission to the award selection/notification was ~90 days. This is a very reasonable period.

- There was no selection letter to the successful proposer provided in the COV materials. Declination letters were generic and provided little if any detailed feedback to the proposers. This hinders the ability of PIs and their Laboratory management to improve future submissions.

Comments:

- Consider convening a face-to-face meeting or telecon for the technical merit review panel to discuss disparate proposal evaluations. There are advantages and disadvantages to this approach.

Recommendations:

The Program Manager should provide the proposers more detailed justification for the select/decline decision in the notification letter.

3. Processes to Monitor Active Awards, Projects, and Programs

The overall ARM science program, while focused on key areas of the cloud and radiation aspects of earth science, is providing an in-depth view of the complex processes from microphysics to aerosol-cloud-precipitation interactions. Also, the ACRF is providing the vital data to support these investigations with an infrastructure that is complex and widespread geographically. Due to the diverse and large set of components of the ACRF, a complex management structure is being used by DOE to manage this infrastructure. However, the national and international recognition and broad use of the ARM data producing on average ~100 peer-reviewed journal articles per year attests to the success of this existing management system. The ARM/ACRF registered user group has grown to around 1000 users, and while the number of unique science users is not increasing significantly, the number of data files and size of data sets downloaded

has increased significantly, illustrating the high level of interest in ACRF data for expanding scientific investigations.

However, there have been significant concerns over the ability of some user communities to easily make the best use of the individual data sets. History has shown, by several other observational data programs as well, that researchers will often ignore observational data sets that are not packaged and/or summarized in formats easily accessible for diagnostic analysis and by modelers.

The ACRF has begun a program of producing a series of "best estimate" data sets to address some of these issues by combining several of the ACRF data sets to produce summary data of significant parameters of special interest to modelers [For example, the ARM Climate Modeling Best Estimate (CMBE) product is a new ARM datastream specifically tailored to climate modelers for use in evaluation of global climate models. It contains a best estimate of several selected cloud, radiation and atmospheric quantities from the ACRF observations and Numerical Weather Prediction (NWP) analysis (for upper air data only)]. This is the type of **proactive management method** that will better serve to establish the ACRF as an indispensible component of the Earth science system model development activity for the global community.

The Program Manager described cloud and aerosol "best estimate" data sets being developed to aid climate modeling. **The COV recommends that "best estimate" data set development activity should be continued and broadened to include other areas of Earth science research.**

A significant management group for ARM and the ACRF is the Science and Infrastructure Steering Committee (SISC), composed of the ARM Chief Scientist, site managers, component managers and science Working Group (WG) leaders. The SISC has a critical responsibility to "Assist ARM Science and Infrastructure Program Managers to develop an overall ARM Program science vision and strategy for implementation". Using a series of reviews, workshops and distributed site management methods, the ACRF has been successful in providing the global science community a significant series of data sets and a strong basis for advancing Earth science. This illustrates how a complex management system with varying monitoring activities has been able to very successfully derive feedback from its projects and users to design a specific enhancement for the overall program.

There is a concern that, as the ARCF infrastructure is split off from the ARM science oversight and monitoring management structure under the new reorganization, that the past successful feedback and interactions with user PIs will not be able to be maintained. However, there may also be some advantages in having the ACRF handled as a supporting infrastructure for the broader program. If the increasing integration of atmospheric chemistry and biogeochemistry

into earth system modeling begins to require a significant increase in the aerosol and chemistry data produced by the ACRF, the separation may prove advantageous. Also, with a new SFA focused upon Arctic tundra – atmosphere interactions, newer questions on the chemistry of these processes under warming climate will need added chemical observational data.

There may be a need to assess whether the ACRF has sufficient chemistry and aerosol data within the basic site data sets to support the newer model land-atmosphere parameterizations, the aerosol-cloud precipitation process characterizations and the air quality products being required of the newer models.

Community feedback has also provided an impetus for the development of the new Mobile Aerosol Observing System (MAOS). Future planning for ACRF should begin now on the possible expansion of this capability to other sites because global aerosol uncertainties have been cited several times within IPCC assessments and there is an increased focus on cloud-aerosol-precipitation process understanding.

Findings:

- ACRF proactive management led to the development of the "best estimate" cloud/aerosol data sets. The COV applauds the proactive approach of the Program Management in data product development and encourages this in other areas.

Comments: None.

Recommendations:

- The COV recommends that "best estimate" data set development activity should be continued and broadened to include measurements/data from other areas of earth science research.

- Assess whether the ACRF measurement suites deliver sufficient chemical and biogeochemical data to support the "basic development of climate model components, with an emphasis on incorporating missing physical and biogeochemical processes in Earth System Models".

4. Effect of the Award Process on Portfolios

During the 2007 – 2009 review period, ARM solicited proposals from National Laboratories to design, assemble, and operate an AMF for marine science and it re-competed the operation of the AAVP. One award was made for each solicitation. The AMF-2 award expanded the ARM portfolio through a modular, robust design that increased the versatility of the deployment options to include marine environments or more challenging topographic locations. The award

for the AAVP reoriented the program away from an emphasis on UAVs toward a single, dedicated piloted aircraft. This recognized the advantages of a dedicated piloted platform and the near-term limitations in obtaining flight clearance for UAV operation, especially over the ACRF fixed sites and populated regions. **The PM should reconsider the AAVP platform selection and flight plan strategy in the future as greater flexibility in UAV operations are realized.**

5. The National and International Standing of the Portfolio Elements

Bibliographic searches indicate that ARCF has had an enduring scientific impact in the fields of climate research, meteorology, and atmospheric science.

Findings:

- During the 2007-2009 review period, more than 235 papers that acknowledged ACRF were published in peer-reviewed journals.

- ACRF keeps statistics on relevant data such as number of archive files requested, and number of unique users.

Comments:

- One member of the COV obtained an ACRF data access account during the COV review. The process was simple, required about 15 minutes, and provided access in real time. The online form did not include a "terms of use" requirement or a request for acknowledgment in publications that make use of ACRF data.

- Add a full text searching function to the ARM Publications web page. The author, title, and/or keyword searching capabilities are insufficient to assess the full scientific impact of the ARM/ACRF program.

Recommendations:

- We recommend that ARM implement an agreement ("terms of use") on the data registration web page to include a standard one-sentence acknowledgment statement in all publications or presentations that make use of ARM/ACRF data.

- The standard one-sentence acknowledgment statement should include "ARM/ACRF" and/or other unique keywords to facilitate citation searches. This will provide a better means for DOE and reviewers to assess the stature and scientific impact of ACRF.

6. Management and Oversight of the Facilities

Findings:

- The ACRF PM executed acquisition of $60M of new instrumentation using ARRA funding. The efficiency of this process was due to the proactive planning of the PM and ARM Science Team who identified critical new measurements in anticipation of this opportunity.

7. Further Considerations

- Are an adequate number of qualified reviewers (free from bias and/or conflicts of interest) selected for review of projects and grants?
  COV Response: Yes. The number, qualifications, and range of expertise of the reviewers for each solicitation were adequate.

- Are the Office of Science (SC) merit review criteria applied appropriately in the evaluations?
  COV Response: Yes.

- Is documentation of the review process adequate and complete?
  COV Response: Yes, the documentation is adequate; however, there was inadequate feedback to the proposing PIs in the decision letters for both solicitations to help improve responses to future solicitations.

- What are the characteristics of the award portfolio?
  COV Response: There was one award made for each of the solicitations evaluated. In each case the solicitations were restricted to proposals from National Laboratories. Each solicitation received multiple highly-rated proposals. This reflected competiveness between the Laboratories, despite the small number of proposals received. It also provided the PM with options in making final selections.

- Are progress reports on previously funded research useful in the evaluation of proposed research?
  COV Response: N/A. There were no progress reports for the COV to evaluate. The National Laboratories submit regular Field Work Proposals (FWPs) for ARM/ACRF related SFA activities. The COV surmises that the PM assesses progress and reflects this in the funding allocations for the FWPs.

- What is the quality of overall technical management of the program?
  COV Response: Very Good to Excellent. The quality of the Program technical management is captured in the high demand for ARM/ACRF measurements, data and data products.

The technical management of the ACRF Infrastructure is based on distributed management and there were insufficient materials presented for the COV to evaluate this in detail.

The technical management of the solicitation, review, and award process is Very Good.

- What are the relationships between award decisions, program goals and DOE mission?
  COV Response: Very strong…see discussion under section 3, p. 33.

- Are there significant impacts and advances that have developed since the previous COV review that are demonstrably linked to DOE investment?
  COV Response: See recommendations in section 3, p. 35.

- Were the responses of the program to the recommendations of the previous COV review appropriate?
  COV Response: Yes. Answers to the questions of the previous COV were provided in the review materials and they appear to have been integrated into the program management.

  The most important recommendation of the previous COV was that ARM should develop a second AMF. This recommendation was implemented; in fact, the current COV evaluated the solicitation process for the design, development and operation of AMF-2. ARM took advantage of the lessons learned from developing and operating AMF-1 in the entire process for obtaining AMF-2.

F. Environmental And Molecular Sciences Laboratory (EMSL)

1. Project Summary

This portion of the COV deals with the evaluation of DOE's oversight and management of the Environmental Molecular Sciences Laboratory (EMSL) based at PNNL. EMSL is a unique user facility within the Office of Science. As described, EMSL is a "…facility where a variety of tools can be used to understand atomic to molecular to nanoscale-level processes that underpin the energy and environmental challenges facing DOE and the nation." Since it is composed of a suite of small instruments (as opposed to neutron or synchrotron radiation facilities which have one large source), it is perhaps closer aligned to the DOE Nanoscience Centers than the neutron or light sources. Operational goals, such as less that 10% of unscheduled instrument downtime, were met in FY09.

The COV felt that EMSL makes a major contribution to the national scientific infrastructure. BER's management and oversight of the facility is effective. This report makes a number of suggestions that it feels will further strengthen the program.

2. Efficacy and Quality of Funding Processes

Findings:

- The COV was only able to make overview comments on this matter because apart from sample proposals and reviews the proposals and reviews were not available as they were reviewed at EMSL.

- A proposal must be submitted for use of facility time. Proposals are three pages single spaced, but it was noticed that principal investigators with much longer proposals were considered and supported for facility use.

- The proposal process is as follows: Users are first recommended to discuss a proposal plan with an EMSL staff person. A proposal is then submitted to EMSL via the Electronic Proposal Review System (EPRS). This system covers all aspects of proposal management including communicating with reviewers. Different types of proposals can be submitted. Currently the largest number of proposals (more than 60% of the proposals) is "science theme" proposals which are submitted in response to a proposal call and can last for up to three years. About 20% of the current proposals are "general" proposals that can be submitted at any time. Other proposal types include "partner" proposals that involve cost sharing and "rapid" proposals that are for short periods of up to one month.

- Once a proposal is submitted it is screened to ensure that it has sufficient information to allow for a review and that EMSL has facilities available to meet the request. An internal reviewer and two to four external reviewers evaluate the proposal upon the following criteria:
  - Scientific merit.
  - Qualification of the proposal team.
  - Relevance of the proposal to EMSL's mission.
  - The extent to which the proposal would make appropriate and reasonable use of EMSL resources.
  - The extent to which the proposal would lead to highly cited publications.
- Proposals are also reviewed for safety and the meeting of requirements for animal or human studies. Only proposals that require confidential work that will not be published are charged for facilities time. The criteria above are weighted as follows:

From the external reviewers:

- 50% for scientific merit
- 10% for an evaluation of the qualifications of the proposal team.

From the science panel review led by an EMSL lead scientist:

- 10% for relevance to EMSL's mission.
- 20% for relevance to the focus of the Call for Proposals.
- 10% for resource use and integration.

- Proposals are evaluated on a five point scale, defined as "Extraordinary (5)" replacing the earlier use of "Excellent (5); "Excellent (4)" replacing the earlier use of "Very Good (4); Good (3); Fair (2); and Poor (1). elected proposals were typically in the range 3.6 to 5.0.

- In FY09 there were 122 proposals, 80 of which were supported for facilities use, and 42 were rejected giving a 66% success rate. In the supported proposals, the amount of facility time provided was close to that requested.

- *Three Science Themes*

The EMSL user program is based upon three science themes:

- Biological Interactions and Dynamics (headed by Steve Wiley).
- Geochemistry/Biogeochemistry and Subsurface Science (headed by Nancy Hess).
- Science of Interfacial Phenomena (headed by Don Baer).

The largest number of proposals are submitted in the Science of Interfacial Phenomena science theme (approximately the same as the other two themes combined).

- *Distinguished Users*

Users are tracked so that distinguished users can be identified. The target is to have a significant number of distinguished users, indicating the positive impact of the EMSL facilities on outstanding science.

Distinguished users need to meet at least one of the following criteria:

- Nobel Laureate.
- Member of the National Academies.
- Endowed chair (or professorship).
- Cited as a top author (top 1%) by Essential Science Indicators.

- *Distribution of Users*

The largest number of proposals came from the academic community (63% in FY10) with a substantial number from the Pacific Northwest National Laboratory (PNNL) (29% in FY10). There were a number of proposals from other DOE laboratories (4.5% in FY10). Only 1% of

the proposals were from EMSL. The Science of Interfacial Phenomena also had a proposal from a foreign laboratory, and one proposal from industry.

Comments:

- Overall the panel found the proposal review and solicitation process to be effective, fair and efficient. The reviewer comments in the sample reviews seen were very brief.

- The COV is concerned that they did find evidence that proposals which did not follow the proposal requirements were supported. In particular one supported proposal was 8 pages long even though the proposal requirements stipulated a maximum page length of 3 pages. ***It is essential that EMSL enforce the proposal requirements***, otherwise the process is unfair to investigators who follow the instructions to make their case in 3 pages.

- The COV is concerned about the very small number of proposals from industry. It is recognized that industry is particularly sensitive to confidentiality issues, but the allowance of proprietary use of the facilities should reduce this concern. The level of industrial involvement has varied over the years, but it has always been small. In FY09 there were no "science theme" based industrial proposals, industrial proposals being "general", "rapid" or "computationally intensive". It is hoped that EMSL will be able to attract more industrial users, especially bearing in mind that many of our foreign industrial competitors use their national facilities extensively for industrial research.

- The percentage of Partner Proposals is very low. Partner proposals are important as they provide for a close interaction between staff and the PIs of the Partner proposal. It is also a way for the user to feel engaged/involved with the direction of the facility through his/her contribution.

Recommendations:

- The program is effective with an appropriate external and internal review process which, if conducted in the future in a manner that enforces the proposal requirements[1], will make the appropriate allocation of facilities time.

- The definition of "distinguished" user could be usefully modified to recognize that an endowed chair or professorship is not necessarily the indicator of the highest distinction at a university. Endowed chairs or professorships depend upon the passions of a donor, and are not necessarily distributed in a uniform manner across different disciplines. In addition, a number of universities award such positions to associate professors or even assistant professors. A more useful indicator is to identify university positions that

[1] The proposal review process is conducted by EMSL and not DOE, so this comment is directed at EMSL.

recognize the highest level of scholarship and research accomplishment. Such positions are given titles such as "Distinguished Professor", "Regents Professor", "University Professor", etc. These positions are generally supported by university funding and are selected following a university-wide competition with rigorous external review and are not dependent upon gifts from donors.

- BER and EMSL are encouraged to attempt to attract more industrial users. The panel recommends that the facility work hard and encourage more "partner proposals" with individuals and groups of users.

3. Processes to Monitor Active Awards, Projects and Programs

Findings:

- The COV found an appropriate set of measures to monitor the selected projects for facilities use. The evaluation of the program ensures that EMSL priorities are followed.

Comments:

- Program productivity is monitored mainly by the reporting by investigators of publications. These reports lead to an annual report of publications. User surveys are used to assess user satisfaction.

- EMSL is to be commended for holding a regular series of workshops designed to get the best user input, and to get the best input for deciding future facilities purchases and developments. EMSL regularly reports (weekly and annual) highlights of the facility usage.

- EMSL is evaluated by science and operations reviews which are held every three years.

- The COV regards the present methods for monitoring the facility as being effective and appropriate.

Recommendations: None.

4. Effect of the Award Process on Portfolios

Findings:

- EMSL has established an outstanding facility consisting of a very diverse range of state-of-the-art instrumentation. The users have published high quality science from the results of the experiments conducted and calculations performed at the facility. The work

conducted has increasingly focused on the science themes of EMSL, which are interdisciplinary and appropriate to DOE's mission.

Comments:

- The COV draws attention to the comments above regarding industrial use of the facility and the desirability for more "partner proposals".

- EMSL is currently playing an important role as part of DOE, and is providing a unique national facility that has benefited a large number of users.

- The COV strongly supports the current activities of EMSL.

Recommendations: None.

5. The National and International Standing of the Portfolio Elements

Findings:

- EMSL is a unique and highly valuable national facility. Users have included a number of distinguished investigators and the facility has international recognition.

Comments:

- Continued support of EMSL is very much in the national interest.

Recommendations:

- Continue to maintain support to allow continued acquisition of state-of-the-art equipment.

6. Management and Oversight of the Facilities

Findings:

DOE Science and Operational Facility Review of EMSL

DOE/BER review their user facilities on a three-year cycle. The last EMSL Science and Operations Review took place in 2008. Issues were summarized in a timely manner by DOE staff and transmitted to the EMSL Director in December 2008.

Five issues from the review were identified by BER managers that required formal action from EMSL.

1) Increase the planning and documentation associated with the science themes.
2) Develop an outreach and communications strategy for the non-PNNL user community.

3) Improve EMSL's engagement with the Science Advisory Committee and User Advisory Committee.
4) Raise the threshold for acceptance of user proposals.
5) Reassess the scope of the proposed 21Tesla FTICR.

From the files provided to the COV, a discussion was held between DOE and EMSL managers on 1/7/09 regarding the results of the Science and Operational Review and each of the issues were discussed with a proposed plan of action. A final plan of action was submitted by EMSL to DOE February 20, 2009, along with milestones. A final report was delivered from EMSL on Dec 30, 2009 outlining the deliverables against the plan of action resulting from the September 2008 review.

Communications between DOE program managers and EMSL managers

There are Quarterly briefings to the DOE EMSL Management team by the EMSL Director. This includes a discussion of the EMSL Dashboard developed by the EMSL staff to monitor various performance milestones. The Dashboard provides both leading and trailing indicators of the facility performance and is a very nice tool for quickly evaluating process by the facility towards various metrics. Finally there are the end-of-year facility statistics that EMSL Management submits to DOE, a standard procedure for DOE User Facilities.

Environmental Health and Safety

In April 2009, EMSL achieved one million safe work hours without any DART (days away, restrictions and transfers) cases. However, the COV supports the PM's intent to include a thorough review of all ES&H aspects of EMSL during the triennial review planned by BER for FY2011.

Comments:

- The program has an effective management structure at EMSL and at DOE, and the COV were impressed by the management of Paul Bayer, and appreciated the excellent overview of the program that was presented to the panel.

- The quick and thorough response to the recommendations of the 2008 science and operations review by both EMSL Management and DOE indicates that those recommendations were taken seriously and acted upon in a reasonable manner and timescale.

- Communications seem very strong between the DOE managers and EMSL managers with monthly telecommunications between EMSL (Director and top managers), DOE

CESD Program Manager (P. Bayer) and Pacific Northwest Site Office (PNSO) representative (J. Day), which at one point had been weekly. This close interaction is to be commended and should be continued so long as it is not an undue burden on either side and remains useful to both sides.

- A comprehensive ES&H assessment is warranted given: (1) the absence of ES&H expertise and lines of inquiry in the scope of the two previous BER operational reviews of EMSL; (2) a significant number of recent operational incidents; (3) the upcoming installation of a large number of new pieces of equipment and substantial facility upgrade ("quiet wing"); and (4) the relatively low rate of satisfaction expressed in EMSL user surveys about safety training.

Recommendations:

- Include in the FY2011 science and operational review of EMSL a comprehensive assessment of ES&H.
- The travel budget for the program manager should be increased by 50% to allow travel to scientific meetings as well as additional travel to EMSL.

IV. Responses to Previous COV Review (May 2007)

Responses to the former COV have been documented in the report by the CESD PMs. The comments below are generally applicable to the various programs but not necessarily all programs. Most specific issues have been satisfactorily addressed. Iterated here are those that are still of some concern.

The workload of the PMs is too large for thorough and timely completion of the routine tasks and for publicizing accomplishments, thorough planning, reading the literature, and profound thinking. While some steps have been taken to remedy this situation, this continues to be a problem.

Documentation of responses to reviewer comments for all funded research is now quite satisfactory. Letters and phone calls provide comprehensive exchanges with potentially successful PIs.

Time limitations are exhibited in the continued concern that declination letters for unsuccessful proposals are not substantive. This issue was raised in 2007 and again here. Such information would allow unsuccessful scientists to make more informed decisions about resubmissions.

Follow up on final reports was noted as often non-existent in 2007. The use of final reports was noted here as unclear. Monitoring receipt of these reports and responding to the information is

likely another casualty of time limitation. At a minimum, the previous COV recommended that completed final reports be a condition for receiving additional funding on new projects.

Project files are now in quite satisfactory condition. However, an electronic tracking system for all documentation might make life easier for PMs.

Changes that ease some of the workload of the PMs are increased specificity in the solicitations and the use of pre-proposals. Pre-proposals are now almost universally used to avoid submission of inappropriate full proposals and to increase the percentage of successful applications. Both PIs and PMs save time through this modification in proposal handling which is to be praised.

Increasing the high risk and innovative research is a challenge for all programs in BER and continues to be a high priority for all PMs. There are no fixes for this concern other than vigilance.

Many of the programs in the CESD involve research and data that have interagency and international consequences. As a result, participation in international meetings and workshops is needed to communicate advances and to avoid duplication of effort. More funds and time are needed to fulfill the leadership role that DOE has.

The funding paradigm at the National Laboratories has changed so that the unique interdisciplinary expertise can be applied to major research questions. This change to Science Focus Areas is to be applauded. However, this change raises the question of how resources will be allocated between National Labs versus university scientists and other agency labs. In the past the distribution was determined by merit review of proposed research on a rather "even playing field." Now the decision is between programs of research versus small groups or individuals.

Appendix A: Charge Letter

Department of Energy
Office of Science
Washington. DC 20585

Office of the Director

August 27, 2009

Dr. Gary Stacey
Associate Director, National Soybean Biotechnology Center
Department of Microbiology and Molecular Immunology
271E Christopher S. Bond Life Sciences Center
University of Missouri
Columbia, MO 65211

Dear Dr. Stacey:

By this letter I am charging the Biological and Environmental Research Advisory Committee (BERAC) to assemble a Committee or Visitors (COV) to assess the processes used by the Climate and Environmental Sciences Division (CESD) within BER to manage CESD research programs and two user facilities, the Environmental Molecular Science Laboratory (EMSL) and the Atmospheric Radiation Measurement Climate Research Facility (ACRF).

The COV should provide an assessment of the processes used to solicit, review, recommend and monitor proposals for research submitted to CESD programs for FY2007-- FY2009. This includes funding at national laboratories and universities and other activities handled by the program during this time period. It should also assess the quality of the resulting scientific portfolio, including its breadth and depth and its national and international standing. Additionally, the COV should also assess the division's management and oversight of the EMSL and ACRF user facilities for the same time period. Specifically, I would like the panel to consider and provide an evaluation of the following:

1. For both the DOE national laboratory projects and university grants, assess the efficacy and quality of the processes used by CESD programs during the past three years to:
   a) solicit, review, recommend and document application and proposal actions, and
   b) monitor active awards, projects and programs.
2. Within the boundaries defined by DOE mission and available funding, comment on how the award process has affected: a) the breadth and depth of the portfolio elements and, b) the national and international standing of the portfolio elements.
3. For the EMSL and ACRF user facilities, assess the management and oversight of these facilities, including facility operations tracking and review, user proposal solicitation, review and recommendation procedures.

For CESD research programs, topics to be investigated can include but are not limited to; the selection of an adequate number of qualified reviewers who are free from bias and/or conflicts of interest; use of SC merit review criteria; adequacy of documentation; characteristics of the award portfolio; usefulness of progress reports on previously funded research; quality of the overall technical management of the program; relationships between award decisions, program goals and

the DOE mission; significant impacts and advances that have developed since the previous COV review and are demonstrably linked to DOE investments; and the response of the program to recommendations of the previous COV review.

COV members will be given access to all program documentation completed during the period under review including applications, proposals, review documents and other requests. COV members may also request, at their discretion, a representative sample of the program portfolio be provided. In response, CESD may suggest a sample of actions, including new, renewal and supplemental applications and proposals, awards and declinations. In addition, COV members may also choose to review files through a random selection process.

A primary requirement is the COV should have significant expertise across all covered areas within CESD programs 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 DOE. A guideline is that approximately 25 percent of the members receive no direct support from DOE. Any person with an action pending (e.g., application or proposals under review, progress report pending approval) in a CESD program under review will not participate as a COV member for that program. Some, but not all members of a COV, may be selected from a previous COV. A least one COV member will also be a member of BERAC. The committee should be balanced and drawn from a broad field of qualified reviewers from academia, DOE national laboratories, other federal agencies, private sector entities, and other appropriate institutions. The BERAC chair should also consider a number of other balance including, institution, geographic region, diversity, etc. In the end, the COV should constitute an exceptional group of internationally recognized researchers with broad research expertise in the program areas within the CESD as well as deep familiarity with DOE programs. Additional guidance on COV reviews within the Office of Science can be found at http://www.science.doe.gov/SC-2/Committe_of_Visitor.htm and attachments therein.

The COV should take place in the second quarter of FY2010 (early calendar year 2010) at the BER/DOE location in Germantown, Maryland. A discussion of the COV report by BERAC should be held no later than the fall 2010 BERAC meeting. Following acceptance of the full BERAC committee, the COV report with findings and recommendations is to be presented to me, as the Director, Office of Science.

If you have any questions regarding this charge, please contact J. Michael Kuperberg 301-903-3281 or by email Michae1.Kuperberg@science.doe.gov.

Sincerely,

[Copy of original text]

William F. Brinkman

cc. David Thomassen
Anna Palmisano

APPENDIX B -- Climate and Environmental Sciences Division Committee of Visitors July 20-22, 2010

Atmospheric Systems Research

Cynthia Atherton, Ph.D.* **Chair**
Senior Program Officer
Gordon and Betty Moore Foundation
1661 Page Mill Road
Palo Alto, CA 94304
Cynthia.atherton@moore.org
650-213-3063

Ana P. Barros, Ph.D.
Civil and Environmental Engineering
Pratt School of Engineering
Duke University
Box 90287
121 Hudson Hall
Durham, NC 27708-0287
ana.barros@duke.edu
919-660-5539

James J. Schauer, Ph.D.
Civil & Environmental Engineering
University of Wisconsin-Madison
148 Water Science and Engineering Laboratory
660 North Park Street
Madison, WI 53706-1484
jjschauer@wisc.edu
608-262-4495

Climate Modeling

Robert Dickinson, Ph.D. **Chair**
Department of Geological Sciences
Jackson School of Geosciences
The University of Texas, Austin
1 University Station
Austin, TX 78712
robted@austin.utexas.edu
512-232-7933

*Cynthia Atherton unexpectedly could not participate

Walter A. Robinson, Ph.D.
Marine Earth and Atmospheric Sciences
NC State University
Raleigh, NC 27695
walter_robinson@ncsu.edu
919-515-7002

Ronald J. Stouffer. Ph.D.
Geophysical Fluid Dynamics Laboratory
Princeton University Forrestal Campus
201 Forrestal Road
Princeton, NJ 08540-6649
Ronald.Stouffer@noaa.gov
609-452-6576

Subsurface Environmental Science Program

Kathy Covert, Ph.D.
National Science Foundation
Chemistry, Rm 1055 S
4201 Wilson Boulevard
Arlington, VA 22230
kcovert@nsf.gov
703-292-4950

David Hyndman, Ph.D. **Chair**
Department of Geological Sciences
College of Natural Science
Michigan State University
East Lansing, MI 48824
Hyndman@msu.edu
517-353-4442

Michael McInerney, Ph.D.
Department of Botany & Microbiology
The University of Oklahoma
770 Van Vleet Oval
Norman, OK 73019
mcinerney@ou.edu
405-325-605

Terrestrial Ecosystem/Carbon Mitigation

Bruce A. Kimball, Ph.D.
Soil Scientist
Arid-Land Agricultural Research Center
21881 North Cardon Lane
Maricopa, Arizona 85239
Bruce.Kimball@ars.usda.gov
520-316-6369

Robert J. Mitchell, Ph.D.
Joseph W. Jones Ecological Research Center at Ichauway
3988 Jones Center Dr.
Newton, GA 39870
Robert.mitchell@jonesctr.org
229-734-4706

Michael G. Ryan, Ph.D. **Chair**
USDA Forest Service
Rocky Mountain Research Station
240 West Prospect Road
Fort Collins, CO 80526-2098
mgryan@fs.fed.us
970-498-1012

ARM Climate Research Facility

Mark Boslough, Ph.D.
Sandia National Laboratories, New Mexico
PO Box 5800
Albuquerque, NM 87185-0370
mbboslo@sandia.gov
505-845-8851

Charles E. Miller, Ph.D. **Chair**
Jet Propulsion Laboratory
M/S 183-501
4800 Oak Grove Drive
Pasadena, CA 91109
charles.e.miller@jpl.nasa.gov
818-393-6294
818-653-3014 (cell)

Paul D. Try, Ph.D.
Science and Technology Corporation
Suite 1550
8403 Colesville Road
Silver Spring, MD 20910-6374
paul.try@stcnet.com
757-345-6088

Environmental Molecular Sciences Laboratory

Steve Meador
Chief Facilities Officer
National Science Foundation
4201 Wilson Boulevard
Arlington, VA 22230
smeador@nsf.gov
703-292-5313

Dennis M. Mills, Ph.D. **Chair**
Argonne National Laboratory
9700 S. Cass Avenue
Argonne, IL 60349
dmm@aps.anl.gov
630 - 252-5680

Peter M.A. Sherwood, Ph.D.
Dean, College of Arts and Sciences
201 Life Science East
Oklahoma State University
Stillwater, OK 74078
peter.sherwood@okstate.edu
405-744-8704

Judy D. Wall, Ph.D. **COV Chair**
Biochemistry Division
University of Missouri
117 Schweitzer Hall
Columbia, MO 65211
wallj@missouri.edu
573-882-8726

Appendix C
Agenda: COV Review

July 20, 2010

Afternoon - Arrival of COV members at the Gaithersburg Marriott Hotel.

6:00 PM Evening - Presentations at the Gaithersburg Marriot Hotel in Gaithersburg, MD
(~2 hours over dinner in room)

a. Welcome and Overview of BER Office structure, **Anna Palmisano**, BER Director [10 min]

b. Overview of CESD Division, **Wanda Ferrell**, Acting Division Director [30 min]

c. Break for buffet

d. Review of COV Charge letter, **Judy Wall,** COV Chair [20 min]
Review of review purpose, procedures and products

e. COV review logistics and timeline for the next two days, **Todd Anderson**, Program Manager and Liaison to COV [20 min]

f. Conflict of Interest and Non-Disclosure review and form signing

Adjourn for the day

July 21, 2010

7:30 AM	CESD program managers meet reviewers at Hotel lobby. All reviewers transported to GTN. CESD program managers ride with reviewers to gain entry to the facility at the front gate. Guards at front door alerted in advance and prepared to process multiple visitors into the GTN facility. Program managers escort COV members to the main meeting room (G-207).
8:30 – 9:30 AM	Breakfast in main meeting room. Introduction of CESD staff, room assignments, explanation of building maps.

9:30 – 10:00 AM COV Executive Session. Overview of charge, assignments to program/facilities, assignment of reporting tasks etc.

10:00 – 11:00 AM COV breaks out into program/facility assignments and relocates to appropriate meeting rooms.

Climate Modeling	**G-207**
Terrestrial Ecosystem/Carbon Mitigation	**E-114**
Atmospheric System Research	**G-426**
Subsurface Biogeochemical Research	**J-108**
Environmental Molecular Sciences Lab	**G-135**
ARM Climate Research Facility	**J-117**

Program/facility presentations followed by Q&A with COV members. ~30-40 min presentation plus Q&A on program history, goals, "big picture", workshops/info and solicitation/review/award selection process

Materials available to COV members in respective meeting rooms.

a. Program background material (see also materials provided in advance)
b. Program Notices
a. Stats (#pre-apps, #proposals, reviewers, panels, etc.)
c. Summary of review and selection process
d. All file jackets for FY2007 – FY2009.

11:00 – 12:00 noon COV begins review of files/processes/decisions and award portfolio. CESD program managers on stand-by for additional information

12:00 – 1:30PM Reconvene in main meeting room for working lunch. COV closed session continues. CESD program staff on stand-by.

1:30 - 3:30PM COV closed session continues. CESD program staff on stand-by

3:30PM *Coffee/ snack break available in main meeting room*

4:00 - 5:30PM COV closed session continues. CESD program staff on stand-by

5:30PM COV members convene back into main session room for report to the chair on progress, additional information needed. List of additional information needs communicated to CESD program staff

6:00PM Adjourn first day of COV review. All COV members escorted from the building for transport back to the hotel by CESD program staff.

July 22, 2010

7:30 AM	CESD program managers meet reviewers at Hotel lobby. All reviewers transported to GTN. CESD program managers ride with reviewers to gain entry to the facility at the front gate.
8:15 – 8:30 AM	Breakfast in main meeting room. Closed COV session, review of progress/issues by COV Chair. Timeline for writing assignments. Presentation of any new materials requested the previous evening
8:30 – 9:15 AM	COV subcommittees summarize major findings from previous day.
9:15 – 12: 00 noon	COV breaks out into program/facility assignments and relocates to appropriate meeting rooms. COV members find their respective program/facility meeting rooms. Writing initiated if not already underway.
9:30 – 12:00 noon	COV continues closed session assessment. CESD program staff on standby
12:00 – 1:30PM	Working lunch in main meeting room. COV closed session continues. CESD program staff on standby
1:30 - 2:45PM	CESD program managers check with COV members in program/facility specific meeting rooms for Q&A. COV members, writing.
2:45 – 3:00 PM	COV reconvenes in main meeting room for briefing with BER management.
3:00 PM	*Coffee/snacks available in main meeting room*
3:00 – 4:00 PM	Report-out of initial findings and closing comments by COV chair.
4:00 PM	**Adjourn COV review.** All COV members escorted from the building for transport back to the Hotel by CESD program staff or taken to Metro etc.

Please note: This table was made available upon request of the Chair of the COV after the review. The COV did not have an opportunity to discuss the data with the PMs and is included here only for reference for future COV evaluations.

Table of CESD Program Funding Opportunities and Outcomes, 2007 – 2009

Solicitations	Program Element	Pre-proposals	Full proposals	Awards	New projects	First time DOE PI
Lab 06-20	ACRF	0	5	1	1	No
Lab 08-14	ACRF	0	6	1	No	No
Notice 07-18	ERSP (SBR)	159	117	18	18	11*
Notice 08-09	ERSP (SBR)	150	105	21	21	16*
Lab 08-30	ERSP (SBR)	5	5	1	1	1
Notice 07-06	Climate modeling	~55	73(55)+	(35)+	(35)+	22
Notice 08-05	Climate modeling	36	30(23)+	14(10)+	14(10)+	12 (of 14 PIs)
Notice 08-18	Climate modeling	56	20	8	8	7
Notice 09-15	Climate modeling	72	79(72)+	17(14)+	17(14)+	11 (of 17 PIs)
Lab 09-06	Climate Modeling	7	7	3	3 (multi-lab projects)	4 (of 16 funded multi-lab PIs)
Notice 07-11	TES	51	12	6	6	3^
Notice 07-24	ASR	120 (102)+	107 (89)+	25	11	8
Notice 07-26	ASR	88	72 (67)+	15 (15)+	7	6
Notice 08-23	ASR	63	58	27	11	9

ACRF – ARM Climate Research Facility
ERSP – Environmental Remediation Science Program
SBR – Subsurface Biogeochemistry Research
TES – Terrestrial Ecosystems Science
ASR – Atmospheric Systems Research

*Some "First Time DOE PIs" have participated as Co-PIs on past proposals. The number reflects first time Lead PIs in the SBR and includes exploratory awardees.

+ Numbers in parentheses indicate the number of "unique" proposals owing to several collaborative proposals submitted individually by Co-PIs.

^Estimated from available TES publication records (1993-2008).