



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C. 20460

MAR 16 1989

Honorable William K. Reilly
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U. S. Environmental Protection
Agency
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Washington, D. C. 20460

OFFICE OF
THE ADMINISTRATOR

Dear Mr. Reilly:

The Science Advisory Board's (SAB) Research and Development Budget Subcommittee has completed its fourth annual review of the President's proposed budget for the Office of Research and Development and is pleased to transmit copies to you and the Congressional committees that authorize and appropriate funds for this office.

The Fiscal Year 1990 President's Budget for the Environmental Protection Agency's research program provides total funding of \$421.5 million, and 1,873 workyears, increases of \$33.6 million and 21 workyears respectively. The SAB Research and Development Subcommittee found encouraging evidence that the Agency recognized the need for longer term research on fundamental environmental processes, affecting the entire planet, and the need to begin addressing the maintenance of the research program infrastructure. Increases in the Exploratory Grants program for investigator-initiated studies will increase the Agency's links to the broader scientific community. They will also augment the research program's capabilities by making available otherwise unobtainable skills and knowledge. The staffing increase, coming after many years of decline, will allow Office of Research and Development (ORD) officials to begin dealing with an increasingly serious skill-mix problem.

Other issues and realities, however, cloud some aspects of the picture. The increase of \$33.6 million, laudable as it is, falls far short of the amount needed. The detailed review of the budget which follows identifies many programs and issues, some quite critical, which suffer for lack of support; this is particularly true in many of the media-specific programs. High impact, critical topics such as air toxics, sludge management, and wetlands decline in support, or at best, receive only modest increases. The resources allocated to maintain and improve the research program infrastructure do indeed constitute recognition of a serious problem, but they are far too small to achieve the needed rate of replenishing the existing inventory of obsolescent equipment.

When the "buying power" of this budget proposal is analyzed, the severity of the problem is more evident. Stated in terms of 1982 dollars, the 1990 budget, even with Superfund resources (not included in the 1980 data) provides some \$50 million less capability than did the 1980 budget. Considering that major legislative changes have substantially increased the Agency's responsibilities and needs over that period, and that many emerging environmental problems unknown or only dimly perceived in 1980 must be addressed, the decline is even more dramatic than the numbers themselves indicate. Until this issue is addressed, the SAB Subcommittee harbors serious reservations as to the overall adequacy of this budget.

The Subcommittee and the SAB Executive Committee believe that the enclosed report adds to the range of points of view that the Administration and Congress should consider in reaching budgetary decisions. Scientists and engineers have a responsibility to present their thoughts and evaluations of the needs for research in the area of environmental science, and we appreciate the opportunity to do so.

Sincerely,



Raymond C. Loehr, Chairman
Executive Committee
Science Advisory Board



John Neuhold, Chairman
Research and Development Budget
Subcommittee
Science Advisory Board

cc: John A. Moore
Erich Bretthauer
Donald Barnes

United States
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Report of The Research And Development Budget Review Subcommittee

Review of The Fiscal 1990 President's Budget For Research and Development

U. S. ENVIRONMENTAL PROTECTION AGENCY

NOTICE

This report has been written as a part of the activities of the Science Advisory Board, a public advisory group 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.

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1.0 Executive Summary

The Fiscal Year 1990 President's Budget for the Environmental Protection Agency's research program provides total funding of \$421.5 million, and 1,873 workyears, increases of \$33.6 million and 21 workyears respectively. In its review of the budget, the Science Advisory Board's (SAB) Research and Development Budget Review Subcommittee found encouraging evidence that the Agency recognizes the need for longer term research on fundamental environmental processes, affecting the entire planet, and the need to begin addressing the maintenance of the research program infrastructure. Increases in the Exploratory Grants program for investigator-initiated studies will increase the Agency's links to the broader scientific community. They will also augment the research program's capabilities by making available otherwise unobtainable skills and knowledge. The staffing increase, coming after many years of decline, will allow Office of Research and Development (ORD) officials to begin dealing with an increasingly serious skill-mix problem.

Other issues and realities, however, cloud some aspects of the picture. The increase of \$33.6 million, laudable as it is, falls far short of the amount needed. The detailed review of the budget which follows identifies many programs and issues, some quite critical, which suffer for lack of support; this is particularly true in many of the media-specific programs. High impact, critical topics such as air toxics, sludge management, and wetlands decline in support, or at best, receive only modest increases. The resources allocated to maintain and improve the research program infrastructure do indeed constitute recognition of a serious problem, but they are far too small to achieve the needed rate of replenishing the existing inventory of obsolescent equipment.

When the "buying power" of this budget proposal is analyzed, the severity of the problem is more evident. Stated in terms of 1982 dollars, the 1990 budget, even with Superfund resources (not included in the 1980 data) provides some \$50 million less capability than did the 1980 budget. Considering that major legislative changes have substantially increased the Agency's responsibilities and needs over that period, and that many emerging environmental problems unknown or only dimly perceived in 1980 must be addressed, the decline is even more dramatic than the numbers themselves indicate. Until this issue is addressed, the SAB Subcommittee harbors serious reservations as to the over-all adequacy of this budget.

2.0 Introduction

Review of EPA's research and development budget by the Science Advisory Board's Subcommittee on the Office of Research and Development (ORD) Budget was initiated four years ago when the Board became frustrated with its annual reviews of the "Research Outlook" five year plan. The frustrations stemmed from the lack of information on the implementation of the plan, i. e., the budget. With a budget attached to a plan, the Board can assess the proposed actions based on scientific feasibility, priorities, and capabilities.

The Science Advisory Board in its research strategies study, "Future Risk" (SAB, 1988) remarked that EPA's budget for its Office of Research and Development had declined dramatically from \$398 million in 1980 to its 1988 level of \$314 million (in terms of constant 1982 dollars). This decline was happening despite emerging environmental issues for which we had little fundamental knowledge and a consequent inability to implement feasible control or avoidance measures. Paramount among these issues are the ozone depletion and global warming problems, but we also face enhanced concerns for indoor air pollution, groundwater pollution, hazardous and municipal waste disposal and many other challenging questions which continue to plague us.

The Science Advisory Board has also recognized that the future of effective environmental conservation, control and regulation lies with our ability to anticipate environmental problems before they happen or become critical. The ability to anticipate environmental problems requires a level of knowledge about our ecological/biological systems that we have, as yet, not achieved. And the only way that we will achieve it is to implement and carry through research programs that are at once fundamental in nature, long term in scope, yet also applicable to the known problems facing EPA. The staff and scientists of the Agency recognize these research issues as well. They expressed similar thoughts in their "Environmental Progress and Challenges: EPA's Update" (OPPE, USEPA, 1988).

This particular report is one of a series of activities in which the Science Advisory Board attempts to improve the quality, direction and support of research at EPA. The primary activity taking place during the past fiscal year was that of the Research Strategies Committee (EPA-SAB, 1988). The effort was divided into five strategy areas including 1) sources, transport and fate research, 2) exposure assessment research, 3) ecological effects research, 4) health effects research and 5) risk reduction research. The effort outlined EPA research strategies for the 1990s and suggested means for implementing and updating them.

This report specifically resulted from a meeting on February 15 and 16, 1989 at EPA headquarters but builds upon complementary SAB efforts over the past years. The Subcommittee received background briefings on the ORD and EPA-wide budget submissions for 1990. The Subcommittee prepared an outline of the initial draft of their report and completed its report by mail and telephone. Following approval by the Executive Committee of the Science Advisory Board, the report was transmitted simultaneously to the EPA Administrator and the Congress. As stated earlier, this is the fourth annual report of the Research and Development Budget Subcommittee of the Science Advisory Board. In previous years, the Subcommittee has sought to identify continuing core needs for maintaining productive and high quality research at EPA, while highlighting specific needs for individual research programs. This year's report continues that effort and adds another dimension, that of relating the proposed budget to the recommendations of the SAB's Research Strategies report.

3.0 Budget Overview

The Office of Research and Development is confronted with the complex issues noted above, as well as many others, including assuring that it has the workforce and skills necessary to manage research on these issues. It must also acquire and manage the resources necessary to adequately address the issues either in its own laboratories or extramurally via sponsored or directed research. The Subcommittee recognizes that, with limited resources, priorities must be set, and that the proposed budget is the net result of many policy decisions and conscious "trade-offs" between many research areas in which increased investment would be both desirable and rewarding.

The Subcommittee was generally impressed with the way the ORD leadership addressed the issues, acknowledging and responding, in many instances, to the advice of the Science Advisory Board. The budget proposal is proactive and forward looking. It acknowledges the need to undertake long-term, trend-monitoring research which will allow anticipation of emerging environmental issues. The Subcommittee was also pleased with the additional resources proposed in the President's budget although it questions the adequacy of the increase and, in some instances, the distribution of the resources.

4.0 Generic Issues in Managing EPA's Research Program

4.1 Research Budget Trends

The Research Strategies Committee (SAB, 1988) recommended that EPA's Office of Research and Development budget be doubled over the next five years. The report argued that the increased funding is necessary to make up for the decreases suffered in both constant and actual dollars during the past decade. During the same period Congress enacted major environmental legislation, including the Superfund (1980), the RCRA amendments (1984), the Superfund amendments (1986), the Safe Drinking Water Act amendments (1986), the Global Climate Protection Act (1987), and the Clean Water Act amendments (1987) that gave EPA broad new regulatory responsibilities in areas in which the knowledge base was inadequate for planning and implementing cost effective controls. The major environmental concerns noted earlier--acid precipitation, global warming, stratospheric ozone depletion and indoor air pollution--also emerged during this period. Both fundamental and applied research are necessary to address the questions posed by such issues.

A doubling of the ORD budget over the next five years would require an increase of approximately \$75 million per year in 1988 dollars. The increase in the total ORD budget for 1990 is proposed to be \$33.6 million (Table 1), a laudatory increase in view of tight budgets, yet still far short of the amount necessary to meet the five year goal and the Agency's realistic needs.

Table 1

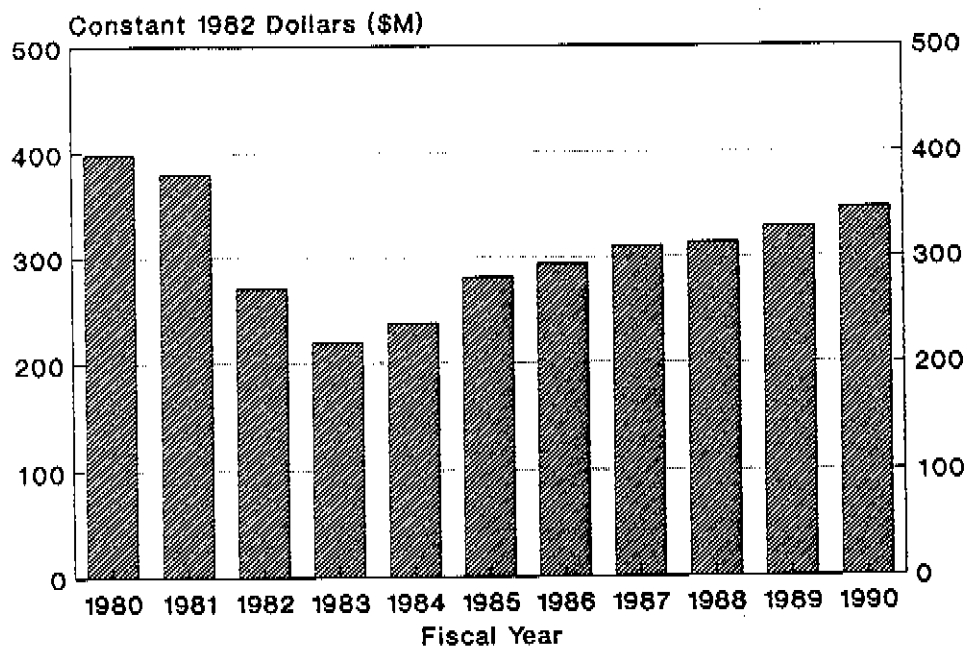
President's 1990 Budget for Research and
Development by Appropriation.
(Dollars in Millions)

<u>Appropriation</u>	<u>1990 Total Dollars</u>	<u>Change from 1989</u>
Salaries & Expenses	\$117.2	+ \$5.9
Research & Development	235.0	+ 32.5
Superfund	68.5	- 4.8
LUST	0.8	0.0
TOTAL	\$421.5	+ \$33.6

When the 1990 budget is translated into 1982 constant dollars, the shortfall is even more pronounced. As Figure 1 displays, the "nominal dollar" budget total of some \$421.5 million equates to only \$346.2 million in "buying power" equivalent to 1982.

Figure 1

Constant Dollar Funding for R & D
Total Resources, 1980--1990



On this basis, the research program is still funded below the 1980 and 1981 levels, despite the increased needs noted above. This fact must be kept in mind as one examines the following discussion of the budget, couched as it is in terms of changes in nominal dollar funding. Even with an additional increase of \$41.1 million over the proposed \$33.6 million, the program's buying power would barely approach par with the 1980 budget.

4.2 Infrastructure

This Subcommittee recommended in last year's budget review (Research and Development Budget Review Subcommittee, SAB, 1988) that the need to rebuild the infrastructure of ORD's laboratories was critical. Laboratory equipment is ageing and, if functional, is outdated and not capable of attaining the levels of resolution and precision necessary to accommodate the analytical and computational demands of doing "state of the science" quality environmental research. The Agency estimates that \$80 million (replacement value) worth of equipment is seven years or older and,

now or soon, will require replacement. Yet it was able to address this need only by redirecting from the various media-specific research programs an additional \$4 million to supplement a base of \$2 million for equipment replacement--approaching but not reaching par with the attrition rate. New monies should be made available to accelerate bringing the infrastructure up to the state-of-the science condition.

4.3 Personnel Skill Mix

The Agency conducts its research in two major ways, in-house and extramurally. To do this it must have the appropriate staff capabilities to conduct the research itself and/or to select and monitor external researchers. With restrictions on personnel ceilings over the past twelve years, the numbers of Agency research scientists have decreased. Losses to attrition through retirement or recruitment by academia and industry could be not replaced with younger talent. The result has been an ageing scientific staff with relatively fixed capabilities. The composition of this staff thus results from random, rather than planned, processes. Faced with issues requiring scientific capabilities which it does not have, the Agency is placed at a disadvantage to respond adequately to the questions posed by these issues.

The Subcommittee was, therefore, pleased to see an increase of 21 positions in the work force proposed by the Budget, although it is only a small first step to address the problem. ORD has also undertaken an in-depth assessment of its existing skill mix so that it might better be able to cope with future environmental "surprises" and to adjust to revised objectives and changes in goals. The Agency has also taken the initiative in establishing new academic research centers to augment its capabilities to address classes of questions for which its staff lacks the needed expertise.

The Subcommittee feels that the Agency could be more aggressive in pursuing its visiting scientist program which it has moved from its Office of Exploratory Research and left to the discretion of the several field research laboratories for funding. Lacking also is any effort in establishing a long term training program in cooperation with academia to enhance the skills of EPA scientists or to provide a continuing source of new graduate level scientific talent.

4.4 Centers and Investigator Initiated Grants

Investigator initiated grants are increased by \$10 million in the proposed budget, a welcome development. The Agency is in need of all the expertise it can get in view of the ever increasing complexity of environmental issues. The grants program not only benefits from the fundamental work which is undertaken by academic and other scientists outside the Agency but, in the process, develops an interested and concerned scientific clientele. It also provides a source of trained replacements for those scientists lost to the Agency through attrition, as well as a source of new personnel.

That the existing Centers program is proposed for level funding is regrettable particularly in view of our consistent recommendation that productive centers be funded at a realistic level of some \$1 million (rather than the current \$0.5 million level) to provide a stable "critical mass" of support. These research centers have demonstrated over the past few years that they add considerably to the skill mix and research productivity of the Agency. Their continued support (and even expansion) should be encouraged.

4.5 State of the Environment

Once again the Subcommittee encourages the Agency to continue with its assessment of the state of the environment and commends it for having produced its "Environmental Progress" report (OPPE, 1988). With the information produced by the status and trends activity proposed for initiation during FY 1990 the Agency will be in more powerful position to assess progress made and identify the challenges to be met. A biennial (or longer period) is suggested as a suitable period for the production of such a report.

5.0 Global and Transboundary Issues

5.1 Global Climate Changes

Atmospheric warming as a result of increased carbon dioxide and methane emissions is an example of a force that will have serious consequences on natural and agricultural production and thus on the long term welfare of Earth and its inhabitants. Similarly, stratospheric ozone depletion will allow more ultraviolet radiation to reach the Earth's surface, affecting productivity and causing an increase in carcinogenesis. Acid precipitation resulting from sulfur dioxide and nitrogen oxide emissions will also affect productivity and human health. All these emissions know no boundaries. What we and others emit

affects us all.

It is, therefore, gratifying to see ORD aggressively attack the issue with a significant increase for both the Air and Interdisciplinary programs (Table 2). Particularly important is

Table 2.

President's 1990 Budget for Research and
Development by Media
(Dollars in Millions)

<u>Medium</u>	<u>1990 Dollars</u>	<u>Change from '89</u>
Air	84.2	+ 15.1
Water Quality	26.3	+ 2.1
Drinking Water	23.3	+ 1.7
Hazardous Waste	42.3	- 3.1
Pesticides	14.3	+ 0.8
Radiation	4.2	+ 0.7
Interdisciplinary	77.7	+ 37.3
Toxic Substances	28.0	0.0
Energy/Acid Deposition	38.2	- 16.7
Superfund/LUST	69.3	- 4.8
Management & Support	13.7	+ 0.5
TOTAL	421.5	+ 33.6

the role the Agency proposes as a part of an interagency effort to approach the global warming issue (FCCSET, Com. on Earth Sciences, 1989). Also important is the emphasis the Agency is placing on research in the area of long term ecological monitoring and trend assessment. All too frequently the research efforts of the Agency have concentrated on issues directly related to specific and immediate regulatory problems. Research in this "fire fighting" mode was characterized as too little and too late. Although there will always be a need for some research in immediate response to regulatory needs, this type of research will not prepare the Agency for its role to safe-guard the environment in the face of the increasingly complex problems that it will have to face in the future.

Complex issues, such as global climate change, stratospheric ozone depletion, acid deposition, as well as potential effects of combustion products, point out the need for a solid research foundation prior to the development of strategies for the control of adverse impacts. Regulatory initiatives based upon inadequate information may not be very effective and are likely to be increasingly wasteful of scarce resources.

Therefore, the Subcommittee welcomes the research initiative

on Environmental Status and Trends in the Interdisciplinary medium. It is anticipated that the monitoring of parameters describing environmental status will be directly related to environmental processes and that research will be undertaken to understand these processes while analyzing the environmental trends so that the totality of the research will lead to the ability to predict.

Nothing in the budget documentation indicated much of a role for remote sensing and geographic information system (GIS) studies, work already underway in ORD. The Agency does have a history of early work with GIS which has the capability for scoping site specific information to regional and international scales and would seem to have direct relevance to the issue of environmental status and trends. That activity should be reviewed and, perhaps, given greater prominence, perhaps with greater extramural effort, in the research plans of the Agency.

It is also important to recognize that the Agency is phasing out its program in acid precipitation and shifting some of those resources into the Interdisciplinary global climate area, as evidenced by Table 2. Careful management will be required to apply staff experience gained through acid precipitation research to global issues, while maintaining needed efforts in the former program area. Particular attention should be given to efforts examining atmospheric quality interactions and effects such as forest damage that may be related to air pollution.

6.0 Media Specific Issues

6.1 Air

We support the added emphasis placed on regional ozone modeling (ROM) and on acid aerosols but question again, as we did last year (SAB Research and Development Budget Subcommittee, 1988), the prudence of cutting air toxics studies in the budget. State governments in particular are very much concerned with setting air quality standards for toxicants which are not common air pollutants but are hampered by the lack of criteria with which to set the standards for many of these toxicants.

We were lead to believe that a research plan for indoor air pollutants has been prepared and will be submitted to the Congress shortly. The funding level proposed for FY 1990, however, is only some \$300 thousand higher than the 1989 level (the net of a reduction in extramural funds, and an increase for in-house work) and does not appear to indicate sufficient activity in this area. Work on radon also receives a small increase.

6.2 Water Quality

The sediments in our lakes, rivers and estuaries are a vital part of the functioning aquatic ecosystem. The complexity of the role of sediments is gradually becoming known, but our state of knowledge lags considerably behind the need to set criteria for limiting sediment contamination. It is in the sediments that much of the biological reduction (breakdown of complex organic materials to elemental nutrients) activity occurs and upon which other elements of the ecosystem are dependent. When toxicants are emitted into the aquatic system, some find their way into the sediments where they kill or debilitate invertebrate fauna, microflora and bacteria disrupting ecosystem processes. Sediments also serve as a toxicant reservoir from which toxicants are emitted to the aquatic medium where they can once again expose organisms. Criteria for sediments are at long last being studied but even with the increase proposed in this budget (+\$300K) the effort appears to be too little to measure up to the complexity of the problem or to permit criteria to be enacted in a reasonable time frame.

The increase in the budget for constructed wetlands research (for treatment purposes) is to be commended. However, much work still needs to be done with naturally occurring wetlands since they are the recipient of much surface runoff and consequent toxicant loading. These wetlands are also the primary nurseries for many of our commercial and sports fish (costal marshes) and waterfowl (inland marshes). The complexities involved in understanding the impact of wetland pollution on these populations needs our urgent attention, and merits increased resources.

Sludge management is becoming an increasingly important problem for our water treatment systems. The Environmental Engineering Committee of the Science Advisory Board strongly recommended that research attention in this area needs to be encouraged (Environmental Engineering Committee, 1987), but the budget provides no increase. The ban on ocean dumping, and increasing problems with land disposal will further complicate dealing with this problem for state and local governments. Increased attention to this problem is needed before it reaches crisis status.

6.3 Interdisciplinary

Though the Interdisciplinary Program does support an academic-based epidemiological research center, the Agency has insufficient in-house epidemiological expertise to effectively direct an epidemiological initiative. The Health Effects Research Laboratory in North Carolina should be afforded the funds to mount such a

program as was recommended by the Research Strategies Committee (RSC, 1988). All of the established academically-based Centers continue to be seriously underfunded, as noted earlier.

6.4 Toxics and Pesticides

The increased funding for biotech research is commended, but, in view of the magnitude of the potential hazard involved with bioengineered organisms and the rapid development of the technology, the effort could be afforded more support.

The ecological risk assessment effort is an important activity which could utilize the information to be generated by the status and trends effort proposed in the interdisciplinary program. The ecological risk assessment project has been historically underfunded. It is paradoxical that, with the growing emphasis on risk assessment and analysis in the ecological area, the ecological risk assessment research program, a potential source of models and analytical methodology, is still being underfunded. An infusion of funds could produce results that, in turn, would make EPA decision-making less tenuous.

6.5 Hazardous Waste

In regard to pollution prevention (waste minimization) the SAB acknowledges a major increase from the \$350,000 level in FY 1988 to \$2.4 million in FY 1989, but is concerned over the proposed level funding for FY 1990. As noted in the SAB Research Strategies Report "Future Risk" (RSAC, 1988), pollution prevention is the linch-pin of risk reduction. We understand largely process oriented research will be addressed in FY 1990 due to limited funding. This is an area that may be complementary to industry efforts and does not break any new ground. Research planned for later years is in so-called non-technological areas such as incentives for environmentally accepted products, in anticipating emerging environmental issues due to technology and societal changes and in using pollution prevention to mitigate them. If this work could be started in FY 1990 with additional funds, greater strides or break-throughs might result.

The SAB notes the welcome increase of \$200 thousand for chemical accident prevention (and a related \$300 thousand increase in the toxics medium). More work needs to be undertaken on low probability/high consequence events of this nature.

6.6 Superfund

Superfund research declines \$4.8 million from a level that already seems too meager. Considering the national investment in hazardous waste control, not only in this Agency, but also in other organizations within the federal government and the private sector, the program's funding of \$68.5 million is a minuscule research effort destined to yield a small return on the investment.

7.0 Conclusions

The Subcommittee finds much to applaud in this budget, along with a few items which cause concern. On the positive side, increased staffing signals a change to a long period of decline; increased support for fundamental research on global climate and long term ecological monitoring, along with similar commitments in other key research areas, suggests that a careful and thoughtful decision process underlies this budget--a decision process which for the first time in many years seems to take account of the special and particular needs of a scientific research program.

We must express serious reservations as to the adequacy of the funding increases, however, particularly in light of the reduced purchasing power available to the R & D program when inflation over the past decade is taken into account. As noted earlier, the requested 1990 total funding, in terms of actual buying power, is LESS than the support provided in either 1980 or 1981, despite the increased research responsibilities placed on the Agency during this decade.

The reduction in buying power has especially adverse effects on the support available to rebuild the equipment infrastructure, and evidences itself in the reductions sustained in the various media-specific programs to support the modest infrastructure increase. We have noted particular areas (e.g. air toxics and sludge management, to name just two) in the report, and feel that such trade-offs between the long-term viability of the research program, and the "hard" immediate needs of the Agency's regulatory program and state and local governments should not have to be made.

It is the SAB's hope that, by presenting these views directly to policy makers in the Executive Branch and the Congress, it can highlight some of EPA's most important research directions and needs, and, by so doing, persuade policy makers to allocate the resources necessary to fund research to anticipate and resolve environmental issues and achieve our common goal of protecting the public health and the environment.

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