

March 17, 2000

EPA-SAB-RSAC-00-007

Honorable Carol M. Browner
Administrator
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue, NW
Washington, DC 20460

Subject: An SAB Report: Review of the FY2001 Presidential Science and Technology Budget
Request for the Environmental Protection Agency

Dear Ms. Browner:

On February 23 and 24, 2000 the Research Strategies Advisory Committee (RSAC) of the Science Advisory Board (SAB) met to review the Science and Technology component of the FY2001 Presidential Budget Request for the US Environmental Protection Agency (EPA). As in past years this report was developed by the entire RSAC in a rapid response fashion before the Congressional hearing on EPA's Science and Technology budget. RSAC's report was approved by SAB's Executive Committee during a public meeting on March 8, 2000.

The Committee was pleased to see the Agency has continued to make marked improvements in the budget and planning process. In particular, the committee commends the initiative taken by the Agency's Office of Research and Development to build upon the Government Performance and Results Act (GPRA) framework that has been developed for Agency planning and budget development. Innovations such as developing an inventory of science activities in the Agency, beginning to construct an Agency-wide science strategy and developing basic principles for how to do it, piloting a series of multi-year planning processes and developing futures assessments can significantly improve the science planning and budgeting process if implemented effectively.

Special concerns were the need for additional scientists and engineers to maintain core competencies and the observation that programs for which EPA has no statutory authority to regulate (e.g., indoor air and Naturally Occurring Radioactive Material) receive consistently low budget priorities despite their potentially high impacts on the environment and public health. Also, long-term research projects are at special risk because they are terminated or truncated due to cost-cutting imposed to provide the resources needed to respond to high-priority, short-term needs.

As part of the review process, the RSAC responded to six charge questions:

- a. Can the objectives of the research and development program in ORD and the broader science and technology programs in EPA be achieved at the resource levels requested?

The Presidential budget request levels were similar to the levels requested in the last two years. The science and technology activities included in the request were selected using a process similar to that used in the previous year. This involved a priority-setting process that identifies the highest environmental risks within each environmental goal established in the EPA Strategic Plan and uses the sound scientific principles of the risk assessment/risk management framework. The RSAC found the funding request priorities to be consistent with the environmental goals established in the Agency's Strategic Plan. However, RSAC is concerned about the impacts of the hiring freeze at EPA which prevents ORD from hiring postdoctoral fellows and other scientists needed by the Agency to provide continuity in the research program to meet program needs, and to maintain the core competencies needed to ensure that EPA has the scientific ability to address emerging environmental issues.

RSAC concurs with the Agency's increased science emphasis on endocrine disruptor chemicals, epidemiology of particulate matter, cumulative risks/intermittent exposure, drinking water Candidate Contaminant List (CCL) pollutants, Resource Conservation and Recovery Act (RCRA) corrective action, global change assessment, ecosystem research and monitoring, and children's environmental health. Nonetheless, RSAC reiterates its concerns expressed previously relative to the adequacy of the overall level of the Science and Technology budget to address ever more complex environmental issues. Although ORD was not able to share with RSAC its own priorities for research efforts that would have been proposed for the FY2001 budget had its budget ceiling been higher, drinking water CCL, tropospheric ozone, RCRA corrective action, endocrine disruptors, ecosystem, and combustion science are examples of project areas from our members' areas of expertise that we believe need even more resources. Undoubtedly, other research project areas also have great merit for immediate funding.

- b. Does the budget request reflect priorities identified in the EPA and ORD-Strategic Plans?

As with recent budget requests, ORD and Program Office Science and Technology budgets have aligned with the priorities for FY2001, with the Agency and ORD strategic plans, and with the Agency's Government Performance and Results Act (GPRA) goals. However, RSAC concluded that the budget for several potentially high risk, high uncertainty and/or high cost areas is not adequate, including: naturally occurring radioactive material (NORM); indoor air quality; and Non-Aqueous Phase Liquids (NAPL) remediation technologies. Our overall impression is that the budget is reasonably consistent with the stated priorities of the strategic plans, but we are concerned that some important research needs are unfulfilled because they are not given priority in the plans or, in some cases, do not even appear in those plans.

- c. Does the budget request reflect coordination between ORD and the Program Offices?

The Committee was impressed with the progress made in the past year in heightening the level of interaction between ORD and Program Offices. Evidence of this effort was provided in a variety of ways. First, the Scientific Inventory explicitly identifies the science activities of many Program Offices. Second, a high degree of coordination is evidenced by the explicit coupling of ORD's research portfolio to specific goals of the program office. Finally, there was the explicit acknowledgment by some of the program offices that research was an important underpinning of many regulatory actions.

The Agency has further improved the coordination between ORD projects and the needs of the program offices, and we can see that the program office needs are well integrated into the ORD budget request. There were good indications of communication and responsiveness of ORD efforts to support program offices needs. There are also excellent examples of ORD and Program office teams working together on specific issues, such as in the area of particulate matter. RSAC recommends that the Agency continue to expand these joint efforts. In addition, for the first time the Agency has developed an inventory of all of the science activities underway at the Agency. The inventory is a critical tool for further coordination of science activities across all offices. Without it effective coordination is not possible.

- d. Does the budget request support a reasonable balance in terms of attention to core research on multimedia capabilities and issues and to media-specific, problem-driven topics?

The RSAC concludes that the Office of Research and Development budget request is appropriately balanced between core research (~44%) and problem-driven research (~56%). However, the reasons for the distribution of projects between these two categories is not always obvious. As importantly, the Agency needs to focus on maintaining and securing the core competencies that it will need to address current and unforeseen future environmental impacts. On this point, the environmental fellowship and postdoctoral programs are important components that improve the vitality of the EPA work force.

- e. Does the budget request balance attention to near-term and to long-term research and science and technology issues?

It is difficult to assess the proper balance of long-term and short-term science and technology issues. Nonetheless, RSAC has a continuing concern about the over-emphasis on shorter-term issues. The Agency needs to move forward with a multi-year planning process or "road map" that lays out the steps it plans to take to use science to increase its understanding of environmental impacts and ways to

prevent them. The road map also needs to show how EPA plans to sequence and integrate the steps it plans to take to reach these science goals and how reaching them will better inform Agency decision-making. It will be difficult to properly maintain a sustained focus on these longer-term issues with a yearly budget planning process as opposed to a multi-year budget planning process. An explicit approach that incorporates the requirements of longer-term research programs within the short-term budgetary process needs to be developed. We reiterate our recommendation that the Agency strengthen its strategic planning processes to fund the longer-term research on critical environmental issues that transcend the year-to-year budget framework. The Committee believes that emerging issues need to have ongoing stable support, because EPA is the key Agency responsible for aggressively watching for critical new environmental threats to human health and to ecosystems.

- f. How can EPA use or improve upon the Government Performance and Results Act (GPRA) structure to communicate research plans, priorities, research requirements, and planned outcomes?

The GPRA-goals structure used by the Agency to organize its FY2001 budget request provides a clear picture of how the research and science programs relate to EPA's overall mission. The Committee applauds EPA's efforts to use case studies as pilot efforts to map out research program plans over many years. We look forward to the expansion of these pilots to include more- and ultimately all- of the Science and Technology (S&T) budget. As the Agency moves to update its Strategic Plan, RSAC recommends that it move forward with evaluations of research programs by environmental outcomes rather than outputs. As noted above, RSAC encourages the Agency to build on the science inventory and strategic principles currently under development and to move to a multi-year planning process for research that includes annual performance goals and outcomes on the critical path of activities for achieving each major environmental objective.

We appreciate the opportunity to review and provide advice on the Science and Technology component of the FY2001 Presidential Budget for EPA. The Research Strategies Advisory Committee would be pleased to expand on any of the findings in our report, and we look forward to your response.

Sincerely,

/signed/

Dr. Morton Lippmann, Interim Chair
Science Advisory Board

/signed/

Dr. William Randall Seeker, Chair
Research Strategies Advisory Committee
Science Advisory Board

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ABSTRACT

The Research Strategies Advisory Committee (RSAC) of the Science Advisory Board (SAB) met February 23 and 24, 2000 to review the Science and Technology portion of the FY2001 Presidential Budget Request for the US Environmental Protection Agency. RSAC felt that EPA has continued to make marked improvements in the budget and planning process. It found the request to be appropriately prioritized based on the Agency Strategic Plan, but it had reservations about the adequacy of the overall funding level given the increasing complexity and cost of environmental problems. Special concerns were the need for additional scientists and engineers to maintain core competencies and the observation that programs for which EPA has no statutory authority to regulate (e.g., indoor air and Naturally Occurring Radioactive Material) receive consistently low budget priorities despite their potentially high impacts on the environment and public health. Progress has been made to heighten the level of interaction between the Office of Research and Development (ORD) and Program Offices. RSAC notes that many of the problems confronting the Agency are not solvable by the “media-specific” driven research. Thus, it is critical that the Agency maintain its core research program. The balance between long-term and short-term research needs and science and technology issues seems appropriate (e.g., in recent years, the Agency has initiated numerous long-term research efforts in the areas of children’s health, global climate change, coastal ecosystem health, and dry deposition monitoring), but there is still no overall explicit approach to incorporate the requirements of longer-term research programs within the short-term budgetary process. Research on emerging issues needs to have ongoing, stable support because EPA is the key Agency responsible for aggressively watching for critical new environmental threats to human health and to ecosystems. The Government Performance and Results Act (GPRA) goals structure provides an excellent framework for aligning research priorities with the resources allocated to perform the work. However, RSAC is concerned that annual performance goals are still focused on specific products (i.e., reports, data collected, etc) and recommends that the program goals should focus instead on outcomes, and that the annual performance goals be related to milestones aimed towards achieving the long-term objectives identified in the Strategic Plan.

Keywords: GPRA, budget, research, strategic planning

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SCIENCE ADVISORY BOARD
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1. EXECUTIVE SUMMARY

On February 23 and 24, 2000, the Research Strategies Advisory Committee (RSAC) of the Science Advisory Board (SAB) reviewed the FY2001 Presidential Budget Request for the US Environmental Protection Agency (EPA). The Committee was pleased to see that the Agency has continued to make marked improvements in the budget and planning process. In particular, the committee commends the initiative taken by the Agency's Office of Research and Development (ORD) to build upon the Government Performance and Results Act (GPRA) framework that has been developed for Agency planning and budget development. Innovations such as developing an inventory of science activities in the Agency, beginning to construct an Agency-wide science strategy and a set of principles for how to implement it, piloting a series of multi-year planning processes, and developing ways to conduct futures assessments are actions that can significantly improve the science planning and budgeting process if implemented effectively.

As part of the review process, the RSAC responded to six charge questions.

- a) Can the objectives of the research and development program in ORD and the broader science and technology programs in EPA be achieved at the resource levels requested?

RSAC found the funding request to be appropriately prioritized based on the Agency Strategic Plan, but the Committee continues to have reservations about the adequacy of the overall funding level given the increasing complexity and cost of environmental problems. An influx of new researchers is required in order to maintain core competencies that ensure continuity in the research, and to be prepared to address newly emerging issues. This is particularly important given that ORD has a aging workforce. It is critical that ORD find some way to bring additional scientists on board to ensure that EPA's current and future science needs are met.

Areas of emphasis highlighted in the FY 2001 plan identify major science and technology issues that, with some exceptions, reflect the highest environmental priorities identified by the risk assessment/risk management framework. ORD was not able to share with RSAC its own priorities for research efforts that would have been proposed for the FY2001 budget had its budget ceiling been higher. We suspect that numerous research project areas have potential benefits for EPA's regulatory and guidance programs that would far outweigh the costs of the research and are therefore excellent candidates for funding. Example project areas from our members' areas of expertise that we believe to have such favorable benefit/cost characteristics include tropospheric ozone, RCRA Corrective Action, endocrine disruptors, drinking water Candidate Contaminant List (CCL), combustion research, and ecological research. Undoubtedly, other research project areas also have great merit for immediate funding. The RSAC also feels that the Agency needs to more fully integrate the risk assessment paradigm into the strategic planning process.

- b) Does the budget request reflect priorities identified in the EPA and ORD Strategic

Plans?

In general, the RSAC was able to understand from the information provided about how items in the budget relate back to the goals and objectives stated in the EPA and ORD strategic plans. Although RSAC did not always understand how the size of a particular request reflected the priorities assigned in the plans, there were no obvious inconsistencies.

RSAC suspects that omissions in research activities often relate to the lack of a legislative authority or executive mandate to pursue the issue at hand. For example, naturally occurring radioactive materials (NORM) and indoor air are good candidates for high Agency research priorities, but EPA has no statutory authority to regulate either indoor air or NORM and these issues have received consistently low budget priorities over the years.

c) Does the budget request reflect coordination between ORD and the Program Offices?

The Committee was impressed with the progress made in the past year in heightening the level of interaction between ORD and Program Offices. Evidence of this effort was provided in a variety of ways. First the Science Inventory explicitly identifies the science activities of many Program Offices. Second, a high degree of coordination is demonstrated by the explicit coupling of ORD's research portfolio to specific goals of the program office. Finally, there was the explicit acknowledgment by some of the program offices that research provided an important basis for many regulatory actions.

The Agency has further improved the coordination between ORD projects and the needs of the program offices, and we can see that the program office needs are well integrated into the ORD budget request. There were good indications of communication and responsiveness of ORD efforts to support program offices needs. The Office of Pollution Prevention, Pesticides and Toxic Substances (OPPTS) and the Office of Air Programs (OAR) presentations provided the strongest evidence of this. In the latter case, the Agency effort to understand the effects of exposure to PM_{2.5} and to prevent harm to human health and the environment is a very good example of how a highly coordinated and synergistic program has been built between the research and regulatory programs of the Agency.

d) Does the budget request support a reasonable balance in terms of attention to core research on multimedia capabilities and issues and to media-specific problem-driven topics?

The FY2001 ORD request allocates approximately 44% and 56% of the budget, respectively, to core and media-specific research areas, consistent with the National Academy of Sciences (NAS) past recommendations and with ORD's strategic plan. RSAC is encouraged by the continued efforts of ORD to improve coordination with the Program Offices so its projects can better meet program needs. The criteria used for the classification of research activities as "core" or "problem-driven" are not always obvious and should be clearly stated and applied consistently. It is most important to maintain

core research capabilities, as many of the problems confronting the Agency are not solvable by the “media-specific” driven research.

- e) Does the budget request balance attention to near-term and to long-term research and science and technology issues?

The Agency has given thoughtful consideration to both long-term and short-term research needs and science and technology issues. In recent years, the Agency has initiated numerous long-term research themes (e.g., children’s health, global climate change, coastal ecosystem health, and dry deposition monitoring). However, there is still no overall explicit approach to incorporate the requirements of longer-term research programs within the short-term budgetary process. Long-term research projects are at special risk because they are terminated or truncated due to cost-cutting imposed to provide the resources needed to respond to high-priority, short-term needs. RSAC notes that the upcoming change in administration also places long-term research projects at risk. RSAC urges the establishment of a mechanism to identify and pursue emerging issues because recognition of such issues often forms the bases for future research and science and technology programs and may aid in the timely identification of environmental problems before they become major problems with sizable impacts and remedial costs. The Committee believes that emerging issues need to have ongoing, stable support because EPA is the key Agency charged to watch aggressively for critical new environmental threats to human and ecological health.

- f) How can EPA use or improve upon the Government Performance and Results Act (GPRA) structure to communicate research plans, priorities, research requirements, and planned outcomes?

EPA uses the GPRA goals structure to organize its budgets. This format provides an excellent framework for showing the alignment of the research priorities with the resources allocated to perform the work. RSAC is concerned that annual performance goals are still focused on specific products (reports, data collected, etc.) rather than on the improved understanding of environmental functions and processes. The Committee recommends that the program goals should focus on outcomes rather than outputs and that the annual performance goals truly relate to achieving the identified objectives in the Strategic Plan.

2. INTRODUCTION

2.1 Background and Schedule

RSAC is made up of members from most of the other standing committees of the SAB. The Committee has reviewed the Office of Research and Development's (ORD) budget request annually for more than a decade. This is the second year that all of the Science and Technology components in Agency Program Offices were reviewed and the third year that a GPRA goal-based budget was presented. The purpose of the review is to provide the Agency and Congress with advice and insight on the adequacy of the FY2001 budget request to implement a science program of high quality that is responsive to the Agency's needs. The Committee was provided with background documents supplied by the Agency, supplemented by briefings from Agency senior managers during the meeting.

The Science Advisory Board (SAB) review of the proposed Science and Technology budget for the Environmental Protection Agency is normally an annual event. The timing associated with the public availability of the budget materials often makes scheduling of a formal review difficult. Reviews completed by RSAC also require formal public review and approval of the SAB's Executive Committee. This year, the budget materials were released in early February, with the review materials made available to the Committee on February 8th. The Committee met on February 23 and 24, 2000, with formal review and approval by the Executive Committee completed on March 8, 2000.

Generally, the Chair or another Member of the RSAC provides expert testimony to the House Committee on Science during its annual budget hearings, which are normally scheduled shortly after the release of the proposed budget. This year's budget hearing will be held on March 23, 2000, with Dr. Seeker testifying on behalf of RSAC.

2.2 Charge to the Committee

- a) Can the objectives of the research and development program in ORD and the broader science and technology programs in EPA be achieved at the resource levels requested?
- b) Does the budget request reflect priorities identified in the EPA and ORD Strategic Plans?
- c) Does the budget request reflect coordination between ORD and the Program Offices?
- d) Does the budget request support a reasonable balance in terms of attention to core research on multimedia capabilities and issues and to media-specific problem-driven topics?
- e) Does the budget request balance attention to near-term and to long-term research and

science and technology issues?

- f) How can EPA use or improve upon the Government Performance and Results Act (GPRA) structure to communicate research plans, priorities, research requirements, and planned outcomes?

Responses to these questions, and other issues the Committee wishes to address, are provided to both the Agency and the Congress.

2.3 Format of this Report

Following the Executive Summary and this Introduction, this report provides specific responses to the questions in the Charge to the Committee (Chapter 3).

3. RESPONSE TO THE CHARGE

3.1 Objectives Versus Resource Levels Requested

Charge Question: Provide advice on whether the objectives of the research and development program in ORD and the broader science and technology programs in EPA can be achieved at the resource levels requested

The Presidential budget request levels were similar to the levels requested in the last two years. The science and technology activities in the request were selected similar to last year, involving a priority-setting process that identifies the highest environmental risks within each environmental goal established in the EPA Strategic Plan and using the sound scientific principles of the risk assessment/risk management framework. The RSAC found the funding request priorities to be consistent with the environmental goals established in the Agency Strategic Plan. However, RSAC is concerned about the impacts of the hiring freeze at EPA which prevents ORD from hiring postdoctoral fellows and other scientists needed by the Agency to ensure continuity in the research program, to meet program needs, and to maintain the core competency needed to ensure EPA has the scientific ability to address emerging issues.

An influx of new researchers is required to maintain core competencies. This is particularly important because ORD has an aging workforce. ORD has attempted to solve this problem through its postdoctoral fellowship program, but the EPA hiring freeze prevents ORD from hiring postdoctoral fellows this year and for the foreseeable future. It is critical that ORD find some way to bring additional scientists on board to ensure that EPA's current and future science needs are met.

RSAC was pleased to see that the Agency developed the ORD Strategic Plan for FY 2001 as an outgrowth of the previous year's effort. We feel it is necessary to emphasize that most of the programs and problems confronted by the Agency do not lend themselves to short-term answers but instead are only resolved through multi-year research efforts. Areas of emphasis in the FY 2001 plan identify major science and technology issues which, with some exceptions, reflect the highest environmental priorities identified by the risk assessment/risk management framework. ORD was not able to share with RSAC its own priorities for research efforts that would have been proposed for the FY2001 budget had its budget ceiling been higher. We suspect that numerous research project areas have potential benefits for EPA's regulatory and guidance programs that would far outweigh the costs of the research and are therefore excellent candidates for funding. Below, we list example project areas from our members' areas of expertise that we believe to have such favorable benefit/cost characteristics. Undoubtedly, other research project areas also have great merit for immediate funding.

a) Tropospheric Ozone

Although tropospheric ozone research has been increased slightly in the proposed budget, the level of support is insufficient to meet Agency needs. There is still a significant lack of knowledge on the full range of atmospheric processes that lead to ozone formation and accumulation, and on the relative importance of major precursors (e.g., NO_x, hydrocarbons) in control strategies. There are also significant knowledge gaps in atmospheric chemistry pathways that are common to both ozone and secondary particle formation; without this understanding it may be difficult to achieve either PM or ozone compliance with the NAAQS. Knowledge about the major determinants of exposure to ozone and PM, as well as the health effects from the combined exposures to these pollutants is also limited. A better understanding of tropospheric ozone will require more support than is currently being proposed.

b) RCRA Corrective Action

RCRA correction action is an effective regulatory program which has very high potential for cleaning and restoring our land and water resources. However, a significantly greater budget needs to be allocated to this initiative in order to assure achieving EPA's GPRA goal and objectives for corrective action. Integration of technical and engineering experiences for use by the EPA regions that are implementing the RCRA corrective actions requires significantly more funding than that currently proposed if we are to restore contaminated sites to productive use and to reduce health risks to acceptable levels at each site.

c) Endocrine disruptors

It is a concern of the RSAC that in EPA's effort to reach each of its GPRA goals, it may overlook or not provide for the essential research needed to reach those goals. For example, under the endocrine disruptor program, five essential effects-related goals were presented in the budget narrative that, in the long-term, will begin to meet the Agency's mandate under the 1996 FQPA and amendments to the SDWA. However, the critical research that will provide the foundation for meeting those goals is not apparent in the budget narrative, is not clearly defined in any budget line, nor is it reflected in the Agency's 2001 budget request. The 1996 FQPA and amendments to the Safe Drinking water Act (SDWA) directed EPA to:

develop a screening program, using appropriate validated test systems and other scientifically relevant information, to determine whether certain substances may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or other such endocrine effects as the Administrator may designate.

EPA was to design a screening program for chemicals of this nature by August, 1998, which it

did through the use of the Endocrine Disruptors Screening and Testing Advisory Committee (EDSTAC). The EDSTAC recommendations included a set of four *in vitro* and seven *in vivo* screens for Tier One screening and a set of three mammalian reproductive and four multigenerational tests in other taxa for Tier Two testing. EPA was to implement the program by August, 1999 and report to Congress in August, 2000 on the effectiveness of the program. The recommended screens and assays required further testing and modification, as well as standardization, and validation before they could be applied under FQPA or SDWA. Not one of the screens or tests has been standardized or validated yet and the budget request is insufficient to support the R&D required for these efforts. It is critical that the screens and tests be standardized or validated before any testing for endocrine disruption is done to ensure it is done appropriately.

d) Candidate Contaminant List

The Candidate Contaminant List (CCL) serves as a driver for research under the SDWA. The briefing material provided a long list of contaminants that are to be regulated in the next two years. This list serves to identify those contaminants (both microbial and chemicals) for which research information will be needed. The budget allocated (\$48.9M) appears inadequate to meet the stated objectives for the diverse research (occurrence, exposure, health effects and remedial action work) that will underpin these major environmental regulations. The many and varied agents involved demand a diverse set of research activities. For example, current methods for detection of pathogens such as *Cryptosporidium* are too insensitive to meet regulatory goals. Risk assessments for key contaminants and populations (e.g., arsenic, copper, dichloroacetic acid, microbial pathogens in immunocompromized individuals) require much more complete information than is currently available. The Agency's plans to explicitly consider sensitive individuals add significantly to this research burden. In addition, there are many precedent-setting rules that will have to deal with modes of action not explicitly addressed in previous regulations in order to properly consider alternative technologies for remediation. Consequently, the Agency will have to carefully consider its research priorities to determine what information it will need to meet the most important of its regulatory goals in this area.

e) Combustion Research

There has been a steady decline in the combustion science research conducted at the Agency. Combustion remains today the dominant source of power production, transportation, and waste treatment in today's society. This dominance is likely to continue for many years to come. Combustion-based sources also generate significant quantities of many types of pollution including ozone and acid rain precursors, fine particulate matter and air toxics. For this reason, the Agency must enhance its core competency in combustion science including combustion chemistry, characterization and monitoring systems, combustion generated pollutants and

control technologies.

f) Ecological Research

The responsibilities of the EPA extend to the protection of ecological health as well as human health issues. RSAC is concerned that the level of research funding presently allocated to ecological research is not adequate to address the numerous risks imposed by chemical, physical, and biological stressors on varied ecological resources. In the case of ORD, for example, the Sound Science goal support is decreased for FY 2001. Only global change research shows a significant increase in support from FY 2000 to FY 2001. Both Integrated Science for Ecosystem Challenges (ISEC) and the Coastal Monitoring Initiative program are scheduled for extremely modest increases. Unlike human health concerns, ecological health issues frequently lack organized, special interest support. As a result the Agency has a special responsibility to expand efforts to protect ecosystems. Human health is ultimately and intimately linked to the health of our Nation's ecosystems.

3.2 Budget and Priorities in Strategic Plans

Charge question: How well does the budget request reflect priorities identified in the EPA and ORD strategic plans?

In general, the RSAC was able to understand from the information provided how items in the budget relate back to the goals and objectives in the EPA and ORD strategic plans. Although we did not always understand how the size of a particular request reflected the priorities assigned in the plans, neither did we find any obvious inconsistencies. In the future, RSAC recommends that the Agency be more specific relating the budget requests to Agency priorities.

Our overall impression is that the budget is reasonably consistent with the stated priorities of the strategic plans, but we are concerned that some important research needs may remain unfulfilled because they are not given priority in the plans or in some cases may not even appear in those plans. RSAC suspects that these omissions often relate to the lack of a legislative authority or executive mandate to pursue the issue at hand. If the Agency believes that a particular program proposal may fail to gather support from either the Executive Branch or the Congress because of such a lack of authority, then it is less likely to propose that program over others with lower scientific priority but with obvious authorities or mandates. Even if the program is proposed, the proposed budget may be less than might be justified by the magnitude of the risks addressed and the degree of uncertainty in those risks. Two examples of such "orphan risks" are Naturally Occurring Radioactive Materials (NORM) and hazardous constituents in indoor air.

Screening-level calculations of the individual and population-wide risks of NORM suggest that they may well be of the same order of magnitude or higher than the corresponding risks posed by other materials (e.g., chemical wastes) that are highly regulated by the Agency. These estimates are accompanied by a great deal of uncertainty. The combination of potentially high risks and high uncertainty makes NORM a good candidate for Agency research priority, but in fact this area has been assigned consistently low budgets despite over a decade of attention in the Office of Radiation and Indoor Air (ORIA) and its predecessor organizations. This situation is exacerbated in the FY2001 budget request because it reduces the ORIA's budget while preserving some protected programs funded out of that budget. The result is that NORM investigations will be brought to a virtual standstill at a time when they could benefit from an infusion of support to support EPA's core capacity in this area..

Similarly, the estimated health risks from hazardous constituents in indoor air are widely judged by scientists working in this arena to be greater than those posed by emissions from point, area, and mobile sources, yet research to reduce residual uncertainties or to devise intervention strategies is not well funded in comparison to the more traditional regulated sources of airborne hazards. EPA has no statutory authority to regulate either indoor air quality or NORM.

The Agency does have authority, however, to regulate Non-Aqueous Phase Liquids (NAPLs) that occur in subsurface soils from leaking storage tanks, spills, and improper disposal of wastes. NAPLs are generally thought to pose significant risks and to require significant resources for remediation with currently available technologies. However, development of cost-effective methods to clean up these contaminants has not received a corresponding degree of attention at EPA or elsewhere. It is not clear from the materials presented to the RSAC why higher priority has not been given to NAPL remediation technologies. EPA leadership and federal funding would help address this need. Exploitation of opportunities to leverage EPA funds through partnerships with the owners of contaminated sites and other responsible parties could also be effective.

3.3 Coordination between ORD and the Program Offices

Charge question: How well does the budget request reflect coordination between ORD and the Program Offices?

The Committee was impressed with the progress made in the past year in heightening the level of interaction between ORD and Program Offices. Evidence of this effort was provided in a variety of ways. First the Inventory explicitly identifies the science activities of many Program Offices. Second, a high degree of coordination is evidenced by the explicit coupling of ORD's research portfolio to specific program office goals. Finally, there was the explicit acknowledgment by some of the program offices that research was an important underpinning of many regulatory actions.

The Science Inventory organized by ORD seems to be a very important catalyst for

communication between Program Offices and ORD. Moreover, it provides a tool for identifying points of interaction and synergy between different Program Offices that could be important for advancing the Agency's regulatory agenda with a more cohesive, multimedia approach. This type of information base could be a very effective tool for identifying problems that have cross-Program Office interests. Mistaken actions could well be avoided with an organized and searchable database of this kind. A strategy needs to be developed explicitly to ensure that the database is used to establish cross-program interactions.

If the Science Inventory is used as a basis for instituting a multiyear planning process that develops a road map to guide the Agency by specifying research needs and the sequence of events leading to specific environmental decisions, it will provide a very effective means for identifying critical data gaps that might not be apparent to either the Program Offices or to ORD. In this context, it should also provide a better picture of progress towards particular objectives, a better basis for defending Agency programs, and a more efficient and useful projection of peer review into the regulatory process. Without it, effective coordination of science activities underway across the Agency is not possible.

Certain of the Program Office participants in the budget review meeting clearly indicated they appreciated the contribution of the research program. The OPPTS and Office of Air Program presentations provided the strongest evidence of this. In the latter case, the PM_{2.5} problem appears to be a very good example of how a highly coordinated and synergistic program has been built between the research and regulatory programs of the Agency.

Other Program Offices appear to view ORD as a source of information, but not necessarily the place within the Agency that will help them to identify the problems of the future. The Committee's intent is not to identify this as a negative interaction between the Programs and ORD, but rather to note that the Programs may not be fully utilizing the capabilities within the Agency. An active mission of ORD should be aimed at identifying and anticipating the next big environmental problems facing the Agency. In this regard, the Committee was pleased to see that ORD has assumed a responsibility for identifying future problems. It is hoped that Program and Regional Offices will support and contribute to this activity, because they are often closer to the real world problems and are in a good position to recognize trends that are of potential importance in this regard.

RSAC also feels that the Agency needs to more fully integrate the risk assessment paradigm into its strategic planning process. Considerable energy and resources were spent during the last 15 years, under the direction of the Risk Assessment Forum, to fully develop and test the risk assessment paradigm leading to ultimate publication of risk assessment guidelines in the Federal Register. Agency staff and management should now recognize that they have the most effective and efficient planning and prioritization tool at their fingertips with these guidelines. The well-known steps of problem formulation, risk analysis, risk characterization and risk management apply to essentially all of the Agency activities. RSAC is concerned that many of the new and existing programs within the Agency do not properly reflect the knowledge that could be gleaned from proper application of risk assessment guidelines.

Agency staff should be continually refreshed and tutored on the applications of the risk assessment guidelines. There is not a better tool available to ensure the promotion of high quality science and the proper allocations of budgetary resources.

The RSAC reinforces its support of the use of the risk assessment and risk management paradigm to develop priorities for research and regulation designed to protect both human and ecological health. Resources in all Program Offices are limited and methods that begin with evaluations of exposure and hazard identification for humans or loss of habitat for ecosystems provide a first cut for determining which contaminants and/or biological (e.g., exotic organisms) and physical (e.g., habitat destruction) stressors are likely to be detrimental serve as guides for fuller characterization of the hazard or stressor for purposes of risk assessment. At the same time there must be sufficient flexibility so that efforts can be directed at understanding new problems or addressing older problems too complex to resolve in the past (e.g., meaningful studies of complex environmental mixtures).

3.4 Balance Core and Problem-driven

Charge Question: How well does the budget request support a reasonable balance in terms of attention to core research on multimedia capabilities and issues and to media-specific problem-driven topics?

The 2001 ORD budget request allocates approximately 44% and 56% of the research budget to core and media-specific research areas respectively, consistent with the NAS' past recommendations and with ORD's Strategic Plan. RSAC is encouraged by the continued efforts of ORD to improve coordination with the Program Offices so its projects better meet program needs. This is evident in the budget request. The decision process and criteria that lead to a project being classified as "core" or "problem-solving" research is still not transparent, so the RSAC cannot fully evaluate this charge question. The committee recognizes that the resource allocations to the two areas of research may vary from year to year as budgetary constraints and Agency needs change. However, the criteria used for the classification of research activities as "core" or "problem-driven" should be clearly stated and applied consistently. RSAC believes that it is most important to maintain core research capabilities, as many of the problems confronting the Agency are not solvable by the "media-specific" driven research. It is critical also that the Agency maintain and improve multimedia core competencies that will help address these problems and identify emerging and future issues. RSAC strongly supports the fellowship and exploratory grant programs because they will contribute strongly to competency development.

3.5 Balance Near-term and Long-term

Charge Question: How well does the budget request balance attention to near-term and to long-term research issues?

RSAC concludes that the Agency has given thoughtful consideration to both long-term and short-term research needs and science and technology issues. Addressing both long- and short-term issues with comparable efforts is more important than developing specific criteria for a fixed ratio between the two needs. There are a number of emerging issues that would benefit from longer-term thinking and planning. Examples include the impacts on ecosystems of genetically modified agricultural plants, the potential for outbreaks of waterborne drug-resistant pathogens, and the risk management implications of the ability to identify genetically determined variables in susceptibilities to hazards. We commend the Agency for working towards a balance, and we offer suggestions for improvement.

While some of the programs emphasized in FY 2001 are longer-term efforts, there is still no overall explicit approach to incorporate the requirements of longer-term research programs within the short-term budgetary process. There are several examples of longer term research issues that are addressed in the current budget request including: global climate change assessments, ecosystem monitoring and studies on impacts on developmental children's health. It is important that the Agency strengthen its strategic planning processes to fund and protect the longer-term research on critical environmental issues that transcend the year-to-year budget framework. Long-term research projects are at special risk, because they are terminated or truncated due to cost-cutting imposed to provide the resources needed to respond to high-priority, short-term needs. RSAC notes that the upcoming change in administration also places long-term research projects at risk. Long-term research requires multi-year planning and evaluation.

In addition to the need to balance long-term and short-term research, we urge the Agency to improve its ability to identify and pursue emerging issues. This process should be open and transparent to stakeholders and be coordinated with other agencies. Emerging issues often form the bases for future research and science and technology programs. These programs may aid in the identification of environmental problems before they become major issues with sizable impacts and remedial costs. These efforts are necessary even for a mission-oriented agency such as EPA. Future environmental concerns are difficult to anticipate and, as such, may require the assistance of both internal and external experts. Identification mechanisms, for example, might include the use of workshops, recommendations and assessments from relevant professional societies, and suggestions of experienced researchers both within and without the Agency.

The Exploratory Grants Program is a further mechanism to identify emerging issues. RSAC is very concerned about the decline in funding for this Program. In 1994 support for Exploratory Research was \$22 million dollars. This has dropped to a low of \$10 million in FY 2000 and the request for FY 2001 is that it held at this low level. The Committee believes that emerging issues need to have ongoing stable support from EPA, because it is the key Agency that can aggressively watch for critical new threats to human and ecological health. In addition to an adequate funding level, RSAC recommends that selections for Exploratory Grant proposals be based on the extent to which they identify novel and important themes that are relevant to EPA's responsibilities.

3.6 Improvements to GPRA Structure

Charge: Provide advice on how can EPA use or improve upon the Government Performance and Results Act (GPRA) structure to communicate research plans, priorities, research requirements, and planned outcomes.

EPA continues to utilize the GRPA goals structure to organize its budgets and is now moving toward the first evaluation of the completion of the annual performance goals that were set for FY1999. This format provides an excellent framework for showing the alignment of the research priorities with the resources allocated to perform the work. RSAC is concerned that annual performance goals are still focused on specific products (reports, data collected, etc) rather than on the improved understanding of environmental function and process. RSAC recommends that the program goals should focus on outcomes rather than outputs. In addition, it is important that the annual performance goals really relate to the identified objectives in the Strategic Plan. There needs to be a more substantial effort to identify appropriate milestones that are related to providing the fundamental understanding of impacts to the environment rather than on specific products.

GPRA requires the matching of the Agency's long-term objectives to EPA's Strategic Plan or to the ORD Strategic Plan. These Strategic Plans outline research priorities over a time span of 3 to 5 years. Thus, to really utilize the GPRA process, it is important to use multiyear planning to attain the long-term goals. RSAC applauds the launching of the six pilot multiyear planning efforts. It is essential to look ahead at where the Agency has decided it wants to be as outlined in the Strategic Plans and to lay out a multiple year pathway to achieve those objectives. The implications of changes in planned budgets, new research results, the emergence of other competing priorities, etc. can then be examined in a well-defined context. However, it is important to recognize that these multiyear plans cannot be immutable since research will inevitably lead to unexpected results. Thus, periodic reappraisal and possible revision of the multiyear plans must be an integral part of the process. However, there is no way to determine if the annual performance goals are on the critical pathway to meeting the strategic plan goals without a multiyear plan.

We look forward to seeing the results of this multiyear planning process and encourage its expansion as soon as practical. In the implementation of this process, it is essential to ensure that planning does not become onerous. Otherwise the planning process can consume too much time and energy relative to actually performing the research to obtain the needed information.

The ORD GPRA plans must be integrated with the Program Office plans in order to fully meet the Agency goals. The availability of the Science Inventory provides an essential tool in this planning process. RSAC looks forward to the report of the Science Policy Council on what processes will be used to utilize the inventory and other Agency data bases to foster and facilitate the integration based on the GRPA goals. We hope that in the near-term future, we will see integrated multiyear plans that show how the various components of the Agency are addressing complicated environmental problems in a

coordinated and coherent manner and thereby meeting the Agency's long term goals (i.e., road maps).

While the Committee was impressed with the substantive progress made in the past year, it is important that this momentum continue over the next several years to institutionalize the process. To be useful, the information in the Science Inventory must be uniformly represented. It was difficult to ignore the fact that there was generally more specificity provided for projects in the STAR program than for intramural research.

Another problem for the Committee was that it was frequently not clear how critical a particular set of performance measures were coupled to specific goals. In part this concern may come from the fact that we are not privy to the internal deliberations and negotiations that must occur in the development of a set of prioritized research projects. To compensate for this lack of transparency, the RSAC suggests that ORD might collaborate with the Program Offices to develop a short description (1-2 sentences) of why the specific science product is critical to the Agency Goal.

The RSAC believes that ORD has taken an important step forward in establishing a science activity database. ORD has also developed a database for major products of the Agency that should be peer reviewed. Noting that EPA has recently established an Office of Environmental Information (OEI), the RSAC recommends that EPA integrate these two databases into a single Science database that includes both the Agency's science activities and its science products. A single database consistent with the GPRA goals offers several advantages to EPA including it will: minimize the effort of Agency respondents; allow for consistency in criteria used to assess science activities and peer review; allow cross checking for completion of both products and activities; and provide the user with more complete information on the Agency activities. An integrated database can be an effective foundation for building an Agency-wide science strategic plan. Finally, any integrated database developed by EPA should be a searchable database and web enabled for use by both the Agency and public. To be effective, an interface needs to be built between the Agency's planning process and its science operations and peer review/quality control efforts for which the science activities and peer review databases were developed.

APPENDIX - ACRONYMS

CCL	Candidate Contaminant List
EDSTAC	Endocrine Disruptors Screening and Testing Advisory Committee
EPA	US Environmental Protection Agency
FQPA	Food Quality Protection Act
FY	Fiscal Year
GPRA	Government Performance and Results Act
ISEC	Integrated Science for Ecosystem Challenges
NAAQS	National Ambient Air Quality Standards
NAPL	Non-Aqueous Phase Liquids
NAS	National Academy of Sciences
NO _x	Nitrogen Oxides
OEI	Office of Environmental Information
OPPTS	Office of Pollution Prevention, Pesticides and Toxic Substances
ORD	Office of Research and Development
ORIA	Office of Radiation and Indoor Air
PM	Particulate Matter
PM _{2.5}	Particulate Matter of 2.5 microns or less
RSAC	Research Strategies Advisory Committee
RCRA	Resource Conservation and Recovery Act
SAB	Science Advisory Board
S&T	Science and Technology
SDWA	Safe Drinking Water Act



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**A REVIEW BY THE RESEARCH
STRATEGIES ADVISORY
COMMITTEE (RSAC) OF THE
SCIENCE ADVISORY BOARD**