UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF THE ADMINISTRATOR
SCIENCE ADVISORY BOARD

March 19, 2004

EPA-SAB-ADV-04-003

The Honorable Michael O. Leavitt
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Subject: Advisory Report on the Science and Research Budgets for the U.S. Environmental Protection Agency for Fiscal Year 2005; A Report by the EPA Science Advisory Board

Dear Administrator Leavitt:

This letter transmits the advice of the U.S. EPA Science Advisory Board (SAB) on the President's Fiscal Year 2005 budget request for EPA's science and research activities. The report was developed by the Board subsequent to its meeting and discussions with EPA representatives from February 23 – 25, 2004 in Washington, D.C. The Board also held an informational session with the Agency on December 10, 2003.

In general, the Board, after conducting numerous reviews of EPA's science and research activities over more than 20 years, has come to recognize that the Office of Research and Development has a strong cadre of scientists who conduct high quality, diverse scientific research programs that focus on specific EPA missions. Agency scientists, combined with the scientists involved in EPA's extramural programs, provide a unique and flexible source of expertise for conducting research in support of informed decision-making. This budget causes concerns among the members of the Board about EPA's ability to adequately sustain this important science and research program.

The following four charge questions from the Agency were used as the focus of the Board's attention during this review:

1. In their presentations to the SAB, EPA's National Program and Regional offices identified their priorities for achieving EPA's strategic goals. To what extent do EPA's

science and research programs, described for the FY 2005 S&T account of the President's Budget Request, align with these priorities?

2. How well does EPA's science and research program, as described for the FY 2005 Science and Technology account, complement the other science programs within the National Programs and Regions?

3. To what extent do EPA's science and research programs, as presented to the SAB by ORD, the National Programs, and the Regions, align with what the SAB believes will be the nation's emerging environmental issues in the coming years? In essence, how well is EPA positioned, scientifically and within the context of its mission, to address these issues?

4. Based on EPA's presentations to the SAB, and Board members' own knowledge of efforts in the broader scientific community, how well does EPA's science and research program complement environmental science programs elsewhere?

The Board's conclusions about the science and research budget request, which were developed as a result of its review of information provided to the Board, are briefly highlighted in this letter and explained in more detail in the report that follows.

As a result of the EPA SAB reorganization during FY 2003, the Board's advisory function on EPA's science and research budgets has moved to the larger, chartered Board from a small Sub-committee. This enhances the visibility of the review and significantly increases the number of persons and types of expertise that are available to participate in this activity. This change was made because of our concerns with the limited depth of detail that the Board has been able to offer on EPA's science and research budgets in past years. The Board also works with EPA representatives on a continuous basis to systematically acquire information on Agency science and research programs. EPA is also working to broaden the information to include all agency science and research, irrespective of the office or the appropriation account that it falls within.

The following paragraphs summarize the Board's comments on EPA's FY 2005 Science and Research Program and Budgets.

Erosion of the EPA Research Budget - The Board has consistently noted its deep concern with the constant erosion of the budget for EPA's unique and important research programs over the years. For the FY 2005 budget request, the Board observes that the investments in EPA's research go beyond erosion to the point of receiving drastic cuts. This constrained investment in environmental research will eventually lead to a knowledge crisis as EPA attends to the legacy problems that are a byproduct of the last industrial revolution, and just as importantly, as EPA leads the nation's attempt to avoid a similar legacy from the new economic and materials revolution.

Cuts to the STAR Program - The Board noted substantial cuts to the EPA Science to Achieve Results (STAR) program in the FY 2005 budget. STAR is recognized by this Board as a science program of major importance to the Agency, and thus to the nation. That view is

consistent with the conclusions in the recent National Academy of Science (NAS) report entitled *The Measure of* STAR. STAR provides many benefits, including the necessary flexibility to obtain critical scientific expertise in a wide range of disciplines that is essential for addressing emerging issues that are outside EPA's current areas of expertise. EPA could not maintain the same large base of scientific expertise that is available on an as needed basis to carry out specific research. STAR enhances EPA's collaboration with outside researchers and academic institutions and in the process actually stimulates additional resources for environmental research. STAR also benefits and strengthens scientific research throughout the United States by providing training for graduate students who will reinforce the declining base of engineers and scientists in the U.S. Even though STAR is largely focused on forward-looking core research, the program has already begun to accrue a record of early success. This is noted in the aforementioned "*Measure of STAR*" (NAS, 2003) in which its states that STAR has already resulted in "…peer-reviewed publications that are of immediate use in understanding causes, exposures, and effects of environmental pollution." By any measure, STAR is an excellent investment in the short and the long-term.

To emphasize the seriousness of this situation, the Board notes a number of cuts to STAR research that are a part of the FY 2005 President's Budget Request:

1. Ecosystems Protection Research is reduced by over $22 million with a loss of some 50 STAR grants. The Board is particularly concerned about this cut given the critical need for ecosystems research, which the Board feels is generally under-funded across EPA.

2. Endocrine Disruptors Research is reduced by about $5 million. This is an area of research that investigates the effects that could be associated with some of the many chemicals used in large quantities in our society.

3. Pollution Prevention Research is reduced by $ 5 million even though the focus is on avoiding future problems and reducing the expensive clean up costs that we face today.

4. Mercury Research is reduced by $2 million, just at the time when more information is needed on this ubiquitous contaminant.

In addition, even though the STAR Graduate Fellowship program increases by $1.2 million over the FY 2004 enacted level, it is still nearly $4 million below the level enacted by the Congress for FY 2003 ($9.8 million). This program's aim is to educate the future environmental scientists that will be needed to replace the currently aging population of such scientists. Thus, adequate funding of this program continues to be essential.

The Board believes that these cuts will have a negative impact on the balanced research portfolio that EPA, especially ORD, has developed over the last decade. In that time, EPA has developed a program that balances its problem-driven (shorter term, applied) research with its core (longer term, basic) research. Though components of the core program are not always easy to identify in the budget, EPA, in the past, appeared to have a balanced research program in this

dimension. The nearly half core – half problem-driven research program balance seems appropriate. However, this budget upsets that balance by decreasing core research significantly.

Further, the STAR program helps EPA balance its internal research portfolio with its extramural research portfolio. The result is that science from many different institutions (government, academia, non-governmental organizations, and industry) is integrated into a total research program that complements the scientific niche filled by EPA's own scientists. This provides a more nimble resource than is available to work on existing and emerging environmental issues than would be available with only an intramural program. Changes in this budget, especially STAR, will significantly impair the balance of this integrated research program along the intramural vs. extramural research dimension in addition to the core vs. problem driven dimension noted above.

Building Decontamination - The Board believes that EPA must play a continuing role in Homeland Security. EPA's building decontamination research is one of EPA's contributions to Homeland Security and it appears to be eliminated prior to its completion in an $8.3 million cut. The Board is aware that other agencies have substantial resources devoted to Homeland Security, so perhaps other groups have taken on this role for the future. EPA has the special expertise to carry out this research. However, if it is judged that this is not a research direction for EPA, it is still important to ensure that this work be continued somewhere.

Program Planning and Measurement – Each year, the Board tries to evaluate EPA's research priorities and their role in meeting the Agency's goals. As part of the current review, the Board was given information resulting from the application of a new survey tool, the Program Assessment Rating Tool (PART) that was used to evaluate selected EPA programs. The Board is concerned that decisions are being made about research program funding on the basis of the application of this new tool.

To be clear, the Board did not receive or review information on the rating instrument itself; however, after evaluating PART summaries for several research programs, our conclusion is that PART, may at this time, have a limited capacity to inform budget decisions for research programs. The Board is concerned with the manner in which the weighting formula in PART seems to influence the full analysis and thus favor programs with short-run results over those having near-term costs but longer term benefits. There is also a concern that an evaluator's subjective considerations might be able to bias those weights and the rating itself.

Because research inevitably involves more long-term benefits and fewer short-term benefits, PART ratings serve to bias the decision-making process against programs such as STAR ecosystem research, global climate change research, and other important subjects. The PART seems to be intended as a formula for making prospective predictions about likely program success. However, the weights that the PART assigns to different program characteristics do not seem to have been systematically validated against the contribution of each program characteristic to independent objective measures of program success. If the weights in the tool are arbitrarily assigned, the PART could lead to biases in evaluation due to the subjective judgments of its designers. We believe that the tool should be reviewed to determine its adequacy for its use in supporting budget decisions.

The real issue here is how research programs are to be evaluated and whether a different metric is necessary for basic versus applied research programs. Also, of interest is whether research results should be evaluated separately from the outcomes of programs they are intended to support? Although the Board did not directly evaluate the PART itself, it is obviously difficult to conceive of a simple quantitative metric that could be applied across the broad areas of ecosystem quality, human health effects, endocrine effects, and technology development, to name a few examples of research topics under study in EPA. The question becomes even more complex when you consider that some research is intended to develop limited data in the short run to fill a specific knowledge gap and other research seeks to provide an understanding of whole systems in the long term. In addition, research program measurement must contend with the fact that the knowledge and methods developed by EPA, especially ORD, are not usually directly applied by ORD researchers; rather, they are usually used by others to support decisions on a broad suite of diverse statutory mandates. Thus, we believe that evaluations of the performance of research programs will need to consider the specific factors of each program that the research is intended to support. Further, it is unlikely that simple formulae will be able to handle this task well. It is more likely that realistic research program performance assessment will need to be a combination of quantitative metrics and other information and analyses which is then evaluated by groups of experts with relevant knowledge.

Multi-Year Plans are an important innovation in EPA's research planning process. The SAB has reviewed a limited number of these plans and the process used in their development and believes that they will become more useful to the Board's evaluation of EPA's research and science, and its funding in the future. MYP are tools that identify knowledge and methodology gaps needed to support EPA's mission areas and the body of research that would address those needs. They provide a basis for identifying annual performance goals and measures for efforts that become a part of EPA's research budget. Finally, MYPs are very useful in providing focus on long-term progress toward research goals, especially on cross-cutting subjects (e.g., pollution prevention) where coordination across the Agency is essential. The Board supports the continued refinement of Multi-Year plans and is available to continue its review of EPA's progress in this regard.

A New Vision for EPA Science - Finally, the Board notes an issue of great concern. Our evaluation of the EPA science and research budget this year, and in past years, has convinced us that the Agency is in danger of underestimating the pace of large-scale changes that are occurring in our society. If so we risk repeating the mistakes of the past that force us to spend huge sums of public and private funds to reduce and to clean up the pollution brought on by the first industrial revolution. This is because evidence suggests that we are now in a new, high velocity technological revolution that will yield great economic gains, but at the same time, will offer new environmental challenges. Nanotechnology and biotechnology, to name only two innovations, are proceeding with breathtaking speed, and are compounded by forces such as global transfer of pollution and disease, and possible climate change. EPA must carefully examine all of its science and research programs and available expertise, and ask whether it is conducting research that will help us protect human health and the environment while encouraging innovation and growth.

This is not to say that EPA should neglect the "legacy" issues of the past; rather, they must continue to resolve those problems, and at the same time, work creatively with industry,

citizen groups, academia, and other governmental entities to advance new technologies in a sound manner, thereby, avoiding a new legacy of human health and environmental problems. The Agency has stated that, "Our ultimate goal is to move the Nation from a waste-oriented to a life-cycle management way of thinking about materials." This will be an important part of how EPA changes to meet the new world, but much more will be needed. The Board recommends that a study of the contributions and implications of Agency science to this issue be undertaken. This study should explicitly address ways in which EPA science and research might allow the Agency and the external scientific community to develop the knowledge needed to ensure both an environmentally healthy and economically prosperous future for our nation.

We appreciate the opportunity to review, and to provide you with advice on, the science and research investments in the FY 2005 budget request. The Board will be pleased to expand on any of the findings described in this report and we look forward to your response.

Sincerely,

/s/
Dr. William H. Glaze, Chair
EPA Science Advisory Board

/s/
Dr. Genevieve Matanoski, Chair
Science and Research Advisory Panel

NOTICE

This report has been written as part of the activities of the EPA Science Advisory Board, a public advisory committee providing extramural scientific information and advice to the Administrator and other officials of the Environmental Protection Agency. The Board 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 or commercial products constitute a recommendation for use. Reports of the EPA Science Advisory Board are posted on the EPA website at http://www.epa.gov/sab.

U.S. Environmental Protection Agency
Science Advisory Board
Participants in the February 23-25, 2004
Science and Research Budget Review

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AN ADVISORY REPORT ON THE SCIENCE AND RESEARCH BUDGETS FOR THE U.S. ENVIRONMENTAL PROTECTION AGENCY FOR FISCAL YEAR 2005; A REPORT BY THE EPA SCIENCE ADVISORY BOARD

1. INTRODUCTION

1.1 Background

This report transmits the advice of the U.S. EPA Science Advisory Board (SAB) on the Fiscal Year 2005 budget request on EPA's science and research activities. This report was prepared by the Board after two meetings (one on December 10, 2003 and the other held from February 23 – 25, 2004) during which discussions were held between the Board and EPA representatives. These meetings were announced in the Federal Register (see 68FR66095 and 69FR5339).

1.2 Charge to the Science Advisory Board

The following four charge questions were given by the Agency to focus the Board's attention during its evaluation:

1. In their presentations to the SAB, EPA's National Program and Regional offices identified their priorities for achieving EPA's strategic goals. To what extent does EPA's science and research programs described for the FY 2005 S&T account of the President's Budget Request align with these priorities?

2. How well does EPA's science and research program, as described for the FY 2005 Science and Technology account, complement the other science programs within the National Programs and Regions?

3. To what extent do EPA's science and research programs, as presented to the SAB by ORD, the National Programs, and the Regions, align with what the SAB believes will be the nation's emerging environmental issues in the coming years? In essence, how well is EPA positioned, scientifically and within the context of its mission, to address these issues?

4. Based on EPA's presentations to the SAB, and Board members' own knowledge of efforts in the broader scientific community, how well does EPA's science and research program complement environmental science programs elsewhere?

1.3 Format of this Report

Following this Introduction, the report provides specific responses to the questions contained in the Agency's charge to the Board.

2. RESPONSE TO THE CHARGE

The Board annually conducts an evaluation of EPA's science and research budgets. The report of the activity is used by the EPA Administrator and Congressional Staff in their budget and planning activities. As a result of the EPA SAB reorganization during the past year, the Board's advisory function on EPA's science and research budgets has moved to the larger, chartered Board from the smaller, SAB Research Strategies Advisory Committee. This enhances the visibility of the activity and significantly increases the number of persons and types of expertise available to conduct this activity. This change was made because of the Board's concerns with the limited detail that it has been able to offer on EPA's science and research program budgets in past years. The Board is working with EPA to broaden the information it receives on agency science and research programs to include all programs and all resource accounts and not just the efforts of EPA's Office of Research and Development and the Science and Technology account.

2.1 General Conclusions and Remarks

The Board has consistently noted its deep concern with the constant erosion of the budget for EPA's unique and important research programs over the years. For the FY 2005 budget request, the Board observes that the investments in EPA's research go beyond erosion to the point of receiving drastic cuts. This constrained investment in environmental research will eventually lead to a knowledge crisis as EPA attends to the legacy problems that are a byproduct of the last industrial revolution, and just as importantly, as EPA leads the nation's attempt to avoid a similar legacy from the new economic and materials revolution.

After review of the budgetary process and information, the Board is convinced that the Program Assessment Rating Tool (PART) is not ready to assume a central role in allocating resources within the components of EPA's science and research program. Even though PART has a laudatory goal, it is insufficiently developed as an evaluation tool. PART's terms are not specified clearly enough for managers to be able to describe their programs or to derive predictable guidance from it. That lack of specification is seen in the seemingly inconsistent discount rates applied to different programs, in treating programs with long-term goals as though they should produce immediate results, in the inconsistent funding recommendations received by programs with similar PART evaluations, and in the fuzzily defined PART categories that allow concerns to be double counted. In its current form, PART creates disincentives for participation, because it imposes unpredictable outcomes. It should be treated as a tool in a developmental stage and the programs used to evaluate PART, rather than vice versa.

The recommended reductions in research are disproportionately in those programs that address fundamental issues. They have longer payoff timelines and greater difficulty in demonstrating immediate returns. They are essential for preparing the nation, its citizens, and its economy for the environmental challenges of the future and need to be nurtured, in order to provide stable working conditions that will attract talented researchers for EPA. This fundamental research, whose results can serve many in government and industry, is a natural focus for EPA funding.

EPA needs sustained, predictable programs that integrate internal and external research. Its internal programs are needed to identify problems central to EPA's evolving mission and to translate solutions into mission-relevant terms. These programs are also needed to conduct research whose practical importance requires the highest scientific standards.

EPA needs its external research program to be able to take advantage of theoretical and methodological advances that could be brought to bear on environmental issues. It also needs them to recruit the next generation of researchers, a topic of special importance given the graying of the federal workforce. EPA needs external researchers, in order to be able to adjust its research portfolio quickly, as issues change and sciences evolve. The Board did not see that a strategic vision was applied consistently in the endorsed research program. There are critical research areas, like the social and behavioral sciences, whose importance has been endorsed for many years, but whose funding levels have remained small. The Board is also concerned with the very large cuts directed at the Science to Achieve Results (STAR) research grants program. This Board's high regard for the STAR program resonates with the strongly positive support STAR received in a recent National Academy of Sciences report. In addition, the well-regarded STAR Fellowship program continues to be threatened.

The best researchers, those most needed for addressing EPA's extraordinarily challenging problems, have career options. If EPA cannot provide predictable funding streams, they will go elsewhere. The Board discusses specific aspects of these cuts in the goal-specific sections of this report.

For some disciplines, the STAR program has been the premiere competition for funding for environmental research. Furthermore, to the extent that EPA STAR funding represents "pump-priming" for external research, it has the potential for carrying with it a multiplier effect on outside research activity in areas of interest to the EPA. While there is always the argument that some of this basic research might be funded instead by other agencies, such as the NSF, the EPA does not have as much control over the wording of RFPs or guidance to review panels if it is not managing the research itself.

EPA cannot grow and adapt to address emerging problems and issues when they are charged with addressing so many legacy issues without adequate resources to make the progress necessary to move on the new things.

The above problems are tied to the largest overall problem – and opportunity – that the Board sees with EPA's research program. Namely, EPA lacks the material resources for dealing with the environmental challenges arising from the multi-front technological revolution that is just beginning. Adapting to these emerging issues is especially difficult while the Agency must still contend with the many legacy issues associated with its mission. Genomics and nanotechnology are perhaps the best known of the applied sciences that are changing our world. They may bring great environmental benefits, by offering novel solutions and replacing polluting technologies. They may also create unique problems or novel versions of old ones (e.g., the large waste streams of nanomanufacturing). However, both these risks and these benefits may defy conventional analysis. Failure to anticipate and manage these risks and benefits can deny

society the full benefit of promising technologies and potentially affect our national competitiveness.

EPA is well suited to lead the nation in shaping policies that get the best from these unprecedented opportunities. More than any other institution, it has the full suite of needed staff, advisors, methodologies, contracting arrangements, intellectual tools, and peer review procedures. Others that have tried to duplicate these capacities have experienced difficulties with public opinion in the US or encountered trade barriers abroad. A federal agency can create a unified national philosophy, so that technologists face a single, predictable set of rules and obtain a coherent research base for supporting policy development.

EPA is the best-positioned body, for creating these conditions for growth. In so doing, it should take advantage of lessons learned over its history. It might also be able to move beyond the adversarial relations that have often characterized that history. EPA was established to manage problems arising from the last technological revolution. Meeting them required expensive and sometimes contentious actions. Looking forward, there are opportunities to shape technologies creatively, before large investments have been made in specific designs, manufacturing facilities, and distribution channels.

However, EPA needs additional resources to meet this challenge. The "legacy" issues remain and demand continuing attention, which EPA has had to face with gradually declining (constant dollar) resources. We propose a major new initiative, with EPA creating the research base for environmentally friendly advanced technology. We propose that this program embody organizational as well as scientific innovation. It should enable research that appropriately integrates multiple disciplines and stakeholders. Its default assumption should be that government, industry, and citizens' groups can find common cause in developing these new technologies, without additional regulation. However, it should also evaluate that assumption empirically, identifying the conditions where voluntary measures can bring acceptable, attractive suites of risks and benefits.

The research agenda should include such cutting-edge topics as developing ways to: (a) screen technological options rapidly, in order to identify beneficial opportunities and negative impacts; (b) analyze highly complex and uncertain technologies, ill-suited to traditional risk and benefit analyses; (c) communicate technologies' risks and benefits, in order to create and anticipate informed public response; (d) extend traditional disciplines; and (e) conceptualize research for cross-cutting application. These are exciting topics that can build on and invigorate EPA's internal and external research base.

2.2 Goal 1 – Clean Air and Global Climate Change

2.2.1 Research and Strategic Goal Alignment (Goal 1)

The research that was described to the Board was clearly associated with one or more of the EPA's Goal 1 objectives or sub-objectives. However, the information presented to the Board was more an inventory of actions that the agency wants to take, without any clear statement of EPA's priorities for each of the program components. Even so, priorities that can be discerned

from study of the background information provided appear to favor short term over longer term objectives. For the future, the Board's evaluation would be aided if it is provided information on the EPA's own assessments of where additional funds would best be applied if they were to be available and to learn what would be cut, from which programs, if fewer funds were made available. Admittedly, this information is very sensitive, but it defines the margins at which trade-offs are made. For now, we give the Board's reactions to what was obvious in the budget and program information provided for its evaluation.

At the "Objective" level within Goal 1, only one of six objectives shows a current dollar decrease from the FY 2004 President's budget to the FY 2005 President's budget request (Radiation is reduced by $141 thousand). All other areas increase in current dollars, with increases ranging from $912 thousand to nearly $80 million. Science and Research increase by $2.8 million though this appears to be a pass-through to the Agency for Toxic Substances and Disease Registry.

Goal 1: Clean Air and Global Climate Change Resource Summary by Objective
(Page I-1 Congressional Justification)

Objectives	FY 2004 PB	FY 2005 PB	FY 2004 $S&T	FY 2005 $S&T
Healthier outdoor air	$579,059 K	$659,876 K*	$81,060 K	$85,302 K
Healthier indoor air	48,042 K	48,955 K	1,289 K	1,367 K
Protect the ozone layer	19, 069 K	21,814 K	-	-
Radiation	34,859 K	34,718 K	9,798 K	9,575 K
Reduce Greenhouse gas intensity	106,936 K	108,389 K	-	-
Enhance Science and Research	128,016 K	130,864 K**	107,353 K***	109,544 K
Total Work Years	2738	2757		
TOTALS	**$915,983 K**	**$1,004,615 K**		

*Increase of $65 million of Clean School Busses in the State and Tribal Assistance Grants account.
** Also includes $18,217 K in the Environmental Program & Management account for FY 2004 and $18,724 K in EPM for FY 2005 for Science.
*** Of this, the ORD allocation in FY 2004 is $84,264 K and in FY 2005 is $86,231 K.

One increase is large in the "Healthier Outdoor Air" Objective. That is the Clean School Bus Initiative which increased by $65.0 million (this is in the State and Tribal Assistance Grants account and represents a 4200% increase over the FY 2004 level of $1.5 million). While this may be a worthy program there was no supporting analysis demonstrating the benefits of this program to outdoor air in comparison to other laudable programs. Such questions should always be addressed in instances where such dramatic increases are to be made. Given the Agency's reliance on quantitative measures of projected performance using the PART analysis for other programs, we assume that equivalent quantitative evaluation was given to this issue by the Agency in deciding on the increase to be included in this request.

Programs and projects within the "Enhance Science and Research" objective are shown in the table below. Funding changes from the FY 2004 request to FY 2005 request in these objectives are relatively small and in most cases are increases. However, small decreases are seen in Radiation Protection and tropospheric ozone research.

Goal 1: Enhance Science and Research Objective Resource Summary (Page I-133 Congressional Justification)

Objectives	FY 2004 PB	FY 2005 PB
Climate Protection Program	$ 17,320 K	$ 17,459 K*
Radiation: Protection	1,472 K	1,362 K
Research: Air Toxics	15,701 K	17,639 K
Research: Particulate Matter	63,621 K	63,691 K
Research: Tropospheric Ozone	4,942 K	4,9001 K
Clean Air Allowance Trading Program	3,991 K	3,991 K
Federal Support for Air Quality Management	381 K	482 K
Federal Support for Air Toxics Program	403 K	405 K
Administrative Projects	20,185 K	20,934 K

The Data on the shares and changes in budget allocations to air programs and projects highlight an apparent bias against programs with near-term costs but potentially large long term benefits. Climate change is a particular concern in this regard.

Cuts to STAR program research raise serious concerns about whether the Agency has the in-house capacity to conduct air quality program research on topics that will no longer be addressed via the STAR program. Research needs have been the subject of discussions by the Advisory Council for Clean Air Compliance Analysis (the Council) in its current deliberations (not yet finalized) concerning the Agency's Benefit-Cost Analysis of the Clean Air Act. The research needs include health and ecological effects, air quality modeling, and economic (benefit-cost) analysis. Some examples are shown in the following paragraphs.

Examples of research needs that seemed to the Council to be unmet in the health effects of air pollution, include the following: a) cardiovascular morbidity from long-term exposure to air pollution, b) most air toxics health effects [Agency research plans currently focus on a case study approach (i.e. benzene) where the data are more plentiful, but the risk is not necessarily the greatest], c) exposure assessment (use of grids), d) uncertainty analysis about mortality from PM exposure, e) children's health effects (e.g. infant mortality effects and exacerbation of asthma), f) covariation of ozone and PM and the independent health effects of ozone (morbidity and mortality), g) health effects of sulfur dioxide (SO2), nitrogen dioxide (NO2), carbon monoxide (CO) (the SONOCO Suite), h) source-specific concentration-response functions, i) mortality effects of non-fatal cardiovascular and respiratory events, and j) extrapolation across age groups, long-term effects and the problem of cessation lags in health effects and how these differ by health problem.

Knowledge about the ecological effects of air pollution (and society's valuation of reductions in these effects) lags far behind health effects. Ecological effects remain largely unquantified. Available data are piecemeal and localized. Many fundamental links between emissions levels and endpoints in the form of ecosystems services perceived by humans have not even been established. Without these links, it is impossible to infer social benefits associated with these changes and tie them back to changes in emissions levels.

For air quality modeling, significant unmet research needs include: a) improved measurement of the emissions of particulate matter and particulate matter precursors [significant

uncertainties concern the composition and size distributions of primary particulate emissions, ammonia emissions, emissions from fires, fugitive dust emissions, and emissions of secondary organic aerosol (SOA) precursors], b) an improved uncertainty framework for emissions development and testing [The EPA should be using multiple and redundant sources of information in its emissions estimates (e.g. state and national level on-road emission estimates can be estimated with activity-based emission models employing miles traveled and with alternative models based on fuel consumption].

The science dimensions of air pollution feed the benefit-cost analysis of clean air programs. For reliable policy analysis, the EPA needs to muster additional research resources to better understand: a) how emissions and economic activity are inter-related, especially how air regulations may affect economic activity in a way that will feed back to emissions levels. Computable general equilibrium models are essential for capturing indirect costs and benefits, yet existing models are not sufficiently comprehensive for the Agency's needs, b) morbidity and mortality risk reduction values, especially heterogeneity in these values across types of health threats and affected populations, c) how concepts such as Quality Adjusted Life Years (QALYs) may or may not be helpful in assessment of the benefits of implementing air regulations, d) the comprehensive uncertainties involved in its analyses (from the science through to the benefit-cost analysis) (This requires better approaches to uncertainty analysis and characterization), e) appropriate discounting strategies when the time profiles of cost and benefits do not coincide, especially when long latencies in the effects of air pollution are involved, f) the relationships between air toxics and human health (or ecosystems) effects (In particular, the question of thresholds is critical to any assessment of the social benefits from marginal changes in emissions of air toxics).

Another basic social science research need concerns the U.S. decision to rely upon "voluntary measures" as the linchpin of carbon emissions policy. Environmental management has seen some major gains in cost-effectiveness from reliance on market-based methods for pollution control (for cap-and-trade programs in particular). These market-based methods were introduced after extensive analysis and experimentation. By comparison, however, very little is known about the efficacy of voluntary measures. Given international concerns about U.S. climate change policy, it might be prudent to gain a much better understanding of this control strategy.

2.2.2 Science and Technology Research in Relationship to National Program and Regional Office Science and Research (Goal 1)

ORD research is well integrated into the national programs and the regions because it has direct implementation application. In particular, the particulate matter, air toxics, and ozone activities are of direct benefit to regions, states, tribes and communities as they develop their clean air plans. Additionally, some of the research has implications for indoor air that require voluntary implementation of the tools for risk reduction.

2.2.3 EPA Science and Research Alignment with Emerging Issues (Goal 1)

The SAB is concerned that EPA's ability to address emerging issues is diminishing due to the increasing focus of Agency attention on short term air quality fixes and decreasing attention to maintaining research programs with longer-term payback periods. The EPA planning horizon seems to be shrinking. This shift in attention appears to be embodied in the criteria used in the PART ratings and in the Agency's recent focus on increasing the "velocity" toward environmental outcomes. This evidence suggests a shift within the agency to implicit use of a higher discount rate in evaluating programs with longer-term benefits. This shift serves to disadvantage core research relative to problem-driven research with immediate measurable payoffs.

The Board acknowledges that the Agency faces tough choices with respect to research capacity. The Agency appears to signal a concern that cuts to its internal research would decimate the internal complement of research staff and also harm the Agency's ability to recruit and retain competent researchers in the future. This suggests that temporary cuts to the STAR program are necessary to weather cycles in research funding without harming EPA's own long-term capacity to do research. However, a decision to invoke drastic cutbacks in the STAR research programs is not without adverse longer-term consequences itself. Such cuts can be expected to decrease the external supply of existing and new talent with expertise in air quality, and thus shrink the pool of candidates from which the Agency will be able to replace or expand its internal research staff in response to emerging research needs.

As we make progress on many fronts in reducing environmental threats, the array of programs and projects with social benefits that dramatically exceed their costs will begin to shrink. For programs where measured benefits obviously exceed costs by a wide margin, it does not matter too much that there are unmeasured components of benefits or that costs are not measured very precisely. These policy decisions are "no-brainers." Eventually, however, as the costs of further environmental clean-up continue to increase, and the benefits at the margin get smaller, the right policy choices will become less obvious. It will thus become increasingly important to measure benefits and costs more completely and more accurately. The EPA has to stay ahead of this inevitable shrinkage of the marginal net benefits of additional environmental clean-up efforts with offsetting progress in terms of research to better understand both benefits and costs and to decrease the degree of uncertainty about both.

On this issue, the cuts to Ecosystems research are particularly troubling. For now, the human health benefits of the Clean Air Act seem to be sufficient to offset the costs of these regulations. The desirability of current regulations on emissions from the current complement of emitting firms is not currently in question because ecosystem benefits are essentially unmeasured. However, increased stringency in air quality regulations may be necessitated by increases in the number of emitting sources due to the growth of the U.S. population and the economy. Eventually, it will become necessary to quantify ecosystem benefits if we are to continue to make a case for the social desirability of tighter regulation and increased stringency in air quality regulations.

2.2.4 Science and Technology Research in Relation to Research in the External Scientific Community (Goal 1)

The SAB was impressed with the way that the EPA leverages their resources for clean air research among the federal family. Complementary (but not duplicative) research has been conducted by a number of other organizations. For example, the National Institute for Environmental Health Sciences (NIEHS), Department of Energy (DOE), Department of Commerce, ATSDR, National Park Service, National Academy of Sciences National Research Council (NAS/NRC), the Center for Disease Control and Prevention (CDC), and the National Aeronautic and Space Administration (NASA). Additionally, there has been coordination with the Health Effects Institute (HEI), an organization partially funded by the auto industry. In addition, international cooperation has been fostered through the North American Consortium for Atmospheric Research in Support of Air Quality Management (NARSTO) which is a US – Canada – Mexico consortium.

EPA's participation with other agencies at the federal level in the development of various multi-agency documents involved with radiation sampling and analysis is noteworthy. This collaboration has resulted in better guidance documents with broad applicability. These documents are models of federal cooperation. The Department of Homeland Security is a new partner in radiation monitoring and response to radiological emergencies. Resources have been reallocated to support research in this vital area.

The SAB encourages the Agency to stay abreast of international developments in ways of thinking about public programs for environmental management. For example, attention should be paid to:

a. Developments in sustainability initiatives and complex systems analysis as broader approaches to dealing with environmental protection.
b. The shift in Europe towards the "Precautionary Principle" as an alternative basis for environmental management application. While the EPA may not currently be receptive to such a change in philosophy, it should remain attentive to the consequences of this shift for European countries and maintain an awareness of trends within the international community.
c. The emerging results of major international environmental assessment programs such as the Intergovernmental Panel on Climate Change, the Millenium Ecosystem Assessment, DIVERSITAS, and the International Human Dimensions Programme relevant to EPA research and programs.

2.3 Goal 2 - Clean and Safe Water

2.3.1 Research and Strategic Goal Alignment (Goal 2)

Though little was offered to specifically identify EPA's priorities, the Board agrees that that there is good alignment between the EPA's Science and Technology activities in Goal 2 (Clean and Safe Water) and the priorities reflected in the Agency Strategic Plan for program and

other offices involved in Goal 2. Nevertheless, the Board offers a few comments on where adjustment should be considered in the FY 2005 budget.

Safe Drinking Water

There is a broad international consensus that more emphasis is needed on integrity of distribution systems and source water protection. Since distribution systems and source water protection (Long Term Goal – LTG - 3) have been allocated a small fraction of the drinking water budget (approximately 6 percent), a minor adjustments within the drinking water category could lead to important impacts. In the area of drinking water research the Board recommends more funding for Long Term Goal 3, distribution system and source protection.

Water Quality

The Board recognizes that the budget for water quality is one of the most well established and highly developed areas of activity in the EPA's research agenda. The criteria section of the budget is more mature and well developed and the Board believes it is prudent to consider advancing the newer areas of the budget more aggressively. The Agency is currently facing a major challenge under the Clean Water Act on Total Maximum Daily Load (TMDL) allocations associated with impaired water bodies. Therefore, the Board believes it would be prudent for the Agency to put more emphasis on tools and methodologies associated with diagnostics for both impairment and acceptable in-stream conditions. Experience has shown that developments in impairment assessment and protection and restoration inform the process of criteria development. The Board recommends a shift of funds from Criteria Development (LTG 1) to impairment assessment (LTG2) and protection and restoration (LTG 3).

STAR Grants

Loss of extramural STAR grants in Goal 4 (healthy communities and ecosystems) will have a negative impact on Goal 2's water quality research and will adversely affect the available data to support management decisions. Extramural grants programs, such as STAR, provide a unique vehicle for rapidly delivering scientific advancements and capabilities for better environmental management that enhance the Agency's mission. For example, the Agency has used the STAR grants program to explore the integration of economics, the social sciences, and the natural sciences to advance more effective decision-making regarding water quality at the watershed level.

2.3.2 Science and Technology Research in Relation to National Program and Regional Office Science and Research (Goal 2)

It is clear that the science developed at ORD complements other EPA Regional and National efforts. This is not unexpected since the planning process reflects ORD's response to the strategic needs of National programs and the problems encountered in their implementation at the Regional level. Examples of region-driven issues in the FY05 budget include biosolids and ecosystem valuation.

Nevertheless, there may be regional needs that are not being fully addressed. Examples of Region-specific problems that deserve greater representation in the research budget are 1) invasive species and 2) the impacts of urban development (sprawl). The Board recommends that these issues be incorporated into the funding for LTG 2 and 3 under water quality. This recommendation is consistent with the shifting of funds described earlier.

Within the budget for Goal 2 there is also a need for identification and exploitation of opportunities for research synergies. For example decision tools developed for the Drinking Water area could also have application in the Water Quality area.

2.3.3 EPA Science and Research Alignment with Emerging Issues (Goal 2)

The budget for Goal 2 is highly structured and relatively inflexible. As a result it is difficult for the Agency to respond to emerging issues in this area. Recent examples of emerging issues that have been difficult to find adequate funding to address include: 1) Invasive species, 2) Pharmaceuticals and Personal Care Products in water, and 3) Impacts of development (sprawl).

2.3.4 Science and Technology Research in Relation to Research in the External Scientific Community (Goal 2)

Drinking Water

In the area of Safe Drinking Water, ORD's research is coordinated with other research programs in the nation and in the rest of the world. There has been significant coordination in drinking water research in the U.S. for some time. More recently, a global effort has been made through the auspices of the Global Drinking Water Research Coalition. This effort has reduced duplication of effort in drinking water research.

Water Quality

The Water Quality research agenda is more difficult to coordinate. Unlike drinking water, where the EPA is the only federal agency, there are multiple federal agencies addressing this issue. Coordination across these federal agencies does occur but efficiencies and leverage should be enhanced. EPA also coordinates with US Industry through the Water Environment Research Foundation (WERF). Research on water quality on the Great Lakes is also a good example of international coordination, but not comparable to level of international Coordination in drinking water. The Board recommends that the Agency take a lead in establishing an organization to coordinate water quality research both at the national and global level following the model that has been used in the drinking water arena.

2.3.5 Program Assessment (Goal 2)

It is important to note that both the Drinking Water and Water Quality areas were not subject to the OMB "PART" review. Program areas with long-term research objectives that were reviewed through the PART process were unfavorably discounted. There are also many research

areas in Clean and Safe Water that can only be addressed through long-term research. The Board is concerned that some of the science areas in the water area will also suffer in the future if they are held to Short-term rather than long-term performance criteria.

2.4 Goal 3 – Land Preservation and Restoration

2.4.1 Research and Strategic Goa1 Alignment (Goal 3)

The Land Preservation and Restoration Goal has three objectives: (1) Land Preservation (for which the major element is the Resource Conservation Challenge), (2) Land Restoration (focused on site cleanup), and (3) Enhance Science and Research. Total Science and Research funding is $57.5 million, smallest among the Agency research goals, although the total proposed budget for Goal 3 in FY05 is the second highest among all goals. Of the total science and research funding in Goal 3, the majority comes from the Hazardous Substances Superfund account ($42.8 million) and the Science and Technology account ($9.1 million). It appears that of this amount, the EPA Office of Research and Development receives $39.9 million ($36.6 million of which is for Land Protection and Restoration Research and $6.9 million for the Superfund Innovative Technology Evaluation program). According to comments from Agency representatives at the February 23-25, 2004 Board meeting, the allocation of science and technology research funds is dedicated almost entirely to objective (2) Land Restoration.

Discussions with the Agency at the Board's meeting indicated that only $0.5 million is applied to objective (1) Land Preservation research. Given that the ultimate goal, as expressed under Goal 3 in the Strategic Plan, is to "move the Nation from a waste-oriented to a life-cycle management way of thinking about materials," this lack of alignment of research funding with priorities is regrettable. In reviewing the Agency's approach to objective (1), it appears that a research plan in this area has not yet been developed. The present approach consists largely of the Resource Conservation Challenge, a voluntary model in which industries and municipalities are engaged on a cooperative basis to reduce and recycle wastes. However, like most Agency research the prevailing model for Goal 3 is one of risk reduction, a major tenet of which assumes that wastes will be emitted to the environment under controlled conditions at concentrations that are at or very close to inducing an observable impact. The more forward-thinking concept of waste minimization/elimination has not been translated by the Agency into a cohesive research framework, thus there is no framework for objective (1) into which research can easily be placed.

In contrast, the research program for objective (2) is highly focused on supporting Superfund and emergency management needs. Such "legacy" responsibilities are important, but tend to overshadow other research that focuses on new approaches to waste prevention. This is the probable reason that the overall science and technology budget under goal 3 is the least among all goals—as technologies for remediation have matured and as experience with contaminated sites has been gained, research needs have become less voluminous and pressing.

2.4.2 Science and Technology Research in Relation to National Program and Regional Office Science and Research (Goal 3)

Goal 3 science programs have strong linkages to several other Agency-related activities and offices that address many important areas, among them contaminated sediments, groundwater, site characterization, sampling and analytical methods development, underground storage tanks, risk assessment, and remediation technologies. In viewing these linkages, the mode of cooperation appears to be of two types: highly integrated research (e.g. the cross-office effort between ORD and OSWER devoted to the development of the 3MRA model), and multidisciplinary research in which tasks are "parceled out" according to media and/or expertise. Both approaches serve to leverage scarce research dollars, and to a degree overcome the discipline- and media-specific insularity often present in research organizations.

2.4.3 EPA Science and Research Alignment with Emerging Issues (Goal 3)

The research model for goal 3 is well positioned to respond to certain emerging environmental issues, specifically new hazard-related health threats associated with homeland security and emerging pollutants (cross with goals 1 and 2), and infectious agents such as BSE (cross with other USDA, CDC). Similarly, applications of genomics to risk assessment have great potential for refining our ability to determine the magnitude and specificity of risks associated with environmental hazards (cross with goal 4).

However in looking forward, the Agency approach to research under Goal 3 is likely to miss other risks that arise from larger shifts in societal norms and industrial practice, and the related needs to integrate social and economic perspectives with technical trends. The need to revise waste management from a "disposal-centered" to a "materials flow-centered" approach has been recognized as a strategic value, but the framework that is currently in place in Goal 3 does not support research needs for such a substantial change (the Board notes that research in the area of industrial ecology conducted under Goal 5 may be more closely aligned in this regard, although proposed funding levels here are most likely insufficient also). There is a clear need for research to support current policy initiatives in the industrial ecology area (see Thomas *et al.* 2003). Another emerging area is waste management issues associated with nanoproducts and nanomanufacturing. Concern exists about the health impacts of nanoparticles produced during the manufacture of other products or as end products in themselves. Available information suggests that such technologies are more waste producing per manufactured unit than conventional methods, and these wastes may include new chemicals with unknown environmental impacts.

The proposed reductions in the pollution prevention component of the STAR program, including the Technology for a Sustainable Environment (TSE) program, are especially problematic and short-sighted since this is the principal way that the Agency is able to address emerging longer term research needs, and incorporate external expertise into its research agenda (an exception is the mostly intramural Sustainable Environmental Systems program, which has developed a highly interdisciplinary approach to conducting research on complex systems).

2.4.4 Science and Technology Research in Relation to Research in the External Scientific Community (Goal 3)

As noted in Question 2, Agency personnel have become adept at establishing research partnerships across traditional boundaries, in the process leveraging funds and combining diverse expertise. The Board notes that within current research activities being conducted under goal 3, close cooperation exists with several other agencies (e.g. NOAA, USFWS, OSHA, USGS, States, etc.).

2.5 Goal 4 – Healthy Communities and Ecosystems

2.5.1 Research and Strategic Goa1 Alignment (Goal 4)

The Agency has invested considerable effort in establishing its priorities and short and long term plans through its strategic planning process. However, there are clear contradictions between the priorities established within Goal 4 of the Agency's Strategic Plan and the President's FY 2005 S&T budget.

The majority of the cuts to the entire Science and Research budget were made within the programs related to Goal 4. While some of these reductions were justified (for example, the phase out of the UV research program and its transfer to OAR), many of the cuts were not appropriately justified nor do they reflect the EPA's or the nations priority issues. In particular, the elimination of the extramural research programs for Ecosystems, Endocrine Disruptor and Mercury research appeared to have been heavily influenced by the PART, an analysis that did not appear, from a review of the PART results, to adequately characterize the value of this research.

The elimination of these programs represents approximately a 20%, 40%, and 25% reduction in the ecosystem, endocrine disruptor, and mercury programs, respectively from the President's FY 2004 budget. In all cases, the external research through the STAR program is completely eliminated, and future Agency investment in these programs is limited to internal efforts. These drastic reductions, and their exclusive focus on extramural funding, will affect the overall long-term effectiveness of the Agency by reducing its ability to engage external scientific resources that effectively augment internal EPA science efforts. These reductions are inconsistent with the Agency's mission and strategic emphasis of applying the best science to national health and environmental issues. The three research areas targeted for external funding elimination are issues of high national priority, and affect children's health in particular and ecosystems in general. Therefore, funding for these affected programs should be restored.

A balance of intramural and extramural funding for high priority issues is critical for improving our understanding of environmental problems and for developing strategies for prevention and remediation that inform decision-making. The loss of extramural funding prevents the Agency from accessing a wide array of expertise in academia, government, and the private sector. It also eliminates much of the flexibility of the Agency to respond to new questions that are raised in the normal course of conducting scientific inquiry. It will impede the

development of future EPA research capacity, and will place the Agency well back from its current leadership position in these areas.

The three areas of research mentioned above all represent highly complex systems. As such, these areas should not be evaluated on short-term annual performance (such as PART). The recent NAS report on the effectiveness of STAR emphasized this point ("The Measure of STAR", NAS, 2003). Such complex research programs require more, not less, investment to make substantive and effective progress (OECD, 2003).

As an example of the value of the extramural funding within a program, the STAR program on Mercury was to be focused on understanding the fate, transport, and exposure of mercury. However, we currently assume that the U.S. exposures to mercury are largely from coal-fired power plant emissions, and estimates of the cost to control mercury emissions from these sources are estimated to be as high as $2 Billion per year. The investment of $2 Million in research to truly understand and assess exposure from all sources is a wise investment in that this research provides the information necessary to make risk-informed decisions about source controls.

Finally, the elimination of support for these STAR programs has implications beyond EPA for achieving scientific progress in these areas. Several of these programs are conducted in coordination with other Federal partners, and the loss of EPA support will result in the loss of the entire collaborative effort. For example, the elimination of the STAR grants for the Endocrine Disruptor program will result in the loss of approximately 18 STAR grants of which 50% correspond to EPA funding.

2.5.1.1 Homeland Security Under Superfund (Goal 4)

The agency has been involved in several aspects of homeland security including work on biologic threats (development and validation of environmental sampling, analysis, and decontamination methods for known and emerging biological agents) and developing scientifically defensible and cost-effective building decontamination methods after a biological or chemical attack. The Agency clearly understands the high priority of these efforts as seen by the 2 million dollar increase in the area of biologic threats. However the Board has serious concerns about the elimination of the building decontamination research for several reasons, not the least of which is, the importance of this effort to the national concerns in Homeland security. With the elimination of this program, after the expenditure of millions of dollars to develop the expertise and staff in the agency, the fruits of the national financial, research, and personnel investment will not be realized. The SAB believes the existing and future expertise of the Agency is well positioned to address and complete the core homeland security research responsibilities it is currently assigned, and that this expertise is configured to address new national biologic and chemical threats in the future. The immediate loss of the $8.3 million in funding supporting these efforts jeopardizes the Agency's ability to fully capture the value of this research, and diminishes the ability of the agency to be proactively prepared to address future challenges. This investment in the development of improved cost effective methods could easily be returned to the nation by using more cost effective methods in the decontamination of just one small building.

2.5.2 Science and Technology Research in Relation to National Program and Regional Office Science and Research (Goal 4)

The EPA ORD science and research efforts appear to be well-integrated within EPA. However, the loss of extramural programs will compromise the Agency's effectiveness. The elimination of STAR grants for ecosystem protection leads to the loss of understanding the connection between ecosystem stressors and effects. The elimination of STAR grants for mercury leads to the loss of understanding the integrated fate, transport, and effects of mercury to human health and the environment. The elimination of STAR grants for endocrine disruptors leads to the loss of understanding regarding fate, transport, and effects of endocrine disruptors.

2.5.3 EPA Science and Research Alignment with Emerging Issues (Goal 4)

The agency appears to have identified many of the critical and emerging health and environmental issues facing the nation. Through their development of multiyear plans, the agency has adopted a risk-informed approach to aligning science priorities and budgets. This approach allows the Agency to effectively focus their research efforts in areas of highest risk reduction impact.

The Agency has appropriately provided for increased investment in computational toxicology and bioinformatics. These investments will provide for development of core expertise and new and refined methodologies necessary for integration of the emerging sciences, genomics and proteomics, into health and environmental assessments. EPA needs to continue to invest in more proactive research that focuses on establishing the relationships between stressors and effects (e.g., emerging areas such as nanotechnology, invasive species, as well as conventional contaminants such as mixtures). Given emerging national investments in public outcome studies, e.g., the National Children's Health Study, there is a need for EPA to continue to provide scientific expertise and resources in exposure and other health based sciences to effectively and efficiently engage and support these large interagency national efforts.

The elimination of STAR program funding in selective key areas reduces the EPA's capacity to efficiently address emerging environmental issues. The STAR program provides the agency with expanded capacity to rapidly and effectively tap into external scientific resources that may not be available within the Agency. The STAR program also allows the Agency to develop and attract new scientists and new disciplines into the evaluation of emerging environmental issues, enhancing the depth and breadth of future science capacity brought to bear on national environmental concerns.

The reduction in the STAR program funding is primarily directed at ecological research. The previously cited NAS peer review of STAR included an evaluation of ecological indicators. The NAS concluded that, "The US Environmental Protection Agency's competitive research grants program has yielded significant new findings and knowledge critical for EPA's decision making process". A citation analysis of ecological indicators grants, "indicated that the rate of citations of STAR funded research was similar to other research in the field." The Board agrees with the NAS evaluation of the strong benefits to science from the STAR program

2.5.4 Science and Technology Research in Relationship to Research in the External Scientific Community (Goal 4)

EPA's science and research programs in the area of Ecosystem, Mercury, and Endocrine Disruptors are coordinated with other agencies' programs through the White House Office of Science and Technology Policy, and are critical components of the nation's efforts in these areas. The elimination of the STAR grants in these areas removes a critical link supplied by the EPA that will have domino effects on the entire government program. In addition, elimination of the EPA's Homeland security research will reduce national overall interagency effectiveness and preparedness in this critical arena.

EPA's research on global climate change contributes to knowledge developed by other agencies. As part of the U. S. Climate Change Science Program (CCSP), EPA is the lead or co-lead on three of the 21 synthesis products and supports seven other synthesis products. These efforts constitute only 0.26 percent of EPA's FY 2005 overall budget, and 4.04 percent of EPA's research budget. However, this small amount of funding addresses a critical domain of environmental change and the proposed decrease of 3.9 percent for global climate change research in EPA's FY 2005 budget should be reconsidered.

The EPA needs to assess the functional and strategic implications of this limited research program on its responsibilities addressing Climate Change issues, and accordingly adjust the future program scope. The Board strongly recommends that EPA's climate change program funding be significantly increased. Climate change poses long-term complex impacts and challenges for adaptation and mitigation that requires sustained science and technology capabilities and ongoing research.

2.6 Goal 5 – Compliance and Environmental Stewardship

2.6.1 Research and Strategic Goal Alignment (Goal 5)

There appears to be inconsistency between the stated objectives in goal 5 (improving compliance, preventing pollution, and enhancing environmental performance, and building tribal environmental capacity) and the science and research budget cuts.

The goals of increased compliance, pollution prevention, and environmental stewardship via increased emphasis on voluntary actions represent a fundamental change in regulatory strategy. Yet the economic, social, and decision science needed to understand the likely and potential effectiveness of such strategies is in its infancy. Previous work in the social sciences has largely focused on the consequences of command and control and incentive-based regulation (such as taxes or permit programs). This is distinctly at odds with purely voluntary approaches based on information provision, changing social norms to induce "sustainable" lifestyles, and other notions of stewardship embodied in the goal. If the agency is to seriously pursue this approach, a significant influx of research funds to support the relevant social sciences will be critical.

There appears to be no coherent short term or long term research strategy that integrates the social sciences into the other programs that would benefit from advancements in innovation, pollution prevention, sustainability and stewardship. Background information provided to the Board notes that a Multi-Year Plan for "Economics and Decision Sciences" is under development and some of the necessary research topics seem to be intended for inclusion in that MYP. However, more is necessary. A number of SAB Committees and panels have completed work that could aid in the development of such an overarching strategy (*Toward Integrated Environmental Decision-Making*, EPA-SAB-EC-00-011, *Commentary Resulting from a Workshop on the Diffusion and Adoption of Innovations in Environmental Protection: A Commentary by the EPA Science Advisory Board*, EPA-SAB-EEC-COM-01-001, *Improved Science-Based Environmental Stakeholder Processes: A Commentary by the EPA, Science Advisory Board*, EPA-SAB-EC-COM-01-006, *Understanding Public Values and Attitudes Related to Ecological Risk Management: An SAB Workshop Report of an EPA/SAB Workshop* EPA-SAB-EC-WKSP-01).

Pollution Prevention - The science and technology account for pollution prevention would be cut by almost $5 million or about 12%. A cut of this magnitude is of concern given the importance of pollution prevention in achieving the Agency's long term goal of environmental stewardship. The Board wishes to raise this concern in a broader context, one that makes it clear that the issue involves an appropriate mix of both private and public spending on research, as well as the implications of these cuts on the Agency's own research program. It has often been argued that the private sector is better placed to do successful research leading to innovative technological changes for pollution prevention because of firms' knowledge of their own production processes. However, it is clear that successful pollution prevention research must proceed as a collaborative effort between EPA (who has knowledge of the multi-factorial issues that interrelate to maintain a healthy environment that supports humans and other organisms) and the private sector (who has intimate process and other knowledge).

An important element of this effort will be to induce more private sector research on pollution prevention. For this, we will need stronger incentives, especially market-based incentives that reward pollution prevention with lower costs and higher profits. These incentives could take the form of cap and trade programs, taxes on pollution discharges, deposit-refund systems, disposal fees, and so forth. The Board believes that the Agency should devote more resources to research on market mechanisms and incentives aimed specifically at rewarding pollution prevention. This could be done by some combination of increased support for the market mechanisms and incentives component of the Economics and Decision Sciences program under ORD and additional support for the National Center for Environmental Economics.

The second of the complimentary elements of this well-balanced pollution prevention research program will be Agency-supported research on pollution prevention, such as, life cycle-based decision making, new methods of systems control, development of robust databases for product manufacturing, and applications of the principles of industrial ecology to other types of non-private entities (e.g., municipalities and non-governmental agencies), and non-manufacturing sectors (e.g., service and recreational sectors). Such research is best carried out through Agency internal programs and the STAR research program.

Improve Compliance - The Agency states on page V-17 of the Congressional Justification document that it wants to maximize compliance and to act forcefully to discover /determine violations. Yet, at the same time, the EPA has removed $7 million in science and research to support compliance (pp. V-1, V-78), including cuts for example in NEIC.

Improve Environmental Performance - In the area of pollution prevention and environmental performance, similar apparent inconsistencies occur. On the one hand, EPA says it is shifting responsibilities to the states (p V-12), strengthening the role of state governments (p. V-25) and emphasizing community policing (p. V-24). On the other hand, since 2004, EPA has cut research for pollution prevention by almost $5 million (p. V-78). In addition, ETV was cut by just over $1 million, despite the Agency's indication that this work is essential (p. V-84).

2.6.2 Science and Technology Research in Relation to National Program and Regional Office Science and Research (Goal 5)

The agency's economists primarily reside within the National Center for Environmental Economics (NCEE) which is separate from the Office of Research and Development. This has the distinct and important advantage of creating a strong core economics group. However, it may be challenging when doing strategic planning for research, as it tends to separate the economic and social science research from the whole. While we learned from agency representatives that NCEE staff and others are involved in the research budget planning process, the lack of integration of economics into the Goal 1 through 4 presentations raises the concern that this integration is incomplete. Specifically much of the work that the NCEE does, as well as the four long term goals identified under "Economics and Decision Sciences" within the ORD presentation clearly should be used to support the attainment of goals 1 through 4 and are not directly (or indirectly) related to pollution prevention or stewardship --- the goal 5 concern.

Furthermore, while the agency has made progress in the development of an internal coherent economics research group, there is no evidence of such progress for any of the other social sciences. This focus is essential to position the agency to address emerging environmental issues in our changing culture.

This lack of integration of economics and social science research into Goals 1 through 4 may largely reflect the significant under-funding of research (e.g., the economics and decision science component). While the research undertaken under the auspices of ORD (including the NEIC budget), social science research appears vastly under-funded in the agency.

It is critical to continue with funding of the Pollution Abatement Control Expenditures (PACE) survey, as this is the sole source of significant amounts of information concerning the costs of meeting environmental regulations. Without this information, it will be impossible to track and understand the costs of meeting environmental performance measures or the cost savings associated with innovative programs in the agency.

2.6.3 EPA Science and Research Alignment with Emerging Issues (Goal 5)

With the growing population in the U.S., increased demand for environmental resources, changing standards of living and performance expectations, there is a need to increase our understanding of people's views and responses to environmental concerns. Thus, increased research in the social sciences is essential to understand organizational, individual, and group concepts and behaviors associated with environmental issues.

Several areas of important research related to decision-making under uncertainty, bio-complexity and systems analysis are not included in the research agenda. Many of our most difficult environmental problems are associated with multiple stressors, and will require more extensive systems strategies. For example, Chesapeake Bay non-point pollution problems and Midwest water quality concerns require new, systems based approaches that do not easily fit within the previous paradigm.

2.6.4 Science and Technology Research in Relation to Research in the External Scientific Community (Goal 5)

It is important to recognize that in some areas, EPA will be the exclusive source of science because of EPA's specific mandates and authorities. In addition, the science needs associated with methods for compliance (NEIC) and assistance to tribes will not have other sources of funding. While private research can be effective in developing cost saving methods for pollution reduction and/or prevention, there can be no substitute for public funding that will result in public good benefits. For example, development of fundamental knowledge about human behavior will not accrue benefits to individual companies, and so will not be undertaken by them. Additionally, disenfranchised or underserved groups (such as tribes) require public assistance to develop a broader array of culturally sensitive science based approaches.

However, EPA should continue to think about ways to leverage their research resources within the broader research community. One approach may be to partner more extensively with other public agencies and private, nonprofit entities to jointly fund research, especially in the social sciences area. Both the NIH and the CDC have followed such strategies. EPA's own ETV program is a good within agency model, though it is limited to technology transfer.

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