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March 26, 2008

Dr. George Gray
Assistant Administrator
Office of Research and Development
U.S. Environmental Protection Agency
Washington, DC 20460

Dear Dr. Gray:

At the request of Dr. Kevin Teichman, Acting Deputy Director for Science, Office of Research and Development (ORD), the Executive Committee of the U.S. Environmental Protection Agency's (EPA) Board of Scientific Counselors (BOSC) constituted a Standing Subcommittee to provide periodic review of ORD's National Center for Environmental Research (NCER). The Subcommittee (members' names and titles are attached) operated under applicable Federal Advisory Committee Act (FACA) rules and completed its work on this report with one face-to-face meeting with the leadership and staff of NCER held in Washington, DC (July 24-25, 2007) and four teleconferences (July 13, 2007; September 11, 2007; November 1, 2007; and December 14, 2007). The charge developed and submitted by the NCER leadership is as follows:

What steps can NCER take to more effectively engage the external scientific community to better craft a forward-looking portfolio and meet evolving Agency needs?

The charge was addressed by three specific questions:

1. Regarding NCER's niche in ORD and in the greater environmental federal research and development realm, what can it do to more flexibly address emerging issues and technologies and provide timely responses to rising scientific needs of the Agency?
2. What advice can be offered on ways to measure and improve the effectiveness of NCER's communication so that decision-makers will make greater use of NCER's products?
3. What metrics are most useful for measuring the impact of NCER's work?

The Subcommittee was divided into three workgroups that focused on each of the specific questions and wove the supervening charge into their analyses. The report incorporates the evaluation of specific components as they relate to the charge, and provides advice on additional mechanisms/processes that may be employed in achieving the goal of addressing evolving needs. Embedded in this letter report is the element of time, not just for the implementation of processes, but for the collection and evaluation of data obtained.

I. Summary Evaluation and Suggestions

The NCER Standing Subcommittee applauds NCER for its ongoing efforts to increase its relevance to the mission of other components of EPA. In the face of limited resources, the Subcommittee recognizes the extraordinary efforts that already have been made to reach the largest audience possible. These achievements are substantial and, as evidenced by presentations at the face-to-face meeting, NCER has become an integral component of the Agency in meeting many of the research needs articulated by other centers and programs. The following suggestions are extracted from the narrative of the report and are offered as a means by which NCER might create a proactive research agenda that is responsive to input from a wide variety of stakeholders and scientific experts. Emphasis is placed on qualitative and quantitative metrics that enable the Center and the Agency to identify and set priorities that stimulate innovation and discovery, assess achievement and impact in traditional areas of research, and determine the wider effects on policy and improvements in environmental quality.

In the area of priority setting, the Subcommittee suggests that:

- ✍ ORD should generate a prioritized list of metrics that may be used to evaluate the need to address emerging issues.
- ✍ NCER should initiate a dialogue with EPA program offices and with outside stakeholders about what information is most needed for their mission.
- ✍ NCER should fund “meta-research” into value-of-information theory, software, and training.
- ✍ NCER should increase its efforts on cross-media, multiple-substance, and life-cycle research.
- ✍ NCER should balance its extramural research portfolio by funding some social science, cognitive science, and engineering research.
- ✍ NCER should consider using an unsolicited grant submission process to encourage the generation of relevant scientific questions that do not match the exact wording of existing Requests for Applications (RFAs).

Frontiers

- ✍ NCER should use the “grant summaries” and “state-of-the-science papers” to begin a dialogue about important gaps in decision-relevant information with EPA decision-makers and external scientists.
- ✍ NCER should seek input on possible emerging areas of science from a broader community of stakeholders, not simply from funded scientists.
- ✍ NCER should revitalize the Exploratory Grant mechanism and expand it considerably from its current sole focus on nanotechnology.

Measuring Impacts

- ✍ NCER should expand the use of bibliometrics to analyze citations to identify audiences and estimate the use of research results by other scientists.
- ✍ NCER should expand the use of data-mining tools to connect research with immediate and outcomes.
- ✍ NCER should develop case studies of how research funded by the Center facilitates change in tangible indicators of environmental performance (“results”), in addition to how the research is cited, read, and otherwise increases knowledge.
- ✍ NCER should consider the implementation of user/client interviews to collect impact feedback.
- ✍ NCER should consider the use of expert reviews to assess broad scientific impact and program success.
- ✍ NCER should consider implementation of cost-benefit analyses to measure return on investment.
- ✍ NCER should use a broader approach than currently is used to demonstrate the links between NCER research and other approaches beyond rulemaking.

II. Charge Question #1

Regarding NCER’s niche in ORD and in the greater environmental federal research and development realm, what can it do to more flexibly address emerging issues and technologies and provide timely responses to rising scientific needs of the Agency?

The Subcommittee has organized its response to this question around the two themes that emerge from a “deconstruction” of the Charge Question #1:

- ✍ “To more flexibly address emerging issues... and needs” raises concerns about both *demand and supply*—how can NCER discern what the most pressing needs actually are,

and then how can it efficiently match the demands to the intellectual resources in the external scientific community?

- ✍ “To provide timely responses” raises issues of the process for stimulating proposals and evaluating them promptly.

Theme I: Identifying the Most Valuable Research

The Subcommittee members think NCER is severely hamstrung by the fact that EPA as a whole (indeed, the whole Federal Government, in the Subcommittee’s experience) does not think systematically about what information has value. Thus, as part of this portion of the discussion, the Subcommittee suggests that NCER think “outside the box” a bit, by playing more of a role in helping the rest of the Agency think through what are, in fact, the most pressing research needs.

In a nutshell, the well-developed theory of value-of-information (Clemen and Reilly, 2004¹; Yokota and Thompson, 2004²) dictates that to estimate the absolute value of any research that reduces uncertainty, or to rank-order multiple competing proposals, one needs a well-posed decision problem that addresses two issues:

1. What are the choices facing decision-makers (who comprise a primary audience for NCER)? and
2. What are the uncertainties in the problem (in this case, the risk being studied)?

From these two questions, one can estimate the value of reducing any uncertainty by any amount by gauging how much better the choice will be once armed with the new information. One fundamental rule-of-thumb emerging from this approach is that information that cannot change one’s (or an agency’s) decision *has no additional value*, no matter how much it might be “interesting” to a pure scientist.

NCER should expand its efforts to align its research toward information that has the most potential value in decision-making, and to fund work that would improve tools to gauge that value.

First, NCER should initiate a dialogue with EPA program and regional offices about what information is *really* most needed. Ideally, NCER would begin to re-think the way it values information itself—rather than merely looking to see what risks seem to be on the radar screen, and assuming (wrongly, according to this paradigm) that “the more important the risk, the more valuable it is to learn more about it.” NCER could go to the program and regional offices and ask the needed question: What *aspects* of the uncertainty in this risk make it difficult for NCER to

¹ Clemen RT, Reilly T. Making Hard Decisions, 2nd ed., Brooks/Cole Publishers, 2004.

² Yokota F, Thompson KM. Value of information analysis in environmental health risk management decisions: past, present, and future. *Risk Analysis* 2004;24(3):635-650.

know how to control it?³ The Subcommittee notes that the exploratory research themes identified for the members by NCER are much more narrowly targeted during the last few years, which offers the opportunity to ask these questions about decision relevance and value-of-information for reducing decision-related uncertainties.

Second, to support this effort NCER should fund “meta-research” into value-of-information theory, software, and training. Such tools can be helpful for staff to set priorities for filling information gaps that will best reduce decision-relevant uncertainties.

Third, NCER should increase its efforts on cross-media, multiple-substance, and life-cycle research. Typically, Agency decision problems involve such contexts. The Subcommittee notes that some of NCER’s extramural research activities are structured in this way, but believes the Center can go further in breaking out of the traditional substance-specific research orientation.

Fourth, NCER should add back into its extramural research portfolio projects that focus on social science, cognitive science, and engineering research. Materials provided to the Subcommittee, however, left the impression that NCER does not place a high priority on being proactive in these non-traditional areas of research. A quick review of relevant statutes (42 USC 7403 “Research, investigation, training, and other activities”) suggests that Congress did not intend to preclude work in these areas; for example, there is no wording that would appear to preclude such funding and several terms are used (e.g., “welfare effects,” “prevention and control” of air pollution) that can be understood to highlight relevant social, economic, and institutional factors. Methods such as those in the following areas should be considered: economic and cognitive work on huge issues such as the costs of regulatory and other interventions, the economic valuation of health and environmental effects, and the efficiencies of regulatory and other strategies.

Fifth, NCER should use the “grant summaries” and “state-of-the-science papers” to begin a dialogue about important gaps in decision-relevant information with EPA decision-makers and external scientists. In addition, the Center should endeavor to promote a culture of using a value-of-information framework. This can be promoted by highlighting how decision-relevant information is gained in the stories that are written to publicize research (referenced in Estella Waldman’s presentation at the September 11, 2007, teleconference).

Theme II: Identifying the Most “Imminent” Research

The balancing act between supply and demand involves both knowing what information is most needed and knowing what *could most readily be produced*. The Subcommittee members think that NCER could be much more proactive on the latter count, although this would have to be done correctly and carefully. The key would be for NCER to have a good sense of what valuable research initiatives already are underway that could become aligned precisely to EPA needs simply by “tweaking” the direction of the research.

³ As a corollary to this, another common assumption that value-of-information analysis disputes is “the more that a research project reduces an uncertainty, the more valuable it is.” In general, information that resolves the portion of the total uncertainty that acts to make the choice between two or more decision options particularly precarious will be the information of greatest value (even if the uncertainty resolved is relatively small).

According to information supplied to the Subcommittee by NCER:

NCER's research agenda is guided by many forces internal and external to the Agency. EPA's Strategic Plan lays out the Agency goals... The scientific information needed to support these goals changes as new challenges emerge, research improves our understanding of current and new environmental problems, new technologies become available, and novel approaches to environmental risk management take form. All of these factors add to the challenge of planning NCER's efforts to support the best and most relevant science research needed to inform environmental decision-making.

This clearly suggests that NCER is aware of the need to focus research on relevant decision-related issues and that the information needed to support decision-making evolves.

The Subcommittee remains unclear as to the precise mechanism(s) that NCER employs to align ongoing research with Agency needs. The Subcommittee learned from the presentations and discussions during the September teleconference that:

NCER staff scientists interact extensively with the broader scientific community and routinely consult with subject matter experts outside of EPA to discuss research needs. In many cases, NCER staff members are scientists who publish in the scientific literature, and actively participate in professional societies. Also, NCER staff members interact regularly with scientists in EPA's research laboratories who are active in the scientific community. These EPA scientists provide key input to the development of NCER RFAs. Additionally, other avenues such as research progress reviews and grantee meetings keep NCER and other EPA scientists informed about progress and issues in the current state-of-the-science.

In spite of the claim that NCER staff scientists "interact extensively with the broader scientific community," the Subcommittee found little evidence for such "extensive" interaction. For example, the link the Subcommittee was given to workshops (<http://es.epa.gov/ncer/publications/meetings/index.html>) describes primarily workshops with *NCER's own grantees*, which are a fertile source but clearly not the only source of new ideas. In other words, NCER staff members appear to have formalized interactions mostly with others in EPA and with the Center's own grantees.

The broader point is that interaction *per se* is not the goal, but purposive interaction in which NCER staff members can craft some RFAs based on their new knowledge of what investigations think could be done easily (added on to existing work already underway, or even using data collected anyway but not being analyzed for a purpose relevant to EPA). For example, a workshop could be designed in which NCER listened rather than presented, and invited primarily non-grantee scientists to identify important needs related to uncertainties. At this workshop, NCER could ask some important questions, such as: What uncertainties can be reduced? What research is needed to tackle these uncertainties? For existing grantees, NCER could ask each of them what they could do with 10 percent additional funding to make their current grants more relevant to EPA.

The point here is absolutely not to find out what particular scientists want to do and then earmark grants for it—but rather to discern which *competitive* RFAs would have the effect of drawing out

proposals that already have been jump-started for other reasons to compete with whatever else is out there. This would be *complementary* to the existing process, in which EPA sets an agenda and pins all its hopes on the supply emerging to meet its demand. It would appear that there is room for such an approach. For example, in the September 11, 2007, presentation by Estella Waldman, the Subcommittee heard that NCER's Peer Review Division and grant Project Officers encourage the best scientists to submit applications, and the Peer Review Division recruits highly qualified reviewers to evaluate the applications.

Similarly, the "state-of-the-science" reports often seem to be summaries, again, of what NCER's own grantees are doing. An example is the recent synthesis report on mercury transport and fate through a watershed. This is not the way to create new supply. The recurring theme may be that NCER focuses more on internal staff and grantee discussions than on true outreach. The Subcommittee was told that NCER's outreach staff is working with the American Medical Association, which is a promising development, but the Subcommittee does not have the sense that NCER staff members systematically ask themselves what disciplines they should be targeting.

More Rapid Funding Mechanisms

The Subcommittee suggests that NCER consider "semi-unsolicited" proposals—that is, ones that are guided by broad instructions about the area of work but otherwise not constrained by preconceived research questions. Many other grantors solve this conundrum by accepting brief Letters of Intent and then inviting only the best ones to submit full proposals. The Subcommittee suggests that efficiency would be improved significantly if NCER reviewed and selected proposals to encourage from a collection of one-page abstracts written by researchers. Again, the key would be NCER's engagement with the researchers to make the proposals as useful as possible to EPA.

III. Charge Question #2

What advice can be offered on ways to measure and improve the effectiveness of NCER's communication so that decision-makers will make greater use of NCER's products?

The Subcommittee has based its comments largely on the information provided during presentations at the July 24-25, 2007, face-to-face meeting, on background materials provided for the meeting, and on the responses to questions arising at the meeting that were provided during the September 11, 2007, Subcommittee conference call. The initial focus was on the processes implemented and utilized by NCER for assessing product usefulness rather than on the effectiveness of individual products in reaching and communicating with specific audiences. As the assessment progressed, however, the Subcommittee was provided examples of specific types of NCER communications for further assessment. These example materials were received in response to a Subcommittee request made during the November 1, 2007, conference call with NCER staff.

Of particular usefulness to the Subcommittee's assessment was the final report, "Communicating Research Results" by the BOSC Ad Hoc Subcommittee on Communications, dated September 11, 2003. Although covering ORD-wide communications efforts, there was substantial information relevant to NCER in the report. The material contained in the report and its suggestions served as a point of departure for the Subcommittee's evaluation of the current

efforts within NCER and how well NCER has addressed those suggestions in the intervening years. The 2003 report included six recommendations covering the topics of: (1) management and staffing, (2) audience identification, (3) formative evaluation, (4) incorporating feedback and tracking outcomes, (5) standardizing records, and (6) strategic planning.

In a May 9, 2005, letter to Dr. James H. Johnson, Jr., Chair of the BOSC Executive Committee, Mr. Michael Brown, Associate Assistant Administrator of ORD, and Dr. Donna Vincent Roa, Director of the Office of Science Communication in ORD, responded to the BOSC's six recommendations, clarifying some issues and identifying improvements underway. The points specifically relevant to NCER included the following:

- ✍ In an effort to facilitate effective coordination among ORD's communication staffs, the communication teams in NCER and other centers and offices work directly with and are supported by the Office of Scientific Communication (OSC), based in the Immediate Office of the Assistant Administrator.
- ✍ NCER is focusing on the regional offices' needs for usable research information through Science To Achieve Results (STAR)/ORD regional seminars and regional progress review workshops.
- ✍ One-page descriptions of all research projects are being developed for distribution to numerous audiences.
- ✍ Science Summary Reports are being written for specific audiences in the program and regional offices and for use by other external audiences. The reports are provided to OMB as part of the Program Assessment Rating Tool (PART) process.
- ✍ A specific staff member has been identified to serve as the OSC-NCER liaison.
- ✍ NCER has improved document availability by uploading almost 23,000 grantee publications, including more than 7,000 journal articles, to its Web site and has purchased commercial software to more effectively manage document acquisition and control.

In addition to these activities, NCER provided an update of actions taken in response to the 2003 Communicating Research Results BOSC report by answering questions posed at the July 24-25, 2007, face-to-face meeting. These actions include:

- ✍ Eliciting feedback during visits to program and regional offices.
- ✍ Publishing articles in many journals on a variety of topics.
- ✍ Developing a magazine to reach certain audiences.
- ✍ Publishing several state-of-the-science reports.

- ✍ Modifying the NCER database to allow research categories to be viewed as a drop-down topic selection list and adding the ability to input and output bibliography updates in RIS format.
- ✍ Hosting dozens of workshops.
- ✍ Finishing a book chapter on the People, Prosperity, and the Planet awards.

NCER also has undertaken efforts to identify target audiences for STAR research results, which include both internal (NCER, ORD, regional and program offices) and external (other federal agencies, Congress, media, the scientific community) audiences. NCER also has expanded its list recently to include the Hispanic and medical communities. Each audience likely has different communication needs, thus requiring formative evaluation for strategic planning of communication efforts. NCER has acknowledged the need for continued assistance in understanding audience needs, noting the challenges that the Center, as a government entity, faces with conducting large-scale survey research.

The examples of communications products provided to the Subcommittee include:

- ✍ A promotional video on the 2007 National Sustainable Design Expo available at http://es.epa.gov/ncer/events/news/2007/10_17_07_feature.html.
- ✍ The agenda and presentations from the July 14, 2004, Region 5 Seminar available at <http://es.epa.gov/ncer/publications/regions/5/index.html>.
- ✍ A description of the November 8-9, 2007, Collaborative Science and Technology Network for Sustainability Workshop.
- ✍ A description of and report on the State-of-the-Science on Bioengineering for Pollution Prevention available at <http://es.epa.gov/ncer/publications/statesci/bioengineering.pdf>.
- ✍ A synthesis report of the findings from nine grants awarded under the recently completed “Mercury: Transport and Fate through a Watershed,” grant program, available at http://es.epa.gov/ncer/publications/research_results_synthesis/mercury_rpt_final.pdf.
- ✍ A brochure describing the Multi-Ethnic Study of Atherosclerosis (MESA) Air Pollution Study, available at http://es.epa.gov/ncer/publications/factsheets/mesa_air.pdf.
- ✍ A sample design for a one-page STAR Grant Summary.
- ✍ A description of EPA’s Particulate Matter (PM) Research Centers and material from their summary review meeting on September 27, 2004, available at <http://es.epa.gov/ncer/publications/meetings/9-27-2004/description.html>.
- ✍ A brochure on a New Index of Environmental Condition for Coastal Watersheds in the Great Lakes Basin, available at <http://es.epa.gov/ncer/publications/factsheets/gleifinal05.pdf>.

- ✍ The Web pages for the STAR Children’s Environmental Health Research Centers, available at <http://es.epa.gov/ncer/childrenscenters/> as well as a BOSC review of the Children’s Centers Program available at [http://yosemite.epa.gov/ochp/ochpweb.nsf/content/CEHRC_Findings.htm/\\$file/CEHRC%20Findings.doc](http://yosemite.epa.gov/ochp/ochpweb.nsf/content/CEHRC_Findings.htm/$file/CEHRC%20Findings.doc).

From their perusal of this broad spectrum of products and other evidence, the Subcommittee members believe that NCER disseminates its communications materials effectively, that its products are of high quality, and that they appear to be aptly suited to their target audiences. There also is evidence that some of its products have impacted policy. Without additional systematic evaluation of the products and their impacts on their target audiences, the Subcommittee cannot judge the extent of this effectiveness.

Because none of the supplied examples of communications products dealt with drinking water, which is within the purview of NCER, one of the Subcommittee members accessed the NCER publications database at <http://es.epa.gov/ncer/publications/> and conducted a search using the term “drinking water.” Abstracts of 507 projects including titles, investigators, institutions, grant amounts, reports, and publications and journal articles resulted from the search. These 507 abstracts appeared to cover the general subject area of “water” and resulted in 247 final reports, 3,419 publications (posters, proceedings, presentations, non-journal articles), and 908 journal articles. Although imperfect, the publications database represents a decent and reasonably complete effort at summarizing communication to the scientific community and in some sense to the technical public and rulemakers. Because some instances of journal articles were found not to be refereed, what constitutes a journal article should probably be clarified. As an internal exercise, NCER staff also might examine the circumstances surrounding the extremes of productivity, which include zero publications for million-dollar-plus grants and 40 journal articles from a \$200,000 grant.

To determine how research results influence policy, NCER is taking a systematic approach by developing a data-mining tool that allows bulk searching for all NCER principal investigator journal publications that have been cited in program office documents through the EPA electronic dockets and the EPA Web inventory. The tool now is in its second generation and has the ability to cull extraneous documents. NCER also is working with the Office of Resource Management and Administration to determine how publications are being cited to assess their impact on the rulemaking process.

These efforts are elements of a research impact assessment portfolio that either does or could include:

- ✍ Bibliometrics to analyze citations to identify audiences and estimate the use of research results by other scientists.
- ✍ Data-mining to connect research with immediate outcomes.
- ✍ Case studies on how research funded by NCER facilitates change in tangible indicators of environmental performance (“results”), in addition to how the research is cited, read, and otherwise increases knowledge.

- ✍ User/client interviews to collect impact feedback.
- ✍ Expert reviews to assess broad scientific impact and program success.
- ✍ Cost-benefit analyses to measure return on investment.

Full implementation of the portfolio is not possible at current funding levels, so most of the effort to date has focused on bibliometrics and data mining. Although this effort for the large part appears to be headed in the right direction and yielding useful information, the Subcommittee members think that the other approaches in the portfolio (or perhaps yet further options) should be evaluated in terms of finding the optimal mix for determining the usefulness of NCER products to decision makers, given expected resources.

NCER generally does an excellent job of summarizing the scientific findings of its research for decision-makers. The materials provided by NCER, however, show that the Center is not generally attempting to summarize the implications for risk management. For example, the STAR summary on the physiologically based pharmacokinetic/pharmacodynamic (PBPK/PD) model for organophosphates states that the researchers' model (in rodents) could facilitate the development of similar models for children, but it does not go on to suggest anything about how such a model could improve public health. Such models could enable EPA to better target controls on organophosphate exposures so that more members of the most vulnerable populations receive exposures low enough (or dispersed sufficiently in time) to avert unacceptably high risks of serious health effects, and would provide decision-makers with much more compelling information about the research itself. Similarly, the brochure on the MESA study has an excellent section on expected outcomes, but it only suggests a salutary effect on our understanding, not on our ability to improve actual conditions. A greater ability to craft regulations or other controls on PM and gaseous pollutants, so as to most efficiently reduce environmental disease caused by one or both sets of exposures, would enhance the inherent value of research outcomes.

In summary, the Subcommittee found those responsible for communicating programmatic information and research results within NCER to be doing an exemplary job, particularly in light of diminishing budgets and suboptimal staffing levels. These are very talented, competent, and hard-working people. Their successes to date have resulted in inquiries from other government agencies looking for guidance on how to improve the effectiveness of their own communications efforts. The impressive array of communication materials employed by NCER spans the media, including printed brochures on programs and success stories, Webcasts, presentations to their multiple audiences, and electronic media available online and on CD ROM. NCER also appears to understand the importance of developing relationships with key audiences to elicit feedback and improve communication efforts. The media training requirement for staff members who interact with the press provides another example of NCER's efforts to know its audience. If additional resources were brought to bear, this highly professional team could be augmented and its vision of comprehensive communications implemented, enhancing EPA's stature and its contribution to environmental protection and the betterment of society.

IV. Charge Question # 3

What metrics are most useful for measuring the impact of NCER’s work?

The bibliometric analyses already undertaken by NCER are an important first step in measuring impact and will provide, over time, a good baseline point of reference. Some attempts have been made to expand the citation index and link NCER’s research with actual rulemaking and the Subcommittee believes that this work should be further supported. Legislative rulemakings, however, are only one of the tools that EPA has to improve environmental quality, and one that is used less frequently. The Subcommittee suggests that a broader effort be made to demonstrate the links between NCER research and other approaches beyond rulemaking, such as market-based incentives (e.g., emissions trading), information strategies (which are critical to addressing problems such as radon), and the work to develop better environmental technologies or to specify their use (such as Best Available Control Technologies). In each of these areas, it would be useful to demonstrate how EPA-funded research, much done by (or funded through) NCER, has provided important inputs to strategies and policies that have measurable impacts.

To document the linkages and impacts, different time scales would be needed during the data search and analysis and different research areas would have to be mined (see table below).

Environmental Tool	Research Area	Time to Impact (years)*
Regulation/rulemaking (Clean Air Act, Clean Water Act, etc.)	Exposure, fate, transport, risk research...	10-20
Market-based incentives	Economics	5-10
Information strategies	Social science, risk communications	3-8
Technology innovation	Process engineering, life cycle assessments (LCAs)	>10

* Estimated by the Subcommittee

This broader analysis would expand NCER’s understanding of impact across multiple policy tools, better elucidate areas where the Center has done well, and provide a historical baseline needed to begin looking forward. It also would support the development of a conceptual approach that could be applied to help assess the potential impacts of an emerging issues research portfolio.

Additionally, the Subcommittee believes the available evidence suggests that NCER research has had an impact on environmental policies in the broader context of international decision-making. It would be worth undertaking a pilot project to determine research linkages to policy outcomes in countries such as Canada or England (where English language searches are easier).

The Subcommittee suggests that NCER undertake a more thorough look at the impact of technologies funded through the Small Business Innovation Research (SBIR) Program. One can begin by identifying patents that could be linked to NCER-funded research, but a few case studies

that tracked technologies with large potential impacts beyond the patent stage would be illuminating.

The main charge to the Subcommittee was to determine steps that NCER can take to: (1) engage the external scientific community, (2) better craft a forward-looking portfolio, and (3) meet evolving Agency needs. Metrics can be built around these issues, though impact will be harder to determine when looking forward.

To explore engagement with the external scientific community, the NCER research portfolio can be analyzed for joint authorship involving EPA and outside researchers.

The impact of NCER research on emerging issues will be determined over time, but the Center should analyze its research portfolio annually to determine the amount of funding actually dedicated to emerging issues. It is noted with some concern by the Subcommittee that the entire allocation for emerging scientific research has been committed to nanotechnology. The commitment of this entire “pot” of funds to one emerging area significantly hampers the possibility for engagement of the extramural communities in research on equally pressing issues with the potential for high impact. To engage the scientific community in a forward-looking portfolio, ORD should generate a list of issues (possibly near-emerging and far-emerging) that can be used for analysis and strategy development (this list could be developed with input from the BOSC, Science Advisory Board [SAB], National Advisory Council for Environmental Policy and Technology [NACEPT], etc.).

Summary

The Subcommittee would like to thank NCER leadership and all those who participated in the review. The relatively large number of suggestions proffered by the Subcommittee in no way diminishes enthusiasm for the mission of the Center or its ability to operate effectively and successfully with limited resources. Rather, these ideas are submitted with the hope that they will optimize the use of existing capabilities and will prompt the examination of new areas of research and communication that will further align the Center with the goals and needs of the EPA.

Respectfully submitted,



Gary S. Sayler, Ph.D.
Chair, BOSC Executive Committee

**Attachment:
Members of the NCER Standing Subcommittee**

Chair

Martin A. Philbert, Ph.D.

Professor
Department of Environmental Health
Sciences
University of Michigan
1420 Washington Heights
Ann Arbor, MI 48109-2029
Phone: 734-763-4523
Fax: 734-763-7105
E-mail: philbert@umich.edu

Adam Finkel, Sc.D.

Professor
Woodrow Wilson School of Public and
International Affairs
Princeton University
402 Robertson Hall
Princeton, NJ 08544
Phone: 609-258-4828 (M/W/F)
732-235-9754 (Tu/Th)
Fax: 609-258-6082
E-mail: afinkel@princeton.edu

Members

David B. Baker, Ph.D.

Director
National Center for Water Quality Research
Heidelberg College
310 East Market Street
Tiffin, OH 44883-2462
Phone: 419-448-2941
Fax: 419-448-2345
E-mail: dbaker@heidelberg.edu

D. Alan Hansen, Ph.D.

Manager
Tropospheric Studies
Electric Power Research Institute
P.O. Box 10412
Palo Alto, CA 94303-0813
Phone: 650-855-2738
Fax: 650-855-2377
E-mail: ahansen@epri.com

Dennis A. Clifford, Ph.D.

Director
Department of Civil and Environmental
Engineering
Cullen College of Engineering
University of Houston
Engineering Building 1
Houston, TX 77204-4003
Phone: 713-743-4266
Fax: 713-743-4260
E-mail: dacliffo@central.uh.edu

Sallie Keller-McNulty, Ph.D.

Dean, George R. Brown School of
Engineering
Rice University
P.O. Box 1892
MS-364
Houston, TX 77251-1892
Phone: 713-348-4009
Fax: 713-348-5300
E-mail: sallie@rice.edu

Kenneth S. Ramos, Ph.D.

Distinguished Professor and Chairman
Department of Biochemistry and Molecular
Biology
Director
Center for Genetics and Molecular Medicine
University of Louisville Health Sciences
Center
Louisville, KY 40292
Phone: 502-852-5217
Fax: 502-852-6222
E-mail: kenneth.ramos@louisville.edu

David Rejeski

Director
Foresight and Governance Project
Woodrow Wilson International Center for
Scholars
1300 Pennsylvania Avenue, N.W.
Washington, DC 20004-3027
Phone: 202-691-4255
Fax: 202-691-4001
E-mail: david.rejeski@wilsoncenter.org

Consultants

Katherine A. McComas, Ph.D.

Assistant Professor
Department of Communications
Cornell University
313 Kennedy Hall
Ithaca, NY 14853
Phone: 607-255-6508
Fax: 607-254-1322
E-mail: kam19@cornell.edu

Seth Tuler, Ph.D.

Researcher
Social and Environmental Research
Institute, Inc.
278 Main Street, Room 404
Greenfield, MA 01301
Phone: 413-773-9955
Fax: 530-348-7325
E-mail: sptuler@seri-us.org

Designated Federal Officer

Susan Peterson

U.S. Environmental Protection Agency
Office of Research and Development
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Mail Code 8104R
Washington, DC 20460
Phone: 202-564-1077
E-mail: peterson.susan@epa.gov

Contractor Support

Beverly Campbell

The Scientific Consulting Group, Inc.
656 Quince Orchard Road, Suite 210
Gaithersburg, MD 20878
Phone: 301-670-4990
E-mail: bcampbell@scgcorp.com