UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

May 12, 2008

EPA-SAB-08-008

The Honorable Stephen L. Johnson
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460

Subject: Comments on EPA's Research Budget for Fiscal Year 2009: A Report of the Environmental Protection Agency (EPA) Science Advisory Board (SAB)

Dear Administrator Johnson:

The EPA Science Advisory Board (SAB) has evaluated the Environmental Protection Agency's Fiscal Year 2009 research budget. This year, the SAB separated its review of the upcoming year's research budget from its review of EPA's long-term strategic research directions (i.e., research to be conducted over the next 5 to 10 years). The SAB and the Assistant Administrator for Research and Development agreed to this approach for two reasons. The first was to enable the SAB to handle its annual review of the research budget in a more focused and efficient way than in the past. The second was to allow the SAB to begin to engage with EPA scientists in an ongoing process aimed at developing periodic feedback on EPA's future research vision. The SAB believes that this approach has led to a more effective and appropriately thorough evaluation of EPA's annual research budgets within the context of how it will allow the Agency to move forward with the vision embedded in its long-term research vision. The SAB's overarching findings on the FY 2009 research budget are in this letter, and additional details are in the enclosure to this letter.

The Mission of the Environmental Protection Agency is "…to protect human health and the environment." In order to do that the Agency must pursue two kinds of research:

1. Research that directly supports the Agency's ability to better and more efficiently operate its ongoing programs;

2. Research that generates the knowledge to help the Agency and the Nation prepare to deal with future and emerging environmental problems.

Environmental problems are growing steadily more complex and challenging. Thus, in both these contexts, the research that EPA must conduct is becoming more complex and demanding. However, despite the growing research challenge, overall levels of research support across the Agency's Office of Research and Development (ORD) have fallen, in the aggregate, by about $90 million[1] (a drop of 14.2% computed as FY 2008 dollars) since 2004. If one excludes research related to Homeland Security the total decrease is $97.1 million (a drop of 16.2%). Changes in individual research and development programs (in Millions of Dollars and percent) are shown in Figure 1.

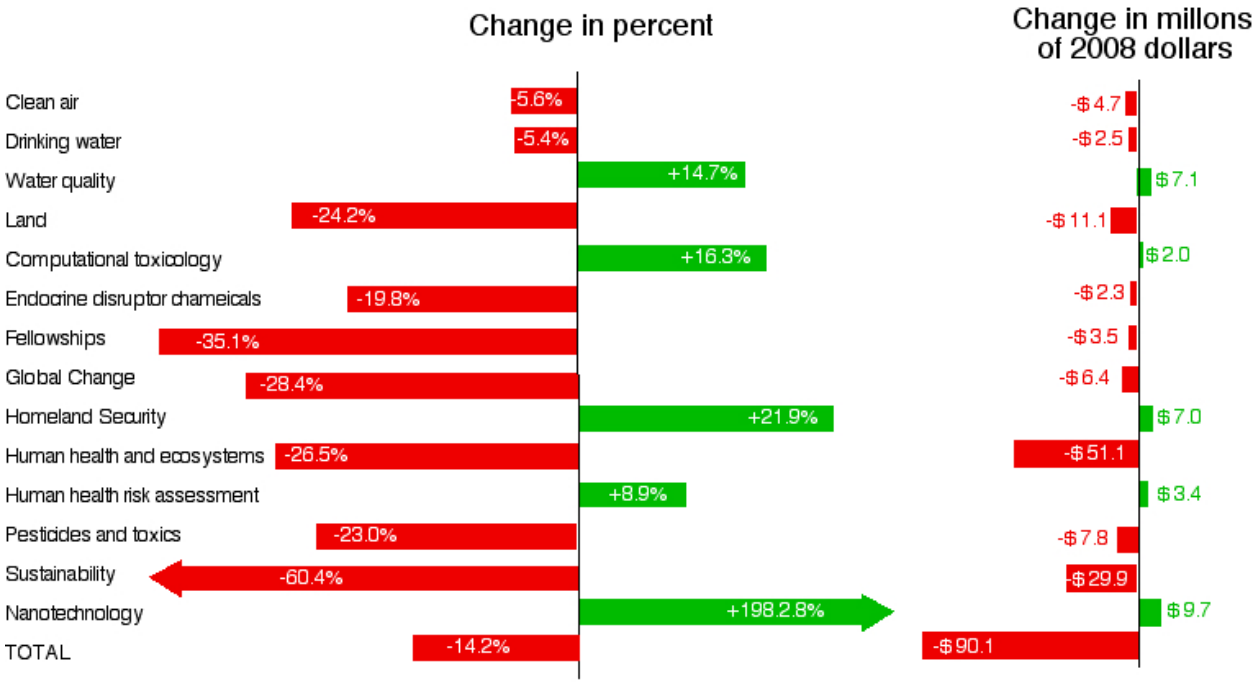

Figure 1: Percent change (left) and dollar change (in millions -- right) in EPA ORD budget between 2004 enacted levels and the 2009 President's Budget in constant 2008 dollars. This plot excludes earmarks, which have declined in recent years.

EPA's scientific staff has done a remarkably good job sustaining as strong a research program as they have in the face of an ever more challenging funding environment. Several programs, such as nano-technology and computational toxicology have experienced modest growth in the dollars they receive. However, where there has been growth it has generally come at the expense of other programs such as extramural research and research to monitor the status of the nation's ecosystems.

Despite the best efforts of the Agency's scientific staff, with the research budget so tight, more and more of the research effort has shifted to supporting the short-term needs (e.g., data generation and methods development) of existing regulatory programs. This is important, but not sufficient to meet the nation's future needs. When proposals are made for activities that are

[1] Budget data are from EPA ORD. Adjustment to constant dollars has been done with the NASA Gross Domestic Product Deflator /Inflation Calculator available at http://cost.jsc.nasa.gov/inflateGDP.html (computed on a 2004 resource total that does not reflect Congressional earmarks of approximately $55 M).

more forward looking, but which do not fit under current narrow regulatory mandates, we understand that management often declines to pursue such requests because of tight budgets.

The effect of this "eating our seed corn" is that EPA is under-investing in research on a wide range of emerging science needed to understand and manage current environmental problems and those that are likely to be recognized in the future. As a consequence we run a considerable risk that we will not be able to address these problems adequately in the future. We also run the risk of incurring much larger future costs because we do not understand the subtle intricacies of these risks and hence could blunder into difficulties, such as inappropriate regulatory responses, from which it may be much more expensive to recover than if we understood what we were facing ahead of time.

The SAB offers two examples of this, but there are more. Climate change is going to result in dramatic impacts on ecosystems. Yet, since 2004 EPA's research budgets for both climate change and for characterizing the state of the Nation's ecosystems have undergone dramatic reductions (Figure 2). While Congress restored some resources in the climate change budget in FY 2008, the President's budget for 2009 proposes to continue the downward trend.

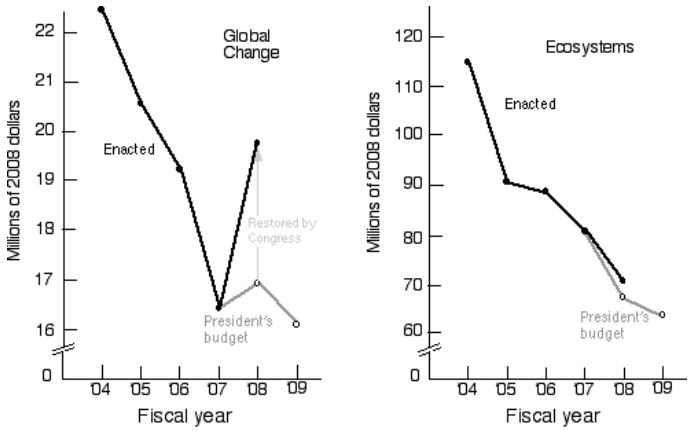

Figure 2: Time trends, in 2008 constant dollars, of research budgets for climate change and for ecosystems.

One of the best ways to better identify and develop an understanding of future and emerging environmental problems is to enlist the talents of America's broader research community, including both university faculty and inventive young doctoral students. However, since 2004, support for both the Science to Achieve Results (STAR) program of extramural research, and the more focused program of STAR Graduate Fellowships, have undergone reductions of roughly 35% (Figure 3).

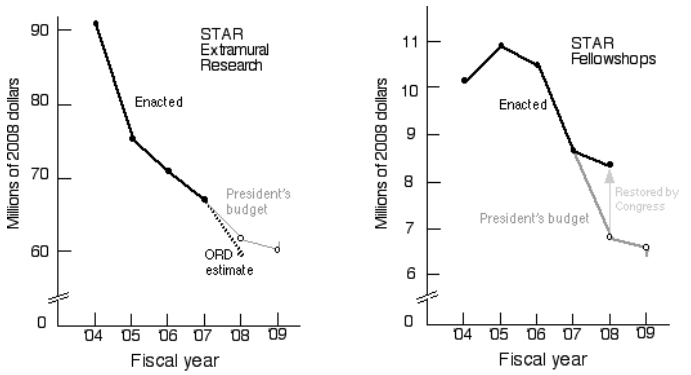

Figure 3: Time trends, in 2008 constant dollars, of research budgets for STAR extramural research and STAR Fellowships.

The SAB is also concerned that ORD may be developing tools that get handed off to others who, because of their own tightening budgets, do not have the resources to use them. We are also concerned that, in an area related to research and data collection funded by the State and Tribal Assistance Grants (STAG) appropriation, support for air monitoring is being reduced and in the future will require a 40% match by state agencies. There is reason to believe that this could result in a substantial loss of critical air monitoring data.

It is sometimes argued that deficits in EPA budgets for research and data collection are made up by environmentally related expenditures being made in other Federal agencies. However, in at least some cases we know this is not the case. For example, USGS water quality monitoring, assessments, and research have all been decreasing over the past decade and are proposed for very significant additional decreases in the FY2009 budget. Under the President's budget the USGS water budget will fall from $221-million enacted in 2008, to a proposed level in 2009 of $203-million. The number of locations where the USGS collects long-term data on nutrients, pesticides, metals, and major ions has decreased by more than 50% since the early 1990's. Also, the number of USGS research scientists working on water quality issues such as nutrient enrichment or emerging contaminants has steadily decreased at rates of 5% per year for at least a decade.

In order to develop a better understanding of the overall adequacy of the Nation's environmental research and data collection, we urge you to work with others in the Executive Branch and with the Congress to initiate an integrated assessment of environmental research and monitoring investments across the entire Federal system. For example, many of the water quality data that are collected in the U.S. are collected by the US Geological Survey.

Over the next few years, the Science Advisory Board will continue to review and offer comments on the year-to-year changes in the Agency's R&D budget. However, because we believe that a strategic focus on the Agency's research needs is so essential, we have also embarked on a process to develop and offer strategic guidance to the Agency on research needs. The Office of Research and Development has been extremely helpful in supporting this effort.

ORD now plans its long-range view of EPA’s research around sixteen specific areas. The focus on these sixteen research areas is important. However, if EPA is to be prepared to address future needs, the Agency's research program will have to adopt a more integrated view, one that recognizes the inherent complexities and interconnections among human and ecological systems, gives greater consideration to feedbacks, and focuses on the relevant scales of each issue. In this context, it is clear that if the Agency is to truly protect the environment, it must undertake a larger, more adequately funded, program of research that goes beyond its immediate regulatory needs and address the broad array of environmental problems facing the nation. Several changes are needed to address pressing environmental problems that do not fall neatly within existing regulatory mandates. Today these needs are only addressed within the Agency's research plans in fragmentary ways. In its research programs, we believe EPA should:

1) broaden the interpretation of "land preservation" to include systems analysis pertaining to future land-use decision making and managing the consequences of complex issues such as bio-fuels, urban-sprawl, green-field development, and the pressures of unconstrained coastal development;

2) expand the focus on the environmental consequences of new technologies to include a broader consideration of the life-cycle of new products and their globalization;

3) in light of changing socio-economic pressures and the growing stresses that will result from climate change (reduced snow pack, more intermittent precipitation and stream flows, more frequent drought, etc.), expand the analysis of water infrastructures, supply, demand and quality;

4) expand and strengthen work on multi-pollutant health impacts and environmental control;

5) reinvigorate and modernize research on sensitive human and ecological populations;

6) improve the science foundation needed to respond to unexpected and emerging problems and environmental disasters;

7) expand policy relevant research on developing, testing and evaluating new and innovative alternatives to conventional command and control regulation;

8) dramatically improve the integration of economics and the decision and behavioral sciences into research and policy development across the Agency; and

9) continue to work on improving the effective communication of research results to potential users both inside and outside the Agency.

The SAB recognizes that research can only successfully provide the science to respond to the nation's needs if senior leadership in the Agency and the Congress work to provide the resources needed to pursue a research program that fully supports EPA's mission of protecting human health and the environment, now and in the years to come. The SAB looks forward to working with ORD as this effort proceeds.

Sincerely,

/Signed/

Dr. M. Granger Morgan, Chair
EPA Science Advisory Board

Enclosure

NOTICE

This report has been written as part of the activities of the EPA Science Advisory Board (SAB), a public advisory group providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The SAB is structured to provide balanced, expert assessment of scientific matters related to problems facing the Agency. This report has not been reviewed for approval by the Agency and, hence, the contents of this report do not necessarily represent the views and policies of the Environmental Protection Agency, nor of other agencies in the Executive Branch of the Federal government, nor does mention of trade names of commercial products constitute a recommendation for use. Reports of the SAB are posted on the EPA website at http://www.epa.gov/sab.

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ENCLOSURE

THE SCIENCE ADVISORY BOARD'S PROGRAM-SPECIFIC COMMENTS ON THE FY 2009 US EPA RESEARCH BUDGET

1. Human Health Research "Cluster"

The areas discussed in the "Human Health Research" cluster include the specific research areas of Human Health, Computational Toxicology, Endocrine Disruptors, Safe Pesticides/Safe Products, and Human Health Risk Assessment[2]. These comments apply to all those areas collectively except those portions of the Endocrine Disruptors research area and of the Safe Pesticides/Safe Products areas that focus on ecosystems research issues. The latter are not included in these comments.

The Human Health area is proposed for a net 6% reduction in budgeted funding for FY 2009. The resulting proposed funding will likely be insufficient to effectively evaluate and implement the monumental changes in biological sciences that the Agency faces in the years ahead. The rapid emergence of toxicogenomic and computational sciences is significantly impacting not only the expectations of how the Agency will test environmental contaminants for health and environmental effects, but also how it will translate these test results to quantitatively predict human health risks for informing policy decisions. The SAB recommends strongly that resources for the Human Health Research program be increased, not decreased, in order to meet the above expectations.

In addition, due to progress in reducing environmental levels of many individual contaminant compounds, the SAB believes that future health evaluations conducted by EPA will need to address the scientifically more challenging problem of cumulative health risks associated with "environmentally relevant" exposures to complex mixtures of chemicals. Significant questions remain about how these "environmentally relevant" mixture exposures may interact with other endogenous or exogenous chemical exposures, disease and/or physiologic states, and/or other factors (e.g., age, gender, etc.).

Implementation of research to address these challenges will require access to significantly expanded and changed expertise and technology resources both inside and outside of EPA. Meeting the expected needs will also require that the new skill sets be highly integrated. At a minimum these needed skills will include: molecular biology, computational modeling, information technology, database management and maintenance, exposure modeling, human biomonitoring, clinical and molecular epidemiology, and risk evaluation and communication. Increased resources are needed to be directed to build rapidly Agency capacity in these areas.

[2] The long-range view of the components included within these research areas are addressed in the "Compilation of EPA ORD Research Program Descriptions," October 2, 2007 – see pages 2 through 29 (SAB, 2007).

The complexity and rapid change of these emerging sciences also demands that the Agency collaborate with, and engage in stable partnerships with, other federal agencies, the external academic and private scientific communities, and other societal stakeholders. Given current resources levels it is not reasonable to expect that EPA to be entirely self-sufficient in the implementation of the complex testing and risk evaluation paradigm needed now and for the future. Thus, EPA must be able to make expanded and longer-term extramural funding commitments that are not vulnerable to year-to-year fluctuations associated with current shorter-term funding strategies. Extramural research resources will be critical to developing the needed research tools and technologies into Agency research strategies, as well as to assure adequate opportunities for regular stakeholder dialogues and scientific oversight of EPA's strategic science direction.

2. Ecosystems, Water, and Security Research "Cluster"

Overarching Comments on Ecosystems, Water and Security Research

The areas discussed in this "Ecosystems, Water, and Security Research" cluster include the specific research areas of Drinking Water, Homeland Security, Water Quality, and Ecosystems Protection Research[3].

Given the highly constrained budget environment, EPA ORD's research priorities and available funding choices in this area are for the most part in alignment with the long-term vision for EPA research in this area. Funding choices have been made in a thoughtful way. However, resources for research in all these programs, especially ecosystems, are entirely insufficient to address all the critical water issues that need to be addressed – EPA is only funded at a level that allows the research to address the "tips of the icebergs" for these issues. EPA water research programs are reduced to the "bone," and thus the ability to protect the environment and position the U.S. to address coming environmental threats is extremely compromised.

This part of the research program's emphasis is almost entirely focused on today's needs. EPA must devote some effort, and resources, to research that develops the knowledge base upon which the nation's emerging environmental problems can be anticipated.

The STAR research grants program has been a major part of EPA's approach to addressing the nation's future science needs. Reductions in EPA's STAR grants program significantly limit EPA's ability to support research to help it to understand future emerging issues.

After years of significant budget cuts, especially for Ecosystems Research, and the overall budget erosion in general, these programs are running "lean and mean." Thus, even small investment increases would have a substantial impact in allowing EPA to conduct important needed research that can not now be done. Those who implement ORD's research planning process have been exceptionally nimble in their planning of this research program,

[3] The long-range view of the components included within these research areas are addressed in the "Compilation of EPA ORD Research Program Descriptions," October 2, 2007 – see pages 30 through 50 (SAB, 2007).

especially given the shrinking resources experienced by ORD. EPA ORD must continue to be adaptive and flexible as it plans for the future in this research program.

Those who manage these research programs are commended for excellence and creativity in leveraging unique outside partners (e.g. Ecosystems researchers have been working with The National Geographic Society on mapping ecosystem services). Further, with limited resources available for traditional partnerships, sharing data and study results with EPA's academic and federal partners, through use of a virtual, collaborative platform (the NSF concept of a "collaboratory") is a useful paradigm to pursue. Some EPA research programs are exploring this practice, known as "open-source-science," and the practice is encouraged by the SAB.

It is imperative to keep the climate change stressor explicit in EPA's research. Some programs (e.g., the water quality program) do not appear to be addressing how climate may be impacting storm waters and quality of ambient waters.

Education and outreach are crucial issues that need to be addressed by EPA's water and security research program.

Drinking Water

The budget for drinking water is decreased by $3.5M from the FY 2008 enacted level. This was attributed to completion of specific disinfection byproducts (DBP) work and implementation of the arsenic rule making. A number of important issues in drinking water seem to need more attention. For example:

a) For arsenic research, a demonstration program for small communities on arsenic control in drinking water. ORD phased out this work as implementation occurred. Additional questions remain to be answered for arsenic to improve the implementation of that rule.

b) For DBPs, a four laboratory study looking at non-cancer effects was completed and is about to be published. Further research is being phased out. However, only nine DBPs are regulated (albeit as surrogates for DBPs as a class). There are more than one hundred DBPs already identified for which explicit health research data do not exist.

c) New contaminants are being considered for regulatory attention through the Contaminant Candidate Listing (CCL) process. Listing is a cyclical process and it will be a major need as EPA goes forward. The SAB is concerned that not enough research is being directed toward new contaminant issues in water to adequately address the current CCL or future listing needs.

d) About $1M was appropriated by Congress for research on geological carbon sequestration and its potential effect on drinking water in FY 2008, but this was removed from the budget for FY 2009. The Drinking Water program is working with CDC and the EPA air program to begin to address this issue. In addition, the Drinking Water research program will issue some STAR grants in 2008. However, without further funding and continued research in FY 2009 the potential longer term gains from this investment will not be sustained.

e) The Total Coliform Rule revision is on a fast track and is due out by the end of the summer of 2008. This rule may be expanded to be a broader distribution system rule. There clearly are not enough resources being invested in this important area considering the infrastructure improvement needs that are suggested by the hundreds of local orders that are issued to drinking water system users to boil water for certain periods of time to reduce the threat of waterborne diseases. Biofilms will be a big area for research as will monitoring the distribution system. A component organism for this issue, *Legionella*, is now proposed for the Contaminant Candidate List (number 3) and this will need to be addressed.

f) Drinking Water research priorities have been driven by statutory needs, and the agency can only do emerging issues at the fringe of its program. Issues not able to be addressed include: nanomaterials in drinking water, applications in terms of distribution systems, and technology associated nano-based water treatment research.

g) The drinking water research program will have to leverage work in Homeland Security regarding biosensors and microbial risk assessment. Drinking water is likely one of the most important exposure routes for microbial pathogens. Decreased funding in this area has the potential to directly influence the health of millions of citizens.

Homeland Security

Homeland Security research programs continue to expand in FY 2009. Programs underway or under development respond to Presidential Directives intended to ensure that comprehensive surveillance, monitoring, and decontamination techniques are available for the environment.

As detection and sensor techniques continue to mature, research is expanding into detection and treatment of possible future events that could occur in indoor and outdoor areas. EPA's focus on anthrax builds on existing research programs that deal with chemical, biological and radiological agents. However, it is not clear that there is a science-based or risk-based argument for addressing only anthrax without consideration of other biological agents of concern. Considerable challenges still remain in the areas of risk communication and particularly with surveillance and decontamination issues arising from potential wide-scale events.

One of the Homeland Security activities in the Land Preservation area addresses training of volunteers to serve in a Response Support Corps or as part if an Incident Management Team. The agency estimates that it will need between 3,000 and 3,500 members to respond to five concurrent incidents of national significance. The FY 2009 budget provides funds to train 700 of these individuals. However, research has shown that only 50% of volunteers can be relied upon to respond to incidents, so the number of volunteers to be trained should be at least doubled, even without taking into account normal attrition. The agency should pursue social science research to identify the barriers to volunteer participation in incidents.

Water Quality

The resources for water quality increased from FY 2004 through 2008 from $45 million to $55.6 million and from FY 2008 to the FY 2009 President's Budget to about $56 million. Though seemingly substantial, this increase largely reflects resources directed at infrastructure research and "administrative" costs associated with ORD staff. The Water Quality research program faces difficulty because of the large number and diversity of issues that need to be studied and the lack of extramural funds to support the research program. The Agency has had to slow activities across the research program because of the resource availability, and while no project is being eliminated, many will be delayed. Thus, research on storm waters, Consolidated Animal Feeding Operations, Total Maximum Daily Loads, the effects of nanotechnology on water quality, how climate change may affect water quality, how water quantity may be affected by water consumption, and pharmaceuticals in surface water all are receiving less resources than are necessary to answer the many major uncertainties that the SAB sees in the Water Quality area. There are additional demands in at least one of the long term goal areas on scientific staff time that comes from responding to an ongoing lawsuit dealing with recreational waters and microbial standards for recreational waters.

Ecological Research

As we have noted in past years, the long-term erosion of funding for EPA's ecological research is of great concern to the SAB. Funding has decreased from $102 million in 1995 to about $66 million in 2009, a decrease of nearly 36% in nominal dollars. Because ecosystem goods and services provide the natural infrastructure supporting the health and well-being of our society, it is essential for EPA to conduct a robust ecological research program targeted at understanding how stressors affect ecological services.

EPA has reconfigured its ecosystems research program to focus on ecological services. The SAB commends EPA for being creative in developing and initiating a strategic research program focused on ecological services. The SAB commends EPA for developing partnerships and being innovative in exploring "open source science" approaches to catalyze further research on ecological services. However, the levels of funding to be allocated for the important areas of decision support systems development, research on the relationships of ecological services to human wellbeing, education of the public about the importance of ecological services, and implementation of research on valuation approaches are entirely insufficient. These components of the ecological research program are critical to improvement of environmental decision-making in the Agency. We encourage increased funding for EPA's Ecological Services Research Program, especially in the area of the STAR grants program. Because the Ecosystem program is embarking on a new direction with considerable potential, it is moving into an area of science that is still in its infancy. This is precisely when the Agency needs to engage as many minds as possible to help develop the science. STAR funds would be well spent to further the development of this program, resulting in a more robust end product. In addition, resources must be available to ensure that EPA can hire and retain the highest level of professionals in the diverse areas of expertise that make up the analysis of ecosystem services. In some cases, this may involve the acquisition of specialized consultants when specific expertise is needed that is not available within the agency.

While ecosystems are valuable for the services they provide they also have intrinsic value in their own right. The tight budget means that broader questions of the overall health of the nation's ecosystems, and how stressors such as climate change, may affect that health in the future, are now largely being ignored by the Agency's research programs.

3. Economics and Sustainability "Cluster"

Economics and Decision Sciences

The areas discussed in this "Economics and Sustainability Research" cluster include the specific research areas of Economics and Decision Sciences and Sustainability[4].

Economics and Decision Sciences research has been shifted from ORD into EPA's National Center for Environmental Economics (NCEE),where it is now focused almost exclusively on economics. The extramural research budget is no longer included in the Science and Technology (S&T) appropriation for ORD. The budget has declined sharply from more than $2M several years ago to $1.1M in FY2007 to approximately $600,000 in Fiscal Year 2008. This remaining budget is likely to be directed toward issues of evaluating ecosystem services, including definition, evaluation, and valuation, and perhaps toward issues of valuing reductions in mortality risk, though the levels to be invested in specific areas are not certain.

EPA's level of research investment in economic, decision, and behavioral sciences appears grossly inadequate to support its mission, i.e., to protect human health and the environment by developing regulations and other policies to alter behavior of individuals, firms, and other organizations. Economic, decision, and behavioral sciences that clarify how these agents respond to alternative policies, and how policies can be designed to be more effective and less burdensome, should be a central component of EPA research. EPA's past research in this area has led to major advances in policy with benefits that appear to dwarf the Agency's cumulative expenditures on this research. For example, EPA research on economic-incentive regulatory mechanisms has contributed to shifting tradable permits and similar mechanisms from politically unacceptable to a preferred choice, sharply reducing the cost of achieving environmental quality. Similarly, EPA research on methods to estimate the monetary value of reductions in health risk provide a basis for showing that regulations for fine particulate matter, despite being among the most expensive, are well-worth their cost.

Sustainability

The EPA's sustainability research strategy attempts to disperse the sustainability paradigm throughout EPA's programmatic areas. This research program emerged during a transitory period from the Pollution Prevention (P2) program. The program's current focus is on the development of meaningful metrics and indicators, support tools such as Life Cycle Analysis (LCA), and research on innovative technologies.

[4] The long-range view of the components included within these research areas are addressed in the "Compilation of EPA ORD Research Program Descriptions," October 2, 2007 – see pages 51 through 64 (SAB, 2007).

One measure of the effectiveness of the strategy might be the extent to which other programs influence, and in turn are influenced by, the sustainability approach. Indeed, several (perhaps as many as 11) Agency programs have clear connections to sustainability. Thus it is somewhat puzzling that among all of ORD's research programs, funding for the sustainability, and its predecessor program pollution prevention, has declined the most (60%) over the past five years. The SAB is concerned that within a few years the program will face elimination through funding attrition.

It is ironic that at a time when environmental problems are increasingly regional or even global in scope, and characterized by a high degree of complexity, that the kinds of metrics and tools envisioned within the sustainability program have not been applied within the agency and spread to other agencies in a more systemic way. Clearly LCA methodologies are powerful ways to weigh options among competing or alternative decisions that society must make.

A new opportunity has been presented to the Agency through the new Energy Independence and Security Act of 2007, which calls for the EPA to lead the assessment of the environmental consequences of biofuels development in the US. Although this is but one of the many critical areas which will have major environmental impacts, it may present a key opportunity to demonstrate the value of applying the LCA approach. For the agency's sustainability metrics and support tools, this might at last propel the sustainability strategy to a greater level of recognition, thus funding of this effort is encouraged.

4. Clean Air and Global Change Research "Cluster"

The areas discussed in this "Clean Air and Global Change Research" cluster include the specific research areas of Global Change and Clean Air Research[5].

Global Change

EPA'S Global Change research program is assessment-oriented and focuses upon understanding the effects of global change on air and water quality. EPA'S program is a part of the integrated Climate Change Science Program (CCSP) that is carried out by many U.S. agencies. The EPA research program is reduced by over $3 Million in the FY 2009 budget to just over $16 Million. The EPA Global Change Research Program performs well considering its declining funding and relatively small, though focused and important role, in the overall Federal program on climate change.

In general, the SAB believes that the Agency needs to report their strategic objectives for global change in terms of overall greenhouse gas emission reductions in addition to energy intensity (efficiency) goals (million metric tons of carbon equivalent [MMTCE] of emissions from a growing baseline).

The Intergovernmental Panel on Climate Change (IPCC) 4th Assessment, a consensus report of the world's scientific community, has shown that dramatic emission reductions (~80%)

[5] The long-range view of the components included within these research areas are addressed in the "Compilation of EPA ORD Research Program Descriptions," October 2, 2007 – see pages 65 through 75 (SAB, 2007).

will be needed by 2050, and emission reductions must begin soon. States are leading the way in these planning efforts, and for EPA to be relevant in the future, research is needed on the most effective strategies to reach these reduction goals. Thus, EPA should adopt some consistent emission reduction objectives identified by IPCC to inform and to better define their research portfolio.

Clean Air (formerly NAAQS and Air Toxics)

The Air Program of EPA's Office of Research and Development (ORD) is commended for providing high-quality scientific information to support EPA's development of National Ambient Air Quality Standards (NAAQS) for criteria air pollutants and for moving the Agency toward of a multi-pollutant approach to the regulation of air pollutants. ORD's Air Research Program has expanded the scope and value of its research results through leveraging the research done by other Federal agencies such as the National Institute of Environmental Health Sciences (NIEHS) and publicly- and privately-funded organizations such as the Health Effects Institute (HEI). It is essential that this core research program be maintained or expanded in real research dollars to continue this successful effort.

In a related area, the EPA FY 2009 Annual Performance Plan and Congressional Justification budget figures indicate that the President's Budget for Healthier Outdoor Air continues to decrease funding for State and Tribal Assistance Grants (STAG) for routine air monitoring [such as particulate matter (PM)]. In addition, there is a requirement for 40% in matching funds for states involved. Such data are greatly needed for risk assessments and strategic goal assessments. There is a very limited ability for states and tribes to increase their budgets to accommodate this 40% match. Thus, the change in this part of STAG will mean a loss of monitoring capability which EPA needs in order to assess nationwide trends. Once these programs are eliminated at the state level, they will be difficult to resume. Restoration of full funding of these STAG grants is important to prevent the cascading effect of federal cuts leading to state cuts, leading to irreparable loss of monitoring capability.

Likewise, the reduction in the President's FY 2009 proposed budget for Reducing Greenhouse Gas [GHG] Intensity has cut funding for the clean car program, the GHG Registry Rule, and Energy Star by more than $9 M. These changes seem counterintuitive given the crisis affecting our environment from climate change and the relative cost effectiveness of these programs.

Indoor air is an unfunded ORD responsibility. While some of the air research, such as the near road research, can lead to indoor air mitigation in buildings housing sensitive populations such as schools, this is not a focus of the EPA's research program. Providing funding for indoor air research can be another avenue to address asthma issues.

Responsibility for mercury research may be moved into the air program, but it has extremely limited funding. Yet the concern for climate change has led to voluntary energy conservation efforts which include an increasing demand for compact fluorescent lights (CFL). These CFLs contain mercury which can be released inadvertently into homes if broken, or into waste facilities when discarded. The impact of this nationwide trend where CFLs are widely available through nearly all low cost or other retail outlets, coupled with consumer education

programs to encourage their use for energy conservation, needs to be coupled with research on the impact on human health in indoor air as well as the impact with regard to the mercury materials balance. Life cycle analysis of these new trends is a cross-cutting issue which needs to be included in the research budget.

5. Technology "Cluster"

The areas discussed in this "Technology Research" cluster include the specific research areas of Land Preservation and Restoration, Nanotechnology, and Global Earth Observation System of Systems/Advanced Monitoring Initiative research[6]. Many of the research areas within the EPA ORD program seek partnerships with other government agencies and some non-governmental organizations. This leveraging mechanism is important to the success of EPA's mission because of the difficult budget constraints that are associated with the EPA research program. Nowhere in the program is this more necessary and appropriate than in the technology area where the private sector often benefits directly from EPA's research and development activities (e.g., see the SAB comments on technology verification below).

Land Preservation & Restoration

EPA's Land Preservation and Restoration research continues to focus on cleanup of contaminated sites, control of releases to land, and control of leaking underground tanks. In deciding on its program focus, ORD has worked in cooperation with other EPA offices and some organizations outside the Agency to assess key research needs. The Office of Solid Waste and Emergency Response (OSWER) relies upon this research in order to meet its objectives in EPA's land pollution prevention and cleanup programs under the Resource Conservation and Recovery Act (RCRA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Many land preservation and restoration research needs remain. Given the limited resources available, ORD's leveraging and identification of information gaps and cross-cutting multiple program opportunities appears to make good use of the funds available to address high priority problems.

An area from which nearly all EPA financial support has been withdrawn is technology evaluation and verification. This should be reconsidered. The function of the EPA Environmental Technology Verification (ETV) and the Superfund Innovative Technology Evaluation (SITE) programs are essential to moving technology to commercialization and have involved substantial leveraging of limited EPA funds. From the evaluations conducted by the National Advisory Council for Environmental Policy and Technology (NACEPT, 2006; NACEPT, 2007) Environmental Technology Subcommittee, it is clear that (a) the ETV program has been very effective in moving environmental technologies forward in the marketplace, and (b) the EPA support for the verifications – amounting to 50 – 66% of the cost on average – is important for program vitality. The financial support of EPA for technology verification is critical for many environmental technology firms which typically are small operations. There is discussion and documentation of these findings in the May 2006 report of the subcommittee entitled "EPA Technology Programs and Intra-Agency Coordination." Technology verification

[6] The long-range view of the components included within these research areas are addressed in the "Compilation of EPA ORD Research Program Descriptions," October 2, 2007 – see pages 76 through 92 (SAB, 2007).

is discussed further in the May 2007 report of the subcommittee entitled “EPA Technology Programs: Engaging in the Marketplace.” In both reports, the subcommittee recommended the expansion and support of the Agency’s programs for technology verification as a core function within EPA. It was the view of the subcommittee that EPA’s technology verification activity has had significant positive impact on environmental technology development and advancement, and that there is much more impact that this activity could have. The SAB believes that it is important to maintain the unique ability of EPA to help advance environmental technologies to commercialization through technology evaluation and verification and targeted development.

Related to environmental technology development, the EPA SBIR budget, already modest, is slated for significant reduction. The EPA has used small business innovative research (SBIR) RFPs (Request for Proposals) to target particular areas of technology development need, and has been effective in stimulating technology development as documented by the NACEPT subcommittee noted previously. The SBIR budget reduction should be reconsidered.

As in other research areas, an activity that has been lost due to budget constraints is the connection with the academic community largely via programs such as STAR. Academic research is an effective way to leverage EPA research in important areas. ORD should consider opportunities for developing critical relationships to build flexible research capacity in key areas.

While the current and planned ORD land preservation and restoration research activities pertaining to RCRA and CERCLA are well linked to specific regulatory needs under that legislation, it is clear that large-scale, important land preservation and restoration challenges facing the nation are largely unaddressed by ORD efforts. This is understandable considering budget constraints and the focus on immediate mission that the budget constraints impose. Nevertheless, the Board recommends that ORD seek to broaden the interpretation of "land preservation" to include systems analysis pertaining to future land-use decision making and managing the consequences of bio-fuels, urban sprawl, green-field development, and the pressures of unconstrained coastal development.

Nanotechnology

The ORD program on nanomaterials has been formulated strategically, considering EPA needs and with an eye towards leveraging and potential needs for future regulatory decisions. This program involves many external groups. EPA held three rounds of carefully targeted extramural research competitions on the environmental implications of nanotechnology. EPA has given careful attention to building on areas of internal expertise such as fate and transport, ecological assessment, and small particle inhalation. The program integrates activities at the international, national and cross-agency levels. If more funding became available, the recommendation would be to expand investment in the current focus areas. An important, unaddressed challenge is the implication of mixtures and environmental transformations of nanomaterials and other contaminants.

Global Earth Observation System of Systems (GEOSS) and the Advanced Monitoring Initiative (AMI)

GEOSS effectively leverages opportunities with other agencies, using high quality data sets to serve EPA needs. Some of the additional benefits of GEOSS are that it develops a technologically collaborative culture, creates an understanding of the need to plan for such collaboration, and, that done right, it will work itself out of business. The current $5M funding supports 34 projects, which together are well balanced in meeting program needs across the EPA. However, after completion of the demonstration stage, the SAB recommends focusing on a smaller number of high impact projects such as monitoring the temporal and spatial changes in water quality within the Chesapeake Bay or the Mississippi River.

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ABBREVIATIONS

AMI	Advanced Monitoring Initiative
CAFO	Consolidated Animal Feeding Operations
CCL	Contaminant Candidate List
CCSP	Climate Change Control Program
CDC	Centers for Disease Control
CFL	Compact Fluorescent Lights
CERCLA	Comprehensive Environmental Response Compliance and Liability Act
DBP	Disinfectants, Disinfection Byproducts
DW	Drinking Water
EPA	U.S. Environmental Protection Agency
ETV	Environmental Technology Verification
FY	Fiscal Year
GEOSS	Global Earth Observation System of Systems
GHG	Greenhouse Gasses
HEI	Health Effects Institute
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Analysis
MMTCE	Million Metric Tons of Carbon Equivalents
NACEPT	National Advisory Council on Environmental Policy and Technology
NAAQS	National Ambient Air Quality Standards
NCEE	National Center for Environmental Economics
NIEHS	National Institute for Environmental Health Sciences
ORD	US EPA Office of Research and Development
OSWER	Office of Solid Waste and Emergency Response
PM	Particulate Matter
PP or P2	Pollution Prevention
RCRA	Resource Conservation and Recovery Act
RFP	Request for Proposals
SAB	Science Advisory Board
STAG	State and Tribal Assistance Grants
STAR	Science to Achieve Results
SBIR	Small Business and Innovative Research
SITE	Superfund Innovative Technology Evaluation Program
U.S.	United States
USGS	US Geological Survey