

**Report to the Biological and Environmental Research
Advisory Committee (BERAC)
by the Committee of Visitors
for the Review of the
Climate and Environmental Sciences Division**

Review of Fiscal Years 2016-2018

4/8/2020

Acknowledgements

We, the Committee of Visitors, appreciate the efforts in the Office of Biological and Environmental Research (BER) and the Climate and Environmental Science Division (CESD) staff in their assembly and organization of the materials for this review, and for their excellent presentations and the answers that they provided to our many questions.

Special thanks go to Jay Hnilo for his work in preparing for the review. Sharlene Weatherwax, Director of DOE's Biological and Environmental Research Program, was very supportive of our efforts, and Gary Geernaert, Director of CESD, provided excellent introductory overviews and set the stage for a productive meeting. Program Managers Paul Bayer, Jay Hnilo, Sally McFarlane, Ricky Petty, Shaima Nasiri, Daniel Stover, Renu Joseph, and Bob Vallario did an outstanding job of providing us with the information required to conduct this review. We appreciate the effort that was invested in the presentations, and the staff's willingness to engage on and answer a wide range of questions.

Administrative support was provided by Andrew Flatness of DOE, and Tracey Vieser of the Oak Ridge Institute for Science and Education. We thank them for their excellent work, which made this review possible.

Executive Summary

A Committee of Visitors (COV), under the guidance of the Biological and Environmental Research Advisory Committee (BERAC), reviewed the programs in the Climate and Environmental Sciences Division (CESD) of the Office of Biological and Environmental Research (BER) active during fiscal years 2016, 2017, and 2018, including the following:

1. User Facilities (EMSL and ARM)
2. National Laboratory Scientific Focus Area (SFA) projects, NGEE projects, and other smaller laboratory projects
3. Funding Opportunity Announcements (FOAs)

Fourteen COV members plus the COV chair met at the Rockville Hilton in Rockville, Maryland, on July 10-11, 2019. The charge to the COV, from Dr. J. Steve Binkley, the Acting Director of the Office of Science, was to: (i) Assess the efficacy and quality of the processes used to solicit, review, recommend, and document proposal actions and monitor active projects; (ii) Within the boundaries defined by the DOE missions and available funding, comment on how the award process has affected the breadth and depth of portfolio elements, and the national and international standing of the portfolio elements; and (iii) assess the division's management and oversight of the ARM and EMSL user facilities, including facility operations tracking and review, user proposal solicitation, review, and recommendation procedures. The COV was chaired and co-chaired by Drs. James Hack and James Randerson, respectively.

The format was similar to those of previous COVs. The COV committee had three breakout groups: National Laboratory SFAs and projects, FOAs, and User Facilities/Enabling Capabilities.

Overall, the committee was extremely impressed with the management of the BER CESD scientific portfolio which has led to very high-quality science outcomes for BER over the 3-year period examined. The level of professionalism and dedication of the program management and CESD leadership is outstanding.

The committee thought there was an outstanding level of detail and completeness in the information captured by program managers in the proposal review process. Panel selection by program managers yielded a robust and qualified set of peer-reviewers for most FOAs. The documentation supporting proposal reviews is remarkably substantive and an indication of a fair and rigorous review process.

The COV makes the following specific major recommendations:

- Hiring several additional program managers and staff is strongly recommended to allow for more effective management of CESD's science portfolio.
- CESD is encouraged to maintain an active engagement and partnership with software developers in the Office of Science to improve the speed, organization, and efficacy of review and award management functions in PAMS.

- The COV recommends BER maintain its commitment to excellence in engaging laboratory and university partners in planning and synthesis through its workshops and town halls.
- Sustained funding for program managers to travel to important meetings and to conduct program review functions at laboratories and universities is recommended to allow program managers to be more effective and make more informed funding decisions.
- The COV recommends CESD embark on developing a strategic plan for harmonizing its data collection, archiving, and data access/manipulation capabilities. An effective plan may include best practices guidelines, archiving procedures, standards for data longevity and access, and co-location of data and computational resources required to create a new environment for machine learning.
- The COV recommends regular comprehensive reviews of CESD's computational needs at all levels across its broad range of scientific programs and to use this information to develop a living plan for new computer investments.
- Development of new mechanisms to collect information from the science community about the accessibility and quality of BER's computational resources is recommended.
- The COV recommends the CESD find ways to reduce wait times and increase access to computation for BER scientists.
- The COV strongly recommends that CESD develop a process for more effectively streamlining the allocation of computational resources to funded projects.
- CESD is encouraged to strengthen investment in the university community with the goal of improving BER science outcomes.
- The COV recommends that CESD and BER develop the means to track funding trends for lab and university programs over the past 10 years, and for this information to be included in review materials for the next COV.
- The COV recommends flexibility on the renewal process and timeline for successful SFAs.
- For SFAs, the COV recommends better and more transparent mechanisms for engaging the broader university community.
- The COV recommends that CESD develop a strategy for model integration across scales. This can mean different things within and across different programs. A key goal of this program should be to encourage new interdisciplinary modeling science that spans different existing program areas.
- The COV recommends reviewing programmatic means to align observational and modeling components of the scientific program and that any synergies are optimally benefiting broader

scientific objectives.

- The COV recommends that CESD (and BER) makes a formal commitment to inclusive excellence by creating a plan that articulates diversity goals and strives to broaden diversity within review panels, strategic planning exercises, workshops, and among the set of CESD-funded PIs.
- The COV recommends that long-term statistics on diversity be compiled within CESD and BER to quantify how diversity has changed over time.

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1. Introduction

This report documents the findings from a Committee of Visitors (COV) that was assembled under the charge to the Biological and Environmental Research Advisory Committee (BERAC) to evaluate the processes and programs of the Climate and Environmental Sciences Division (CESD) in the Office of Biological and Environmental Research (BER). The COV met at the Rockville Hilton in Rockville, Maryland for two days from July 10-11, 2019. This was the fourth in the series of COV reviews for CESD; the first was held in June 2011, with subsequent reviews in 2014 and 2017.

2. The Charge to the Committee of Visitors

On October 15, 2018, Dr. J. Steve Binkley, Director of the Office of Science, charged BERAC with assembling a COV to assess the processes used to create and manage the research portfolio in BER-CESD during fiscal years 2016-2018. The letter is attached as [Appendix I](#). The components of the Division that the COV was asked to review were:

- b. National Laboratory Scientific Focus (SFA) programs and projects
- c. Funding Opportunity Announcements grants
- d. User Facilities – ARM and EMSL and workshops

The COV was asked to focus on the following major elements of the CESD portfolio: (i) Assess the efficacy and quality of the processes used to solicit, review, recommend, and document proposal actions and monitor active projects; (ii) Within the boundaries defined by the DOE missions and available funding, comment on how the award process has affected the breadth and depth of portfolio elements, and the national and international standing of the portfolio elements; and (iii) assess the division's management and oversight of the ARM and EMSL user facilities, including facility operations tracking and review, user proposal solicitation, review, and recommendation procedures.

3. The Committee Membership

The COV membership was selected by the COV chair, Dr. James Hack, in consultation with BER staff. The members were chosen to represent a cross-section of experts in their particular scientific field relevant to the activities supported by CESD. A balance was achieved between researchers who currently receive funding from BER (5) and those that do not (10), between academic (6) and national laboratory scientists (4), between those that have previously served on a COV (3) and those that have not (12).

A full listing of the COV members and their panel assignments is given in [Appendix II](#) and [Appendix III](#), respectively. The COV consisted of a total of 15 members, including the chair. To maximize the effectiveness of the analysis of the CESD portfolio, three subcommittees of the COV were formed – each assigned to do an in-depth review of the broad and diverse programs or projects within the overall CESD research portfolio. For each subcommittee a Lead was selected,

who was responsible for leading the team to produce a written summary of findings, comments, recommendations for their assigned area. The following COV members served as panel leads: Hack, Fridlind, and Wilkins.

4. The Review Process

The COV assembled at the Rockville Hilton at 8:00am on Wednesday, July 10, 2019, and adjourned at 12:00pm on Thursday, July 11, 2019. The agenda for the COV is attached as [Appendix IV](#).

Prior to convening in Rockville, MD, each COV member was supplied with a link to access the CESD COV in the Office of Science's Portfolio Analysis and Management System (PAMS) that included a comprehensive set of information pertaining to: all funding opportunity announcements (FOAs), proposals received, proposal reviews, and proposal decisions. Additional information was also supplied to each member during the COV meeting, including: projects funded at labs under Science Focus Areas (SFAs), reviews of SFAs and User Facilities, and final research guidance as a result of reviews. Care was taken by the COV and CESD program managers to ensure that none of the COV had access to any information protected under conflict of interest restrictions.

The COV began the night prior to the two days of in depth discussions, on Tuesday, July 9, 2019, with a working dinner where Dr. Sharlene Weatherwax, Associate Director of BER, welcomed the committee and presented an overview of BER followed by an overview of CESD by Division Director, Dr. Gary Geernaert. COV Chair, James Hack, reiterated the charge to the committee given by Dr. J. Steve Binkley, Acting Director of the Office of Science. Panel members were then presented with further details on the overall review process, schedule, and PAMS overview.

The following morning began with the CESD staff providing short presentations before adjourning to their panel breakout rooms. These overview presentations were grouped as follows:

- Earth system modeling group (ESM, RGCM, and IAR/MD research areas)
- Atmospheric science and data group (ASR, ARM, CMDV, and DM research areas)
- Ecosystem science research (TES, SBR, and EMSL research areas)

The panels were free to request any additional information that they felt would help them in their evaluation process. After the initial discussion period, the program managers were excluded during the review process but were available to answer questions or provide additional input as needed.

Each panel prepared preliminary conclusions that were to be shared with the COV chair and with BER management. The checklist used by the panel during their review of the files is presented in [Appendix V](#); it correlates with the report templates used by the panels as presented in [Appendix IV](#).

At the end of the afternoon of the first full day, the COV members reconvened with the CESD staff to ask questions and/or request for further information before breaking for dinner. That evening, the COV members convened for an executive session to begin discussing their major

findings and recommendations.

On the second day, the COV continued looking through materials in the morning while preparing materials for the final report. The entire COV met in an executive session to discuss their findings and reach consensus on the major findings and recommendations. This session was followed by a meeting with BER leadership, CESD management, and CESD program managers to present the COV's findings and recommendations. Following this presentation by the COV Chair, there was a period of open and productive discussion between COV members and BER leadership and staff.

5. Major Findings of the COV

Science Impact of CESD

Overall the committee was extremely impressed with the management of the BER CESD scientific portfolio that has led to very high-quality science outcomes for BER over the 3-year period examined. CESD has established itself as a foremost leader in climate and environmental science research in the United States.

CESD Management

The level of professionalism and dedication of the program managers and CESD leadership is outstanding.

Review Process and Award Management

The committee thought there was an outstanding level of detail and completeness in the information captured by program managers in the proposal review process. Panel selection by program managers yielded a robust and qualified set of peer-reviewers for most FOAs. The documentation supporting proposal reviews is remarkably substantive and an indication of a fair and rigorous review process. Overall, the COV finds that the funding decision process is appropriate and leads to outcomes that are consistent with the language given in the FOAs.

Principal investigators in the various programs are of high-caliber, and the scientific output is of high quality. The CESD programs have made significant scientific impacts on the respective fields and are well respected by the national and international community.

Program solicitations appear to be entirely consistent with CESD priorities. Review panels have been of high quality with relevant scientific expertise. In general, CESD appears to be supporting a mix of large and small projects, university and lab projects, proposal-driven funding, and science focus areas (SFAs). For the most part, only the most highly-ranked proposals have been funded, with a few exceptions to maintain program balance. These rare cases were well documented and supported by documentation.

As has been noted before, publications and users remain the primary metrics of programmatic impact. These metrics alone may not fully reflect the value of CESD's investment, especially in

terms of its benefits to the general public and policy makers.

The online PAMS software is an effective system, but can clearly benefit from further technological improvements. There are organizational opportunities for improving the collection and navigation of data for external program review by visiting committees.

Community Engagement

The COV thought that CESD was very effective in engaging the external community of scientists and stakeholders interested in BER climate and environmental science. Effective mechanisms included an active workshop program that allows DOE and university scientists to develop community planning and synthesis reports. Town hall meetings led by CESD program managers (in coordination with lab scientists) at the Fall AGU meeting also appeared to be an effective means to keep the broader science community informed of CESD activities and priorities.

Once again, this COV commends CESD for a good job of incorporating the visions of DOE and USGCRP and coordinating with other federal agencies in developing its own vision and priorities. The inputs from broader scientific communities are generally provided by workshops that are often sponsored by DOE where the workshop participants are invited by program managers or workshop co-chairs. The level of engagement in external workshops appears to be limited by budget constraints and program management staff bandwidth.

New changes in Office of Science policy and funding to allow program managers to travel more widely were viewed as a very important and needed step toward effective engagement and management by CESD staff of their science portfolios. This change directly addresses a major COV recommendation from the previous report.

Data

Within CESD, there are at present a number of different archives for data and model simulation output, including ESGF, MYEMSL, ESS-DIVE, ARM, and Ameriflux, operated by different Labs, on different equipment, and with different staff. These different facilities offer differing levels of service to PIs and communities. They also vary in ease of access. It was unclear if standards for metadata were similar across different data systems. The longevity of data streams and access to posting and accessing datasets as implied through grant mechanisms varies. ARM and EMSL, for example, are DOE designated user facilities with long lifetimes, whereas ESGF and ESS-DIVE appear to operate on shorter term 3-year contracts. Users and program managers indicated that it was not always clear where new data should be placed and which datasets should be maintained in each archive. Usually significant economies of scale can be achieved when combining back end data center functions - storage, processing, servers, staff, even when maintaining separate community specific services. CESD may want to consider a consolidation of their services, enabling an incorporation of the capabilities described below with the restructuring and savings.

The COV notes that machine learning and artificial intelligence are key priorities for the Office of Science. Currently, as far as the COV was aware, there is no platform where DOE BER CESD and

other Earth system data streams (e.g. NASA satellite observations or NSF NEON observations) are available, along with co-located computational infrastructure to enable machine learning science. Nor does there appear to be any co-location of ecosystem and genomic data streams from CESD and BSSD. This new type of merged data and computational environment is needed at a large scale to enable ML-driven science to thrive. A key step toward developing such an environment is to develop priorities for the first set of datasets that would be integrated into this new type of system.

Computation

The COV finds that CESD leverages ASCR computing resources effectively for its mission accomplishments, and supplements these resources as needed with resources procured internally for specific programs. With the growth and success of the E3SM project, however, computational facilities within the Division appear to be under stress, and may not be keeping pace with community needs. Several committee members noted that the wait times on NERSC and other computer systems available to CESD scientists were relatively long. It was unclear what the mechanisms were by which CESD program managers formally queried the science community to understand their computational needs and their perspective on the performance and quality of existing computer facilities. It was also noted that priorities for ASCR and BER scientists are not always aligned, and that effective machine architectures for machine learning and other cutting-edge applications in computer science that are often pursued by ASCR are not necessarily the same as those required for climate simulation. To this end, it was suggested that CESD develop plans for increasing self-reliance and improving computational resources specifically for climate science. CESD should hereby consider that similar to data, computing service benefits from economies of scale if colocated; conversely a distribution of resources leads to a significant overhead in staff costs, in particular for complex HPC systems.

For both Laboratory and University CESD projects, requests for computational resources are reviewed at multiple levels. First, by the panel and program manager that approve the initial science proposal (i.e., SFA or FOA). Then, additional work must be done by the proposing team to apply for computational resources on various BER and Office of Science computer facilities. This step is complex, requires additional science justification, and many requests for resources at this stage are denied or pared down considerably for projects that the Office of Science has already agreed to fully support. Finally, a third level of review often involves CESD program managers responding ad hoc to emergency requests. This double or triple jeopardy does not appear to be an effective use of time for either scientists or program managers. Comparison of DOE policies and procedures with those followed by other agencies, like the National Science Foundation's management of the NCAR-Wyoming Supercomputer Facility, may yield insight that will improve allocation procedures.

Laboratory and University Portfolio Balance

The committee was left with the strong impression that the balance of funding support has shifted away from university researchers and towards laboratory scientists over the last decade. During periods of funding expansion, support for university scientists has not kept pace with growth in climate and environmental science focus areas at the laboratories. It will be important for future

reviews that a quantification of funding trends over time for lab and university programs be included in review materials.

Broadly, a sustained high level of support to universities is essential for creating a pipeline of high-quality scientists for the National Labs. In this context, it is difficult to understate the critical hiring challenges many of the Labs face over the next decade. With respect to CESD's leadership position in climate observations and modeling, arctic and tropical ecology, and other large science programs, a robust funding stream to engage the university community is essential for elevating the quality and impact of CESD science.

Science Focus Areas

The COV notes that Science Focus Areas (SFAs) have had a positive transformative effect on the CESD scientific program over the past decade. They allow program managers and leaders at the National Labs to build effective teams to address high priority science challenges for BER and the Office of Science. In many instances they provide a means for drawing together expertise across multiple National Laboratories, building a critical mass necessary to address a major science challenge that would be otherwise impossible to achieve at an individual lab or in a university setting. Many large SFAs are yielding science outcomes that are frequently published in high impact journals like *Science* or *Nature*. Most current SFAs are renewed on a three-year time interval.

SFAs are composed primarily of laboratory scientists. The degree of involvement and mechanisms for engaging (and funding) university scientists are uneven and vary from project to project. Some university scientists can become associated with an SFA through one of the university FOAs, yet the funding for these engagements is often limited and this mechanism restricts the role university scientists can have in project planning and design. This engagement model with university scientists contrasts with the model used in the previous generation of BER large projects such as Free Air Carbon Dioxide Enrichment (FACE), where university and laboratory scientists were engaged in all the different phases of project design. It also contrasts with models used by other agencies to design and manage large field campaigns and other large projects.

Model Integration across Scales

The COV found that integration across programs was supported within BER and was evident in the FOAs and SFAs. However, a systematic plan for integration of modeling across different scales (and program elements) needs further development. CESD should develop a concrete overarching vision for integrated modeling across scales and subject areas (including engagement with BSSD for microbe-to-Earth System scale initiatives), and increase community engagement (broad audiences such as AGU) around this vision to enable the development of new strategies and research topics. The goal should be to ensure that observational and modeling components of the scientific program are more tightly aligned and that the synergies are optimally benefiting broader scientific objectives.

Commitment to Inclusive Excellence

The COV has the impression that BER management cares deeply about improving diversity of CESD scientists. It appears, however, that efforts to increase the representation of underrepresented minorities and to improve gender balance at review panels, strategic planning workshops, and other scientific community engagements may still face significant hurdles. This observation was made by the previous COV with the recommendation that program managers report diversity metrics for these various activities. Further, with current data available to the COV, it was difficult to track trends in diversity metrics (for example, underrepresented minorities or gender balance) within the pools of science awards to lab or university science (and how these percentages compare with the composition of the application pool).

The COV also believes it is important to explore CESD (and BER) specific mechanisms to increase inclusive excellence within the pool of laboratory and university principal investigators; this issue is also closely related to building effective pipelines for the next generation of Laboratory scientists. The COV notes that there is a large body of social science literature that indicates inclusive excellence and science excellence are tightly coupled; these goals are not orthogonal. Best practices documents for workshop invitations, identifying keynote speakers, and consideration of award broader impacts would likely be valuable to scientists in the CESD community.

ARM

CESD has played an unparalleled role in providing observations for advancing the understanding of climate processes, both nationally and internationally. The current budget of the Atmospheric Radiation Measurement (ARM) User Facility is about \$68 M per year, and the total amount expended since inception in 1989 is close to one billion dollars. It is the largest field program in the history of atmospheric science. The COV is pleased that ARM has broadened its collaborations with other programs within CESD through joint calls for proposals, such as GOAmazon, land-atmosphere interactions, and a recent joint proposal call with EMSL to study aerosol processes.

The COV is impressed with ARM facility management. There may be room to consider how management of ARM data can be aligned with other BER-led data management systems (e.g., ESS-DIVE, ESGF).

The ASR program, similar to other programs in BER, is managed well and transparently. However, there appears to be a focus on process research at a regional level, which generates concern that the bridge between ARM measurements and Earth system modeling would benefit from explicit critical evaluation periodically.

Subsurface Biogeochemical Research Program

The Subsurface Biogeochemical Research Program has maintained a high quality research portfolio despite the 50% funding reduction and a gradual shift of focus area away from its historical emphasis on contaminants and towards watershed-scale carbon cycle studies over the

past two funding cycles. Excellent use is being made of the unique facilities of participating laboratories (e.g., EMSL, JGI, synchrotrons), especially by new program directions. However, the merging of SBR with TES has caused some growing pains (such as transitioning of field sites) and may have resulted in some loss of momentum in the SFAs during reorientation. The COV applauds CESD's efforts to maintain scientific innovation and encourages continued engagement of the broader scientific community as SBR and TES jointly make their transition to new focus areas.

6. Major Recommendations of the COV

CESD Management

CESD program managers are exceptional, dedicated, and hardworking. Loss of several program managers over the past several years and increases in the CESD budget over time have placed a very significant strain on program managers. Hiring several additional program managers and staff is strongly recommended to allow for more effective management of CESD's science portfolio.

A key need in this context is the flexibility to allow program managers more time to develop interdisciplinary FOAs and science projects that engage multiple traditional programs within the Division. More staff may increase CESD's ability to partner effectively with other agencies (i.e., NASA) and to respond more rapidly to emerging opportunities (and environmental threats).

Review Process and Award Management

CESD is encouraged to maintain an active engagement and partnership with software developers in the Office of Science to improve the speed, organization, and efficacy of review and award management functions in PAMS.

As was noted by the previous COV, it's important that the program managers continue to work to provide more detailed, constructive feedback to proposers. In particular, communication of the reasons for rejections of proposals should be more clearly stated to the applicant so that he or she can determine which aspects of the proposed project reviewed well or poorly. This is particularly important for proposals that are reviewed well but were not funded. Program managers might want to consider internal peer-review of decision letters, and might want to ask review panel members to review and contribute to panel summaries.

Community Engagement

The COV recommends BER maintain its commitment to excellence in engaging laboratory and university partners in planning and synthesis through its workshops and town halls.

Sustained funding for program managers to travel to important meetings and to conduct program review functions at laboratories and universities is recommended to allow program managers to be more effective and make more informed funding decisions.

Data

The COV recommends CESD embark on developing a strategic plan for harmonizing its data collection, archiving, and data access/manipulation capabilities. An effective plan may include best practices guidelines, archiving procedures, standards for data longevity and access, and co-location of data and computational resources required to create a new environment for machine learning. An integrated architecture and harmonized strategic plan would be helpful for future investment and research planning, and may lead to substantial savings (in hardware, infrastructure management, and software design). For users, such a plan may clarify where to find data, and what mechanisms are available for exploring the available data. A long-term data strategy needs to be developed by and communicated to the user community to enable the Division to establish a leadership role in machine learning and artificial intelligence within the field of climate and environmental science.

Computation

The COV recommends that CESD conduct regular comprehensive reviews of its computational needs at all levels across its broad range of scientific programs and use this information to develop a living plan for computational resource investments. This will result in better use of available resources and a more strategic way of making new computational infrastructure investments.

New mechanisms should be developed to collect information from the science community about the accessibility and quality of BER's computational resources.

The COV recommends the CESD find ways to reduce wait times and increase access to computation for BER scientists.

The COV strongly recommends that CESD develop a process for more effectively streamlining the allocation of computational resources to funded projects.

Laboratory and University Portfolio Balance

CESD is encouraged to strengthen investment in the university community beyond current levels with the goal of improving BER science outcomes.

The COV recommends that CESD and BER develop the means to track funding trends over for lab and university programs over the past 10 years, and for this information to be included in review materials for the next COV.

Science Focus Areas

The COV recommends flexibility on the renewal process and timeline for successful SFAs.

For SFAs there needs to be better and more transparent mechanisms for engaging the broader university community. This is particularly important for larger projects such as NGEES, E3SM, and other projects that have considerable budgets and/or duration. Over the past decade, much of

the growth in the CESD portfolio has been in SFAs that have moderate to large annual budgets, often comparable to, or exceeding budgets allocated to university FOAs. Mechanisms to increase transparency and engagement may include, but are not limited to, an open, peer-review process for identifying the most qualified university partners for SFA team membership, prior to SFA proposal design and review. A method to draw from a broader pool of university scientists will considerably increase the talent within SFAs, science outcomes, and strengthen university to laboratory hiring pipelines.

Model Integration across Scales

The COV recommends that CESD develop a strategy for model integration across scales. This can mean different things within and across different programs. A key goal of this program should be to encourage new interdisciplinary modeling science that spans different existing program areas.

Diversity

In the absence of specific strategies at the Office of Science level we recommend that CESD (and BER) makes a formal commitment to inclusive excellence by codifying a plan that articulates diversity goals and strives to broaden diversification of review panels, strategic planning exercises, and CESD-funded PIs.

The COV recommends CESD explore alignment with other Federal Agency best practices for capturing relevant statistics and for reporting (and responding to) to complaints of sexual harassment in CESD-funded programs. This might be achieved through a BER working group or through a separate BERAC subcommittee.

The COV recommends that long-term statistics on diversity be compiled within CESD and BER to understand how diversity has changed over time. This tracking should encompass planning activities and workshops, SFA teams, and awards to lab and university PIs (along with application and rejection information) to better understand the efficacy of CESD programs in maintaining and increasing diversity within their science portfolios.

Atmospheric Radiation Measurement Program

We recommend that CESD explore a formal review process for evaluating the management of ARM facilities whose support is distributed across the national labs, including but not limited to ARM mobile facilities (AMFs). It was unclear to the COV how CESD formally evaluated the performance of different National Labs in their management of important program elements. A more formal process may allow for documentation of successes and failures, and lead to improvements in overall program efficiency.

The COV believes it's important to ensure that climate model developers are well represented on panels that advise on the selection of field campaigns. Although the ARM program dedication to process-level understanding is expected to lead to many activities that cannot appropriately be led by climate model developers, during our review of field campaign panel review, we noticed that panel membership sometimes had no large-scale climate modelers. Entraining a broader swath of

the atmospheric science community may generate outcomes that more closely integrate different program elements within the CESD program.

The COV recommends that ARM systematically track data set use and publication citation statistics. While we recognize that this is not an easy activity, the sheer volume of ARM data sets necessitates prioritization of effort, sometimes urgently. To make sound and methodical decisions about effort allocation, such statistics are urgently needed, but it did not seem apparent to the COV that data set use is tracked with the granularity required.

We recommend that CESD consider developing new best practices to strengthen confidence that that process-level work supported across the program is optimally aligned with the ARM program objective of improving climate models and national priorities in climate science. The COV believes there would be considerable value in external review of the program elements by leading climate scientists and modelers that had no affiliation with ARM.

Regarding the breadth of the funded portfolio, the COV recommends CESD consider dedicating additional funding to instrument development. The DOE laboratories have a legacy of instrument innovation.

The COV reiterates what had been emphasized in previous reviews: ARM needs to identify and prioritize its legacy data products so that they can be easily and reliably used by the broader atmospheric science community.

Atmospheric System Research Program

We recommend to consider a more explicit role for climate modelers as a group within the current ASR working group structure. Historically, the program had a working group dedicated to modeling at all scales. To continually improve the penetration of program contributions to climate model development, we recommend that the program consider establishing a working group or other such body that is dedicated specifically to discussion by climate model developers.

Historically, many model intercomparison studies with broad international participation were begun and supported by ASR scientists. We recommend that the program actively look for ways to support activities that will attract such broad participation from the modeling community internationally and elevate the impact and use of ARM products. For instance, a workshop/working group could explore new themes to connect ASR to CMIP6 and CMIP7 model intercomparison projects.

The COV supports the recommendation from the previous COV that ASR build a portfolio in atmospheric science that is broader than solely providing direct support for the analysis and interpretation of ARM observations. This is crucial for the vibrancy and impact of the program.

Data Management

We recommend that CESD develop a plan to assess how different data archives, including ESS-DIVE, the ARM archives, and others, may be integrated. We recognize that data characteristics in different archives are diverse, but believe that by tackling this challenge systematically (including

consideration of metadata structures that can accommodate the full range of data types) there may be important synergies. This recommendation contributes to the broader overview findings and recommendations described above related to Data.

During the conversion from CDIAC to ESS-DIVE, support for the development of high-value and unique regional and global fossil fuel emissions data set was discontinued. The US science community has not been able to replace this capacity, and as far as we are aware, no other US agency is tracking this information worldwide. High quality and spatially resolved fossil fuel emissions time series are essential for understanding anthropogenic forcing of climate change, including carbon dioxide and aerosol components, and are essential for independently monitoring progress and self-reporting of other nations efforts to meet climate agreement targets. We recommend that CESD evaluate (through a workshop or other means) what the costs and benefits would be of rebuilding a vibrant carbon cycle research program in this area. We also recommend that ESS-DIVE explore the possibility of stewarding some of the unique data originally housed at CDIAC.

Appendix I: Charge from the Acting Director of the Office of Science



Department of Energy
Office of Science
Washington, DC 20585

OCT 15 2018

Dr. Gary Stacey
Endowed Professor of Plant Sciences and Biochemistry
National Center for Soybean Biotechnology
271E 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 of Visitors (COV) to assess the processes used by the Climate and Environmental Sciences Division (CESD) within BER to manage CESD research programs and its user facilities, the William R. Wiley Environmental Molecular Sciences Laboratory (EMSL) and the Atmospheric Radiation Measurement (ARM) Climate Research Facility.

The COV should provide an assessment of the processes used to solicit, review, recommend and monitor proposals for research submitted to CESD programs for FY2015 – FY2018. 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 ARM and EMSL 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 ARM and EMSL user facilities, assess the division's 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 the Office of Science 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



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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 that the COV have significant expertise across all covered areas within CESD programs and that this expertise 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. At least one COV member must 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 factors 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://science.energy.gov/sc-2/committees-of-visitors/> and attachments therein.

The COV should take place in the third quarter of FY2019 (Summer 2019) in Germantown, Maryland. A discussion of the COV report by BERAC should be held no later than the Fall 2019 BERAC meeting. Following acceptance of the full BERAC membership, the COV report with findings and recommendations is to be presented to me, as the Acting Director, Office of Science.

If you have any questions regarding this charge, please contact Gary Geernaert, 301-903-3281 or by email Gerald.Geernaert@science.doe.gov.

Sincerely,



J. Stephen Binkley
Deputy Director For Science Programs
Office of Science

cc. Sharlene Weatherwax

Appendix II: COV Members and Affiliations

Last Name	First Name	Affiliation
Donner #	Leo	NOAA Geophysical Fluid Dynamics Laboratory
Dumas	Melissa	Oak Ridge National Laboratory, Computational Sciences and Engineering
Fridlind #	Ann	NASA Goddard Institute for Space Studies
Hack*, #	James	Oak Ridge National Laboratory, National Center for Computational Science
Johnson	Randi	USDA, National Institute for Food and Agriculture
Kleese van Dam #	Kerstin	Brookhaven National Laboratory, Computational Science Initiative
Lee	Tsengdar	NASA, Scientific Computing Portfolio
Randerson**, #	James	University of California, Irvine, Department of Earth System Science
Rice	Jennie	Pacific Northwest National Laboratory
Shevliakova	Elena	NOAA Geophysical Fluid Dynamics Laboratory
Sobecky	Patricia	University of Alabama, Office for Academic Affairs
Tharayil	Nishanth	Clemson University, Plant and Environmental Sciences
Wilkins	Michael	Colorado State University, Soil and Crop Sciences
Williamson	David	National Center for Atmospheric Research, Climate and Global Dynamics Laboratory
Zhang	Minghua	Stony Brook University, School of Marine and Atmospheric Sciences

*COV Chair

**COV Co-chair

#BERAC Member

Appendix III: COV Panel Assignments

Group	Program Area(s)	Funding Opportunities	Reviewers
1	<p>Earth System Modeling (ESM)</p> <p>Regional and Global Climate Modeling (RGCM)</p> <p>Integrated Assessment Research (IA)</p>	<p>18-1862 (RGCM, ESM)</p> <p>LAB 17-1681 (ESM - SciDac)</p> <p>LAB 17-1682 (ESM - SciDac)</p> <p>16-1682 (ESM - SciDac)</p> <p>16-1482 (ESM)</p> <p>16-1531 (RGMA, IA)</p>	<p>Jim Hack</p> <p>Leo Donner</p> <p>Melissa Dumas</p> <p>Jennie Rice</p> <p>David Williamson</p>
2	<p>Atmospheric Systems Research (ASR)</p> <p>Climate Model Development & Validation (CMDV)</p> <p>Data Management (DATA)</p> <p>Atmospheric Radiation Measurement (ARM) User Facility</p>	<p>18-1845 (ASR)</p> <p>16-1638 (ASR)</p> <p>16-1430 (ASR)</p> <p>16-1431 (ASR)</p> <p>16-1530 (ARM, ASR, ESM) LAB</p> <p>16-1530 (ARM, ASR, ESM)</p>	<p>Ann Fridlind</p> <p>Kerstin Kleese Van Dam</p> <p>Tsengdar Lee</p> <p>Jim Randerson</p> <p>Minghua Zhang</p>
3	<p>Terrestrial Ecosystem Science (TES)</p> <p>Subsurface Biogeochemical Research (SBR)</p> <p>Environmental Molecular Sciences Laboratory (EMSL) Facility</p>	<p>18-1855 (TES)</p> <p>16-1437 (TES)</p> <p>16-1724 (SBR)</p>	<p>Mike Wilkins</p> <p>Randi Johnson</p> <p>Elena Shevliakova</p> <p>Patricia Sobecky</p> <p>Nishanth Tharayil</p>

Appendix IV: COV Agenda

**Department of Energy
Office of Biological and Environmental Research,
Climate and Environmental Sciences Division
2019 Committee of Visitors Meeting**

Rockville Hilton, 1750 Rockville Pike, Rockville, MD 20852

Agenda July 9-11, 2019

Tuesday, July 9, 2019

- 6:00-6:15 pm Working Dinner (Rockville Hilton, Eisenhower Room)
- 6:15-6:30 pm Welcome and overview of BER office structure
(Sharlene Weatherwax, Associate Director, BER)
- 6:30-7:30 pm Overview of BER and CESD (Gary Geernaert, CESD Division Director)
- 7:30-8:00 pm Review of Charge Letter and Agenda (Jim Hack, COV Chair)
- 8:00-8:30 pm Review of Meeting Logistics, Conflicts of Interest,
Q&A (Justin Hnilo, Program Manager)
- 8:30-9:00pm PAMS overview (Renu Joseph)

Wednesday, July 10, 2019

- 7:00 Breakfast (Provided outside of Eisenhower Room)
- 8:00-8:30 am Introductions and Logistics (Eisenhower Room)
- 8:30-10:30 am Briefings by Program Staff to Breakout Groups
Group 1 (ESM, RGCM, IAR/MD), Jackson Room
Group 2 (ASR, ARM, CMDV, DM), Montrose Room
Group 3 (TES, SBR, EMSL), Twinbrook Room
- 10:30-10:45 am Break
- 10:45-12:00 pm Breakout Sessions (CESD staff as needed)
Group 1 (ESM, RGCM, IAR/MD), Jackson Room
Group 2 (ASR, ARM, CMDV, DM), Montrose Room
Group 3 (TES, SBR, EMSL), Twinbrook Room
- 12:00-1:00 pm Working Lunch (Provided outside of Eisenhower Room)

- 1:00-3:00 pm Breakout Sessions continue (CESD staff as needed)
 Group 1 (ESM, RGCM, IAR/MD), Jackson Room
 Group 2 (ASR, ARM, CMDV, DM), Montrose Room
 Group 3 (TES, SBR, EMSL), Twinbrook Room
- 3:15-5:00 pm Crosscutting Topical Breakouts with CESD Staff (Eisenhower Room)
 Topic 1: User Facilities and Community Infrastructure
 (Paul Bayer, Jay Hnilo, Sally McFarlane, Ricky Petty)
 Topic 2: SFA Administration and Management
 (Shaima Nasiri, Daniel Stover, Renu Joseph, Bob Vallario)
- 5:00-5:30 pm Meeting with CESD Staff (Questions/Requests for Further Information),
 (Eisenhower Room)
- 5:30-7:30 pm Dinner on your own (Eisenhower Room)
- 7:30-9:00 pm Executive Session: Reviewers at Hotel (Eisenhower
 Room)

Thursday, July 11, 2019

Breakfast (Provided outside of Eisenhower Room)

- 8:30-10:15 am Breakout Sessions and Writing (CESD staff as needed)
 Group 1 (ESM, RGCM, IAR/MD), Jackson Room
 Group 2 (ASR, ARM, CMDV, DM), Montrose Room
 Group 3 (TES, SBR, EMSL), Twinbrook Room
- 10:15-10:30 am Break
- 10:30-12:00 pm Breakout Sessions and Writing (CESD staff as needed)
 Group 1 (ESM, RGCM, IAR/MD), Jackson Room
 Group 2 (ASR, ARM, CMDV, DM), Montrose Room
 Group 3 (TES, SBR, EMSL), Twinbrook Room
- 12:00-1:00pm Lunch (Eisenhower Room)
- 1:00-2:00 pm Executive Session (Eisenhower Room)
- 2:00-3:00 pm Committee Report Preliminary Findings to BER Staff (Eisenhower Room)
- 3:00 pm Adjourn