



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

EPA-SAB-EC-90-012

OFFICE OF
THE ADMINISTRATOR

March 29, 1990

Honorable William K. Reilly
Administrator
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460

Subject: Science Advisory Boards's review of the FY 1991
President's Budget for Research and Development

Dear Mr. Reilly:

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 five 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 more accurately the proposed actions based on scientific feasibility, priorities, and capabilities.

This specific report resulted from a meeting on February 27 and 28, 1990 at EPA headquarters. The Subcommittee received background briefings on the ORD and EPA-wide budget submissions for 1991. Following approval by the Executive Committee of the Science Advisory Board, the report is being transmitted simultaneously to you and to the Congress. As noted, this is the fifth 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 is shaped around the charge to the Subcommittee:

a. How do the budget proposals compare to the previous year, in both absolute dollar amounts and in the distribution of resources across the major research areas and scientific disciplines?

b. What changes/redirections have been made in the "base" program? Are new initiatives appropriate to known knowledge gaps and Agency science needs? Is there a "critical mass" level of funding provided for the initiatives? Are institutional and infrastructure needs being met? Is the proposal consistent with the Core Strategy and Future Risk documents?

We are pleased to note the substantial improvement in the concept and rationale underlying the Office of Research and Development (ORD) budget plan evident in the 1991 presentation. Although the ORD budget remains grossly inadequate in relation to the needs (see below), we find that the allocations to the various programs are, within the overall limits imposed, and with the exceptions noted, reasonable and appropriate. They will permit progress in the most critical areas of concern and make effective use of available personnel and resources.

Specific findings are:

a) The 1991 budget for the Office of Research and Development barely keeps up with the increase in the Consumer Price Index from last year, and continues to provide less purchasing power than was available in fiscal 1980. This is in spite of an increase in demands on the office. An annual increase of \$80 million will be needed to catch up with the 1980 budget buying power level by 1995, disregarding further inflation.

b) The Agency must spend more effort and funds in providing continuing education opportunities for its staff to accommodate changes in the environmental issues facing EPA. The Agency also needs to implement a program of support for beginning graduate students in order to assure a source of environmental scientists to replace attrition (due to retirement) in the program's ageing cadre of scientists.

c) A schedule and commitment to replace aging scientific equipment (on a basis of a 7 year turnover) will require the expenditure of \$26 million per year for the next 5 years to bring the Agency's equipment into a reasonable state-of-the-art level.

d) The Agency is urged to study its research facilities needs and begin to budget their updating and renewal.

e) The laboratory operating portion of ORD's (currently) S&E funds should be transferred to the R&D accounts so the Office can have greater latitude in meeting the requirements of its grant, contract, cooperative agreement and in-house modes of operation.

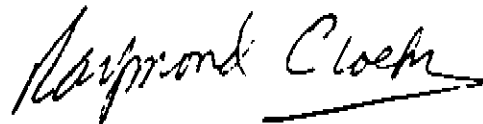
f) Specific areas needing greater emphasis and increased funding include:

1. Increased research on the control of non-point pollution sources
2. Increased research on alternative drinking water treatment technologies
3. Increased research in hazardous waste, wastewater, and municipal waste combustion control technologies
4. An assessment of the LIMB (Limestone Injection Multi-stage Burner) research program's results to determine if the technology offers a cost-effective means of

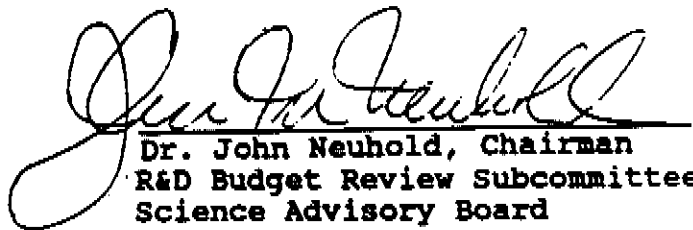
obtaining SO_x/NO_x control levels expected to be targeted in the Clean Air Act Amendments of 1990

5. Better balance between intra- and extra mural activities in the core research program

We are pleased to have had the opportunity to conduct this review, and look forward to your response.



Dr. Raymond Loefer, Chairman
Science Advisory Board



Dr. John Neuhold, Chairman
R&D Budget Review Subcommittee
Science Advisory Board



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

OFFICE OF
THE ADMINISTRATOR

March 29, 1990

Honorable James H. Scheuer
Chairman
Subcommittee on Natural Resources,
Agriculture Research, and Environment
Committee on Science, Space, and
Technology
U.S. House of Representatives
Washington, D.C. 20510

Dear Mr. Chairman:

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 five 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 more accurately the proposed actions based on scientific feasibility, priorities, and capabilities.

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- a. How do the budget proposals compare to the previous year,

in both absolute dollar amounts and in the distribution of resources across the major research areas and scientific disciplines?

- b. What changes/redirections have been made in the "base" program? Are new initiatives appropriate to known knowledge gaps and Agency science needs? Is there a "critical mass" level of funding provided for the initiatives? Are institutional and infrastructure needs being met? Is the proposal consistent with the Core Strategy and Future Risk documents?

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- c) A schedule and commitment to replace aging scientific equipment (on a basis of a 7 year turnover) will require the

expenditure of \$26 million per year for the next 5 years to bring the Agency's equipment into a reasonable state-of-the-art level.

d) The Agency is urged to study its research facilities needs and begin to budget their updating and renewal.


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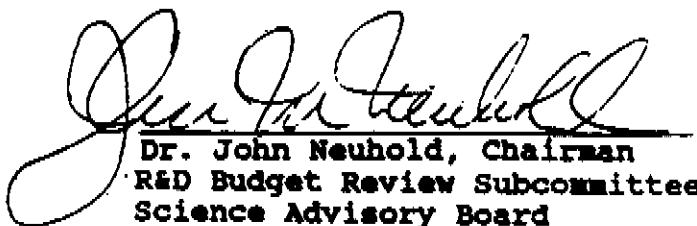
1. Increased research on the control of non-point pollution sources
2. Increased research on alternative drinking water treatment technologies
3. Increased research in hazardous waste, wastewater, and municipal waste combustion control technologies
4. Assessing the LIMB (Limestone Injection Multistage Burner) research program's results to determine if the technology offers a cost-effective means of obtaining SO_x/NO_x control levels expected to be targeted in the Clean Air Act Amendments of 1990
5. Attaining better balance between intra- and extramural activities in the core research program

We are pleased to have had the opportunity to conduct this review, and believe that the enclosed report adds to the range of viewpoints that the Administration and the Congress should consider in reaching budgetary decisions. We appreciate the opportunity to present our findings to you.

Sincerely,

A handwritten signature in cursive script, appearing to read "Raymond Loefer".

Dr. Raymond Loefer, Chairman
Science Advisory Board

A handwritten signature in cursive script, appearing to read "John Neuhold".

Dr. John Neuhold, Chairman
R&D Budget Review Subcommittee
Science Advisory Board



EPA

U.S. Environmental
Protection Agency

Washington, DC
EPA-SAB-EC-90-012

**Report of the Research And
Development Budget Review
Subcommittee**

**Review of The Fiscal 1991
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 We are pleased to note the substantial improvement in the concept and rationale underlying the Office of Research and Development (ORD) budget plan evident in the 1991 presentation. Although the ORD budget remains grossly inadequate in relation to the needs (see below), we find that the allocations to the various programs are, within the overall limits imposed, and with the exceptions noted below, reasonable and appropriate. They will permit progress in the most critical areas of concern and make effective use of available personnel and resources.

Specific findings are:

- a) The 1991 budget for the Office of Research and Development barely keeps up with the increase in the Consumer Price Index from last year, but continues to provide less purchasing power than was available in fiscal 1980. This is in spite of an increase in demands on the office. An increase of \$80 million in each of the next four years would be needed to achieve the 1995 levels recommended in the Science Advisory Board's report Future Risk (disregarding further inflation).
- b) The Agency must spend more effort and funds in providing continuing education opportunities for its staff to accommodate changes in the environmental issues facing EPA. The Agency also needs to implement a program of support for beginning graduate students in order to assure a source of environmental scientists and engineers to replace attrition (due to retirement) in the program's aging staff cadre.
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5. Better balance between intra- and extra mural activities in the core research program

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 five 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 more accurately the proposed actions based on scientific feasibility, priorities, and capabilities.

This report specifically resulted from a meeting on February 27 and 28, 1990 at EPA headquarters. The Subcommittee received background briefings on the ORD and EPA-wide budget submissions for 1991. 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 above, this is the fifth annual report of the Research and Development Budget Subcommittee of the Science Advisory Board. In previous years, the Subcommittee has sought to

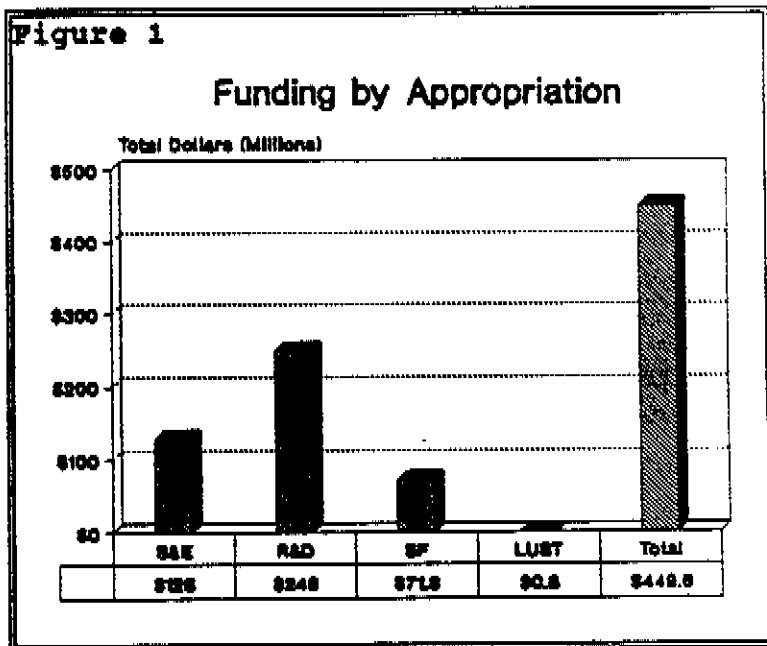
identify continuing core needs to maintain productive and high quality research at EPA, while highlighting specific needs for individual research programs. This year's report continues that effort, and is shaped around the charge to the Subcommittee:

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3.0 BUDGET OVERVIEW

3.1 FUNDING The FY 1991 President's Budget provides a total of \$449,606,000 for EPA's research and development program, an increase of \$25.1 million over the current estimate for FY 1990. These monies are allocated across several different appropriations, and there are constraints as to the use of the funding provided by a specific appropriation (Figure 1 displays the distribution of monies by appropriation).



The Salaries and Expenses (S&E) appropriation pays staff salaries and benefits, and provides most of the support for in-house laboratory operations and research--e.g., utilities,

chemicals, experimental animals, and most laboratory supplies.

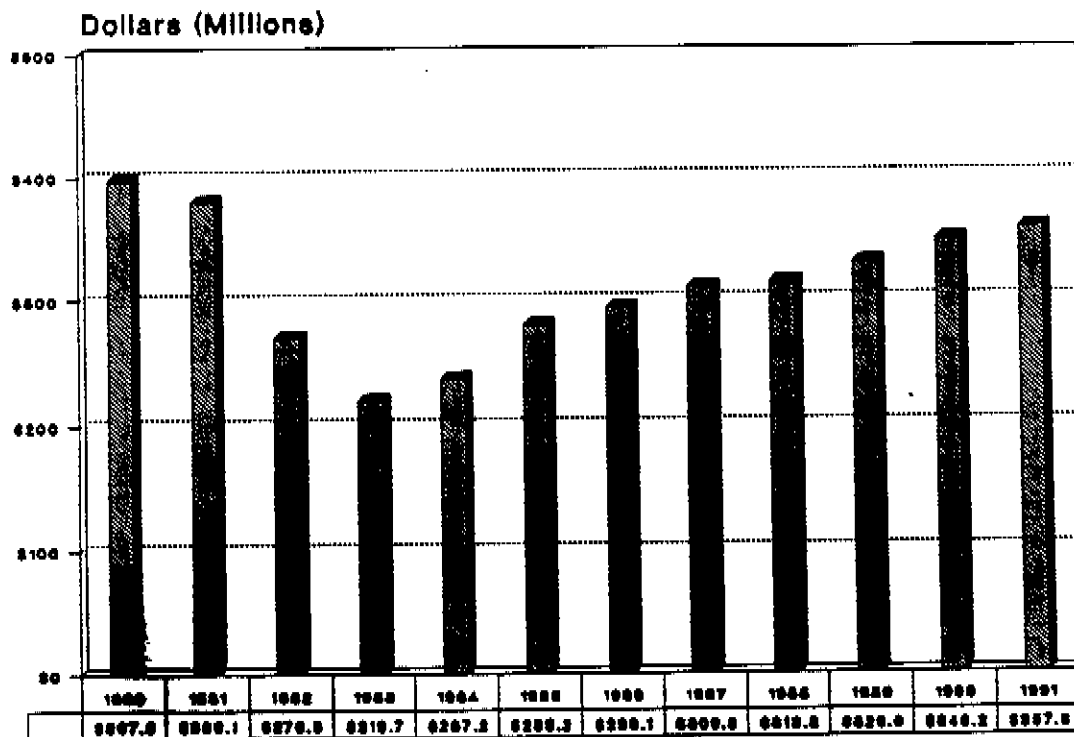
The Research and Development (R&D) appropriation funds the extramural programs--contracts, grants, and cooperative agreements, as well as the purchase of most scientific instrumentation.

Additional funding is earmarked for support of Superfund (SF) activities and support of the Leaking Underground Storage Tank (LUST) program.

The overall increase in the budget this year is disappointing, amounting to barely 5.6% (\$25.1 million), or about equalling the increase in the consumer price index for 1989. This increase is

Figure 2

ORD Funding in Constant 1982 Dollars



a far cry from what the Research Strategies Committee of the Science Advisory Board recommended in its 1988 report, "Future Risk" when it suggested that the ORD budget be doubled from \$360 million by 1995¹.

The small increase is disturbing in yet another sense: when measured in 1982 dollars, the \$449 million recommended for 1991 is still \$40 million short of the resources provided in the 1980 ORD budget (Figure 2, above, displays ORD's resources from 1980 to 1991 in 1982 constant dollars). As the data demonstrate, not much progress is being made on restoring the disastrous reductions inflicted upon the ORD budget in the early 1980s. Considering that environmental research expectations since 1980 have doubled, EPA's research capabilities have regressed significantly rather than kept pace, in spite of what appear to be substantial dollar increases during the past two years and including the proposed \$25.1 million increase over the 1990 budget. To meet the goal suggested by the Science Advisory Board during the next four years we would have to average annual increases of almost \$80 million in new funds.

In terms of specific scientific disciplines, changes were noted in monitoring (down \$8.7 million to \$106.9 million); environmental processes (up \$15.9 million to \$95.2); engineering and technology programs (down \$6 million to \$89.2); and health effects (up \$6.3 million to \$63.6 million). Where significant, these changes are discussed in the context of the specific media programs (Section 4).

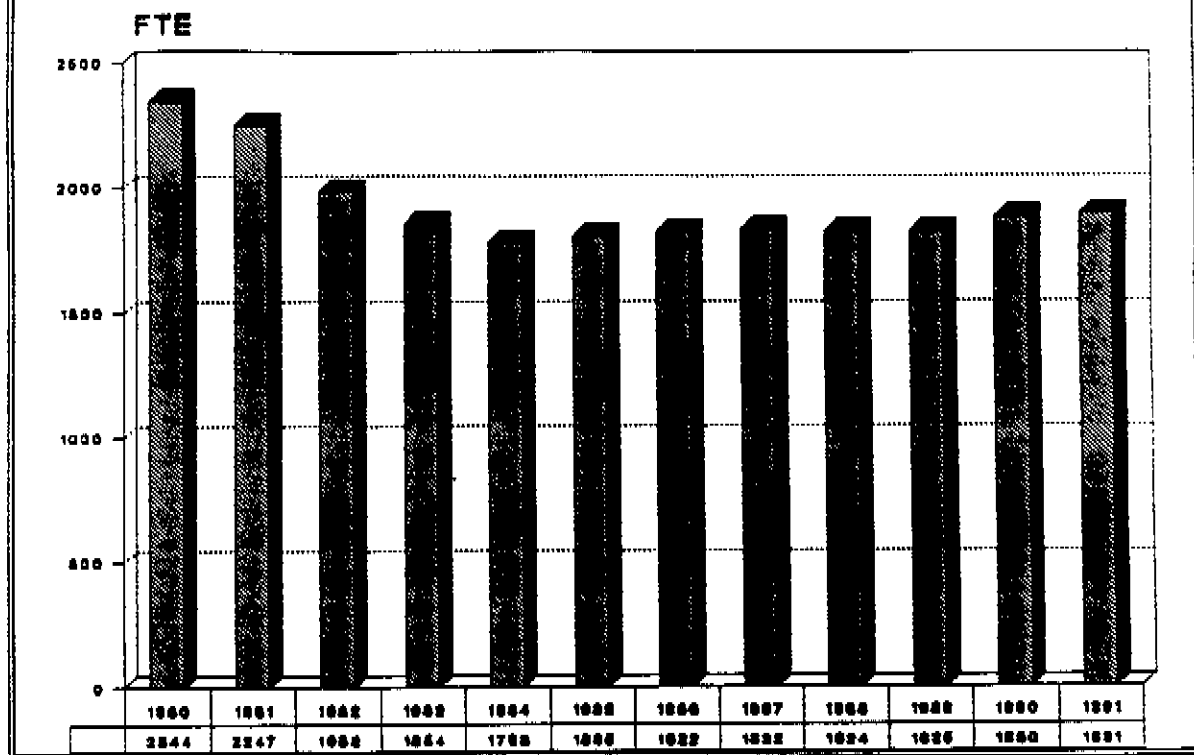
3.2 STAFFING The proposed FTE (Full Time Equivalent) level of 1,891 adds 11 FTE to the current staffing level, and continues the recent trend of gains, albeit falling short of the 1990 increase of 55 FTE. As Figure 3 displays, however, staffing is still far short of the 1980-81 levels of over 2200. There should be a more rapid restoration of the talent which "drives" the research program.

The ORD recently completed a study to determine the demographics of its work force--age, years of federal service, educational

¹Science Advisory Board. 1988 Future Risk: An Environmental Research Agenda for the 1990s. USEPA SAB, WASHINGTON D.C.

Figure 3

ORD Staffing History

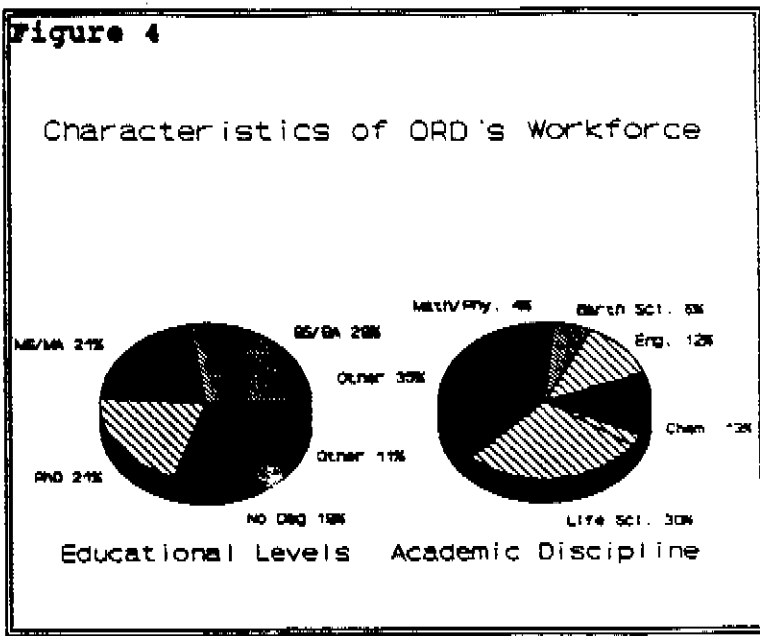


levels, scientific discipline, and other factors². We are pleased with the results of the efforts the Agency expended when it undertook the study. It is a very useful document for assessing the strengths and weaknesses of the research program and we expect it to be of considerable help in resolving staffing problems rationally. Figure 4 displays, in broad categories, composition of the work force by educational levels and academic discipline.

It is clear from the detailed data developed by this study that the ORD work force is ageing and in need of an infusion of younger talent to help maintain a healthy distribution of experience and fresh ideas. This "ageing" population is the result of earlier hiring freezes and a decrease in staff levels from 2344 FTE in 1980 to 1702 in 1984, a decline of 27%. Since 1984, and

²Office of Research and Development. ORD Work Force '89, Final Draft, March 1990. USEPA, Washington D.C.

including the proposed 1991 budget period, the staff will have grown to 1981 positions, a recovery of only 43% of what was lost. The aging nature of the population is attested to by the fact that the median age is between 46 and 50 years; the median years of federal service fall between 15 and 19 for holders of PhDs, and 20 to 25 years for graduate engineers; and over 25 for all others.



The data shows that significant numbers of the scientific work force will be eligible for retirement within the next few years. For example, nearly 40% of the chemists and engineers will be eligible for retirement within the next five years. Since chemists and engineers comprise almost half the scientific work force, the opportunity to accommodate changing research needs with new talent is great.

The proportion of PhDs and graduate engineers in the scientific work force is improving, amounting to 70%. A good goal for any research organization is 100% and upgrade training for the non-terminal degree worker should be encouraged.

There is one caveat concerning the report--we were disappointed in the level of resolution provided among the various scientific disciplines. The report differentiated disciplines only to very broad levels such as life sciences, earth sciences, engineering, etc, as shown in Figure 5 above. However, the data collected for the study did identify disciplines very specifically. Those data were made available to us for examination and raised some specific concerns noted below.

It is clear from the detailed data provided to us that ecological talent is grossly under-represented in the Office of Research and Development with only 17 positions out of 1800. At

a time when the emphasis in EPA is changing to regional and global ecological impacts, this small group of ecologists is not enough to give adequate direction to the program's initiatives. Similar discrepancies were noted between disciplinary competence and research needs in areas such as epidemiology, biotechnology, geography, etc. As is mentioned in our "Core Research" section, capability within the Agency is of paramount importance if competent planning and direction is to occur. There is considerable concern in the educational community today that not enough people are in the academic pipeline to meet the future demands of environmental sciences. There may not, in fact, be enough to meet immediate demands. This is reason enough to consider stronger measures for training new talent to replace the old and for retraining the existing staff to meet the demands of a changing research scenario.

While the exploratory research grants program does permit support for advanced graduate and post doctoral students, as is recognized in our section on "Programs," it leaves largely unmet the support for early phases of graduate work when students spend most of their time in graduate courses preparing for their research. Thus, many students are deterred from entering into environmental graduate programs simply because the resources are not available to support them.

We therefore recommend that EPA and the Congress develop a program of support which will allow students to enter into their in residence course-work phase of graduate environmental technical education. These programs should be established in research universities with proven records of success in winning peer-reviewed research grants to provide the necessary opportunities for student research projects in their later years of training.

EPA is also urged to establish an enhanced program of continuing education to update existing expertise and to retrain individuals in fields relevant to the Agency's changing needs. We note, with concern, that EPA spends only about \$240 per person per year for professional development. Research oriented companies in private industry spend between \$1000 and \$2000 per person simply to keep their people on top of their fields. The environmental

quality problems facing the nation are extremely complex and their science base is rapidly changing. The people asked to provide the knowledge to manage it should know what they are doing.

3.3 INFRASTRUCTURE Scientific equipment in the Agency's laboratories is ageing. As recommended in previous reviews, the Agency must replace ageing equipment to maintain research and analytical state-of-the-science capability. An analysis of the age and serviceability of equipment in ORD's laboratories indicates that close to \$100 million is needed to replace equipment which is 8 years or older (some \$16 million are needed to replace equipment which is older than 15 years)³. Considering the rapid pace of scientific instrumentation development and the need to become ever more precise in the measuring of chemical and biological substances in a variety of environmental media, a goal of replacement within seven years is not only desirable but mandatory if EPA science is to remain productive and credible.

The \$11.6 million proposed for equipment purchases is a laudatory increase, but is still far short of the estimated \$26 million per year needed if the replacement goal is to be achieved in the next five years.

Laboratory buildings and attendant facilities are also ageing. Most of these buildings were constructed before the Agency came into existence and were designed to meet the needs of the 1950s-1960s. Environmental issues have changed considerably in the past 25 years. As society's technologies for production, transportation, etc. have developed, so have the environmental problems, creating demands for knowledge that did not exist before. For example, with the emergence of genetic engineering, problems have been created that require the attention of an area of science new to the Agency, with attendant new facilities and equipment. Global warming, stratospheric ozone depletion, ocean oil spills are all issues which have emerged since the Agency's environmental research facilities have come into being. Facilities, equipment, and appropriately trained people are necessary to address these problems. The current facilities are simply not adequate to do the job.

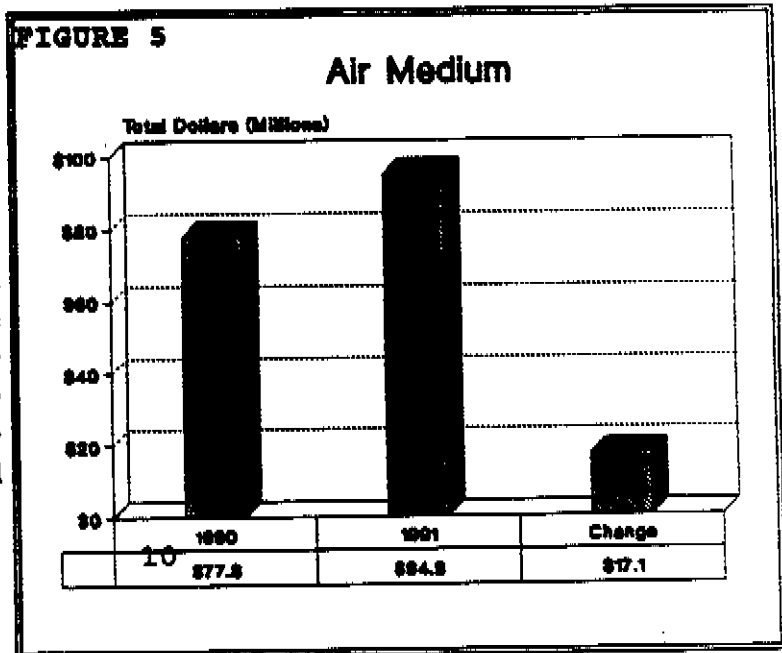
³ORD Office of Research Program Management staff study

We recommend that the Agency study its facilities needs and include in its future budget proposals a line item for facilities upgrading tailored to the needs of the research strategies for the 1990s.

3.4 OPERATING BUDGET The Office of Research and Development operates under a variety of funding modes, including, contracts, grants, cooperative agreements, inter-agency agreements, and in-house operations, supported with S&E Appropriation funds. The use of a standard, across-Agency S&E allocation formula, based largely on the needs of offices which do not have the diversity of operational activities as does ORD, places an unnecessary burden on ORD operations. The ORD's laboratories would operate much more efficiently if the research-related expenses portion of their S & E budget were made part of the R & D budget. This would provide greatly increased flexibility in meeting the day-to-day operational needs of an on-going research program.

4.0 MEDIA PROGRAMS We are generally pleased with the approach the Agency has taken in supporting projects within the regulatory program areas. By and large, emphasis has been properly placed and divestments and reallocations have been appropriately made. Yet, as with any complex program with limited funds, we have identified areas in which the re- source dispositions can and should be challenged. Each of the budget media are addressed in detail below.

4.10 AIR The proposed budget provides the air research program with a healthy 22% increase (see Figure 5), with emphasis placed on global climate changes, implementing the Clean Air Amendments, alternative fuels, an emissions inventory, air toxics, remote sensing and



indoor air quality.

The reallocations and disinvestments slated for the program seem reasonable, coming from transfers to other programs, completion of research projects, and deleting one-time line-item projects mandated by the Congress last year.

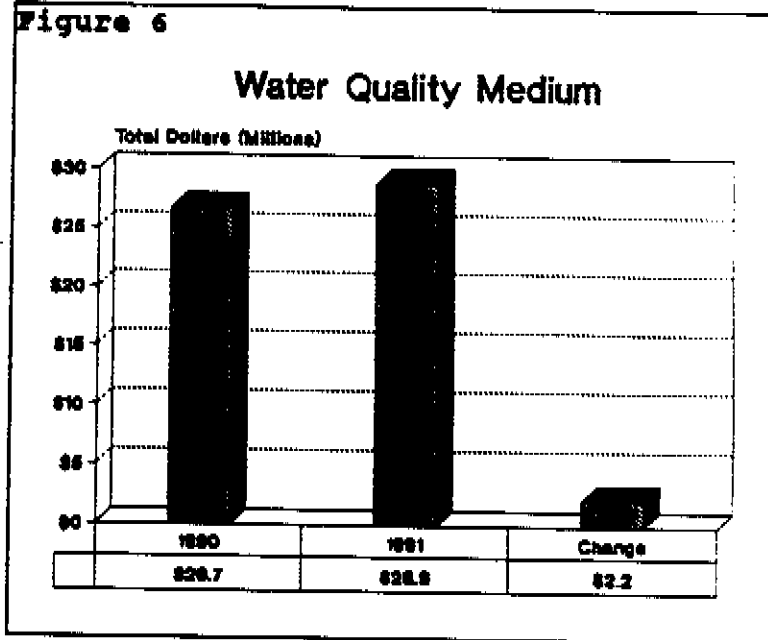
4.11 WATER QUALITY The Water Quality program is slated to receive an 8% increase (see Figure 6), allocated largely to oil spill bioremediation, wetlands ecological definition, research on the fate of substances in sediments, and for pollution prevention activities involving urban runoff.

We generally agree with the distribution of increases within this medium (given the resource constraints), but must express our concern that, with the exception of urban runoff, non-

point source pollution control research continues to be ignored. Non-point source pollution remains an important source of pollution in the United States, contributing to well over 60% of the degradation observed in our surface water quality. It should receive more attention not only from EPA research, but also from the Departments of Agriculture and the Interior, the predominant land use and renewable resource agencies.

4.12 DRINKING WATER This medium received a less than adequate increase of \$1.0 million (see Figure 7), directed predominantly to S&E enhancement and pollution prevention research. The SAB's Drinking Water Committee has expressed concern that cuts have been made in research on alternative disinfection methods. They point out that, although chlorine disinfectants have received extensive study (the results of which have impelled water systems to move away from their use), alternative disinfectants, to which many us-

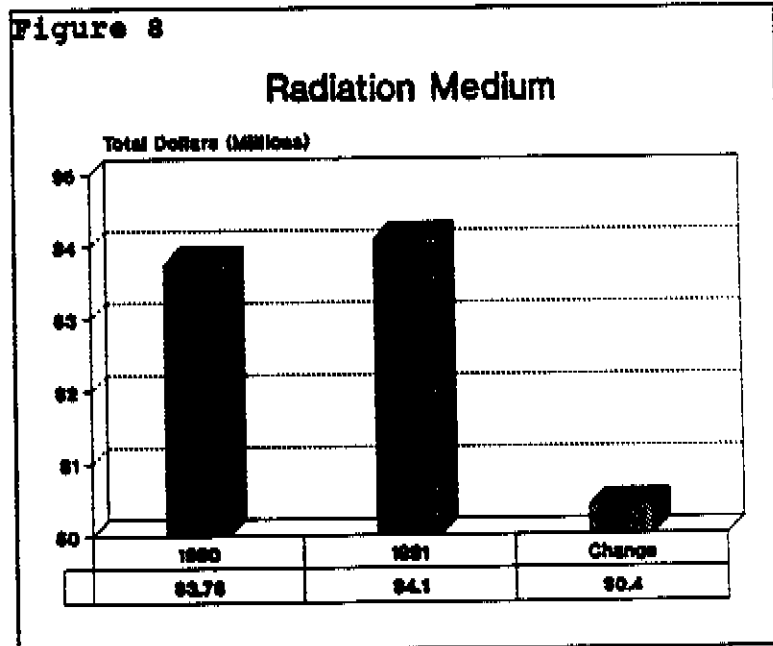
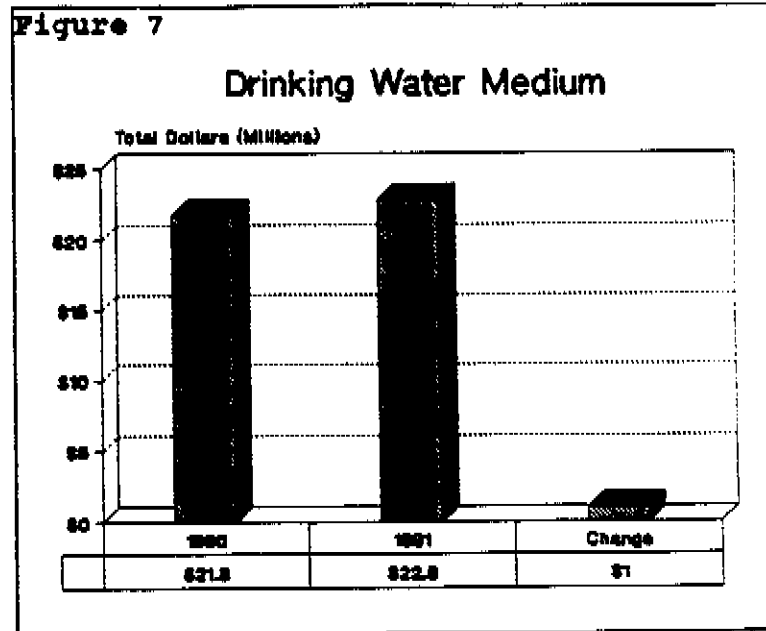
Figure 6



ers are turning, have not been thoroughly evaluated. Research in this area should be increased in order to give water supply systems sufficient information and sound options to choose from in selecting alternative treatment methods. We agree with this assessment.

4.13 RADIATION The radiation program is slated for an 11% increase (see Figure 8), primarily for support of research on the mitigation of radon in homes and schools. This research will emphasize radon mitigation techniques in existing homes and schools as well as in new construction. Monitoring and quality assurance activities will continue, as will support provided to the Departments of Energy with off-site monitoring at the Nevada Test Site. We feel that the level of support provided in this medium is appropriate for the stated objectives.

4.14 HAZARDOUS WASTE It seems paradoxical that the Agency's budget for hazardous and municipal waste regulatory and enforcement activities is increasing by almost \$48 million, yet the research supporting those activities is decreasing by just over \$2.5 million (see Figure

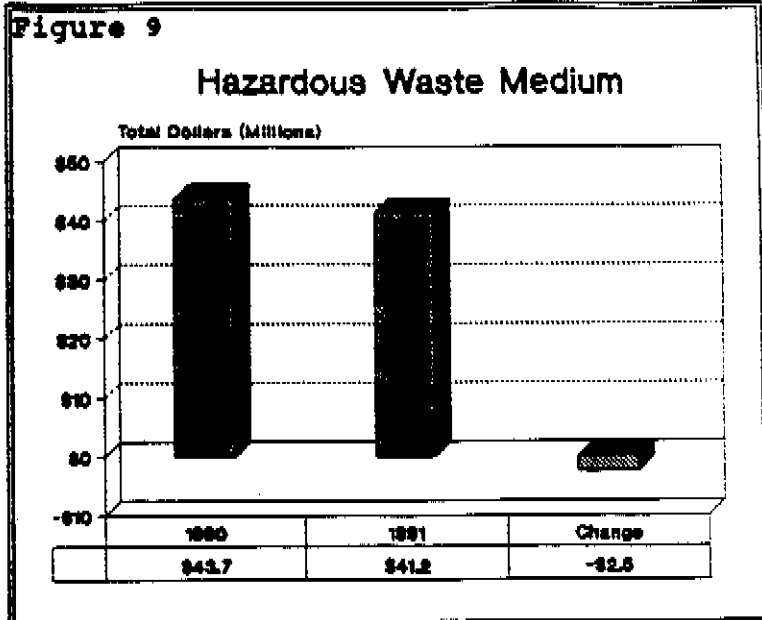


9). These reductions fly in the face of what we consider to be a need for significantly increased research in control technology.

The current crisis in municipal solid waste management is exacerbated by a lack of understanding of the relative risks associated with alternative control technologies. In particular, much more research is needed to improve municipal and hazardous waste combustion control technology.

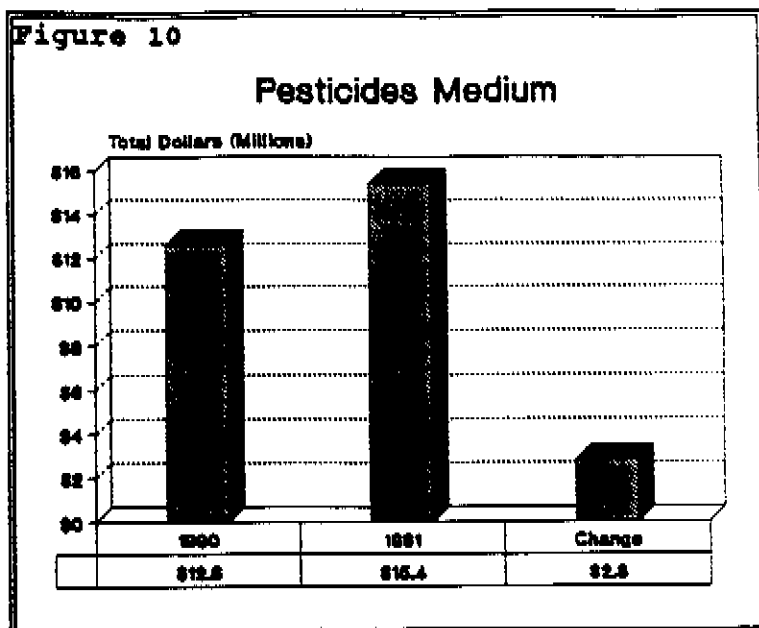
Incineration has been identified as one element of a four-pronged strategy for municipal waste management (including source reduction, recycle and reuse, and land filling of the residual ash from incineration). Communities are currently planning, constructing or operating almost 300 incinerators, the largest of which cost about \$100 million each, representing an estimated \$17 billion investment⁴. This large investment is being undertaken on questionable grounds due to uncertainties about the management of residual ash and the level of concern about organic toxic emissions (including dioxins and furans). Uncertainties about the levels of control of these substances offered by combustion condition control and air pollution control devices has deterred the application of incineration as a municipal waste management practice. Additional research is needed to reduce these uncertainties, but this budget appears to be moving exactly counter to the required direction.

4.15 PESTICIDES We support the 22% increase proposed for pesticides research, particularly since it is directed to address the impacts of genetically engineered organisms and methods for identifying and monitoring biological control agents--areas which



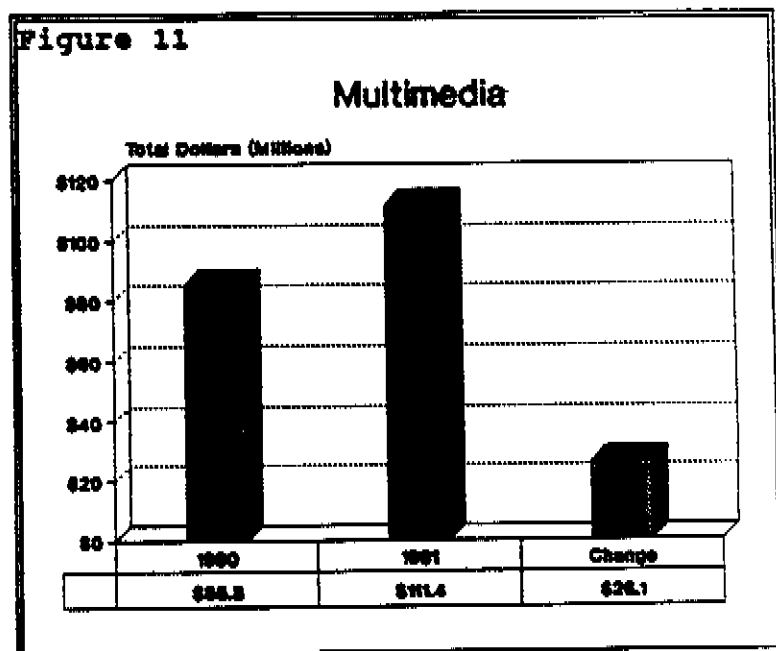
⁴Science Advisory Board. Review of the ORD Municipal Waste Combustion Ash Solidification/Stabilization Research Program, SAB-EEC-90-010, March 1990

will continue to be of high concern to the Agency. Major increases are slated for biotechnology, ecological risk assessment, and pollution prevention. We wish only to comment that the \$900,000 increase for the ecological risk assessment project is long overdue and we are delighted to see some progress made in this area. It is of major importance since future decisions on regional and global issues will be dependent on understanding the ecological risks for any pollution situation.



4.16 MULTIMEDIA Research in this area will increase by \$26.1 million, an increase of 31% (see Figure 11). Some \$12.3 million of the increase goes to the grants and centers program, and \$5.5 million is added to the EMAP (Environmental Monitoring and Assessment Program) effort. The remainder of the increase supports ecological and health risk and risk reduction research--all of which are important components of the core research program addressing longer-term needs and problems. We commend the Agency for taking this long-needed step to increase support for this vital nucleus of activity.

In 1988, the SAB called research "the most fundamental of the tools that promote envi-



ronmental quality."⁵ It was recommended that EPA develop a strategy for addressing environmental problems in the next decade and plan, implement, and sustain a long term research program to support this strategy.

EPA responded with the development of a "core" program that is comprised of four major elements designed to support environmental decision making: 1) ecological risk assessment; 2) health risk assessment; 3) risk reduction; and 4) exploratory grants and research centers. Each of these elements is further divided into a series of objectives which are in turn addressed by research activities. Each research activity can easily be assigned a prospective budget to meet a time line objective.

In order to improve the science base within EPA, it is imperative that there be a strong core research activity within the EPA research laboratories. As it is vital to increase the exploratory grants and academic research centers program, as noted above (since it builds the strength of researchers outside EPA and educates the next generation of qualified environmental scientists and engineers), it is also vital that intramural research capabilities keep pace. Adequate future research funds must be made available for intramural research initiatives.

The need to provide balance between strong intramural core research activities and robust extramural efforts continues to exist. Without a strong intramural effort, EPA will lack, in its laboratories, the cadre of competent scientists and engineers to provide the knowledge for appropriate communication links between the intra- and extramural efforts as well as the guidance to support future Agency scientific decisions.

Both intramural and extramural core research activities must be strongly linked to our long-term environmental issues and, thereby, the Agency's long term research needs. This need demands that the communication links between the intra- and extramural efforts be strong, that the Agency's scientists and the scientists supported with Agency extramural funds (grants, contracts and cooperative agreements) be fully aware of each other's progress towards a common set of research objectives and goals

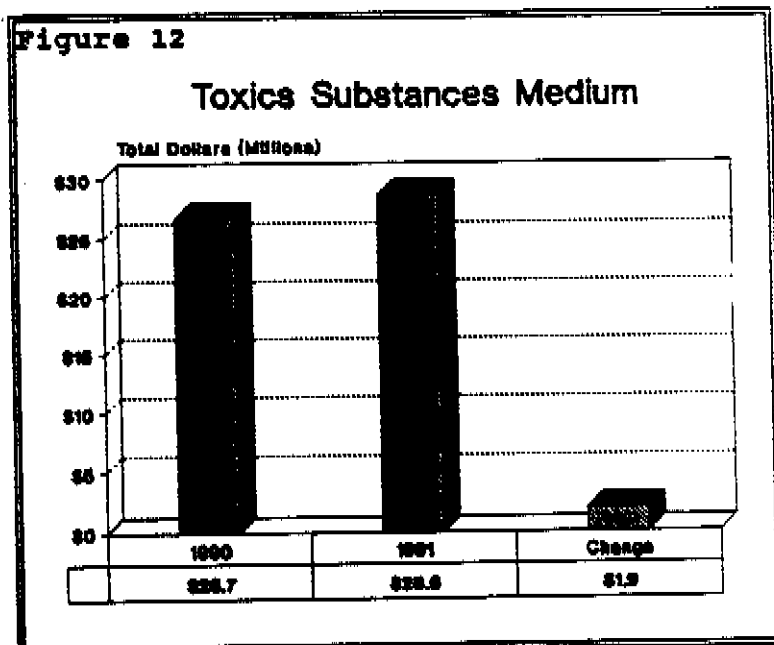
⁵Op. cit

and the programmatic needs of EPA's laboratories and program offices.

The SAB recommended in "Future Risk"⁶ that the Agency give consideration to the development of an "environmental research institute" to undertake fundamental environmental research, research which is not necessarily directly germane to on-going program activities, but which is necessary to understand and cope with emerging environmental issues. We are pleased to note that this Budget Proposal provides one FTE and \$685,000 for a study of the feasibility of creating such an institute.

4.17 TOXIC SUBSTANCES We also support the 7% increase provided for toxic substances re-

search (see Figure 12). Though the increase is barely above the change in the CPI, it does maintain important studies dealing with lead emissions and deposition, and in biotechnology. It is clear that lead deposition around smelters and combustors is still a serious problem, particularly where the health and long-term welfare of children is concerned. It is also important that exposure to, effects of, and risk control of biotechnology products be clearly understood, in order to avoid accidental introduction of possible adverse agents into the environment.

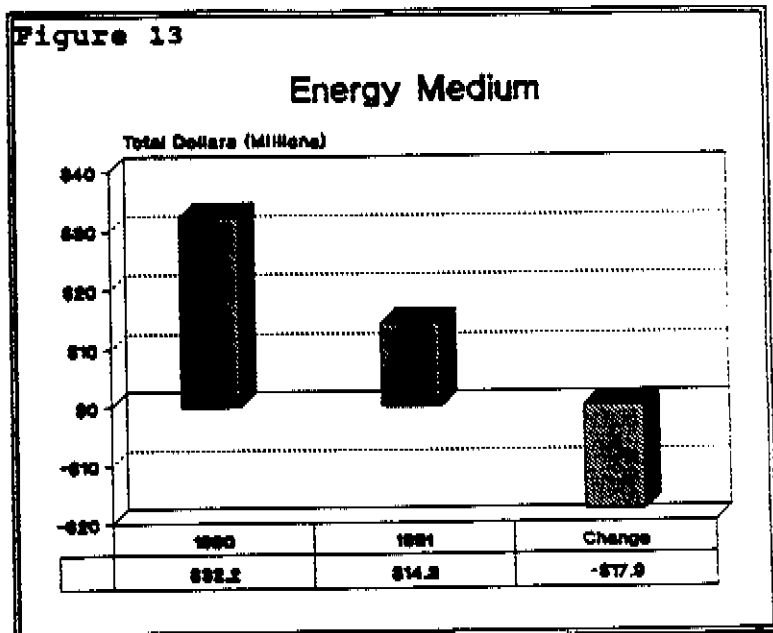


We are in agreement with the research objectives proposed in this research area.

⁶op. Cit

4.18 ENERGY The culmination of acid precipitation research with the delivery of a final assessment report to Congress is reflected in a 56% decrease in the Energy budget (Figure 13). Future research will focus on long term monitoring and modeling and analysis of emission scenarios, and will continue to evaluate the limestone injection multistage burner (LIMB), although that program is also winding down.

We feel that ORD should examine the LIMB program and its products carefully to determine the following:



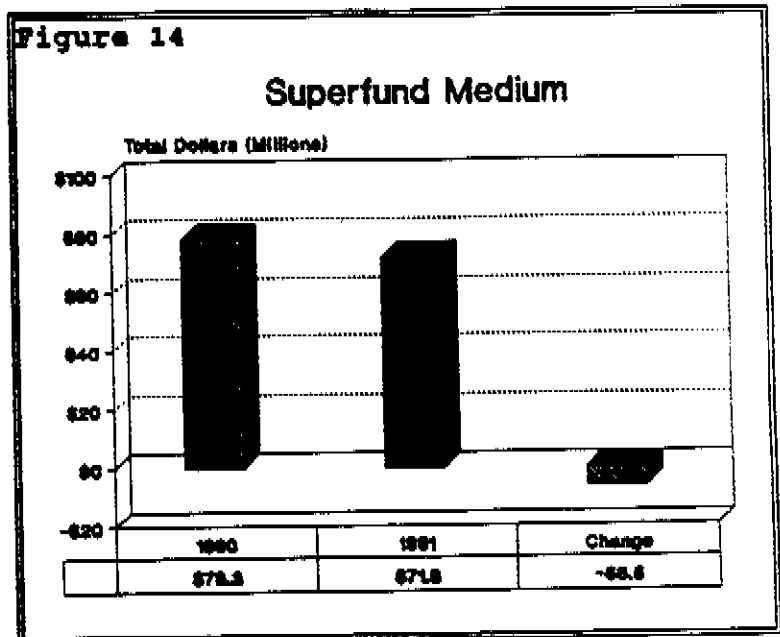
- a) To what extent does the technology developed in the LIMB program facilitate the cost-effective implementation of the SO_x and NO_x emission reductions targeted for the Clean Air Act revisions of 1990? In other words, is the program a success story for EPA control technology development?

- b) Should ORD utilize the personnel and accumulated experience from the LIMB program for a new program in fossil fuel effluent control development? Since LIMB technology is less effective for NO_x control than for SO_x control, and since a higher degree of NO_x control will be needed to reduce ambient O₃ to acceptable levels, an expanded effort to develop more complete NO_x emission controls will be needed. Better NO_x controls will not only reduce ambient O₃ concentrations, but will also greatly reduce the acidity of the ambient air and acidic deposition. NO_x itself is an acidic precursor, and O₃ formation, facilitated by NO₂, leads to more rapid conversion of SO₂, which converts to H₂SO₃, a weak acid, and then to H₂SO₄, a strong acid.

- c) What generic lessons can be drawn from EPA's experience with the LIMB program about the role EPA-ORD should play, if

any, in the development of industrial-scale technology for emissions reductions?

4.19 SUPERFUND As in the case of the hazardous waste program, it seems paradoxical that although the budget for Superfund regulatory, remediation, and enforcement activities is increased 14% (by \$210 million to a level of \$1.7 billion), the research to support these activities is decreased by 8% to a level of \$72 million (Figure 14). The Subcommittee notes and agrees with increasing the program's emphasis on subsurface clean-up and mobilization processes, and on ecological risk assessment, but is concerned with the over-all regression of research activity, and does not see any plausible rationale for such a move.



5.0 CONCLUSIONS AND RECOMMENDATIONS Environmental research in either a controlled or free market, is, by and large, not an activity that results in response to market pressures. However, it is an activity that is mandated by lack of knowledge of important facts and responds to societal values and long-term health and welfare issues.

Of the thousands of substances that emitted to the environment, we have enough knowledge to put limits on a very small fraction. Toxicological, chemical and control technology research must be undertaken to increase our knowledge of the behavior and toxic effects of these substances so that we can act upon those agents that need attention.

Society is concerned enough about environmental quality to demand action. This action, however, cannot be initiated in any

rational way without first knowing what it is upon which we are asked to act. Environmental research, particularly in the areas of broad scale (eg., global) impacts, can show the way.

This society tends to be dominated by an annual "bottom line" mentality. Yet the consequences of environmental pollution do not follow a short-term calendar. They tend to be long term and only slowly reversible. The impact of acid precipitation on forest growth, for example, is measured in decades or centuries. Yet the economic consequences of this reduction in renewing the forest resource can be disastrous. Ecological research is needed to give the decision maker the information necessary to assure adequate resource management.

By and large, the scientists in the Agency's research program are aware of the importance of their activities, and in forwarding their annual budgets they try to place in order of priority those issues which are pressing for answers. They try to balance the research needs of the regulatory program offices with the very real needs of fundamental research that must proceed before applied research can take place. They are seldom successful in this "balancing act," largely because of inadequate staffing and funds. It is to this inadequacy that we address ourselves:

- a) The 1991 budget for the Office of Research and Development proposes an increase of a mere 5.6%, barely keeping up with the increase in the CPI but falling behind the deficits incurred in the early 1980s. This in spite of an increase in demands on for better science and technology. An annual increase of \$80 million would be needed to catch up with the 1980 budget buying power level by 1995.
- b) Scientific staffing in the Office of Research and Development has incurred a similar deficit in numbers and requires an addition of 112 people per year for the next four years before regaining the 1980 level.
- c) The nature of the research being demanded of EPA is changing rapidly. The need exists for the Agency to spend more effort and funds in providing continuing education opportunities for its staff to accommodate those changes.
- d) At the same time the Agency needs to replace expected

attrition due to retirement with young, up-coming scientists and engineers in order to achieve a better mix of fresh ideas and experience. To accommodate this need, a program of support for beginning graduate students should be implemented.

e) Much of EPA's laboratory equipment is outmoded and needs replacement to keep the Agency's work credible. A schedule to replace equipment on a 7 year turnover rate basis will require the expenditure of \$26 million per year for the next 5 years to bring the Agency's equipment into a reasonable state-of-the-art level.

f) Existing laboratory facilities and structures were built to meet the needs of the 1950s and 1960s. In a large measure, these facilities are no longer adequate to accommodate current and anticipated research tasks. The Agency is urged to study its research facilities needs and begin to budget for their updating and renewal.

g) The Office of Research and Development has many modes of operation that do not mesh well with the Agency-wide budgeting structure and that cause an unnecessary burden. The laboratory operating portion of its currently S&E funds should be transferred to the R&D accounts so the Office can have greater latitude in meeting the requirements of its grant, contract, cooperative agreement and in-house modes of operation.

h) Funds for research to support program activities are generally appropriately distributed. However some areas do need greater emphasis and support. These include:

1. Increased research on the control of non-point pollution sources
2. Increased research on alternative drinking water treatment technologies
3. Increased research in hazardous waste, wastewater, and municipal waste combustion control technologies
4. An assessment of the LIMB (Limestone Injection Multi-stage Burner) research program's results to determine if the technology offers a cost-effective means of obtaining SO_x/NO_x control levels expected to be targeted in the Clean Air Act Amendments of 1990

5. Better balance between intra- and extra mural activities in the core research program

i) EPA has had a variable record in utilizing and listening to the advice of the various advisory apparatus available to it. In recent years its record has been very good. However, the tasks EPA has been asked to perform have become increasingly more involved and complex and now require the input of a much broader spectrum of science than was previously needed. At the same time the Agency has felt the need to achieve and maintain a high level of credibility. The combination of increased complexity and the need to maintain a high level of credibility demand a greater level of scientific advisory activity.

At the risk of appearing self-serving, we none-the-less are prompted to recommend that an adequate level of funding be provided to its various advisory boards, councils and committees so that the Agency can have, take advantage of, sound and relevant scientific advice.