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September 8, 2008

Dr. George Gray

Assistant Administrator

Office of Research and Development

U.S. Environmental Protection Agency

Washington, DC 20460

Dear Dr. Gray:

The Board of Scientific Counselors (BOSC) is pleased to provide this mid-cycle progress review report providing advice and guidance for the Global Change Research Program (GCRP). A six-member BOSC Subcommittee was charged to conduct the review focusing on progress of the GCRP since the last BOSC program review, the report for which was delivered to ORD in March 2006.

The Subcommittee conducted two preliminary teleconferences prior to a face-to-face review meeting that was held in Washington, DC, on January 23, 2008. Two post-meeting conference calls were held by the Subcommittee to reach consensus on the substance and language of the report. The report was presented to the BOSC Executive Committee and appropriately vetted during its May 6-7, 2008 meeting in Gulf Breeze FL. Revisions to the report requested by the Executive Committee have been made and the final report is herewith transmitted to ORD on behalf of the BOSC Executive Committee.

The GCRP continues to be a complex research program and an important part of our national climate change program. The reviewers found that the GCRP is progressing well and that the Program is doing the "right" science and the "right" science well. The GCRP received an "exceeds expectations" qualitative rating in the review process. The report provides the full context and details for this rating, responses to the charge questions, as well as other specific recommendations.

This report is anticipated to further assist ORD in longer term program enhancement, comparative analysis with other programs, and intermediate research investment decision making. Again, on behalf of the BOSC Executive Committee, it is my pleasure to transmit to you the GCRP Mid-Cycle Review report. We expect the report will assist ORD in continuing to improve its science, and inform clients within and outside the EPA of the

significance of its research and how it is utilized.

Please feel free to contact me if you have any questions concerning this report. Given the obvious progress of the GCRP, the Executive Committee does not believe that the Program needs to respond to the BOSC concerning the recommendations and guidance offered as a result of this mid-cycle review.

Sincerely,

A handwritten signature in black ink, appearing to read "Gary Saylor". The signature is fluid and cursive, with a long horizontal stroke extending to the right.

Gary S. Saylor, Ph.D.
Chair, BOSC



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**MID-CYCLE REVIEW OF THE OFFICE OF
RESEARCH AND DEVELOPMENT'S
GLOBAL CHANGE RESEARCH PROGRAM
AT THE
U.S. ENVIRONMENTAL PROTECTION
AGENCY**

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July 11, 2008

This report was written by the Global Change Mid-Cycle Subcommittee of the Board of Scientific Counselors, a public advisory committee chartered under the Federal Advisory Committee Act (FACA) that provides external advice, information, and recommendations to the Office of Research and Development (ORD). This report has not been reviewed for approval by the U.S. Environmental Protection Agency (EPA), and therefore, the report's contents and recommendations do not necessarily represent the views and policies of the EPA, or other agencies of the federal government. Further, the content of this report does not represent information approved or disseminated by EPA, and, consequently, it is not subject to EPA's Data Quality Guidelines. Mention of trade names or commercial products does not constitute a recommendation for use. Reports of the Board of Scientific Counselors are posted on the Internet at <http://www.epa.gov/osp/bosc>.

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I. SUMMARY

I.1 Introduction

The purpose of this Global Change Research Program Mid-Cycle Review is to report on the U.S. Environmental Protection Agency's (EPA) Global Change Research Program's (GCRP) progress and performance, and its planned activities for meeting its future responsibilities. This mid-cycle review covers the period since the earlier Board of Scientific Counselors' (BOSC) program review, the report of which was delivered to EPA on March 27, 2006. (The report is available on the BOSC Web Site at <http://www.epa.gov/osp/bosc/pdf/glob0603rpt.pdf>.)

This mid-cycle review was conducted by the Global Change Research Mid-Cycle Subcommittee of the BOSC (the members of the Subcommittee are listed in Appendix A). It responds to a charge (see Appendix B) issued by EPA's Office of Research and Development (ORD). A primary purpose of this mid-cycle review is to evaluate the response of the GCRP to the recommendations (and concerns, if any) provided by the 2006 program review. In meeting this responsibility, the Subcommittee relied heavily upon the report from that program review, the ORD October 17, 2006 response to that program review (<http://www.epa.gov/osp/bosc/pdf/glob0610resp.pdf>), and on the GCRP's subsequent *Progress Report* (December 2007). The Subcommittee also considered other documents and materials, including a CD containing reports emanating from the GCRP and a *Bibliometric Analysis* (see Appendix C) conducted by an independent third party. It also received presentations from the GCRP in two extensive conference calls (January 4 and January 10, 2008). The Subcommittee conducted a face-to-face meeting January 23 in Washington, DC, in order to have questions answered by GCRP staff, to discuss issues, and to reach conclusions on its findings. Subsequent to this meeting, two conference calls were conducted (February 28 and March 4) to reach agreement on the substance and language of this report. The meeting and the above noted conference calls were conducted as public meetings under the guidelines of the Federal Advisory Committee Act (FACA).

Prior to the activities noted above the Subcommittee met via conference call (December 19, 2007) for orientation to FACA requirements and to discuss procedural issues for the review.

I.2 Mid-Cycle Report Overview

This mid-cycle review was conducted in the context of the overarching questions that guided the original program review:

1. Is the GCRP engaged in the "right work"?
2. Does the GCRP conduct its research and assessment activities "well"?

The report from the program review concluded that the answer to both these questions was "yes," but it included a number of recommendations and suggestions for GCRP enhancement

and for adjustments required to meet a changing mission and evolving conditions. Two major responsibilities of the present Subcommittee were to evaluate the progress of the GCRP in following these recommendations and suggestions and to examine whether, in the period since the program review, the GCRP continued to be engaged in the (adjusted) “right work” and whether it was doing that work “well.” Section II of this report addresses these questions in the context of Charge Question 1.

The 2006 program review report noted that the shifting mission of the GCRP demanded that the review be both retrospective and **prospective**—that is, consider how the focus and activities of the GCRP should be and could be altered to better meet the responsibilities it now was charged with fulfilling. That alteration has been underway, and its status and successes—and continuing challenges—are discussed below in Section II. Further change, however, is envisioned by the GCRP and, in the BOSC’s view, is appropriate. In a matter of fortunate timing, the GCRP is in the process of developing a new Multi-Year Plan (MYP) to guide its future course and therefore the BOSC was able to provide its insights at a formative stage of the plan. This task was formalized in Charge Questions 2 and 3, which commissioned the BOSC to examine these issues. The BOSC’s findings are provided in Sections III and IV of this report.

As noted in the 2006 program review report, the effectiveness of the GCRP’s efforts depends on the usefulness and use of its products by clients, defined broadly to include decision-makers both in this country and abroad. It can produce outputs, but socially beneficial **outcomes** depend on those in a position to act more wisely because of the **outputs** the Program yields. Sections II, III, and IV all comment on the GCRP performance in this regard, based on evidence provided by the Program on its activities and results since 2006. The broader issue remains; how effective has the GCRP been, measured in some quantitative or quasi-quantitative and reproducible fashion? Sensitive to this question, and in concert with other programs in ORD, the GCRP plans to conduct a survey to monitor its use and usefulness to clients, and to determine how it might improve upon its performance. ORD asks, in Charge Question 4, for recommendations from the BOSC as to the design, execution, and targets of this survey. The BOSC concluded that it had no expertise on this matter, especially on how any survey could be representative, would elicit responses that could be aggregated in a meaningful way, and that therefore would be of significance beyond the anecdotal. A brief statement of the BOSC’s concerns about this survey is found in Section V of this report.

With or without a client survey such as the one the GCRP seeks to administer, the question remains as to what performance metrics should be used in evaluating its performance and finding opportunities for improvement. In Charge Question 5, ORD requests the BOSC to consider whether the performance metrics used for all programs in ORD are appropriate and sufficient for the Global Change Research Program, and if not, what additional or alternative metrics might be utilized. The Subcommittee’s discussion and conclusion on this charge question are found in Section VI.

In the course of its deliberations the Subcommittee had occasion to observe matters not directly covered by the five charge questions. In Section VII, the BOSC’s reactions, recommendations, and suggestions on two matters—the need to constrain GCRP activities to its mission and the adequacy of resources to accomplish even that limited mission—are presented.

In addition to those charge questions directed specifically at the performance and future direction of the GCRP, the Subcommittee was asked to select the appropriate “one phrase” summary assessment of the GCRP from among four alternatives. Although the Subcommittee members bridled at the task of summarizing a multifaceted and evolving program in this way, Section VIII summarizes the conclusions of this mid-cycle review and provides that assessment.

I.3 Conclusions and Recommendations

The mid-cycle review encompassed information and discussion of the GCRP’s response to the 2006 BOSC program review, its difficulties and successes in adjusting to subsequent new challenges and unforeseen responsibilities, and its plans for moving forward in the face of expanded demands for its products. **The BOSC reaffirms the program review report by concluding that, in general, the GCRP is doing the “right work” and doing it “well.”**¹ Again, as in the previous report, the BOSC has recommendations for improving success and concerns about threats to that success that it believes deserve attention.

Among its accomplishments, the GCRP’s shift in focus toward a more national perspective and its reorganization of its programmatic areas—fundamental recommendations of the 2006 report—have been accomplished fully and effectively. Its responsibilities to the national Climate Change Science Program (CCSP) have been met and the GCRP has taken on a role in that activity beyond what might be expected given its small portion of the overall CCSP budget. Consistent with the BOSC recommendations, the Program has become much more embedded “in the woodwork” of the mainstream activities of EPA; it has taken on roles with both the Office of Air and Radiation (OAR) and the Office of Water (OW) in facilitating the inclusion of global change elements in decisions and analyses. With respect to the latter, the tools it has developed are useful and being used in improving real decisions made elsewhere in the Agency. Further, the regional offices and their state and local counterparts have been sensitized and motivated, and to some extent empowered, by the tools provided by the GCRP to take potential global change into account both in current decisions and in planning for meeting air, water, and health protection requirements in the face of such change. While doing so, the GCRP has taken on tasks not previously planned, and has effectively managed the resources at its disposal, albeit at some cost to its other activities. In the process of performing these more operational responsibilities, the GCRP also has produced a commendable quantity and quality of scientific publications, as evidenced by the glowing report found in the third-party *Bibliometric Analysis*. It has used external researchers under the peer-reviewed Science To Achieve Results (STAR) Program effectively.

In terms of its future work, the GCRP is in the process of revising its Long Term Goals (LTG) and developing a new MYP. The Subcommittee reviewed alternative drafts of the former and an in-draft synopsis of the latter. With reference to the draft LTGs, they each covered essential missions of the GCRP with different emphases; one distinction among them was the extent of the focus on either outputs or outcomes. For reasons of practicality, the BOSC expressed a preference for output-based LTGs but emphasized its agreement with the view that the outputs

¹ The major conclusions and recommendations in this report are presented in bold text so that they are easily discerned by the reader.

themselves should be selected and judged on how well they motivated and empowered the GCRP clients. In addition, the BOSC noted that, as drafted, the LTGs failed to include as clients those parties outside EPA and the CCSP orbit; the target decision-makers, of course, include many other actors both within the United States and internationally, and this should be recognized explicitly.

In the draft MYP, the Annual Performance Goals (APGs) and the Annual Performance Measures (APMs) for the major areas of the GCRP are presented in commendable detail, and the cross-walk with key research questions is clear. **One concern is that the APMs listed under APG 1 should be broader in geographic scope to be considered truly national (e.g., assessments of representative watersheds in different regions of the United States).**

Of greater concern, however, is the absence of the all-important coherent “story” of what the GCRP intends to produce for the environment. That “story” would demonstrate the basis for a transparent priority setting process and thereby discipline the choice of activities and allow stakeholders to understand why the ones chosen and their expected products are the most important. In addition, it also would identify what had to be **left undone**, and the implications thereof, and to make the choices understandable. Such a statement, clearly articulated, is needed to provide an overarching framework at the beginning of the MYP. It is required to provide confidence that the set of outputs and outcomes that will be produced represent an effective and efficient use of the nation’s resources. Further, it is needed to serve internally as an expanded mission statement to which staff and management can relate, and against which they will be able to judge their effectiveness in the larger context of national adaptation to global change.

The GCRP has taken commendable steps to fulfill three other central BOSC recommendations, but the BOSC found that more needs to be done. The first of these is alluded to above: a clear and transparent priority-setting process, possibly including use of expert advice, leading to a defined path forward. The GCRP has commissioned a National Academies study, and has received advice from the Science Advisory Board and other groups internal and external to EPA. It has produced draft LTGs and a detailed MYP. **Still, the BOSC has not been supplied a clear, focused statement of the GCRP mission in enough detail that the Program could use it confidently to monitor its borders to forestall extraneous demands and also to hold itself accountable for a discrete set of activities and results consistent with that mission.**

The second recommendation was for the GCRP to place greater emphasis on nonlinear or threshold-type responses to global change to help prepare its clients for otherwise-surprising results from either sudden or incremental global change. The GCRP has utilized the STAR Program to move the science of this issue forward, and this is commendable but not sufficient. To a large extent the GCRP has been concerned with identifying incremental global changes with similarly incremental changes in societal and natural impacts, which although important, have more readily identifiable adaptation strategies. That is, responses to incentives created by gradual effects produce self-motivated adaptation as a feedback that tends to minimize—though not avoid—the harm from incremental global change. It is becoming clear, however, that nonlinearities in hydrological and ecological systems may produce large and unexpected changes even from **incremental** changes in forcing events; these present different and more important adaptation challenges. In short, there is no incentive for anticipatory adaptation to harmful changes that do not provide a timely signal to those affected. The potential for non-incremental changes from global change processes is a further nonlinearity/threshold issue that must be

addressed. The BOSC recognizes that addressing the issue of nonlinear or threshold responses is a daunting task, which is all the more reason for the GCRP with its skills and resources to undertake it; no one else will. Further, the GCRP brings substantial comparative advantages in the context of other federal research programs. **Therefore, the BOSC recommends that the GCRP include both intramural as well as extramural elements in this task, and devote substantially more resources to both.**

The final recommendation that requires additional effort from the GCRP is in facilitating the “harvest” from prior and current activities. Much has been done, especially with respect to potential clients in the Agency and with its counterparts. The BOSC found, however, that gaps remain, especially in making findings and the lessons of experience known to, and available for the use of, other potential actors. For example, a substantial amount of work funded and completed prior to the shift in focus by the GCRP (primarily work done in regional assessments) appears to be languishing unused. Preparing guidebooks, staffing Web sites with personnel who can answer queries, doing sensitivity and “how to” training, and writing user manuals for queries that arise is not very exciting work, nor is it traditional science. Further, the demands of current activities and new responsibilities are intense. Nonetheless, in the BOSC’s opinion, further effort and attention needs to be given to making prior outputs useful and used. The reason is, as noted before, that the **outputs** of the Program for the most part are converted to **outcomes** by others—and therefore they need both the tools **and** the encouragement and capability to use them. Success in this transfer is **the payoff** for the program. It is not an add-on; it rests at the heart of the GCRP’s success or failure in facilitating adaptation to global change.

The BOSC also made some observations that went beyond the charge questions, and these are noted here. A theme that ran through the deliberations was that the program had inadequate resources. That is, even more needed to be done to foster and empower adaptation than was contemplated in 2006; hence there are **additional** needs for resources to meet the core GCRP responsibilities. The “market” for GCRP services is, admirably, growing. Further, the initiation of GCRP’s direct involvement in EPA’s OW and OAR efforts and new congressional and court-ordered mandates is placing additional future demands on a resource base that is shrinking or constant in real terms. Thus, the resource question is a serious one.

Second, and related to the point made above, the GCRP is likely to be faced with increased intra-Agency demands for aid in **implementing** some of the actions likely to be taken by the line programs in OAR and OW and elsewhere in the Agency, including the regions. Meeting those demands would divert resources from the core mission of the GCRP, which is to provide the tools and the initiative for adaptation activities, not to become enmeshed in operational responsibilities such as helping to develop regulatory policies and actions. As noted above, avoiding this diversion of resources will require drawing, and then policing rigorously, firm boundaries around what is—and therefore what is not—the GCRP mission.

I.4 GCRP Summary Assessment

The resource question, coupled with the shifting and growing set of responsibilities of the GCRP even since the 2006 program review, posed a serious difficulty in arriving at a summary evaluation category. As noted above and described in greater detail in later sections, the GCRP had marked successes in meeting and exceeding key goals. At the same time, the BOSC found

that other goals were only partially met. It further found that new work with high priority and of undoubted worth was undertaken and accomplished. Hence, the BOSC's consensus was that it was of two minds in coming to a decision about the proper descriptor to assign the GCRP's performance. In brief, if the rating criterion were to be the narrow one of meeting the 2006 specific commitments and recommendations, the verdict would be that, despite stellar performance and creative management, the GCRP only merits a "Meets Expectations" rating. Given the stretch goals and the challenging recommendations made in 2006, the unanticipated expansion of responsibilities, and the limited resources available, however, the BOSC concluded that the "Exceeds Expectations" rating was appropriate. In the BOSC's judgment, GCRP managers made the correct decisions from a national perspective in their use of resources and therefore the Subcommittee members decided on an "Exceeds Expectations" rating for the Program.

II. CHARGE QUESTION 1: Responsiveness to BOSC Recommendations and Progress in Integration into EPA Programs

II.1 Introduction

The first charge question to the BOSC required the members to look backward to evaluate the progress of the GCRP on two dimensions. The first of these was the extent to which the GCRP had taken seriously and then performed effectively in response to the BOSC recommendations of 2006. The second was to ascertain the progress made by the GCRP in integrating its work with the ongoing and evolving programs of EPA in support of the Agency's statutory, regulatory, and programmatic requirements. The BOSC concluded that the GCRP had a good record in both respects, but that there were some improvements that could be made.

II.2 Response to BOSC 2006 Recommendations

The BOSC commends the GCRP for the depth of its self-assessment following the 2006 program review and for the seriousness and comprehensiveness with which it has addressed the task of taking action to respond to the recommendations of the BOSC. Two years is a very short time to have made important progress in establishing changes in a federal research program—particularly one with an open access component—and the program managers deserve considerable credit for effecting change, especially because multiple and varied new demands were simultaneously arising.

Taken together, the set of eight BOSC recommendations from 2006 reflected the sense of the BOSC that this generally high-performing program should pay additional attention to its identity as a “**national**” program. This transition has been largely accomplished, and the GCRP is commended for its success in the transformation. The recommendations further suggested that the GCRP act on its responsibility to assure that federal resources were directed toward the **highest priority** research questions central to its mission: those that would lead to knowledge that would further the country's capacity to adapt to global change. Again, the evidence is that the research is well directed, though the explicit analytical process through which it is selected remains unclear.

The thrust of the BOSC's 2006 recommendations remains germane, and continues to offer a significant challenge to the GCRP. Resources available to the Program were and are very limited and the demands upon it continue to increase. Therefore, **the BOSC concludes that a clear and well-defined framework for establishing priorities in a national context, and for flexibility to respond to evolving national needs, is perhaps even more critical than it was 2 years ago.**

In terms of arriving at an explicit framework for priority-setting, the GCRP has put efforts in place to help guide the process. All are good efforts—the decision assessment activity, the

National Academy study of decision support, and the CCSP synthesis and assessment products. The risk, of course, is that the results of these activities will actually broaden the pressures on the GCRP and place additional demands on its resources. The BOSC encourages the GCRP to use these activities as input, but to continue working to identify and make clear the specific challenges that global change presents and how specific investments in research will contribute to improvements in decision-making options. The GCRP focus on helping EPA understand how climate change affects the Agency's ability to meet statutory programmatic and regulatory responsibilities also is an appropriate launching pad for prioritizing its investments.

The BOSC recognizes that the GCRP must balance the benefits of external review and advice (e.g., BOSC, Science Advisory Board [SAB]) for priority setting and other purposes against the substantial resource costs involved in preparing for and responding to reviews. For that reason, and particularly given the enhanced nation-wide concern about impacts and response options related to global change, **the GCRP and ORD should consider reducing the resources devoted to seeking and responding to Agency-specific advice and instead find a mechanism to involve a small number of broad-gauged and wise external advisors on a continuing basis.**

The 2006 BOSC program review identified the need for increased attention to investigation and action with respect to nonlinear response issues, that is, for example, both to sudden changes in climate **and** to sudden changes in ecosystems in response to gradual changes in climate. To the extent that the GCRP will enhance its already productive relationship with the EPA regions, what would the regions identify as their greatest vulnerabilities, and what are the critical issues with regard to rates of change? What is the role of extreme events? Which of all of the range of global change impacts are truly worth worrying about, why, and what can be done to improve adaptive capacity to respond to them? Is EPA (and the nation at large) devoting an appropriate amount of its effort toward potential overwhelming societal threats as compared to more tractable but marginal impacts that might be accommodated without governmental action? A mindset that incorporates matters such as these is an important element in focusing GCRP priorities. **The BOSC reiterates the finding in the 2006 program review report and concludes that more effort is still required on nonlinear response issues.**

The 2006 program review report discussed the related issues of the change in focus of the GCRP from regional assessment to national adaptation, of "harvesting" the products of its research and other activities (including those now concluded), and of the crucial importance (and difficulty) of transforming "outputs" into "outcomes." As noted above, the change in focus has been accomplished. The GCRP is taking measures to ensure that the public has access to the assessments it sponsored earlier. Still, what was learned about the **process** of conducting the assessments? It would be useful to know, for example: What, in particular, was learned about process regarding the identification of specific response options on the part of decision-makers? What processes would be effective in alerting stakeholders of their individual opportunities to make welfare-enhancing adaptations? What new insights were garnered in the context of the assessments that might refine the research agenda—both in terms of global change and in social learning? **It also would be useful in terms of the connection between outputs (of the GCRP) and outcomes (on the part of the intended users) to illustrate, where possible, how issues such as air quality concerns and the role of climate change evolve over the course of time, and what affects the rate of response.** The GCRP provided evidence that it was fully sensitive to the fact that its success must be measured by the usefulness and use of its products. In terms of

“harvesting” and converting outcomes to outputs, this remains a (very difficult) work in progress.

In sum, the BOSC concludes that the GCRP has been very responsive to the recommendations of the 2006 program review and appears to be in the process of continuing the effort to implement the BOSC’s recommendations fully.

II.3 Progress in Integrating GCRP Outputs into EPA Programs

In only a 2-year time frame, the GCRP took major steps to use the mission responsibilities of EPA with regard to protection of air and water quality as its marker for “national-scale” problems. An objective that may have mostly arisen from the need to hone the research agenda positioned the GCRP well as a resource when other parts of the Agency began to consider the question of how climate change would influence their mission interests. That the GCRP had taken steps to integrate investigation of water quality and ecosystems enabled the research effort to provide needed insights when OW determined that addressing the impacts of global change should become a priority.

Similarly, the GCRP has become a “player” in assisting OAR in planning and then implementing some of its regulatory responsibilities in the context of global change. Similar efforts in other environmental protection areas can be envisioned—for example, it may become important to consider changes in water tables and precipitation when determining design requirements for hazardous waste disposal.

To some extent, the swift and effective measures taken by the GCRP to integrate water quality and ecosystems have enabled improved connection to Agency mission interests. This evolving relationship has the potential to promote further synergies in program implementation and evaluation. This continued partnership between the GCRP and the mission side of EPA could provide an improved evaluation of whether we as a nation are able to protect water (and air) quality in the face of global change. It will depend on the capacity of the GCRP to harvest results in ways that promote firmer and more visible connections between the Program’s research outputs and the outcomes it is intended to affect.

The challenge in the future is going to be making better central use of the programs with discretionary research budgets to support changes in statutory, regulatory, and programmatic requirements across the entire federal sector.

III. CHARGE QUESTION 3: Appropriateness of GCRP Long-Term Goal Statements

III.1 Introduction

Charge Question 3, “To what extent does the wording of the Global Program’s long-term goals appropriately reflect the intended purpose of the program?” was considered by the BOSC prior to its consideration of the Multi-Year Plan (MYP) revision, the subject of Charge Question 2, because of the BOSC’s view that determination of goals was a prerequisite for developing a plan for achieving them. To a significant degree, however, these two questions are directly related and this and the succeeding section need to be read together.

ORD requested the BOSC to comment on alternative phrasings of three long-term goals (LTGs) with respect to whether the current draft or alternatives conformed best to the intended purpose of the GCRP, or, indeed, whether any were acceptable. The BOSC concluded that it could be most effective by commenting on the implications of the different wordings without specifically endorsing any. The reason is that there are substantive differences in the implications of the variants and which of them, if any, are suitable going forward depends on what the actual purpose of the GCRP is determined to be.

The GCRP MYP was being revised at the time of the BOSC review, and several alternative wordings of the LTGs were provided, with the understanding that they were subject to change. Therefore, the comments below should be viewed in the context of an MYP and LTGs that were still in flux at the time of the review.

The draft MYP states that the core purpose of the program is “to provide scientific information to stakeholders and policymakers to support them as they decide whether and how to respond to the risks and opportunities presented by global change.” The Subcommittee reviewed four versions of LTG 1, associated with air quality assessment, and five versions of LTG 2, associated with water quality assessment. LTG 3, targeted to direct support of the CCSP and its statutory mandates, has only one draft at present.

The BOSC notes that this formulation of LTGs 1 and 2 in an **EPA program office context** represents a significant (and perhaps unwise or else unintended) narrowing and focusing of the GCRP from the “stakeholders and policymakers” client framework provided in the MYP statement. The BOSC recognizes that other activities can be placed under these media-based umbrellas, but observes that this wording will tend to restrict the GCRP to a role of servicing other elements of EPA (and perhaps their direct state and local counterparts) rather than the broader community of stakeholders and policymakers (importantly, **including** EPA and related policymakers). **The BOSC concludes that this implication should be taken into account as the final decisions about the broader framing of the LTGs are made.**

The BOSC concludes that the wording of all three LTGs can be construed to reflect the intended purpose of the GCRP, but offers several observations about the alternative wordings for LTGs 1 and 2.

III.2 Long-Term Goal 1: The GCRP and Air Quality

Alternate versions of LTG 1 reviewed by the BOSC were as follows:

Current Draft MYP: Air quality managers and decision makers in EPA regional and program offices will use scientific information and models from EPA’s research and assessment program to evaluate and implement adaptation policies that protect air quality from the impacts of global change.

Alternative #1: Enhance the ability of air quality managers to consider global change in their decisions through improved characterization of the potential impacts of global change on air quality.

Alternative #2: Reduce uncertainties to increase understanding of the causal linkages between global change and air quality, enhancing the EPA Office of Air and Radiation’s ability to effectively account for global change while fulfilling its statutory requirements.

Alternative #3: Air quality managers and other decision-makers use information from EPA’s Global Program about the potential effects of global change on air quality and adaptation strategies to inform their climate-sensitive decisions intended to protect air quality.

All four versions clearly reflect the core purpose of providing decision support to stakeholders, but differ in their focus. The current draft and Alternative #3, which is essentially an editorial variation of the current draft, are outcome-focused—the program information *will be used* by decision-makers. Alternatives #1 and #2 are output-focused, emphasizing improved impact characterization and reduced uncertainty, respectively. As a direct consequence of their focus on outputs, the first two alternatives are both more under the control of program personnel and less ambitious. Alternatives #1 and #2 also may allow for more effective measurement of progress made toward achieving the goal. **In revising this LTG, the program should consider the ultimate goal of mission-driven research, which is in fact to affect decisions.** The BOSC also observes, with respect to Alternative #2, the recommendation of the National Research Council (NRC) that “reduction of uncertainty should not be relied on as a metric for assessing progress in the CCSP”² because uncertainty is not necessarily correlated with the degree of understanding of the causal factors of climate change.

The BOSC further recommends that the final wording of the LTGs include a reference to effective communication with decision-makers; this is essential to achieving the outcome of having the information used. One possible compromise is to use Alternative #1 but to add the

² National Research Council. Thinking Strategically: The Appropriate Use of Metrics for the Climate Change Science Program. Committee on Metrics for Global Change Research, Climate Change Research Committee, 2005, 162 pp.

phrase “and effective communication of potential impacts to decision-makers.” This added phrase provides outcome-based wording in an otherwise output-based goal.

III.3 Long-Term Goal 2: The GCRP and Water Quality and Ecosystem Protection

Alternate versions of LTG 2 reviewed by the Subcommittee were as follows:

Current Draft MYP: Decision makers in the states, tribes, and EPA regional and program offices will use scientific information and decision tools from EPA’s research and assessment program to protect water quality and aquatic ecosystems by adapting to global change.

Alternative #1: Enhance the ability of states, EPA offices, and CCSP agencies to consider global change in their decisions through improved characterization of the potential impacts of global change on water quality and aquatic ecosystems.

Alternative #2: Enhance the ability of states, EPA offices, and CCSP agencies to consider global change in their decisions through improved characterization of the potential impacts of global change on public health and the integrity of the nation’s waters.

Alternative #3: Reduce uncertainties to increase understanding of (1) the causal chain from global change stressors to impacts on designated uses and (2) the effectiveness of adaptive management actions, to enhance the EPA Office of Water’s ability to effectively account for global change while fulfilling its statutory requirements.

Alternative #4: Decision-makers in the states and EPA regional and program offices use information from EPA’s Global Program about the potential effects of global change on aquatic ecosystems and adaptation strategies to inform their climate-sensitive decisions intended to protect aquatic ecosystems.

The current draft LTG 2 and alternatives are generally parallel in wording to the LTG 1 current draft and alternatives, except that water quality and aquatic ecosystems are the focus. As with LTG 1, the BOSC concludes that all four versions appropriately reflect the intended purpose of the program: provide decision support to stakeholders. Given the parallel construction of the alternatives, the BOSC’s comments are similar to those for LTG 1. The current draft and Alternative #4, an editorial variation of the current draft, are outcome-focused. Alternatives #1, #2, and #3 are output-focused, and consequently are both more under the control of program personnel and less ambitious. Alternative #2 has a somewhat broader endpoint than Alternative #1 (public health and the integrity of the nation’s waters) based on NRC recommendations (NRC, 2005), and this may be desirable. Alternative #3, focused on uncertainty reduction, should be considered with the same caveat as LTG 1’s Alternative #2.

Again, in revising this LTG, the program should consider the ultimate goal of mission-driven research, which is in fact to affect decisions, and the BOSC recommends that the final wording of the LTG include a reference to effective communication with decision-makers; this is a crucial key to achieving the outcome of *having the information used*.

Similar to LTG 1, one possible compromise is to use Alternative #2 but to add the phrase “and effective communication of potential impacts to decision-makers,” which would provide outcome-based wording in an otherwise output-based goal.

III.4 Long-Term Goal 3: The GCRP and the CCSP

The only wording supplied for LTG 3 is:

The U.S. Climate Change Science Program (CCSP) will be supported in its efforts to meet the statutory requirements of Section 106 of the Global Change Research Act of 1990 to produce periodic Science Assessments of the effects of global change on the United States at least every 4 years.

The wording of LTG 3 simply responds to legal requirements and is clearly consistent with the core purpose of providing decision support to stakeholders.

IV. CHARGE QUESTION 2: Rationale for Draft Multi-Year Plan and Recommendations on Revisions

IV.1 Introduction

Charge Question 2, “How clear is the rationale for the revised Global Change Multi-Year Plan, and are the proposed revisions consistent with the advice given by the BOSC?” was considered by the BOSC in the light of the alternative wordings of the LTGs presented. The BOSC concluded that, because the essence of the differences centered on the degree to which the GCRP was output or outcome dominated, that a decision on this matter would influence the thrust of the MYP but not affect the BOSC’s review of the Program.

Further, the MYP was being revised at the time of this mid-cycle review, and the Subcommittee was provided with a synopsis. As the synopsis notes, “Some portions of the revised MYP are still under development” and the comments below therefore should be viewed in the context of an MYP that was still in flux at the time of this review.

IV.2 Rationale for the MYP

The key reasons stated for revising the MYP are first, that the science has developed rapidly over the past few years with many important new findings that are changing the nation’s perceptions of the rate and severity of global change. Second, external advisory boards, including the BOSC, have provided valuable input on program structure and performance. Finally, external events have placed increased demands on the GCRP. These reasons for revision, while convincing, do not appear in the synopsis supplied to the Subcommittee until after a lengthy introduction. Further, no clear, succinct statement of the **revised** rationale for the GCRP’s efforts (and comparison with what existed before and why change was required) appears anywhere in the document as now drafted, though it may be roughly inferred from the document taken as a whole.

This is not simply an editorial matter but rather a major issue in the ability of the GCRP to communicate its priorities to the outside world, to establish the boundaries of its mission, and to have its products used by decision-makers. **The MYP needs to present a coherent statement of what the GCRP intends to achieve, and not to achieve, and why, at the beginning of the document.** As the paragraphs that follow describe, the BOSC, by dint of close scrutiny, found much that is useful and responsive to earlier recommendations in the synopsis. Particularly insofar as clear writing reflects clear thinking, however, it is critical that the revised MYP not require such scrutiny for external readers to understand the GCRP’s mission and priorities.

IV.3 Response to BOSC Recommendations

The proposed MYP revisions reflect responsiveness to the advice given by the BOSC in the 2006 program review, as evidenced by examples in several key areas: priority setting, integration of program focus areas, cooperation with other efforts and the resulting synergies, and a strategy for place-based decision support with national applicability. These examples, while not comprehensive, support a preliminary conclusion that the revised MYP when complete will be highly consistent with the BOSC recommendations.

The MYP itself should constitute the basis of an explicit framework for priority setting. Consistent with Recommendation 2 of the BOSC program review report it identifies LTGs, associated annual performance goals (APGs), and annual performance measures (APMs) corresponding to those goals. **Properly formulated as previously discussed, the final MYP can be an effective guide to help the GCRP set priorities and make clear to the public what types of activities are or are not candidates for action. The BOSC recommends that the GCRP keep this communication requirement in mind as it completes the MYP.**

The proposed revision of LTG 2 directly responds to BOSC Recommendation 4 by explicitly integrating the GCRP's water quality and ecosystem focus areas. It also links these efforts both to other ORD programs (such as water quality, ecosystems research, and drinking water research) and to the goals of EPA's OW. This integration also responds to BOSC Recommendation 5, addressing in part the need to take account of external synergies in research, and Recommendation 7 on exploring cooperation with other efforts to provide decision support tools and information. The integration of the Program's water quality and ecosystems focus areas appears to be well underway and is leading to improved coordination of these areas. The BOSC applauds these efforts.

The BOSC further notes and commends the GCRP's active involvement of EPA's media and regional offices in the revision of the MYP, consistent with Recommendations 5 and 7. For example, the OW, OAR, and regional offices are partners with the GCRP in developing research plans for new activities such as geologic sequestration of carbon dioxide.

Finally, the watershed focus of programs under LTG 2 responds directly and effectively to BOSC Recommendation 8 concerning the development of a new strategy for place-based adaptation support that has national significance. A specific example of activity under this focus as described in the synopsis is a planned "...atlas of vulnerability, risk, and resilience with national coverage that will highlight potential issues and priorities across issues and regions of the country." This will be an excellent product. The somewhat limited geographic scope of the APMs listed under APG 1 ("Research and assessment of key aquatic ecosystems and associated watersheds") is, however, a concern of the BOSC. Understandably, the APMs listed under APG 1 are influenced by the interests and capabilities of regional offices as well as by outside factors; nonetheless, they are not reasonably representative of national ecosystems. **Selection of representative watersheds in different regions of the United States for assessments of global change effects may be a more valuable approach—one that will meet the 'national significance' test more effectively.**

Two areas addressed by the BOSC recommendations appear to receive limited attention in the proposed MYP revisions. First, Recommendation 3 urges the engagement of external advisors in helping formulate future program directions, with those advisors tasked, among other things, to address intergenerational concerns. The MYP synopsis clearly identifies the importance of past external advice from the BOSC and the SAB, and references plans to seek advice from a cross-agency (OW/ORD) advisory committee to guide stakeholder interactions and outreach. The synopsis, however, does not identify roles and plans for engagement of external advisors (see also Section II above). **It should consider explicitly addressing the intergenerational and other long-term issues within the MYP. Further, program leaders should consider developing charge questions about how the program can address intergenerational concerns for future BOSC and SAB reviews.**

Second, Recommendation 6 urged expansion of efforts on nonlinear issues such as thresholds and episode-driven changes. Future program plans on this issue appear to be limited to a STAR Request for Applications (RFA) that would be released in Fiscal Year 2011, following on a previous 2005 RFA. **Given the potential significance of nonlinear changes for adaptation to global change, the GCRP is urged to: (1) give the extramural effort a higher priority (moving up the funding date), and (2) devote some intramural resources to this topic.** The BOSC emphasizes that these recommendations do not refer primarily to thresholds and nonlinearities in global (particularly climate) systems, but rather to thresholds and nonlinearities in ecological systems and the hydrological and biogeochemical processes controlling water quality in response to global change. Nonlinearities and threshold responses may be the result of sudden and large changes in climate or the result of internal dynamics in hydrological, biogeochemical, or ecological systems that produce large changes in response to gradual change in, for example, climate.

Further, relying solely on external scientists to accomplish the needed research in this area may not produce timely results given the long delays between development of RFA's and publication of significant results by external researchers. **The BOSC believes that a significant intramural effort is warranted over the next 2-3 years, particularly in terms of conducting assessments (harvesting relevant information) on what is known on this subject and where major gaps in knowledge exist.** This is an extremely difficult area of research, but a very important one needing both assessment and clever new approaches. As with the climate system, it is the big "surprises" (e.g., ecosystem phase shifts or collapse, unpredicted large declines in water quality) that the Program needs to attempt to anticipate if possible.

V. CHARGE QUESTION 4: Survey Instrument to Assess Client Response to GCRP

V.1 Introduction

Charge Question 4 requests the BOSC to provide recommendations on the design and coverage of a proposed survey to monitor the timeliness and usefulness of the information the GCRP provides to clients. Commendably, the GCRP asserts the need to assess the effectiveness of its efforts to advance the ability of its clients to achieve their adaptation and related missions. As noted earlier, being effective in this regard is crucial to achieving outcomes by others in response to its own outputs. Therefore, the evaluation sought by the GCRP is needed and potentially productive in identifying opportunities to improve its contribution to the national welfare. The Subcommittee examined a “model” survey (proposed for use elsewhere in ORD) that is being considered as a starting point for this effort.

V.2 Design of the Survey

The BOSC concluded that it did not have among its membership or available to it the expertise to be able to assist the GCRP with explicit recommendations for such a survey, and could not with confidence comment on the model survey presented for examination. **The BOSC recommends that if the GCRP moves forward with such a survey it solicit expert advice from authorities who may be able to make such recommendations.**

While again emphasizing that it does not have the expertise to comment on the proposed survey, the BOSC does question the usefulness of an instrument of this kind for this Program. In no way does this observation suggest that the BOSC underestimates the importance of effective feedback to the GCRP from the clients it seeks to serve.

V.3 Coverage of Survey or Other Elicitation Instrument

Charge Question 4 also requests BOSC comment on the communities to which the survey should be sent. On this issue, the BOSC does have an observation—one that, however, calls into question the potential usefulness of a survey. The communities to which the GCRP is responsible are very diverse and numerous. They include other elements of EPA itself, including regional offices, but they also include regulatory and planning counterparts at the state and local levels. Further, they include (as demonstrated by earlier GCRP work) citizens groups, private-sector actors, non-environmental governmental bodies (e.g., water and sewer utilities and power planners), and even international and transnational organizations and other sovereign governments. Finally, of course, the national CCSP and its constituent parts have a clear interest in and reliance upon the GCRP. Results from any elicitation instrument or process that excludes

large elements of this client base must be considered incomplete and potentially misleading unless interpreted very carefully.

It appears implausible to the BOSC that this diverse client base could reasonably be surveyed by any single instrument. Moreover, it suggests that the magnitude of the task of doing so reliably likely would be overwhelming. Further, it also appears implausible to the BOSC that the results of any such survey could realistically result in any findings with quantitative significance.

VI. CHARGE QUESTION 5: Performance Metrics for the GCRP

VI.1 Introduction

Charge Question 5 calls upon the Subcommittee to determine whether the performance metrics generally used by ORD programs are appropriate and adequate for use by the GCRP, and if not, what additional or more appropriate metrics might be better. Although the BOSC has some observations on this issue, for reasons given below it cannot be dispositive on this matter at this time.

VI.2 Adequacy and Appropriateness of ORD Metrics Now in Use by the GCRP

The performance metrics being used by other ORD programs, including quality and impact of publications as assessed using bibliometric analyses, and the timeliness of completing goals, are appropriate for the GCRP as measures of output. The *Bibliometric Analysis* provided to the Subcommittee demonstrates that the GCRP is producing high quality publications for high impact journals. As to goals, the past and the draft revised MYP have clearly articulated specific products and specific due dates against which the GCRP can be evaluated. Clearly, it is important that the GCRP be held accountable and measure up to these metrics as **part** of its criteria for success.

The ability of the BOSC to comment in detail on the adequacy and appropriateness of these metrics, and/or to propose additional metrics of greater salience, however, is limited by several circumstances. First, some ORD programs use client surveys as one form of performance metric, and the Subcommittee was asked to comment on the development of such a survey. As a result of being embedded in the multi-agency CCSP, among other reasons, the GCRP has a uniquely diverse client base as compared to other ORD programs. As noted in Section V of this report, although the Subcommittee lacks expertise in survey development, it is skeptical about whether such a survey would be either feasible or quantitatively useful.

Second, the GCRP's LTGs are being rewritten at the time of this review. The BOSC has commented in Section III on several alternative wordings of the LTGs, with the key distinction among them being whether they are output- or outcome-based. The final wording of the LTGs will ultimately determine what kinds of performance metrics are appropriate, with a respective focus on either output- or outcome-based measures. In the case of the former, the metrics should be such as to measure the **potential** national benefit from the products, and the success of the GCRP in making those products both **useful and used** by clients empowered to put them into practice to ease adaptation to global change. On the other hand, if the focus selected is outcome-based, the metric must be capable of showing whether or not adaptation occurs, and preferably that it occurs **because of** GCRP activities **and** that it results in **net national benefits**. As the

BOSC observes in an earlier section, its opinion is that the output-based focus is most amenable to actual observation as an indicator of GCRP performance.

Finally, as discussed in Section IV regarding Charge Question 2, the MYP also was being revised at the time of the mid-cycle review. The draft synopsis presents a detailed set of APMs tied to APGs, but the wording of these is not final. The BOSC further understands that the MYP is likely to be reviewed later this year by the BOSC or SAB, and as a consequence did not think it appropriate to conduct a detailed review of metrics that have not yet met with final approval by the GCRP, much less ORD.

In terms of developing additional metrics, although the BOSC does not have specific suggestions, it cannot be overemphasized that the GCRP, as one component of a multi-agency effort, faces demands and constraints distinct from and in addition to those faced by other ORD programs that support only EPA's mission. **Performance metrics need to be carefully crafted to take into account the GCRP's contributions to the CCSP as a whole, to the EPA mission, and to the broader national community it should serve.**

VII. GENERAL OBSERVATIONS BEYOND THE CHARGE QUESTIONS

VII.1 Introduction

In the course of its deliberations the Subcommittee had two general observations about the GCRP that did not fit within the assigned charge questions but that the BOSC considered worthy to present.

VII.2 Limiting the Scope of the GCRP Mission

The first of these observations concerns the scope of the mission of the GCRP and pressures that BOSC members, based on their experience in government and elsewhere, concluded might be placed upon the Program. The BOSC emphasizes that it had neither presentations nor evidence specifically regarding this issue but that it foresees the possibility of a problem arising in the future.

In brief, as EPA moves toward regulatory and other actions regarding adaptation to global change—as is happening and as the Subcommittee predicts will be accelerated in the future—there will be large requirements for skilled people and funds to perform some of the necessary work. The temptation will be to draw GCRP personnel and funding into performing “line” responsibilities associated with these operational programs because resources to meet these new requirements will be strained. If this diversion is allowed to happen, however, the GCRP core mission will be short changed. As the BOSC envisions it, that mission is to support the generation of new knowledge that provides information and tools to users, and to be at the initiating end of adaptation efforts by diverse stakeholders, including other units of EPA. The GCRP is designed to exercise leverage over a large body of potential actors. Diverting its resources to operational activities will diminish that role, a role no other body at EPA is charged to play.

To avoid this unfortunate outcome, the BOSC elsewhere recommends that the GCRP in its planning be precise in its description of its mission so that the “borders” of what it will *not* do are clear. Obviously, once ORD and EPA as a whole agree to that mission, it will be necessary to support the GCRP in directing its resources only toward its assigned role.

VII.3 Resources Adequate to Fulfill the GCRP Mission

The second observation of the BOSC is tangentially related to the first. Again, other than in response to Subcommittee inquiries with regard to past budgets, it received no presentations on this matter but is relying on its own observations and conclusions. The BOSC found that the budget for the GCRP has been relatively stable or declining in real terms over the past 5 years. It

also observed that there had been substantial new responsibilities that the GCRP had been tasked to undertake. The BOSC further observed that, consistent with the BOSC recommendations in 2006, there had been disinvestment in a number of activities and a reprogramming of resources in recommended directions. Unfortunately, the net result of these changes—all of which appear justified—was to leave the GCRP unable to fully meet other of the BOSC recommendations, as detailed above.

The BOSC also is aware that it is making forceful recommendations for expansion of GCRP activities in a number of areas, but that it has not determined through its deliberations any activities that it recommends the GCRP curtail. In contrast, the recommendations in the previous review made firm arguments for curtailing certain high-cost activities, which made room for expansion of others.

The BOSC is fully aware of the fiscal constraints under which EPA and the government as a whole operate, and recognizes that hard choices must be made. **It does observe, however, that the GCRP's mission not only is of importance to the nation, but also that changes in public understanding and concern about global change over the past 2 years have greatly increased the receptivity of stakeholders to taking action regarding adaptation. In this sense, the leverage that the GCRP can bring to bear has been increased, and the value of its efforts to provide information, motivation, and empowering tools to stakeholders has been magnified. In this context, the BOSC observes that special consideration of the budgetary requirements to meet the core GCRP mission is justified.**

VIII. SUMMARY ASSESSMENT OF THE GCRP

VIII.1 Introduction

In addition to the specific charge questions discussed above, the charge to the BOSC requires it to assign a qualitative rating (from four choices) based on largely quantitative measures associated with the number of program goals met. The purpose of this exercise is to "...reflect the extent to which the program is making progress in moving the program forward in response to the BOSC review of 2006." In contrast, the program review report concluded that the criteria for success of the GCRP were two in number and qualitative—doing the "right" work and doing it "well." The current Subcommittee reaffirmed these latter sentiments and they guided its deliberations. It also responded to the charge, and its conclusions and reasoning follow.

VIII.2 Problems in Responding to the Rating Request

With relevance to the criteria and process invoked in request for a ranking, the BOSC found that the GCRP differs from some other ORD programs in two ways. First, the core of the Program's mission is to produce research and other products that motivate and empower other players (elsewhere in EPA at the state and local level, and in the private sector) to prepare wisely for adaptation to global change. Its mission also is to foster these other players in taking the steps to implement such adaptation strategies and actions as are likely to produce net social benefits over the long term. It works through others, and therefore can influence, but not ultimately control, outcomes.

These functions, in part, do require that specific, definable, and ultimately measurable products (including scientific research and publication) be produced. Thus, in part, the GCRP's outcomes can be measured. To this extent, it is possible to quantify the progress of the GCRP since the 2006 BOSC program review, as requested. With respect to other activities, however, it is not similarly possible, and these other activities (properly) dominate much of the effort of the GCRP. **To measure only the measurable fails to evaluate the GCRP properly.**

The second source of difference is that, inherently, the GCRP is dealing with an evolving context of requirements and opportunities. If the GCRP is to be responsive to stakeholders, which it must be to succeed, it does not have the ability to define a specific set of activities and outputs/outcomes and then proceed sequentially to achieve them and only them. In the 2 years since the program review, for example, congressional mandates have increased, court-ordered requirements have been imposed, significant EPA regulatory programs requiring GCRP involvement have been launched, and the political and cultural salience of its efforts have escalated, bringing more requirements to the GCRP. **Unfortunately, funding and other resources have lagged these increases in demands on the GCRP.**

VIII.3 Evaluation of the GCRP Performance

The GCRP has performed well on many of the key recommendations of the 2006 BOSC program review, exceptionally well on some. At the same time, other recommendations were not met or at least not met to the extent that the Subcommittee members had hoped. (Specifics on which these conclusions are reached are discussed more fully in Section II and elsewhere above.) If the ORD criteria referenced above were strictly applied, therefore, the BOSC would be required to recommend the “Meets Expectations” rating for the GCRP. The differences between the GCRP’s mission and that of the more common ORD programs for which the criteria were developed, however, caused the BOSC to consider the matter further. In its judgment, the GCRP is doing the “right” work and does it “well.” This conclusion follows when the GCRP is evaluated in the context of the changing and increasing work requirements it has faced, the resource constraints with which it has had to deal, and the results that it has achieved. On this basis, the BOSC concludes that “Exceeds Expectations” is the appropriate rating for the GCRP for the period since the program review.

There is, of course, room for improvement and the BOSC has noted in its recommendations above some areas in which it might be found. Note, however, that some of these recommendations would again add to the tasks of the GCRP. The BOSC is fully aware that to meet these recommendations before the next program review will require that the GCRP be granted the additional resources required.

The BOSC is mindful of the bureaucratic truism: “that which is measured, gets done.” It applauds ORD’s process of creating such measures and of holding its programs to the standard of meeting them. On the other hand, this appears to the BOSC to be a case where changing external conditions made it wiser for the GCRP to elect to concentrate on what it concluded were more productive efforts in the national interest than those that would have been selected if strict priority to meeting the BOSC recommendations had been chosen. The BOSC concurs in the GCRP’s conclusions, and believes that such flexibility, when carefully and fully justified, is appropriate and that programs should be rewarded, not punished, for exercising it.

IX. APPENDICES

Appendix A: Global Change Research Mid-Cycle Review Subcommittee

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Appendix B: Subcommittee Charge

12-12-07

CHARGE GLOBAL CHANGE MID-CYCLE SUBCOMMITTEE

1.0 Objectives. The objectives of this mid-cycle review are:

- Primarily, to evaluate the progress made by the Office of Research and Development's (ORD's) Global Change Research Program relative to the commitments it made following its last review (September 26-28, 2005), and
- Secondly, to obtain advice and feedback on issues related to the future directions of the research program and measures of success.

2.0 Background Information. Independent expert review is used extensively in industry, federal agencies, Congressional committees, and academia. The National Academy of Science has recommended this approach for evaluating federal research programs.¹

For the Agency's environmental research programs, periodic independent reviews are conducted at intervals of four or five years to characterize research progress, to identify when clients are applying research to strengthen environmental decisions, and to evaluate client feedback about the research. Mid-cycle evaluations are an important part of this program review process. Scheduled midway through the review cycle, these independent assessments give ORD an opportunity to gauge the program's progress relative to the commitments it made following its last review.

For the upcoming mid-cycle review, the Global Change Research Program is preparing a progress report that will provide the context for discussions during the meeting. The report will identify progress the program has made towards its long-term goals, and changes implemented by the program in response to the major recommendations from its 2005 review.

The Multi-Year Plan (MYP) for Global Change is undergoing significant revision based upon (1) recommendations from the 2006 BOSC review, (2) feedback from the 2006 OMB PART review, (3) significant advances made by EPA Program and Regional Offices to incorporate considerations of climate change into their operations and consequent commitments made by ORD Global Program to support these offices, and (4) scientific advances made in the ORD Global Program. A synopsis of the draft MYP will be provided to the Subcommittee for its review. These and other documents will be available for the Subcommittee to use to address the charge questions.

This review is not intended to be the in-depth technical evaluation of a full program review. Presentation time will be minimized in favor of discussion.

¹ Evaluating Federal Research under the Government Performance and Results Act (National Research Council, 1999).

3.0 Charge Questions for ORD’s Global Change Research Program. ORD is interested in receiving feedback concerning the following questions:

1. How responsive has the Global Change Research Program been to the recommendations made in the April 2006 BOSC program review report? The subcommittee will evaluate progress made regarding “commitments” to the BOSC recommendations as outlined in ORD’s response. Additionally, the program has responded to the BOSC recommendation that it ensure its place-based, decision-support activities have national-scale significance. What progress has the program made towards integrating its results into EPA programs to support the Agency’s statutory, regulatory, and programmatic requirements?
2. How clear is the rationale for the revised Global Change Multi-Year Plan, and are the proposed revisions consistent with the advice given by the BOSC?
3. To what extent does the wording of the Global Program’s long-term goals appropriately reflect the intended purpose of the program?
4. The Global Program is designing a survey to monitor the effectiveness with which it is providing timely and useful information to its clients. The results will be used for internal program management. What recommendations does the BOSC Subcommittee have to help ensure that the survey is designed appropriately given the program’s objectives? And what recommendations does the Subcommittee have regarding the communities to which the survey should be sent?
5. Are the performance metrics being used by all the ORD programs (e.g., quality and impact of ORD publications, timeliness of completing goals) appropriate for the Global Change Research Program? What are additional or more appropriate metrics?
6. In developing a report that responds to these questions, the BOSC Mid-cycle Subcommittee should provide a summary assessment, including a single qualitative rating that reflects the extent to which the Global Change Research Program is making progress in moving the program forward in response to the BOSC review of 2005. The rating should be in the form of one of the adjectives defined below, which are intended to promote consistency among BOSC program reviews. The adjective should be used as part of a narrative summary of the review, so that the context of the rating and the rationale for selecting a particular rating will be transparent. For mid-cycle reviews, the rating should be based on the quality, speed, and success of the program's actions in addressing previous BOSC recommendations. The adjectives to describe progress are:
 - o **Exceptional:** indicates that the program is meeting all and exceeding some of its goals, both in the quality of the science being produced and the speed at which research result tools and methods are being produced. An exceptional rating also indicates that the program is addressing the right questions to achieve its goals. The review should be specific as to which aspects of the program’s performance have been exceptional.
 - o **Exceeds Expectations:** indicates that the program is meeting all of its goals. It addresses the appropriate scientific questions to meet its goals, and the science is competent or better. It exceeds expectations for either the high quality of the

science or for the speed at which work products are being produced and milestones met.

- o Meets Expectations: indicates that the program is meeting most of its goals. Programs meet expectations in terms of addressing the appropriate scientific questions to meet their goals, and work products are being produced and milestones are being reached in a timely manner. The quality of the science being done is competent or better.
- o Not Satisfactory: indicates that the program is failing to meet a substantial fraction of its goals, or if meeting them, that the achievement of milestones is significantly delayed, or that the questions being addressed are inappropriate or insufficient to meet the intended purpose. Questionable science is also a reason for rating a program as unsatisfactory for a particular long-term goal. The review should be specific as to which aspects of a program's performance have been inadequate.

4.0 Potential Subcommittee Approach for Mid-Cycle Review

- Hold one (1) administrative call in the month preceding the face-to-face meeting.
 - ▶ allows the subcommittee Chair to make review and writing assignments
- Hold two (2) teleconference calls prior to the face-to-face meeting.
 - ▶ allows the ORD to present background and other relevant materials to the subcommittee
 - ▶ allows the subcommittee to ask clarifying questions
- EPA shall distribute background materials and documents requested by the Subcommittee in advance of the teleconference calls.
- Hold a one-day face-to-face meeting for the mid-cycle review.
 - ▶ The meeting will include brief ORD presentations on program progress and discussions with members of the Global Change Mid-Cycle Subcommittee.
- If needed, hold one (1) teleconference call within one month following the face-to-face meeting to finalize the draft letter report.

Appendix C: List of Acronyms

APG	Annual Performance Goal
APM	Annual Performance Measure
BOSC	Board of Scientific Counselors
CCSP	Climate Change Science Program
EPA	U.S. Environmental Protection Agency
ESI	Essential Science Indicators
FACA	Federal Advisory Committee Act
GCRP	Global Change Research Program
JCR	Journal Citation Reports
LTG	Long-Term Goal
MYP	Multi-Year Plan
NAAQS	National Ambient Air Quality Standards
NRC	National Research Council
OAR	Office of Air and Radiation
ORD	Office of Research and Development
OW	Office of Water
RFA	Request for Applications
SAB	Science Advisory Board
STAR	Science To Achieve Results