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EPA

AN SAB REPORT: REVIEW OF FY 1993 PRESIDENT'S BUDGET REQUEST FOR R&D

REVIEW, BY THE RESEARCH STRATEGIES ADVISORY COMMITTEE (RSAC), OF THE FY 1993 PRESIDENT'S BUDGET REQUEST FOR RESEARCH AND DEVELOPMENT (R&D) ACTIVITIES WITHIN THE U.S. EPA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON D.C. 20460

March 11, 1992

SCIENCE ADVISORY BOARD

EPA-SAB-RSAC-92- 017

March 12, 1992

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

Subject: Review of FY 1993 Research and Development Budget Request

Dear Mr. Reilly:

The Budget Review Subcommittee of the EPA SAB's Research Strategies Advisory Committee met on February 12, 1992, to review the 1993 President's Budget Request for Research and Development activities within the Agency. As you know, this annual review was instituted several years ago to provide the Agency and Congress with insights on the scientific quality and responsiveness of Agency research proposals to national needs. This year, the Subcommittee attempted to provide a more critical look at specific activities outlined in the submission. To achieve this goal, representatives were selected from each of SAB's standing committees. These individuals provided a broad spectrum of scientific expertise (ranging from the physical and biological to the social sciences and from applied to fundamental activities) from which to draw the conclusions found in this report.

For FY 1993, the overall ORD budget is increased by $28.8M. While the Subcommittee applauds any increase in funding for high priority issues, we are extremely concerned about the level of effort which is actually afforded for the 1993 program. Our report points out a ten year decline in buying power which is impacting every program in ORD. By comparing the media program resources (in constant dollars) for 1980 with 1993 totals, the overall research and development budget has been reduced by nearly $6.5M (or 1%) over the past 13 years. Although several programs (such as multimedia and Superfund) have been significantly increased, many of the on-going media efforts continue to be weakened by inflation and, increasingly, by

earmarking of resources for project-specific activities. Over the last ten years, the buying power of ORD dollars devoted to several critical issues has dramatically decreased: e.g., drinking water research support has decreased by $9.5M (in constant dollars) since 1980 — similarly, pesticides research support has declined by over $3.0M, toxic substances research by over $14.0M and water quality research by an astounding $47.0M!

In addition to the general inadequacy of funding for research activities in FY 1993, the Subcommittee is extremely concerned about the continued deficit in infrastructure support. Aging physical facilities and equipment continue to need upgrading and replacement while increased workload has far surpassed laboratory managers' abilities to provide adequate space and improvements in instrumentation. As you know, the number of identifiable environmental issues requiring research attention has markedly increased. Unfortunately, it seems that ORD is expected to address more concerns each year with fewer resources (both dollars and FTEs). If such inadequacies in research funding continue, they will result in a debilitated research program and much greater risk in environmental decision-making due to scientific uncertainty. It is clear, therefore, that infrastructure, coupled with a lack of salaries and expenses monies to fund even ORD's on-board employees, must be addressed immediately.

Several members of the Subcommittee also raised issues regarding potential improvements to the process. Members felt that, despite the large amount of documentation that was provided for review, there were problems with the quality and timeliness of the submissions. We first note our frustration at the last-minute delivery of review materials. Although we acknowledge the fact that the annual submissions are often changing until their actual delivery to Congress, materials must somehow be provided to the SAB in a more timely and informative fashion. Many of this year's briefings contained varying amounts of detail and the formats were often inconsistent with budget submission materials and were somewhat unfocused. Frankly, this year's presentations and background materials made it difficult to grasp the significance of the material, particularly for the new Subcommittee members. Consequently, to improve the process, we recommend the following:

1) Changes which are subsequent to the OMB passback and appeal should be addressed in errata sheets,

2) ORD should determine breakouts of its budget by office prior to the SAB briefing and provide this discipline-oriented information in hard-copy and cite the relevant changes in the annual briefing to the SAB (whether the presentations are given by medium or are done in the new issue structure, this information is imperative as the Congress requires review at this level).

3) The levels of information provided for parallel aspects of the budget should be made more consistent.

Further, we recommend that SAB staff meet with ORD management to develop a new approach to our annual review, including ways to obtain necessary materials in a more timely fashion and to develop a new format for both written and oral information.

The Subcommittee thanks you for the opportunity to again participate in this review and looks forward to your response.

Dr. John Neuhold, Chairman
Budget Review Subcommittee
Research Strategies Advisory Committee

NOTE:

In order to accomodate Congressional requests, the contents of this report have been reviewed and approved by the Budget Review Subcommittee, but have not been reviewed or approved by the Executive Committee of the Science Advisory Board.

Enclosure

U.S. ENVIRONMENTAL PROTECTION AGENCY

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NOTE:

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ABSTRACT

On February 12, 1992, the Budget Review Subcommittee of the Research Strategies Advisory Committee (RSAC) reviewed the FY 1993 President's Budget Request for Research and Development activities within EPA. The Subcommittee included representatives from each of the Science Advisory Board's standing Committees and focused on the budgetary impacts on both existing and future research endeavors.

The Subcommittee concluded that insufficient S&E funds and FTEs pose a serious threat to the continued viability of the EPA research program. Such inadequacies result in three major weaknesses which threaten the core capabilities of the Agency's research efforts:

1) reliance on on-site contracts for continued research effort rather than mere support services.

2) attrition of federal career scientists with a subsequent loss of historical perspective and invaluable experience with the Agency. This situation is compounded by inability to hire due to inadequate Personnel Compensation and Benefits (PC&B) funds, and lack of funds for adequate training and professional development.

3) increasing obsolescence/inadequacies of equipment and facilities capabilities.

Although the Subcommittee commented that ORD has made tremendous strides in environmental research and has the potential to become the premier environmental research facility, each of the above deficiencies continue to erode such capabilities. Consequently, Administration and the Congress are urged to provide an infusion of resources to abate the decline of EPA's scientific capability.

Key Words: budget, research and development, FY 1993, resources, scientific capability, core research

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1. EXECUTIVE SUMMARY

The SAB's annual review of the EPA Research and Development President's Budget Request was held in Alexandria, Virginia, on February 12, 1993. At that session, the Budget Review Subcommittee of the Research Strategies Advisory Committee examined the 1993 proposals, focusing on 1) the content (science) of the proposed activities, 2) the viability of such current and and future ORD efforts given the budget request, 3) the relationships and impacts of the proposals on past, current, and future environmental research efforts and 4) trends in research and development activities in the Agency.

In comparing ORD funding trends, the Subcommittee noted that research and development support has decreased by $6.5M in constant 1980 dollars over the past three years. Similarly, the number of Full Time Equivalent employees (FTEs) has dropped from 2,352 FTEs in 1980 to 1,957 FTEs in 1993. CLEARLY, SUCH INADEQUACIES IN RESEARCH FUNDING WILL RESULT IN A DEBILITATED RESEARCH PROGRAM LEADING TO GREATER RISK DUE TO LESS INFORMED ENVIRONMENTAL DECISION.

In addition to inadequate support for staff, the Subcommittee was troubled to learn that THE PHYSICAL FACILITIES AND EQUIPMENT WHICH ARE NECESSARY FOR AN EFFECTIVE RESEARCH PROGRAM ARE REACHING OBSOLESCENCE AT AN ALARMINGLY INCREASING RATE, WITH LITTLE REPLACEMENT FUNDING AVAILABLE. In our 1990 report we indicated that approximately $80 million worth of equipment (replacement value) was seven years of age or older. Funds were made available to the Agency in the 1991 budget for upgrading purposes; however, at the current rate of of obsolescence and minimal influx of replacement resources, it will take ORD thirty years (assuming no increases in costs for such purchases) to obtain acceptable instrumentation.

The Subcommittee also wishes to state its concern for increased activity, visibility and accountability for social sciences research. In the 1993 proposals, virtually no activities are highlighted in this critical area, and the SAB again strongly recommends that socioeconomic research become an integral part of the Agency's research activity if pollution prevention is truly to be the cornerstone of EPA's long-term risk reduction vision. SOCIOECONOMIC RESEARCH IS NEEDED TO SUPPORT DEVELOPMENT OF RISK REDUCTION TOOLS OTHER THAN COMMAND-AND-CONTROL, AND THAT CANNOT BE DONE EFFECTIVELY WHEN DIVORCED FROM OTHER ENVIRONMENTAL RESEARCH ACTIVITY. The Subcommittee has also included a number of media-specific observations and recommendations within the review document. Finally, the Subcommittee has an overarching concern that affects the overall research and development effort: the continued overuse of on-site contract support. Inadequate S&E funds and FTEs noted above continually force ORD laboratories to obtain services from contractors who can provide on-site support with R & D funds. These services may range from care and maintenance contracts to establishment of entire research sections in various disciplinary areas. Such practices result in numerous inefficiencies which exacerbate

growing resource deficits. CONSEQUENTLY, THE COMMITTEE RECOMMENDS THAT RELIANCE ON ON-SITE CONTRACTUAL SERVICES BE DECREASED — ESPECIALLY IN THE MANAGEMENT AND ANALYSIS AREAS — AND THAT GREATER EMPHASIS BE PLACED ON SECURING ADDITIONAL COMPETENT SCIENTISTS ON THE FEDERAL WORK FORCE.

2. INTRODUCTION

2.1 General Issues

The annual review of the Office of Research and Development's (ORD) President's Budget Request was held on February 12, 1992 in Alexandria, Virginia. The meeting was conducted by the Budget Review Subcommittee of the Science Advisory Board's (SAB's) Research Strategies Advisory Committee (RSAC). The Subcommittee, which was composed of representatives from each of SAB's standing committees, provided a broad spectrum of scientific expertise (ranging from the physical and biological to the social sciences and from applied to fundamental activities) from which to draw the conclusions found in this report.

Although nearly 18 years of involvement in such annual R&D reviews has provided significant historical perspective, the dynamic nature of the SAB membership has also provided new and innovative input from newly appointed members. Consequently, the background materials and presentations from senior R&D managers were carefully scrutinized to determine not only the dollars necessary to conduct research, but also to examine available personnel, equipment, facilities and contractual services which are essential to such tasks. In attempting to address each of these critical components of the R&D programs, the review attempts to: 1) determine the content (science) of the proposed activities, 2) comment on the viability of such current and and future ORD efforts given the budget request, 3) examine the relationships and impacts of the proposals on past, current, and future environmental research efforts and 4) provide insights on the trends in research and development activities in the Agency.

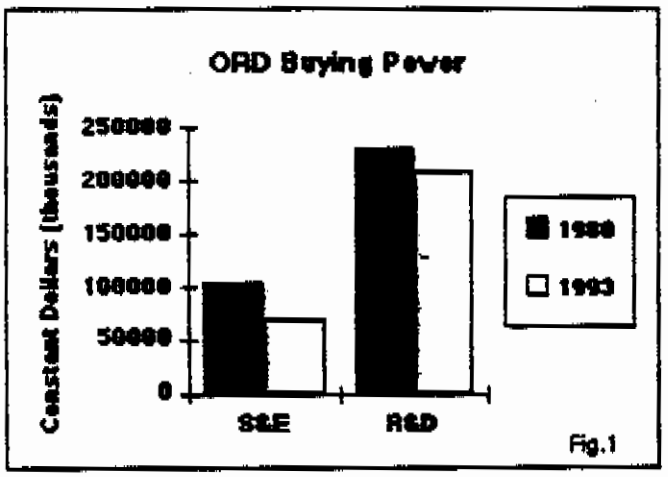


Fig.1

2.1.1. Budget Trends

The proposed FY 1993 budget for research and development activities reflects an increase of $28.8 million or 6% over FY 1992. However, when comparing the dollar's buying power today with 1980, the research and development support has been reduced by $6.5M, or 1%. (Figure 1). Similarly, the number of Full Time Equivalent employees (FTEs) has dropped from 2,352 FTEs in 1980 to 1,957 FTEs in 1993 or a reduction of 17% of the actual workforce (Figure 2). To compound this situation, continued inadequacies in salaries and expenses funding will force ORD to lapse 3% of its authorized FTEs, thus resulting in an available workforce nearly 20% smaller than that in FY 1980.

During the 1980-1992 period, the number of identifiable environmental issues requiring research attention has multiplied in spite of (and in some cases resulting

from) considerable advances that have been made in our ability to identify more subtle problems. For example, although our nation has made significant advances in controlling point source pollution affecting surface waters and certain air pollutants, non-point source problems remain unsolved. We are aware that stratospheric ozone depletion and global warming are issues of paramount importance, that pollutant intrusions into groundwater (and subsequent mitigation) continue to pose major technical problems, and that solid and hazardous waste disposal is causing economic and social stress. Such issues are only a few examples of the steadily increasing number of issues requiring investigation. Nevertheless, ORD IS EXPECTED TO ADDRESS MORE CONCERNS EACH YEAR WITH FEWER RESOURCES (BOTH DOLLARS AND FTEs), AN UNRENEWED SCIENTIFIC STAFF AND INADEQUATELY FUNDED FACILITIES AND EQUIPMENT.

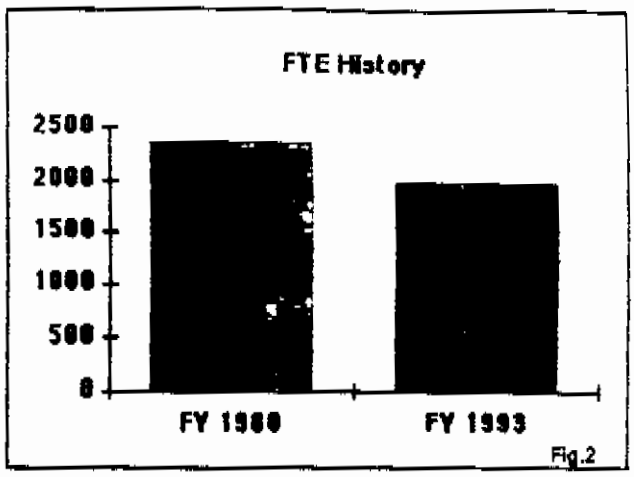


Fig.2

Although the resources provided to ORD have increased over the past 10 years, the increases have not begun to reverse the damage from the reductions incurred in the early 1980s. At the same time, the Agency has been unable to approach the goal of doubling the ORD budget as recommended by the SAB in its 1988 "Future Risk" report (see "Future Risk: Research Strategies for the 1990s". EPA SAB. SAB-EC-88-040. 1988). CONTINUED INADEQUACIES IN RESEARCH FUNDING WILL RESULT IN A DEBILITATED RESEARCH PROGRAM RESULTING IN MUCH GREATER RISK IN ENVIRONMENTAL DECISION MAKING DUE TO SCIENTIFIC UNCERTAINTY.

2.1.2. Research Planning

Research planning was unfocused and reactive during the first years of the Agency's existence. At the recommendation of the National Academy of Sciences/ National Research Council report (see "Research and Development in the Environmental Protection Agency". NAS/NRC. 1977.), ORD implemented a committee-oriented research planning process organized along EPA program-office media structure. While this system was an improvement over prior years, the committee deliberations were often too parochial. Since each program office which participated was essentially constrained by medium, (air, water etc.) or to a broad legislative mandate (toxic substances, pesticides), intermedia issues were often overlooked, deemed of low importance, or, in light of dwindling resources, considered to be the province of other committees. In recent years, more attention has appropriately been focused on intermedia issues.

With the release of the SAB report "Reducing Risk" (See "Reducing Risk: Setting Priorities and Strategies for Environmental Protection." EPA SAB-EC-90-021. 1990), it became apparent that an issue oriented approach to research planning was essential if risk was to be effectively assessed and reduced. Since the concept of risk involves human values, human and ecological health and welfare (economic and social), risk reduction in the environment encompasses each.

While the Subcommittee recognizes ORD's philosophical agreement with the importance of social sciences research in environmental protection programs, lapses in action are occurring and must be corrected. In spite of strong recommendations by the SAB, the ORD budget request contains virtually nothing in the social sciences research area. While ORD contends that the Office of Policy Planning and Evaluation (OPPE) and program offices "unofficially" support research in this area, lack of central research coordination and oversight makes it impossible to identify such high priority activities, resulting in an unacceptable situation. This conclusion is supported by recent efforts of the National Research Council (NRC) Committee on Environmental Research to identify the level of environmentally-related social science research efforts. This group, too, has been unsuccessful in identifying such federally funded activities. Consequently, the SAB recommends that EPA devise a way of making socioeconomic research an integral part of the Agency's research activity — which is critical if pollution prevention is, indeed, to be the cornerstone of EPA's long-term risk reduction vision. IT SHOULD ALSO BE RECOGNIZED THAT SOCIOECONOMIC RESEARCH IS NEEDED TO SUPPORT DEVELOPMENT OF RISK REDUCTION TOOLS OTHER THAN COMMAND-AND-CONTROL, AND THAT IT CANNOT BE DONE EFFECTIVELY WHEN DIVORCED FROM OTHER ENVIRONMENTAL RESEARCH ACTIVITY.

In addition to the specific comments offered above, THE COMMITTEE WISHES TO OFFICIALLY ENDORSE THE TERMINATION OF THOSE CONGRESSIONALLY MANDATED PROJECTS THAT HAVE BEEN ASSIGNED TO THE AGENCY WITH RESTORATION OF THE FUNDS TO OTHER CRITICALLY IMPORTANT ORD PROJECTS. The committee is concerned, as is a major segment of the national scientific community, about the increasing incidence of congressionally mandated projects not subject to peer review . Such earmarkings represent a major threat to the long established approach to research support which has resulted in the Agency's outstanding record in science. Such practices also interfere with the basic premise upon which an issue-based planning system is founded by risking the placement of colloquial issues at a higher priority than prime environmental issues.

2.1.3. Infrastructure

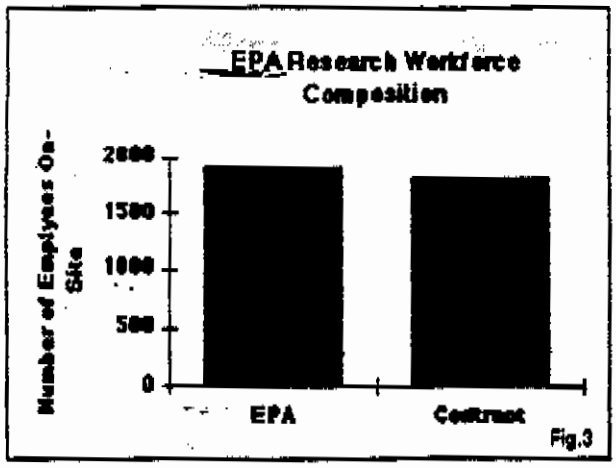
THE PHYSICAL FACILITIES AND EQUIPMENT WHICH ARE NECESSARY FOR AN EFFECTIVE RESEARCH PROGRAM ARE AGING AND CONTINUE TO NEED UPGRADING. The Subcommittee has addressed this issue in past years, and Congressional responses have been favorable. However, increased efforts in several on-going programs, coupled with new and unanticipated endeavors (not to mention the

rapid advances in instrumentation and other technologies) have surpassed laboratory managers' abilities to provide adequate analytical space and upgraded equipment. Technological advances in the analytical area have placed much of ORD laboratories' equipment on the verge of obsolescence. In our 1990 report we indicated that approximately $80 million worth of equipment (replacement value) was seven years of age or older. Funds were made available to the Agency in the 1991 budget for upgrading purposes; however, at the current rate of of obsolescence and minimal influx of replacement resources, it will take ORD thirty years (assuming no increases in costs for such purchases) to obtain acceptable instrumentation. Such inadequacies must be resolved and NEW MONIES FOR FACILITIES AND EQUIPMENT MUST BE MADE AVAILABLE IF ORD IS TO FUNCTION AS A CREDIBLE RESEARCH INSTITUTION.

Finally, the Subcommittee is pleased to see that the Agency is participating in the Nation's high performance supercomputing effort. The concept of parallel processing offers great potential for advances in environmental science and engineering, and we endorse the plans of the Agency to focus the initial effort in one Laboratory. Given a relatively modest budget, efforts would progress more rapidly by focusing a single team in one facility, rather than smaller multiple efforts which would be thinly divided among a number of laboratories.

2.1.4. Intramural Research and Extramural Contracts

A successful research organization must employ a cadre of scientists at all stages of their development. The educational/experience levels of the investigators should range from entry level Ph.D. novitiates to senior level scientists who can serve as mentors. Such a continuum of experience — from the new and innovative ideas of the new generation to the discipline and wisdom of the senior scientist — is essential to provide the steady flow of talent necessary to resolve problems posed by an ever-changing environmental scenario. Nevertheless, FTE and S&E constraints continue to be a major impediment in supporting the influx of such essential talent, thereby diminishing the Agency's ability to establish an adequate R&D effort. Consequently, inadequate funding has resulted in a reliance on on-site contractors which transcends mere support services and now seriously threaten the scientific excellence of the organization. Unrealistic ceilings placed on S&E funds cannot support the already inadequate number of FTEs which are authorized for R&D activities each year. Such inadequacies subsequently force ORD laboratories to obtain services from contractors who can provide on-site support with R & D funds. These services may range from care and maintenance contracts to establishment of entire research sections in various disciplinary areas. These "management tools" inevitably result in numerous inefficiencies which exacerbate the growing resource deficits. In obtaining such services, overhead is duplicated and direct communications which would be inherent with in-house support is compromised, thereby reducing the return on the investment in both dollars and lost time of principal investigators/contract managers. In effect, a "shadow bureaucracy" is created. More importantly, continuity and historical knowledge and perspective are lost — resulting in detrimental long-term consequences to the viability of the R&D effort. The Subcommittee is therefore greatly concerned



that continued lack of sufficient funding for the in-house research program is resulting in a disproportionate amount of resources being directed to on-site contractor support. In 1991, nearly 50% of the work force employed at the laboratories was on-site contractor support. In some instances, the total of on-site support was as high as 75% (Figure 3). Such an inordinately high proportion of contractor support is of great concern to the SAB (see "Office of Research and Development Work Force '91". EPA/600/9-91-029. August 1991).

In addition to concerns about lack of in-house expertise and inadequate in-house facilities, contractor support creates another burden which impairs the scientific excellence of EPA's research laboratories — contract management responsibilities. An increasing number of the scientific staff members of the ORD Labs are being forced to serve as project managers and coordinators over on-site contractors. This responsibility, which is being imposed on many new and unseasoned government scientists often results in a loss of hard won scientific skills and results in a sense of frustration from seeing their scientific careers and abilities atrophy before they have had the opportunity to make significant contributions in the fields of environmental science and engineering.

Given EPA's critical role in the nation's environmental research and development efforts, it is essential that the Agency's decisions be based on the best science available. Ideally, this results from the research performed by first rate in-house scientific staff coupled with research groups in academia, the private sector and in other major government laboratories. When necessary, contractor support should be used to fill in areas of temporary need, and should augment the in-house research groups on occasions of increased, but temporary, demand. Laboratory scientists should also be authorized and encouraged to make much greater use of doctoral and post-doctoral students within their research projects. Such individuals bring fresh and innovative approaches to research. This not only enhances the research program, but stimulates the staff and creates an atmosphere of intellectual excitement, creative potential, and scholarly tension, thereby promoting the kind of competition that leads to the best science.

Although the Subcommittee recognizes the propriety of an Inspector General audit of on-site contractual services in EPA laboratories, we are concerned that additional emphasis on audits, reviews and criticism of the extramural support could adversely impact and further debilitate the already overburdened research function of the laboratories. While it is clear that duplicative and unnecessary managerial overhead is imposed on the laboratories in terms of people, funds and communication lines, it is equally clear that laboratory science management must remain in the hands

of the federal scientists in a direct line relationship. CONSEQUENTLY, THE COMMITTEE RECOMMENDS THAT RELIANCE ON ON-SITE CONTRACTUAL SERVICES BE DECREASED — ESPECIALLY IN THE MANAGEMENT AND ANALYSIS AREAS — AND THAT GREATER EMPHASIS BE PLACED ON SECURING ADDITIONAL COMPETENT SCIENTISTS ON THE FEDERAL WORK FORCE. TO ACHIEVE THIS GOAL, WE AGAIN STRONGLY RECOMMEND THAT S&E FUNDS AND FTEs BE DRAMATICALLY INCREASED IN ORDER TO REVERSE WHAT APPEARS TO BE AN INEXORABLE TREND TOWARD THE EXTINCTION OF EPA's RESEARCH CAPABILITY. IT IS ALSO RECOMMENDED THAT LABORATORY DIRECTORS BE REQUIRED TO USE A PEER REVIEW PROCESS IN ALLOCATING EXTRAMURAL FUNDS SO THAT OUTSTANDING SCIENTISTS OR GROUPS OF SCIENTISTS ARE SELECTED TO WORK ON AUTHORIZED RESEARCH PROJECTS.

3.0 RESEARCH AREA ISSUES

The following comments are organized in the media specific format in which ORD is organized. The Subcommittee has made an effort to present the historical funding perspective of the ORD program between 1980 and 1993 (Graphic illustrations are provided for 1992 vs. 1993 and, where appropriate, for comparisons of 1980 and 1993 totals using 1980 constant dollars) and has provided comments on perceived weaknesses and strengths:

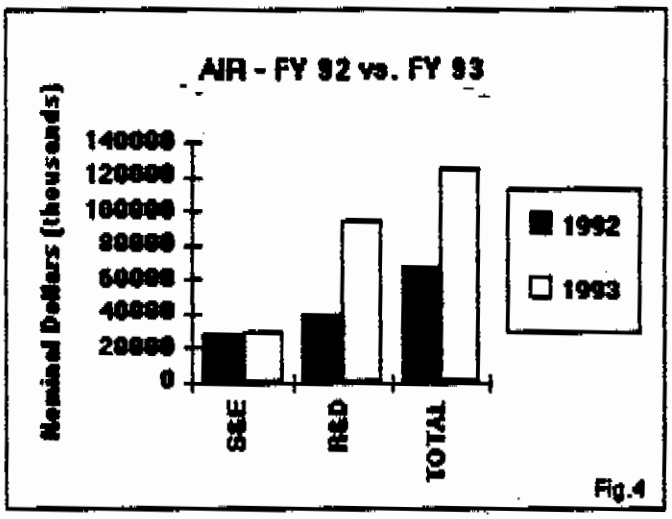


Fig.4

3.1. Air Research

The air research submission reflects an increase of 5.4 FTEs and $10.6M, for a total of 496.4 FTEs and $136.4M (Figures 4 & 5). Since 1980, this represents a significant influx of resources, with the majority of the annual increases occurring due to 1) the enactment of the Clean Air Act Amendments, 2) the emergence of global climate change issues and 3) the inclusion of acid deposition resources with the air medium (moved from its own separate category.) Of the total, 30.9 FTEs and $12.5 million are requested for acid deposition research (down $0.8 million), 38.9 FTEs and $25.7 million are requested for Global Climate issues (up $2.4 million), and 426.6 FTEs and $98.1 million (up $8.1 million) is requested for air quality research.

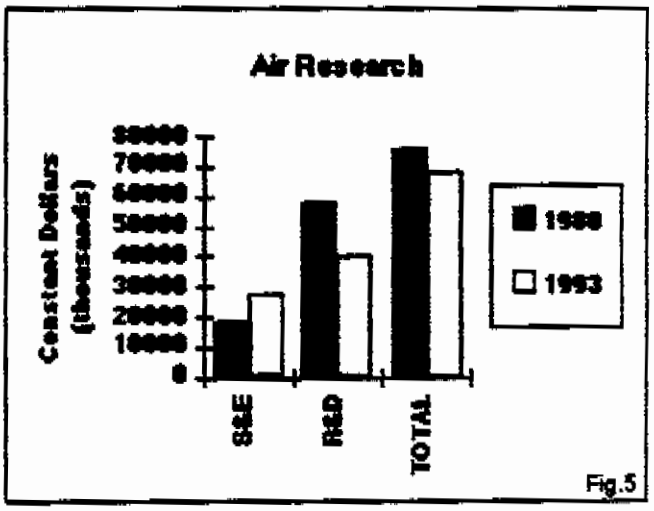


Fig.5

In general, the Subcommittee agrees with the distribution of the funds among the various programs within the air research area. Still, we are concerned about whether the overall program can provide adequate support to fulfill all of the requirements of the Clean Air Act Amendments. Additionally, concerns about three cross-cutting issues were raised as follows:

Models:

The Subcommittee is concerned with the proposed air modeling efforts and their ultimate implementation. Resources earmarked for improving ozone formation models

are inadequate and the marginal improvements proposed for these models are not likely to lead to demonstrably more realistic air quality scenarios. If progress is to be made within the timeframe necessary to establish effective ozone precursor control programs, resources for this effort must be increased and the program priorities be restructured. The recent NAS report "Rethinking the Ozone Problem in Urban and Regional Air Pollution" amply demonstrates that NO_x plays a critical role in photochemical smog formation in certain areas and that role can only be quantified by using a state of the art, urban scale grid model. However, because VOC emissions inventories are poorly defined, and none of the currently used models have been adequately validated, much work needs to be done to obtain realistic results from the models.

EFFORTS MUST BE MADE TO PROVIDE THE BEST INPUTS TO THE REGIONAL OXIDANT MODEL (ROM) AND URBAN AIR SHED MODEL (UAM), THEIR TESTING, AND THEIR PROPER VALIDATION. The poor condition of the Volatile Organic Compound (VOC) emission inventories and the lack of proper measurements to establish initial and boundary conditions are causes for great concern. This is especially true in any given geographical area where there is insufficient information to determine whether NOx reductions will have a benefit or "disbenefit" on ozone air quality. This can only be determined by properly applying the Urban Airshed Model (UAM) to each geographical area where NO_x reductions are being considered. If this decision is made utilizing anything less than the best available science, additional VOC reductions may be necessary to compensate for a mistake.

Although the Southern Oxidant Study (SOS) presents a unique opportunity to perform validation studies, such efforts should not be focused exclusively on SOS. Different parts of the country will require different solutions, and the observed high ozone levels demonstrate that needs in the Northeast are much greater than in the South. Consequently, the solution to this problem will be considerably more expensive than EPA has recognized. Therefore, EPA's MODEL VALIDATION EFFORTS SHOULD BE INCREASED, WITH A LARGE PORTION CONCENTRATING ON PROBLEMS IN THE NORTHEAST.

Epidemiology:

The increase in air pollution epidemiology in the 1993 ORD budget is strongly endorsed by the SAB. The Board has long encouraged ORD to establish a viable epidemiology research effort to complement its relatively greater efforts in clinical studies and animal toxicology. The chronic effects of O_3 represent one of the most critical areas where knowledge is needed, and easily lends itself to epidemiological study. Consequently, the Subcommittee again strongly supports air epidemiology research with an emphasis on the chronic health effects of ozone. WE ALSO ENCOURAGE ORD TO CONTINUE TO BUILD ITS PROGRAM IN EPIDEMIOLOGY. HOWEVER, WE FEEL COMPELLED TO NOTE THAT THE LONG UNFILLED POSITIONS IN THE HERL OF DIRECTOR OF THE HUMAN STUDIES DIVISION AND CHIEF OF THE EPIDEMIOLOGY BRANCH WILL PROVE TO BE AN IMPORTANT AND SEVERELY LIMITING FACTOR IN ENSURING APPROPRIATE AND NEEDED GROWTH IN THIS AREA OF HEALTH EFFECTS RESEARCH.

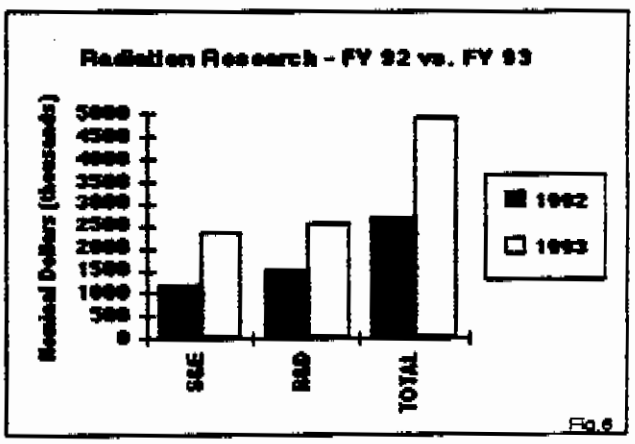
Emissions:

It is likely that the highway vehicle portion of the VOC inventory is underestimated by a factor of 2 to 3 in EPA's MOBILE 4 vehicle emissions model and that biogenics are uncertain to at least a factor of 3. Also, concerns have been raised that the explicit treatment of isoprene chemistry in the photochemical models overestimates the production of ozone. Since it is imperative that such uncertainties be reduced, these issues must be examined in a timely manner in order to preclude issuance of additional State Implementation Plans (SIPS) which are both unrealistic and ineffective. Consequently, THE SUBCOMMITTEE RECOMMENDS THAT HIGH PRIORITY BE ASSIGNED TO IMPROVING ANTHROPOGENIC AND BIOGENIC VOC EMISSION INVENTORIES.

Alternative fuels efforts are also concerned with emissions and are part of an ongoing research program that will last many years as fuel formulations continue to change. It is therefore recommended that EPA consider some cooperative research efforts with fuel users, manufacturers and their associations. This type of arrangement, with full quality oversight by EPA, could provide leverage which frees FTEs for other high priority EPA programs.

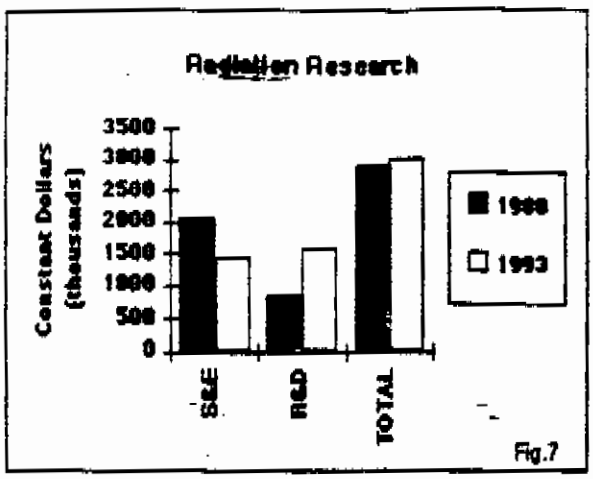
Indoor Air:

The indoor air research program emphasizes those indoor pollutants that cause neurotoxic, irritant and other non-cancer health effects, with particular focus on organic vapors, their combinations and bioaerosols. Other indoor pollutants with potentially significant health effects are therefore judged to be of lower research priority. Such substances include environmental tobacco smoke (especially its respiratory effects in children), asbestos and its fibrous substitutes, and combustion effluents from non-vented sources. It was agreed that bioaerosols and organic vapors warrant more research. However, concerns were raised whether productive clinical research on individual organic vapors would be feasible and whether the areas of emphasis selected were the most critical in terms of reducing risks of indoor air pollutant exposures. Consequently, it is clear that the levels of funding are quite limiting and that they will not permit adequate investigation of more than one or two pollutant classes.



3.2. Radiation Research

ORD requests 23.4 FTEs and $4.9 million, (an increase of $2.2 million) for off-site radiation monitoring, and research on indoor radon exposure and electromagnetic radiation (Figures 6 & 7).

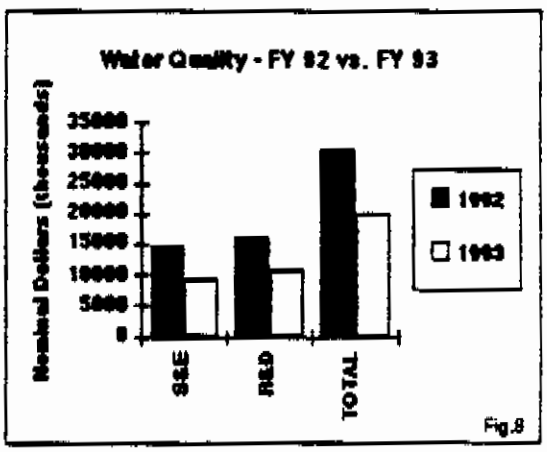


The Subcommittee is pleased that the Agency is proposing increased efforts to address the complex issues associated with electromagnetic radiation. However, we must reiterate the concerns voiced by the SAB's Radiation Advisory Committee over the past several years. Specifically, the Committee wishes to point out that the computer models used to assess the exposure of individuals to radionuclides in various media are no longer state of the art and do not take into account new knowledge and concepts which have emerged during the ten years following the development of the original models . Finally, the Subcommittee is concerned that no 1993 activities have been proposed to relate short term to long term tests for indoor radon measurement and exposure determination. This is a continued area of high priority which should be reexamined for possible inclusion in the FY 1993 program.

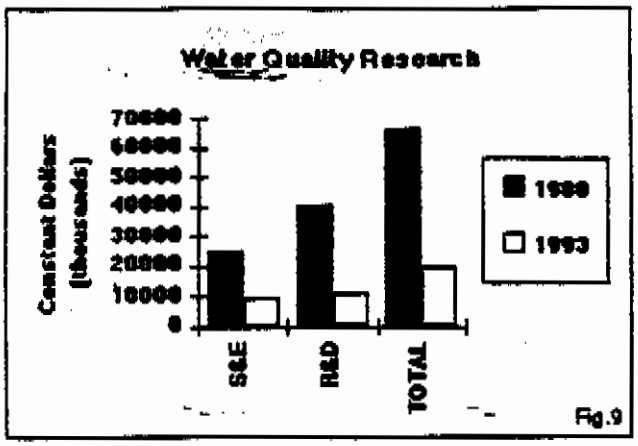
In conclusion, the SUBCOMMITTEE RECOMMENDS THAT ORD REVISE AND UPGRADE EXISTING RADIATION TRANSPORT MODELS TO MORE ACCURATELY MONITOR RADIATION EXPOSURE. WE ALSO RECOMMEND THAT ADDITIONAL EFFORTS BE MADE TO RELATE SHORT TERM TO LONG TERM TESTS FOR INDOOR RADON MEASUREMENT AND EXPOSURE DETERMINATION.

3.3. Water Quality Research

ORD's Water quality request totals 236.9 FTEs (- 17.5 FTEs) and $32.6 million,(+ $2 million), for research on criteria development, multimedia nitrogen input to estuarine and near-coastal systems, risks to habitat values, multi-chemical exposures, sediment quality and wetlands (Figures 8 & 9).



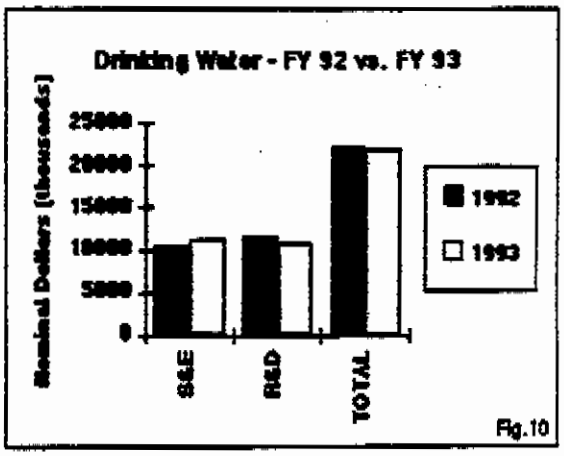
Since the concept of applying ecological criteria as a basis for judging the quality of our lakes, streams, and waters is both timely and scientifically valid, the SAB endorses the proposed new effort and major increase in funding for enhanced research in Aquatic Criteria. However, we would remind the Agency that stream and lake conditions depend heavily on the status and conditions of the riparian ecosystems or the ecosystems of the surrounding watersheds that supply and drain the aquatic systems. For these reasons WE RECOMMEND THAT RESEARCH IN LANDSCAPE ECOLOGY DEALING WITH THE PATTERN DYNAMICS OF TERRESTRIAL ECOSYSTEMS AND THEIR CONSEQUENT INFLUENCE ON AQUATIC



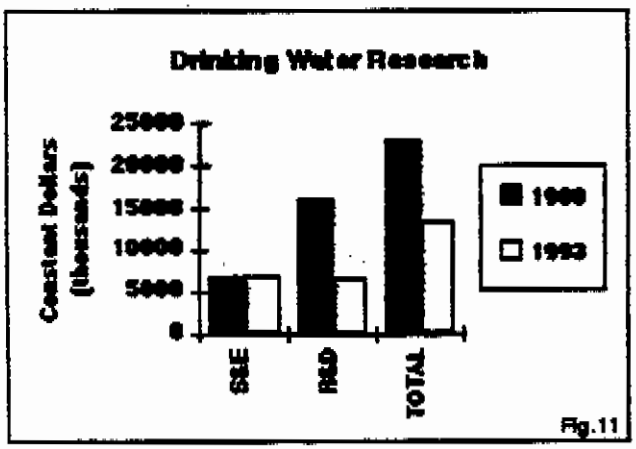
ECOSYSTEMS BE INCLUDED IN THIS AUGMENTED RESEARCH EFFORT.

Increased emphasis on wetlands research addresses a major environmental concern and is also strongly endorsed. The Science Workshop convened to identify important risks to be addressed by reauthorization of the Clean Water Act (CWA) concluded that physical loss of aquatic-related habitat was the major risk. THEREFORE, ALONG WITH THE RESEARCH ON WETLAND HABITATS, ADDITIONAL RESEARCH ON THE UNIQUE HABITATS OF RIPARIAN SYSTEMS, SHORELINES, AND BENTHOS IS RECOMMENDED.

3.4. Drinking Water Research



A total of 171.2 FTEs and $21.9 million (a decrease of 4.9 FTEs and $0.2M) is requested for drinking water research (Figures 10 & 11). The research covers health effects of contaminants and microbial pathogens and the health risks of disinfectants and their by-products. The Subcommittee notes that ORD has followed the Drinking Water Advisory Committee's recommendation to continue research on the effects of drinking water disinfectants and their by-products. However, given the magnitude of uncertainty concerning THE POTENTIAL EFFECTS OF DISINFECTANTS AND THEIR BY-PRODUCTS, SIGNIFICANTLY INCREASED EMPHASIS IN THIS AREA IS ESSENTIAL.



3.5. Toxic Substances Research

The toxic substances request is increased by 0.5 FTEs and $1M for a total of 185.5 FTEs and $26.8M (Figures 12 & 13). This is a broad and varied program involving multidisciplinary research and development of protocols and guidelines for TSCA, extrapolation of toxicant doses among mammalian

species, biological indicators of dose, toxics control systems, structure-activity relationships, biotechnology, eco- risk, exposure assessment, emission estimation techniques and asbestos measurement and abatement procedures. For FY 1993, the Subcommittee concurs with the distribution of resources as presented.

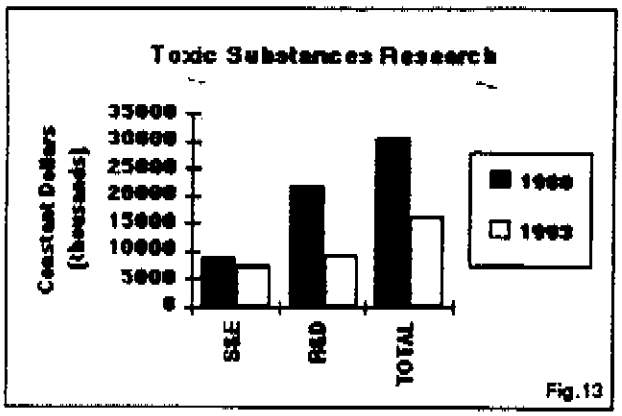


Fig.13

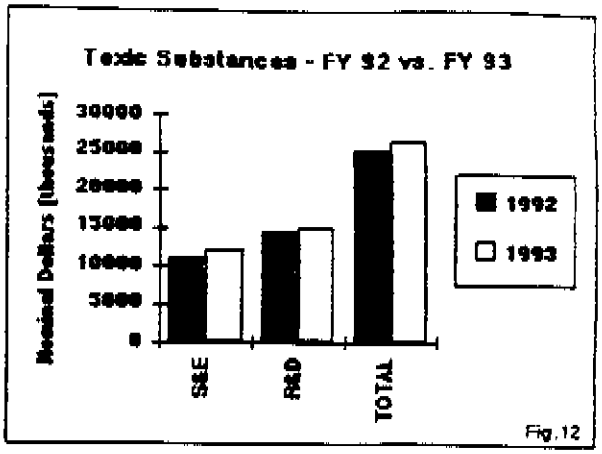


Fig.12

3.6. Pesticides Research

A total of 110.9 FTEs and $15.8 million (+$1.3 million) is proposed for pesticide research (Figures 14 & 15). This research concentrates on environmental and health

test methods,development of biological markers as indicators of exposure, transport and fate of pesticides in the environment, worker safety, human exposure monitoring, evaluation of microbial and biochemical pest control agents, eco-risk and quality assurance. Again, the Subcommittee generally agrees with the distribution of funds and the research emphases in this area of ORD research. THE SUBCOMMITTEE

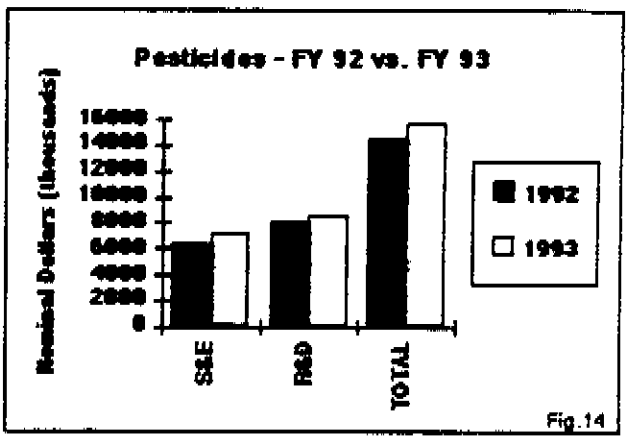


Fig.14

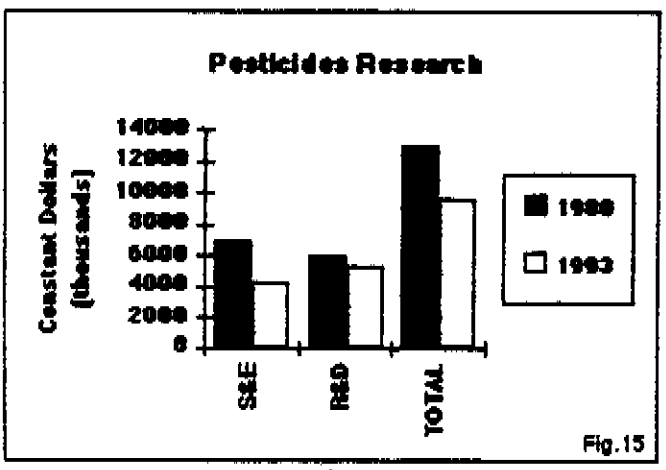


Fig.15

ALSO STRONGLY ENDORSES THE INCREASED EMPHASIS ON NEUROTOXICOLOGY RESEARCH. THIS HIGH PRIORITY BUT UNDERFUNDED PROGRAM CONTAINS INNOVATIVE AND TIMELY ELEMENTS WHICH WILL PROVE TO BE INVALUABLE IN FUTURE DECISION-MAKING.

3.7. Hazardous Waste Research

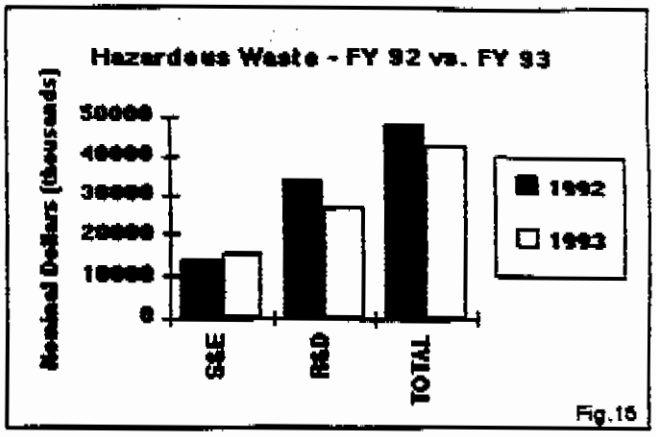


Fig.16

The hazardous waste research program request reflects an increase of 12.7 FTEs and a decrease of $5.3M for a total of 236.6 FTEs and $42.4 million (Figure 16). The FY 1993 proposal concentrates on pollution prevention and waste minimization but also considers alternative disposal systems and processes, underground storage tank (UST) releases and oil spills. The oil spill work, which will be funded by the Federal Oil Spills Response appropriation, will involve activity in developing physical cleanup methods as well as continue work on determining the effectiveness of chemical and biological cleanup methods.

The Subcommittee commends ORD for its efforts in the pollution prevention and waste minimization areas and encourages its realistic approach toward alternative disposal technologies.

3.8. Superfund Research

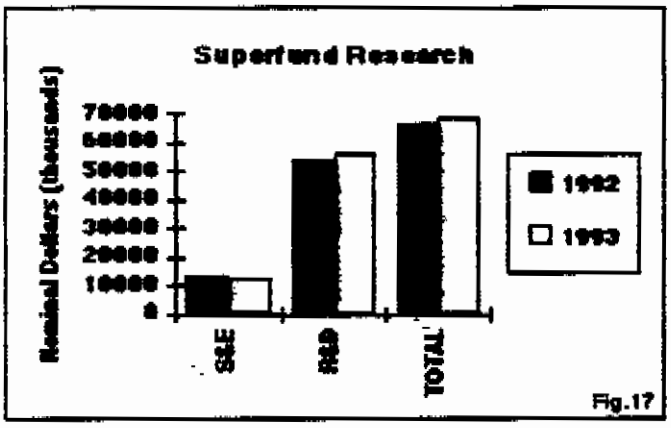


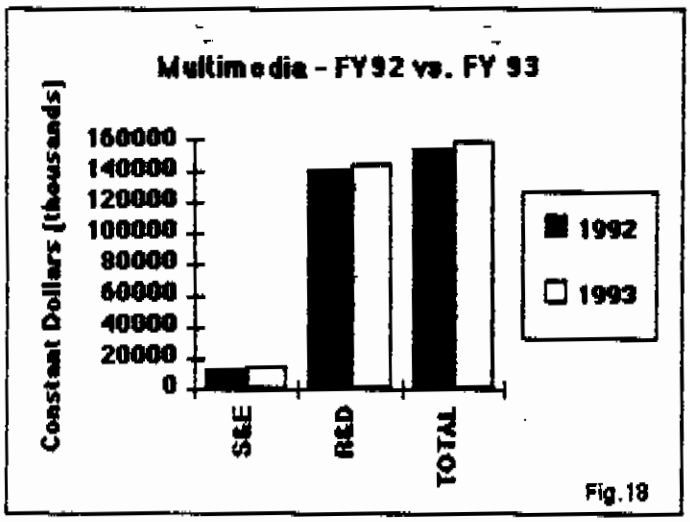
Fig.17

Superfund support is increased in the FY 1993 budget proposal by $2M and requests 136.9 FTEs (Figure 17). The work proposed is largely technology oriented, focusing on monitoring, assessment, and cleanup technology. Though the program has a research component, it is an effort which is, by necessity, strongly site-related and technology oriented with emphasis on the urgencies of cleanup. Therefore, related research involving modeling of surface and ground water contamination by complex toxicant mixtures (with subsequent effects on human health and ecosystems) seems to be dependent on the base efforts of other ORD programs. The reviewers feel that the type of research undertaken in this area is constrained by site specificity and a "job-shop" mentality in response to specific site clean up requirements. Unfortunately, this can often result in "acting before thinking" and exacerbate some problems associated with the cleanup effort. CONSEQUENTLY, THE SUBCOMMITTEE AGREES THAT STRONG EMPHASIS ON MONITORING METHODS AND CLEANUP TECHNOLOGY IS APPROPRIATE FOR THIS PROGRAM, BUT URGES SUPPORT OF RESEARCH IN THE HUMAN HEALTH

AND ECOSYSTEM EXPOSURE AND EFFECTS AREAS CRITICAL FOR IMPROVING ASSESSMENTS.

3.9. Multimedia Research

Pollutants emitted into the environment know no boundaries. Since they are not constrained to a single medium but cross into other media and expose all forms of life to their presence, the Multimedia Research Program has been organized address these complex intermedia issues.



In FY 1993, ORD is requesting 225.6 FTEs and $159.8M (and increase of 30.8 FTEs and$6.2 million) for multimedia research (Figure 18). The proposed research covers work in ecological and health risk assessment, risk reduction, exploratory research, interdisciplinary research centers and a major effort in environmental monitoring and assessment.

EMAP:

This is the Agency's most important and challenging ecological effort. The committee is pleased that the proposed budget increase of $18.9 million is in general accord with the budget increases planned in the original ORD core strategy. As an important program in terms of its potential for environmental management, it has been under intensive review by the SAB since its inception. Efforts are geared toward providing an historical data base against which the efficacy of our environmental programs can ultimately be determined and identifying trends which can identify emerging problems. Initial efforts will result in some amount of immediate, beneficial information but some adjustment of approaches will also be necessary as the researchers gain experience. THE SUB COMMITTEE COUNSELS CAUTION IN EXPECTING EARLY RESULTS. THIS IS A PROGRAM THAT WILL REQUIRE PATIENCE AND CONTINUED SUPPORT IF IT IS EXPECTED TO SUCCEED. THE SAB ALSO URGES SIGNIFICANT STRENGTHENING OF THE DATA MANAGEMENT OPERATIONS AND STRONG AUGMENTATION OF RESEARCH IN SUPPORT OF OVERALL LANDSCAPE BASED DESIGN (an area which is critical to implementation of subsequent detailed sampling and analysis of different ecological resource components of the landscape).

Grants:

The SAB notes its extreme concern and regret that there is no indication of increased funding for the extramural program that supports investigator-initiated research proposals. The announced intention by the Agency for annual increases of $10 million (until a level of $50 million was reached) is now seriously off target. The 1992 and 1993 levels of $1.8 million are too low to maintain an appropriate growth in theknowledge base for environmental science, and insufficient for the development of stable programs in academia for the recruitment and training of the next generation of research personnel. Such individuals are vital to EPA and the entire environmental research community to replace its aging cohorts of scientists and engineers.

The SAB is also dismayed to learn of ORD's intention to terminate its general solicitation of investigator-initiated grant proposals in the area of health research in order to use that part of the budget to support research only in more narrowly focused areas, such as in biomarkers. THE SAB DOES ENCOURAGE EPA TO ISSUE REQUESTS FOR APPLICATIONS (RFAs) IN PROGRAM AREAS SUCH AS BIOMARKERS (WHERE THERE IS A NEED TO STIMULATE MORE RESEARCH), BUT RECOMMENDS THAT SUPPORT FOR RESEARCH IN SUCH SELECTED AREAS NOT BE BORNE AT THE EXPENSE OF CURRENT, EFFECTIVE RESEARCH EFFORTS.

Centers

The Subcommittee is pleased to endorse the Agency's recent change of the level of support for each of its University Based Research Centers. We would hope that this shift and the selection of new Centers is based on a combination of reviews of past efforts, as well as projected needs of the Agency. WE STRONGLY ENDORSE THE CONCEPT OF PERIODIC PEER REVIEWS OF EACH OF THE CENTERS BOTH IN TERMS OF RESEARCH ACCOMPLISHED, AS WELL AS RESPONSIVENESS TO THE MISSION OF THE AGENCY, AND STRONGLY ENCOURAGE A DOUBLING OF THE NUMBER OF CENTERS OVER TO NEXT TWO YEARS, EACH AT THE CURRENT LEVEL OF FUNDING.

4.0 CONCLUSIONS

It is clear to this Subcommittee that certain elements of ORD are at a critical juncture. The most serious threat to the continued viability of the EPA research program stems insufficient S&E funds and FTEs. These inadequacies result in three major weaknesses which threaten the core capabilities of the Agency's research efforts:

1) reliance on on-site contracts for continued research effort rather than mere support services.

2) attrition of federal career scientists with a subsequent loss of historical perspective and invaluable experience with the Agency. This situation is compounded by inability to hire due to inadequate Personnel Compensation and Benefits (PC&B) funds, and lack of funds for adequate training and professional development.

3) increasing obsolescence/inadequacies of equipment and facilities capabilities.

Although the Subcommittee feels that ORD has made tremendous strides in environmental research and has the potential to become the premier environmental research facility, each of the above deficiencies continue to erode such capabilities. Consequently, we again urge the Administration and the Congress to provide an infusion of resources to abate the decline of EPA's scientific capability.