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EPA Organization for Environmental Research: The Third Decade

Office of Research and Development
U.S. Environmental Protection Agency
Washington, D.C. 20460

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

APR 14 1993

OFFICE OF
RESEARCH AND DEVELOPMENT

Honorable Louis Stokes
Chairman
Subcommittee on Appropriations
VA, HUD, and Independent Agencies
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

Enclosed is a report developed in response to the directives in the FY 1993 House Appropriations Bill Report, entitled: "EPA Organization for Environmental Research: The Third Decade." This report reviews the history and current configuration of the research laboratories in the Office of Research and Development and highlights a number of organizational issues confronting ORD. The requirement for this report appears on page 53 of H.R. 102-710.

The new administration will be taking steps to review the roles and the organization of ORD in carrying out these steps. This report provides excellent background information on the past history and the recent progress in ORD and will be valuable to the new appointees.

It is my hope that this report will serve as points of departure for ongoing deliberations with Congress on significant issues and options for environmental research organization and management.

Sincerely yours,

Gary J. Foley
Acting Assistant Administrator
for Research and Development

Enclosure

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

APR 14 1993

OFFICE OF
RESEARCH AND DEVELOPMENT

Honorable Barbara Mikulski
Chairman
Subcommittee on VA, HUD, and
Independent Agencies
Committee on Appropriations
U. S. Senate
Washington, DC 20510

Dear Madame Chair:

Enclosed is a report developed in response to the directives in the FY 1993 House Appropriations Bill Report, entitled: "EPA Organization for Environmental Research: The Third Decade." This report reviews the history and current configuration of the research laboratories in the Office of Research and Development and highlights a number of organizational issues confronting ORD. The requirement for this report appears on page 53 of H.R. 102-710.

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Preface

This report has been developed in response to the request of the House Appropriations Committee.

> "The Committee is very concerned with the status of EPA's research laboratories. Recently, the Inspector General found a number of contracting and other problems in the Agency's facilities. It is the understanding of the Committee that the serious deficiencies found at the Duluth Laboratory represent only initial indications of broader EPA laboratory problems that must be addressed. In addition to the problem identified by the Inspector General, the Committee is concerned with the current EPA laboratory structure. Therefore, a study should be undertaken reviewing the current organizational structure of research laboratories. The study should address the optimal alignment of resources and mission, and include options that will ensure the most efficient and effective delivery of science and information is available to the Agency. This report should be submitted by February 1, 1993." (Page 52 - House Appropriations Report - FY '93)

To respond to this request in a meaningful way, analysis of EPA environmental research must extend beyond the simple (yet significant) organization of field laboratories. Consideration must be given to the unique requirements created by the environmental regulation responsibilities of the Agency, the competing values that shape the science roles and responsibilities within EPA and ORD, and the fact that almost 70% of ORD's research funding is deployed in complex extramural programs of grants, cooperative agreements and procurement contracts.

This report provides an analysis of the historical antecedents of the present laboratory mission configuration and a description of the roles, responsibilities, management processes and customer linkages designed to serve EPA's environmental research needs in the third decade and beyond.

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Chapter 1

Strategic Overview

In the two decades since the creation in 1970 of the U.S. Environmental Protection Agency under Presidential Reorganization Authority, the scientific mission and structure of EPA laboratories and headquarters offices have experienced a turbulent evolution. The first decade (roughly 1970-1980) was characterized by significant organizational turmoil as EPA science managers tested a range of design concepts attempting to shape an environmental research organization within a media-oriented regulatory agency, while absorbing 42 disparate scientific/bureaucratic entities spread across the nation. However, not all scientific organizations moved to EPA were included in what was to become ORD. Some were placed in program offices.

The second decade witnessed continuing efforts at rationalization of laboratory structures and missions and resulted in the present field structure of 12 research laboratories and 5 field facilities. The policy context of the decade reflected significant contradictory pressures: expanding program demands (Superfund, TSCA, pollution prevention); shifting priorities (e.g. reductions in energy related funding, increased Superfund related research and demonstration, increased interest in global climate change, "pollutant of the month," etc.); significant fluctuation in EPA research funding; and reduction in ORD scientific staffing. In response to media office and Congressional demands, a new structure of Research Committees and processes was established for defining research needs of media offices and promoting ORD accountability in meeting these needs. Investment in laboratory facilities continued to be marginal, and almost no new scientific equipment was purchased in the period 1981-86.

The geographic dispersion of 12 relatively small ORD research laboratories and the requirement for specialized scientific expertise for focused research add further complexity to science management in ORD. As noted by the National Academy of Public Administration in 1990, the laboratories represent a "confederation" of independent units, each with a distinct image, reflecting a high degree of stability in federal staffing. These factors have significant influence on the success of efforts at mission realignment, establishment of new scientific capabilities, implementation of new science management and accountability processes, and recruitment and hiring of women and minorities in the science program.

During the first 15 years, policy leadership in the Office of Research and Development lacked stability. Tenure of Assistant Administrators was under two years, punctuated by extended periods of "Acting" officials without clear policy charters.

Nearing the end of the second decade the single-media, single-chemical focus of EPA regulations and related science received significant challenge from external environmental interests, the EPA Science Advisory Board, special science advisory panels and Congressional leaders. The credibility of EPA science was again challenged, both as to its quality and its relationship to program office regulatory decisions.

Major competing perspectives identified in the first years of the Agency continue to shape debates

on ORD missions and organization; a firm agency-wide consensus has not been achieved. The debate is fueled by the following issues:

- Whether research should be oriented to single environmental media (aligned to respond to legislative mandates) rather than to a multimedia perspective.
- Whether there should be individual EPA media office research programs or a single, comprehensive scientific research organization.
- What should be the relative emphasis applied to basic knowledge development vs. regulatory support research vs. technical assistance and information dissemination to private industry and the inter governmental community?
- Whether the principal focus should be on the effects of environmental pollution on human health rather than on total ecosystems.
- How EPA should balance the scientific capabilities of federal staff (intramural) with those of the extramural research community (universities, industry)?
- What is the role of ORD in assuring the quality of science across EPA?
- Whether ORD should operate within a focused R&D strategy, outlining major objectives, priorities, and roles of ORD components vs. a confederation of offices, field laboratories and other field facilities with individual mission perspectives.

Current Initiatives

In response to these challenges and the increasing expectation for ORD leadership to shape the national environmental research agenda, significant management actions were started across ORD and EPA in the past four years. These include:

- Development of a risk-based research agenda with alignment of research program design around cross-cutting environmental issues, rather than specific media.
- Initiation of a process to sharpen the focus of ORD laboratory missions and target the efforts of federal scientists on high impact areas of the environmental research program.
- Adoption of strategies to more effectively engage the national scientific community in the EPA environmental research program.
- Significant strengthening of ORD oversight and management of support contracts and reduction in reliance on broadly focused "level of effort" procurement contracts.
- Increased reliance on open, peer-reviewed competition in the extramural program.
- Significantly increased emphasis on recruitment and hiring of minorities and women in scientific and management positions.
- Increased funding for scientific equipment.

Future Issues

These recent enhancements in planning, organization and management, if fully implemented, will strengthen the ability of ORD to effectively support the environmental management agenda of the 1990's - ORD's third decade.

At the same time, the demands of new issues and opportunities will require a capability for continuous, objective assessment and introduction of appropriate changes. Continuing national interest in environmental issues will keep EPA in the policy limelight. The proposed elevation of EPA to Cabinet status as the Department of the Environment could have significant implications for the organization of environmental research both within the new Agency and in other federal organizations.

Similarly, the proposal for a National Institutes of the Environment, currently being evaluated by the National Academy of Sciences, has potentially sweeping implications for ORD. The breadth of policy interest in environmental research is further evidenced by recent reports of the American Association for the Advancement of Science (AAAS) and the Carnegie Commission on Science, Technology and Government.

Thus, ORD must remain flexible and open to consideration of new strategic directions. However, a number of specific organizational and management issues remain to be addressed in the near term to sustain the pattern of continuous improvement of the past four years. These include:

- Implement throughout EPA the issue-oriented, risk-based research planning process.
- Expand capability for effective transfer of environmental technologies.
- Refinement of the specific missions of each of the ORD laboratories and definition of strategic hiring programs to enhance the needed federal scientific research staff, including continued emphasis on hiring minorities and women.
- Continuing evaluation of the number and role of non-federal personnel (contractors/cooperators) engaged on-site in ORD laboratories.
- Strengthening and further professionalizing the management capability at each operating location, especially in regard to finance, human resources, information management and acquisition management (procurement, assistance, interagency arrangements).
- Evaluation and strengthening of techniques for providing technical assistance and support to program offices.
- Strengthening the agency-wide quality assurance program for environmental measurements, including assessment of the leadership role and related organizational questions of ORD.
- Assessment of the role of ORD management and scientific staff in assuring the quality of science in EPA and in support of the network science advisors being established across the Agency.
- Assessment of alternative management arrangements for ORD laboratories (e.g., the Carnegie Commission has recommended integration of existing ORD laboratories into four functionally defined laboratories).
- Evaluation of the ORD leadership and management responsibilities in the agency-wide Senior Environmental Employee (SEE) human resources program.
- Assessment of the structure and orientation of the ORD extramural research program in light of the Carnegie Commission recommendations for the creation and support of six new Environmental Research Institutes.
- Promotion of the development and use of innovative environmental technologies in order to reduce the cost of compliance with environmental standards at home and to improve the competitiveness of American industry in the world market.
- Assessing the physical condition of the research laboratories and determining the most cost-effective strategies for improvement.

Additional issues and opportunities may be expected to arise as the national debate on environmental preservation and enhancement proceeds. The optimal organizational solution of today may become the bureaucratic constraint of tomorrow. Scientific excellence, organizational and management stability, and flexibility with continuous improvement are goals that should guide ORD's responses to challenges of its third decade.

Chapter 2

Evolution of the Office of Research and Development

The Early Years

EPA was created in December of 1970 in response to growing concerns for the nation's environmental problems. A total of 15 organizations from various agencies and departments were combined to form the headquarters operation, bringing with them 42 field units located at sites across the country.

The inherited organizations forming EPA included several components of the Department of Health, Education, and Welfare, specifically, segments of the Food and Drug Administration, as well as the National Air Pollution Control Administration, the Bureau of Radiological Health, the Bureau of Solid Waste Management, and the Bureau of Water Hygiene. The Department of the Interior transferred components of the Federal Water Quality Administration. Also included were pesticides activities from the Agricultural Research Service in the Department of Agriculture, radiation criteria and standards activities from the Atomic Energy Commission and Federal Radiation Council, and the ecological research component of the Council on Environmental Quality.

As initially constituted, the research function for EPA had only a headquarters component, headed by the Deputy Assistant Administrator (DAA) for Research and Environmental Assessment. EPA also had a separate DAA for Monitoring, which was a headquarters only function as well.

In April 1971, a study was initiated to consider consolidating these functions. The study involved the DAAs for Monitoring and Research and Environmental Assessment, as well as the Assistant Administrator (AA) for Air and Water and the AA for Media Programs. At issue was consolidation of the program offices' respective research and monitoring divisions. All of the 42 laboratories and field stations EPA inherited were under consideration for becoming part of the research office.

On July 28, 1971, the Administrator proposed an order establishing an AA-level Office of Research and Monitoring (ORM), consolidating those existing DAA-ships and the research and monitoring functions from Air and Water and Media Programs. The AA for Media Programs did not concur on the decision package, citing the lack of a mission statement for the new office to address its service responsibilities to the other program offices.

On August 17, 1971, Administrator Ruckelshaus published the final order creating the Office and naming Stanley M. Greenfield the first AA for Research and Monitoring.

As initially constituted, all laboratories and field stations reported directly to the AA for R&M. The AA also had a staff of Special Assistants, made up of an Assistant for Health Effects, an Assistant for Technology Transfer, and an Executive Assistant for Administration and Support.

After a little more than a year of operation (December 1972), headquarters staff was reorganized and renamed (11 of the 13 divisions changed at least their names). Significant among the changes were creation of a Quality Assurance Division and

an Advanced (Monitoring) Techniques Division. Also created was a system of four National Environmental Research Centers (NERCs) to serve as intermediaries or coordinators between the AA and the individual labs and field stations assigned to ORM. The NERCs were located in Research Triangle Park, Corvallis, Cincinnati and later, Las Vegas and served to unite the labs, which were dispersed by geographic area. The majority of laboratories did not have a well defined mission and competition for research assignments was promoted.

Six months after the division-level reorganization at headquarters, another headquarters reorganization was proposed (May 25, 1973). In an attempt to improve responsiveness and liaison with the program offices, regional and other Agency staff, a DAA for Program Integration was proposed. This was to be the contact through which program offices made their research needs known.

This reorganization also involved changing the Office's name from the Office of Research and Monitoring to the Office of Research and Development (ORD). Also, the Washington Environmental Research Center (WERC) was created. Located in Arlington, VA, the WERC focused on socioeconomic and cost-benefit analyses. Among numerous other changes the AA for R&D created a Science Advisory Board to provide independent advice to the Office. Less than a year later the WERC was reorganized (April 1974). Stanley Greenfield left the Agency in early 1974 and was replaced by Wilson K. Talley in late 1974. Albert Trawbowski served as acting AA during the interim.

At about the same time that ORD's leadership was changing three reports were issued relating to ORD management:

1.) Senate Committee on Public Works (October, 1974).

2.) National Academy of Sciences.

3.) Internal EPA Task Force (Breidenbach).

Major findings included that there were significant inadequacies in ORD's research strategies and priorities; the research planning system needed major revision; headquarters organization and staffing needed major change; the planning system needed to be simplified and re-oriented toward the Agency's legislative mandates; and that ORD goals and objectives were too diffuse.

In April 1975, the new AA for R&D implemented a reorganization to clarify the lines of responsibility between headquarters and the labs. The NERCs and the WERC were abolished. Laboratories were assigned to specific DAAs in Washington to which they reported directly. The four DAA-ships with programmatic responsibility were retitled to better reflect the types of products they produced. The rationale behind the reorganization was to make the organization more responsive to environmental problems by making headquarters responsible for policy, planning and program review, and the labs more directly responsible for program implementation, including conduct of the extramural research program. Abolition of the NERCs removed a layer of management between policy-making headquarters offices and its implementation by the laboratories. A Regional Services Staff was created to serve as a focal point for coordinating the research needs for the 10 EPA regional offices. A parallel reorganization consolidated a number of science advisory functions across the Agency into a Science Advisory Board (SAB) located in the office of the Administrator.

The media program offices had significant reservations about this new organization, especially regarding the lack of an organizational focus for making their research needs known and seeking redress when their needs were not met. Overall there was concern that ORD was not recognizing its responsibility to respond to their needs.

In August 1975, an additional change was made when the Office of Technology Transfer (later renamed the Center for Environmental Research Information, CERI) was moved out of Washington to Cincinnati and assigned to the Industrial Environmental Research Laboratory. This last move completed implementation of the AA's decision to limit headquarters responsibilities to budgeting, planning and review, while moving all operational functions to the field. A period of organizational calm took place from the fall of 1975 through the spring of

1977. In April 1977, the Carcinogen Assessment Group (CAG) was established in the Immediate Office of the Assistant Administrator (IOAA). Its purpose was to provide a single source of advice and analysis for the Agency's programs on the impacts of suspected carcinogenic chemicals.

By May 1977, the cumulative effect of a number of earlier studies and evaluations of ORD were felt when the Committee on Environment and Public Works issued a report accompanying the Environmental Research and Development Act of 1977 (extending research authorization through 1978). The report, known as the Culver Committee Report, identified several serious deficiencies and called for major changes in ORD.

Among the problems identified by the Committee were ORD's lack of long-term, anticipatory research and the lack of coordination between ORD and the program offices.

By way of punctuating its desire to see improvements, the Committee concluded by stating that a Bill was being considered for 1978 that would put 60% of research dollars under control of the program offices, 25% would be available for base ORD activities and the remaining 15% would either go to the program offices also or be available for ORD to conduct long-term research.

Wilson Talley resigned on July 1, 1977. Stephen Gage was appointed AA September 8, 1977.

The Research Committee Years

One of the first actions by the new AA was to appoint a task force to examine the options for improving ORD's performance in the areas cited by the Culver Committee and to consider a possible reorganization.

One of the task force's major findings was that there was a great deal of confusion and general dissatisfaction with the separation of responsibility for planning and review from financial and budget management. Although a number of specific deficiencies were cited, the consensus of the DAAs at the time was that consolidation of these two functions would offer considerable improvement for coordinating ORD's research planning and priority-setting with program implementation. It was assumed these functions should remain staff functions at headquarters and be distinct from the line functions served by the DAAs over the labs. To implement this decision, in April of 1978, the Office of Planning and Review was combined with the Office of Financial and Administrative Services to create the Office of Research Program Management (ORPM).

A June 1978 Report to the President and Congress addressed most of the remaining Culver Committee concerns. Although no additional reorganization was planned, several significant management changes were announced. Specific changes included the following:

- Identification of specific planning units or environmental issues around which research would be planned.
- Establishment of a group of standing research committees, composed of ORD, program office and regional staff members, whose function was to develop multi-year research strategies and budgets, resolve issues and conduct program reviews for each of the planning units.
- Linking of ORD's planning and management process to those of the rest of the Agency - specifically, to the Agency's budget process.

Planning units and research committees were envisioned as a six-month pilot study which began in March of 1978 and was due to end that September.

A significant change at headquarters took place in October of 1978 when, building on the capital CAG, the Office of Health and Environmental Assessment (OHEA) was created to centralize responsibility for the Agency's health and risk assessment.

In January of 1979, in a letter from the Administrator to the chairman of the House Subcommittee on the Environment and the Atmosphere, the Research Committee system was praised as having significantly improved ORD's relationship with the regulatory offices. Plans to expand it were believed to offer the mechanism for eliminating the percep-

tion that ORD did not support the Agency's regulatory mission.

The question of the adequacy of the Agency's long-term and anticipatory research program remained unresolved. Although additional resources had been sought to support an expanded program, the 1979 appropriation for this program was drastically reduced. The associated Committee Report chastised ORD for failing to create a distinct organizational entity responsible for planning and implementing long-term research. In response, ORD created the Office of Exploratory Research (OER) that same year.

Beginning in March of 1979 and continuing through August, the AA pursued a realignment of ORD's headquarters offices and the laboratories. It was designed to group the laboratories and headquarters by scientific discipline. This realignment was viewed as a streamlining of the organization to improve organizational functioning through logical groupings, as well as improve support to the regulatory programs

With the exception of Monitoring and Technical Support, all of the DAAs' offices at headquarters were renamed as part of this realignment, reducing the media and problem focus and splitting health from ecological effects. The Office of Energy, Minerals and Industry became Environmental Engineering and Technology; Air, Land and Water Use became Environmental Processes and Effects; and Health and Ecological Effects became the Office of Health Research.

In September of 1979, the AA announced a new research planning process that altered the nature of headquarters. Each of the line office DAAs was designated a "primary research planning official" and was responsible for overseeing the activities of specific research committees. Other key changes included:

- Making research committees responsible for generating portions of the *Research Outlook*, a five-year plan updated and submitted to Congress annually.
- Structuring research planning units (decision units) to coincide with the units of the operating budget (program elements) to facilitate integration of research planning with budget development and execution.

The organization and management structure in place by 1979 became the basis for ORD's operation until the present time. The organization of line and staff offices at headquarters changed little. Although one additional staff office was created in 1985, the organizational names and responsibilities identified in 1978 have remained almost unchanged. The role of headquarters as the focus of research and program planning persisted. The DAAs for line offices, later retitled Office Directors (ODs), continued their role as the primary research planning officials, while also continuing to exercise management responsibility over their associated laboratories. The research planning process built around the research committee system became the center of ORD's program and research planning. Moreover, the early indications of its success in satisfying the Agency's need for input into research planning were confirmed in the ensuing years. However, the research committees failed to develop effective multi-year research strategies and programs.

With the change in Administration to take place in 1981, Gage left ORD at the end of 1980. A replacement AA was not appointed until late 1983. During this period, ORD had three acting AAs serving in four distinct time periods. Courtney Riordan served first, last and longest for almost two of the two plus years covered, with Richard Dowd and Andrew Jovanowich serving several months each.

Bernard Goldstein was appointed AA for ORD in August 1983, following the return of William Ruckelshaus as Administrator. Although several reorganizational options were considered during the next two years, only one significant change was made during that period. This change was part of a larger reorganization package that was deferred for the incoming AA. It involved creating a regulatory analysis staff assigned to the AA's Office. The purpose of this group would be to stay abreast of changes in ORD's and EPA's authorizing legisla-

tion, as well as coordinate ORD's participation in the Agency's development of regulations.

Goldstein resigned from EPA August 2, 1985; Donald J. Ehreth was appointed Acting AA the next day. Although plans for a formal reorganization were deferred, ORD began operating with a regulatory support staff as part of the IOAA in 1985. This group was later called the Office of Regulatory Support and Scientific Analysis (ORSSA).

In 1986, Administrator Lee Thomas created the Risk Assessment Forum to serve as the Agency's referee and coordinator for risk assessment and located the function in OHEA.

Vaun Newill was named AA for Research and Development in October 1986.

Two significant organizational changes were implemented during Newill's two years.

1.) In April 1988, ORSSA was abolished and its mission included as part of the new Office of Technology Transfer and Regulatory Support (OTTRS). Also included in OTTRS was the Regional Services Staff (RSS) and Center for Environmental Research Information (CERI), located in Cincinnati. Both of these organizations were formerly part of ORPM and were consolidated with the regulatory support activity in order to better integrate ORD's Agency outreach functions.

2.) The Support Service Office (SSO) in Cincinnati was reorganized and expanded to create the Office of the Senior ORD Official (OSORDO) to coordinate ORD common services and outreach activities. It was announced in June of 1988 and made part of the IOAA in Washington. The same was done to the SSO in Research Triangle Park in March of 1989.

Vaun Newill resigned in November 1988. Erich Bretthauer was immediately named Acting AA and remained so until his confirmation as AA in March 1990. He served in that position until January 1993, thereby serving longer than any other AA for ORD.

In April of 1991, the Risk Assessment Forum was moved to the IOAA to increase its visibility with EPA.

In July of 1992, the Ecological Monitoring and Assessment Program (EMAP) was constituted as an organizational entity and made part of Office of Modeling, Monitoring Systems and Quality Assurance.

Current Headquarters Structure

Current headquarters staff can be broken into three groups - the Immediate Office of the AA (IOAA), staff offices and line offices.

The IOAA is made up of the AA and Deputy, five special assistants, the Risk Assessment Forum, and the Control Correspondence Unit. As of October 1, 1992, it had 27 staff members (unless otherwise stated, all staffing references are to staff onboard as of 10/1/92).

Although the Senior ORD Officials at both RTP and Cincinnati are technically assigned to the Office, neither is located at headquarters.

The staff offices at headquarters are those whose functions are restricted to headquarters and do not oversee the operations of either laboratories or field stations. These consist of:

- The Office of Exploratory Research (OER), which is responsible for planning, administering and managing EPA's exploratory research program through investigator grants and research center support. It has a staff of 16.
- The Office of Research Program Management (ORPM), which is the principal administrative staff office, has 51 staff members.
- The Office of Technology Transfer and Regulatory Support (OTTRS) leads ORD's involvement in Agency regulatory development, ensures transfer of ORD's research products to user groups both within and outside the Agency and performs liaison with EPA's regional offices. It has 34 staff members.
- The Center for Environmental Research Information (CERI) is assigned to OTTRS but is located in Cincinnati. Its authorized ceiling is 32 positions.

In 1992, ORD began implementing two major management changes that significantly altered the research and line management structure established in 1978. The first consolidates the financial allowance holder responsibility for all of ORD into one account to be managed by ORPM on behalf of the Assistant Administrator. To support this new consolidated function, nine positions were moved from the line offices to ORPM, bringing its authorized ceiling to 53 positions. The second change consolidates management responsibility for research planning in OTTRS. It becomes the coordinating arm of the new issue-based planning system through creation of a new staff organization with an additional 11 positions (which will be taken from the line offices). Also, the Office, OTTRS, is to be renamed Office of Science, Planning and Regulatory Evaluation (OSPRE). OSPRE headquarters will have an authorized ceiling of 44 positions (not including CERI).

The line offices at headquarters are those charged with planning and coordinating the research conducted in their respective laboratories. Distribution of resources among the labs is conducted by headquarters as is oversight of their administrative functions.

The specific offices are:

- The Office of Modeling, Monitoring Systems and Quality Assurance (OMMSQA) with a staff of 28 (includes 7 for QAMS).
- The Office of Health Research (OHR) with a staff of 13.
- The Office of Environmental Engineering and Technology Demonstration (OEETD) with a staff of 26.
- The Office of Environmental Processes and Effects Research (OEPER) with a staff of 26.

The Office of Health and Environmental Assessment is a hybrid organization in that it has no laboratories, but is organized into four functional groups. Two of these, the Human Health Assessment Group and the Exposure Assessment Group, are located at headquarters and including its administrative component, have a combined staff of 60. The remaining two groups are the Environmental Criteria and Assessment Offices in Research Triangle Park and Cincinnati.

Agency-wide Support Functions

ORD provides policy leadership and operational support to two significant agency-wide functions: (1) quality assurance/quality control related to environmental measurement and (2) the Senior Environmental Employee (SEE) human resources program.

The Quality Assurance Management Staff (QAMS) has historically been placed as a component of the Office of Modeling, Monitoring Systems and Quality Assurance. However, both the functions and the agency regulations and standards apply to all intramural and extramural environmental measurement activities.

The SEE program has evolved from a Department of Labor pilot program of the early 1970's and is currently housed in the Office of Exploratory Research. The SEE program provides a vehicle for employment of retired persons through EPA cooperators to work in EPA in support of environmental programs. Currently across EPA 1400-1600 SEE enrollees support offices in headquarters, the regions and ORD laboratories.

Chapter 3

Specialized Laboratory Missions - Areas of Scientific Concentration

Within the EPA, laboratories provide much of the scientific and technical information that supports regulatory development, enforcement, and evaluation of the "state of the environment." Many organizations across the Agency contain laboratories — the Office of Research and Development, other Program offices, and the Regional offices. Each of these laboratories supports the specific needs of its client community. ORD has made a concerted effort to refine the missions of its laboratories balance to the technical support, applied research and fundamental research needs of the Agency.

Organizationally ORD is composed of 8 headquarters offices, 12 field laboratories, and 5 other field facilities. ORD is a confederation of offices and laboratories, each of which operates with considerable independence, establishing necessary relationships, pursuing a research agenda, and defining an operating style in the process.

ORD's confederative nature is fostered by the fact that ORD cannot alone determine the total R&D agenda. It is driven to a considerable extent by EPA's regulatory priorities. This confederative nature also exists because ORD is a multi-faceted research organization and the laboratories are not expected to be in lock step with one another. Each laboratory and field facility presents a distinct image in several dimensions.

Some facilities are involved in scientific research with a long-term focus; others' research and development activities are to solve short-term problems, with some staff in an immediate response mode of operation.

Operational styles differ. Some laboratories are heavily oriented to bench research. Others are staffed primarily by contract managers of research or engineering activities. A few are desk research organizations that review the research products of others to determine if they are relevant to EPA concerns. Still other laboratories have developed discrete types of interdisciplinary research team approaches that use federal and non-federal staff in different configurations.

These distinctly different operating styles have created different skill requirements among the laboratories. Some require traditional scientific researcher skills; others a blend of scientific researcher and contract manager; a number need both sets of skills and a high order of general management talent to coordinate interdisciplinary teams.

Academic disciplines also differ among the laboratories. Some are staffed largely by engineers others by health scientists, others by chemists. Within each academic discipline unique specialization develops within and among laboratories.

There is also a significant difference among the laboratories in terms of the federal/non-federal on-site workforce. For example, the Air and Energy Engineering Research Laboratory at Research Triangle Park is 76% federally staffed, while Corvallis is nearly the reverse, with 69% of the on-site staff from contractor organizations and universities.

The following discussion will outline the basic scope of each of the Agency's laboratories.

Office of Research and Development

ORD research laboratories are distributed among four headquarters program offices. These laboratories are not rigidly structured organizations with fully independent management. They are geographically dispersed, as shown in Figure 1. Many of the laboratories are free-standing facilities, and require specialized support and technologies for their research operations. The unique requirements of the laboratories are not solely facility-related — the scientific specialties and skills needed to fulfill the laboratories' varying research needs are critical to the success of the research, and are often not interchangeable among laboratories or research areas. ORD has processes in place to manage the priorities and resources required to operate this disperse workforce. The distribution of ORD research laboratories in relation to the environmental research process is displayed graphically in Figures 2 and 3.

According to the 1990 National Academy of Public Administration report *EPA's Office of Research and Development: Leadership and Staff for a New Agenda*, 47% of the federal ORD staff is in science and engineering functions; an additional 11% of the staff provides technical support to science functions. The ORD report, *Workforce 91* indicates that 75 % of the ORD staff has bachelor's, master's, or doctoral degrees. No similar data exist for the other program office or regional laboratories.

In the following presentation the FY'91 funding levels do not include ORD headquarters or agency-wide overhead funding.

Office of Modeling, Monitoring Systems and Quality Assurance

OMMSQA and its three laboratories are responsible for research on the characterization, transport and fate of pollutants that are released into the environment; development and demonstration of techniques and methods to monitor human and ecological exposure and to relate ambient concentrations to exposure by critical receptors; research, development, and demonstration of new detection, identification and characterization techniques for pollutants at the source and in the ambient environment and for use as references to standard monitoring methods; development and provision of quality assurance methods, techniques and materials, including validation and standardization of analytical methods, sampling techniques, quality control methods, standard reference materials, and techniques for data collection, evaluation and interpretation; and establishment, coordination and oversight of the Agency-wide quality assurance program.

Environmental Monitoring Systems Laboratory, Las Vegas, NV

FY-91 Intramural and Extramural Obligations:	$38,446,784	
FY-91 On-Site Staffing:	Federal	157
	Non-federal	355
	Total	512

EMSL-LV conducts basic and applied research and technology transfer on the measurement and monitoring of pollutants in all parts of the environment, including quantifying human and ecological exposure to environmental pollutants on a local to global scale. The laboratory supports the Department of Energy's Nevada Test Site's radiological monitoring programs. EMSL-LV maintains a field station at Warrenton, VA.

Environmental Monitoring Systems Laboratory, Cincinnati, OH

FY-91 Intramural and Extramural Obligations:	$14,593,173	
FY-91 On-Site Staffing:	Federal	116
	Non-federal	90
	Total	206

EMSL-CINC conducts research on the development and application of analytical methods, quality assurance procedures and reference materials for environmental assessments, including emerging bio-

Figure 1. ORD Laboratory and Field Sites

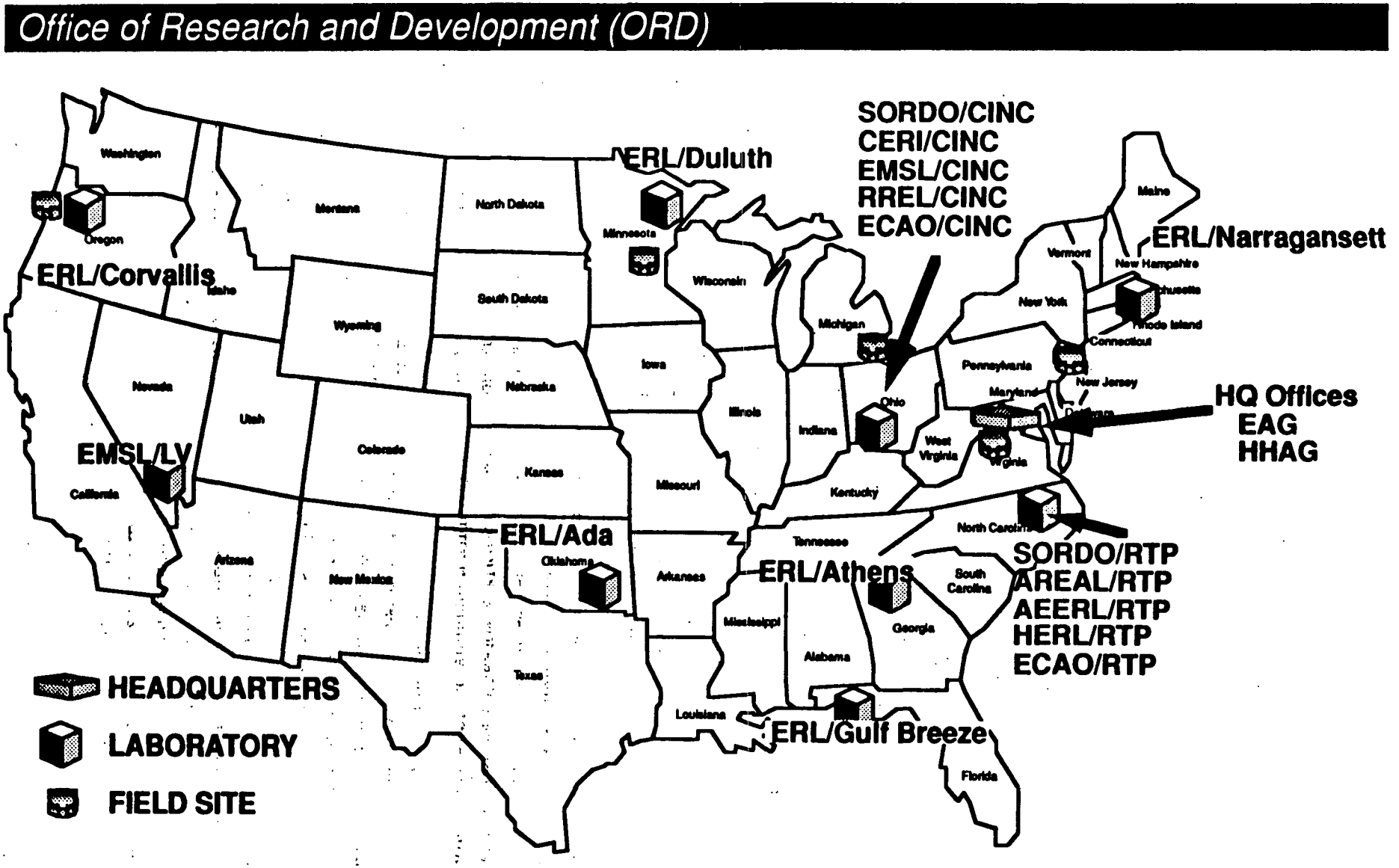


Figure 2. Environmental Research Framework
Distribution of EPA Laboratory Roles & Missions

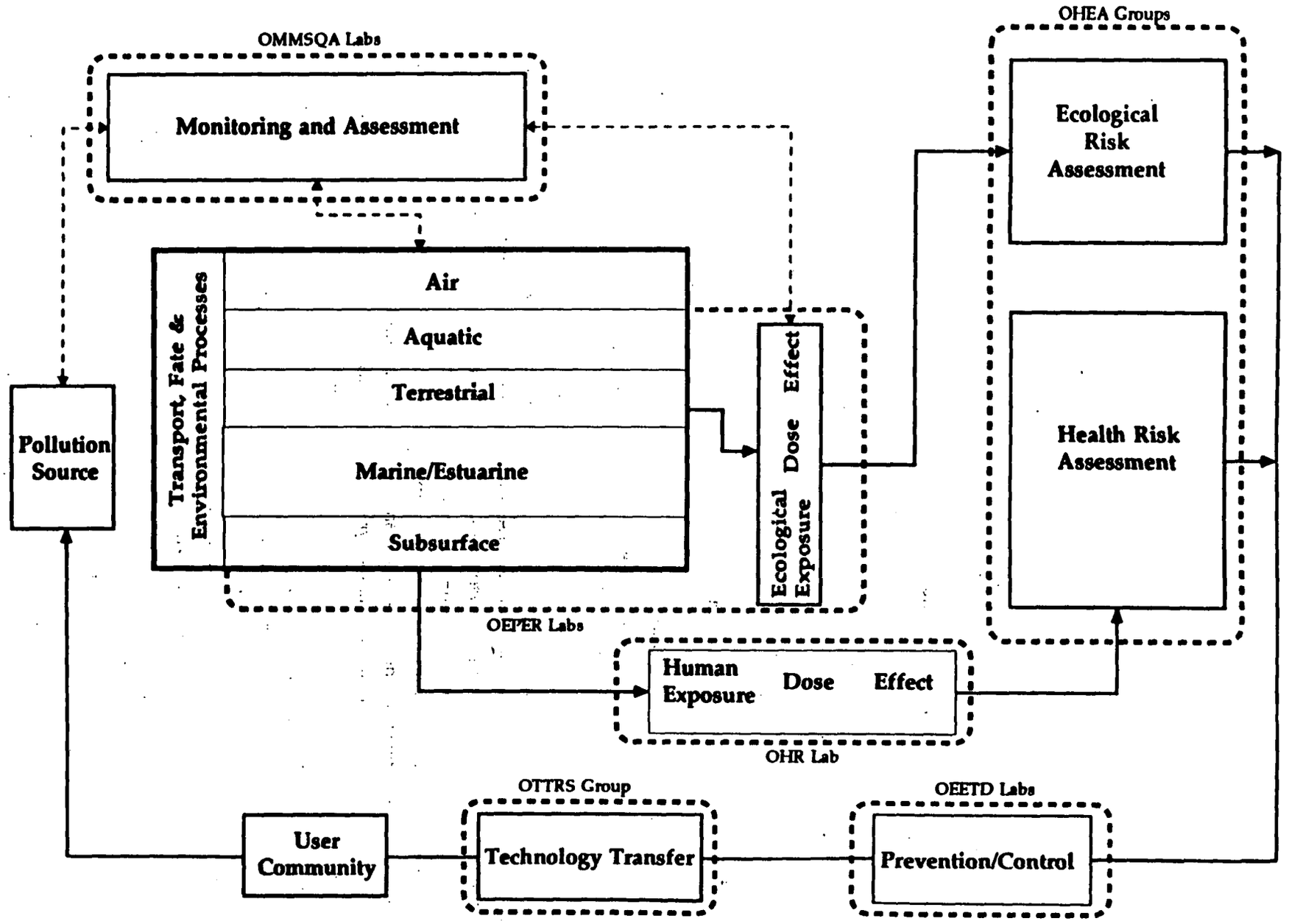
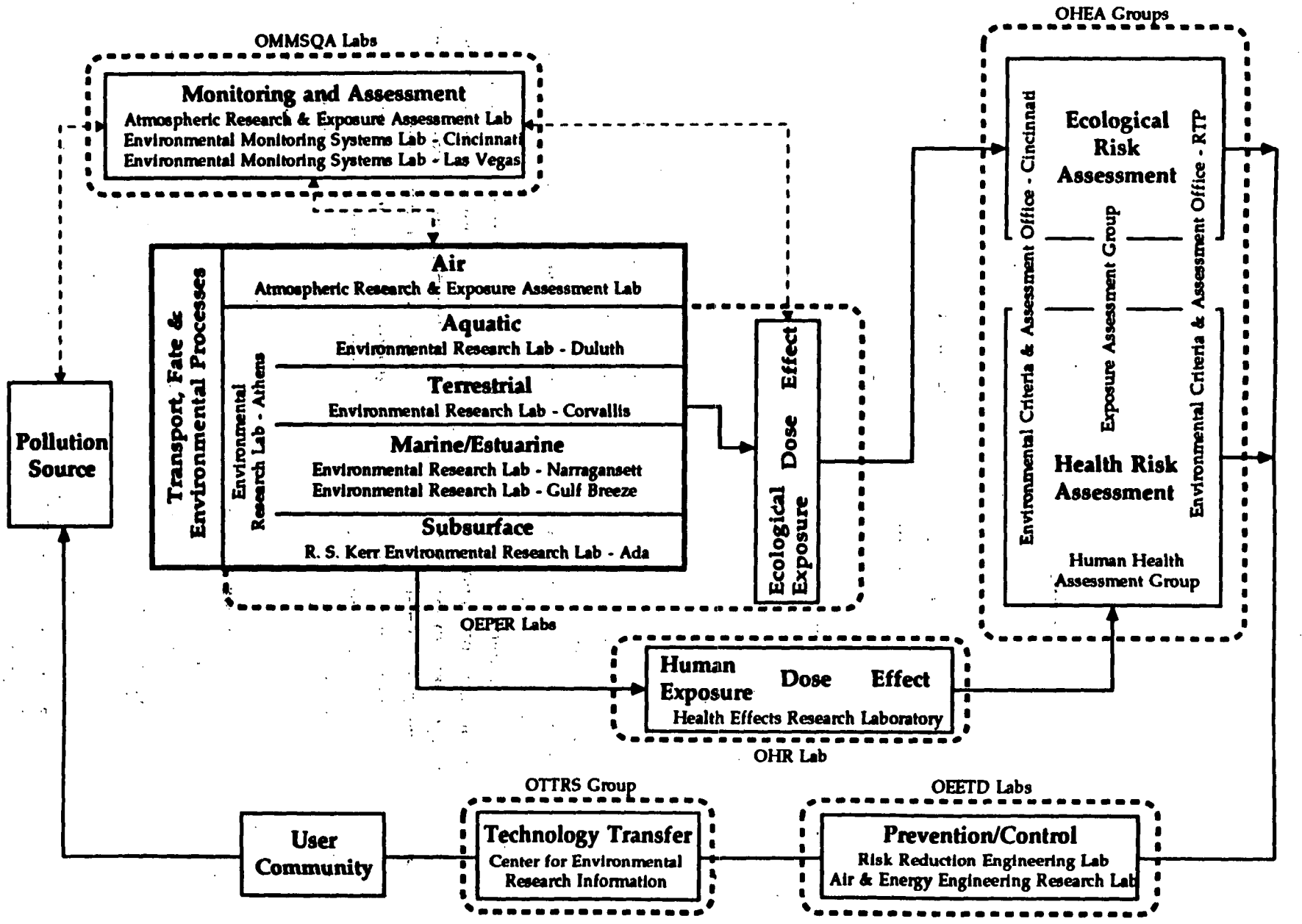


Figure 3. Environmental Research Framework
Distribution of EPA Laboratory Roles & Missions



technological research on the occurrence, transport and fate of microbial pathogens in environmental media.

Atmospheric Research and Exposure Assessment Laboratory, Research Triangle Park, NC

FY-91 Intramural and Extramural Obligations: $43,724,962

FY-91 On-Site Staffing:	Federal	168
	Non-federal	181
	Total	349

AREAL conducts research, technical assistance and technology transfer on the chemical and physical processes in the atmosphere, including mobile source and biogenic activities; ecological exposure from climate and the atmosphere; and models, measurement, and monitoring studies needed to support research and regulatory activities involving the air media.

Office of Environmental Engineering and Technology Demonstration

OEETD and its two laboratories are responsible for research, development and demonstration of cost-effective methods and technologies to control environmental impacts associated with energy, minerals and other resources and industrial processing and manufacturing facilities; control of environmental impacts of public sector activities, including wastewater treatment, drinking water treatment, solid waste management; providing innovative technologies for response actions under Superfund and technologies for control of spills of oils and hazardous wastes; efforts to characterize, reduce and mitigate indoor air pollutants; and efforts to characterize, reduce and mitigate acid rain precursors from stationary sources.

Air and Energy Engineering Research Laboratory, Research Triangle Park, NC

FY-91 Intramural and Extramural Obligations: $26,018,643

FY-91 On-Site Staffing:	Federal	99
	Non-federal	48
	Total	147

AEERL conducts research to identify and develop emission reduction approaches for stationary air pollution sources, which pose risks to public health and the environment, including emission estimating techniques.

Risk Reduction Engineering Laboratory, Cincinnati, OH

FY-91 Intramural and Extramural Obligations: $73,163,566

FY-91 On-Site Staffing:	Federal	261
	Non-federal	128
	Total	389

RREL conducts research to develop and demonstrate engineered approaches and technologies for the prevention, treatment, and control of wastes, contamination in drinking water, and pollution in surface waters and on the land. RREL maintains a field station in Edison, NJ.

Office of Environmental Processes and Effects Research

OEPER and its six laboratories are responsible for developing and applying ecological risk assessment methods to ecosystems; developing scientific and technological methods and data necessary to understand ecological processes and predict broad ecosystems impacts; develop methods to monitor the entry, movement and fate of pollutants into the environment and the food chain and the effects of pollutants upon non-human organisms and ecosystems; monitoring the causes and effects of acid deposition and related pollutants; reducing the uncertainty in the scientific understanding of the causes and effects and corrective measures for acid deposition phenomenon and performing policy-relevant assessments of the scientific findings on acid deposition and related pollutants; and increasing scientific understanding of the global climate change phenomena and the role of radioactive gases in the phenomena.

Robert S. Kerr Environmental Research Laboratory, Ada, OK

FY-91 Intramural and Extramural Obligations: $11,630,979

FY-91 On-Site Staffing:		
	Federal	60
	Non-federal	71
	Total	131

The Robert S. Kerr ERL conducts and manages research and provides technical assistance and technology transfer on the chemical, physical, and biological structure and processes of the subsurface environment, biogeochemical interactions, and linkages to other environmental media.

Environmental Research Laboratory, Athens, GA

FY-91 Intramural and Extramural Obligations: $14,051,568

FY-91 On-Site Staffing:		
	Federal	77
	Non-federal	93
	Total	170

ERL-Athens conducts and manages research and provides technical assistance to predict the transformation, speciation, and transport of chemicals across and within environmental media in order to assess potential human and ecological exposures and risks.

Environmental Research Laboratory, Corvallis, OR

FY-91 Intramural and Extramural Obligations: $23,266,104

FY-91 On-Site Staffing:		
	Federal	73
	Non-federal	227
	Total	300

ERL-Corvallis conducts and manages research on terrestrial, watershed, and landscape ecology, terrestrial exotoxicology, ecological statistics, and comparative ecological risk assessment.

Environmental Research Laboratory, Duluth, MN

FY-91 Intramural and Extramural Obligations: $12,172,341

FY-91 On-Site Staffing:		
	Federal	90
	Non-federal	112
	Total	202

ERL-Duluth conducts cause/effect research in aquatic toxicology and ecology in lakes, streams, wetlands and the Great Lakes, including predicting and assessing the effects of pollutant and polluting activities on freshwater ecological resources. ERL-Duluth supports a field station in Grosse Ile, MI.

Environmental Research Laboratory, Gulf Breeze, FL

FY-91 Intramural and Extramural Obligations: $12,839,977

FY-91 On-Site Staffing:		
	Federal	56
	Non-federal	70
	Total	126

ERL-Gulf Breeze conducts and manages research on the near-coastal environment with emphasis on coastal wetlands and estuaries, including the study and modeling of toxicological, disease, and microbial processes.

Environmental Research Laboratory, Narragansett, RI

FY-91 Intramural and Extramural Obligations: $13,406,004

FY-91 On-Site Staffing:		
	Federal	82
	Non-federal	125
	Total	207

ERL-Narragansett conducts and manages marine, coastal, and estuarine ecological risk assessment research, including the study of the effects of estuarine and marine disposal and discharge of complex waste, dredged materials and other wastes. ERL-Narragansett maintains a field station at Newport, OR.

Office of Health Research

OHR and its laboratory are responsible for planning, implementing and evaluating a comprehensive, integrated human health research program which documents acute and chronic adverse effect on humans; develops test systems and associated methods and protocols, such as predictive models to determine similarities and differences among test organisms and man; develops methodologies and conducts laboratory and field research studies; and develops interagency programs which effectively evaluate the health impact from exposure to environmental pollutants.

Health Effects Research Laboratory, Research Triangle Park, NC

FY-91 Intramural and Extramural Obligations: $44,475,462

FY-91 On-Site Staffing:		
	Federal	240
	Non-federal	216
	Total	456

HERL conducts and manages toxicological, clinical, and epidemiological research on the human health effects resulting from exposure to environmental pollutants and to provide related technical support and technology transfer, including biological assays, predictive models, and extrapolation methods for health risk assessments.

Office of Health and Environmental Assessment

OHEA and its four components are responsible for the development of health criteria, health effects assessments and risk estimation.

Environmental Criteria and Assessment Office, Cincinnati, OH

Total HQ and field OHEA FY-91 Intramural and Extramural Obligations: $21,620,033

FY-91 On-Site Staffing:		
	Federal	41
	Non-federal	9
	Total	50

ECAO-CINC assesses and interprets scientific information for risk-based regulatory decision-making related to health and environmental effects of single chemicals and complex exposures, including chemical mixtures.

Environmental Criteria and Assessment Office, Research Triangle Park, NC

FY-91 On-Site Staffing:		
	Federal	29
	Non-federal	11
	Total	40

ECAO-RTP assesses and interprets scientific information and support of risk-based regulatory decision-making by the EPA Administrator, especially for air-related standards and issues.

Exposure Assessment Group, Washington, DC

FY-91 On-Site Staffing:		
	Federal	16
	Non-federal	1
	Total	17

EAG provides state-of-the-art methodology, guidance, and procedures for exposure determinations; ensures quality and consistency in the Agency's scientific risk assessments; and provides independent assessments of exposure and recommendations.

Human Health Assessment Group, Washington, DC

FY-91 On-Site Staffing:		
	Federal	32
	Non-federal	3
	Total	35

HHAG assesses and interprets scientific information in the health risk assessment process, including preparation and review of health risk studies on environmental agents that are suspected carcinogens, mutagens, or reproductive or developmental toxins, and development of new risk assessment methodologies.

Interagency Coordination

ORD and its laboratories have established interagency relationships with the Department of Energy and the National Oceanic and Atmospheric Administration (NOAA), and the Department of Commerce. The Department of Energy, through an interagency agreement funds approximately 60 EPA positions in EMSL-LV; these resources are used to support the environmental monitoring of the Nevada Test Site and environs. AREAL in RTP includes 48 NOAA employees that support the atmo-

spheric research program in areas such as developing global, regional, local, and micrometeorological computer models of the transport of air pollutants and their exposure to humans and ecosystems. These NOAA employees operate within the Department of Commerce supervisory system.

National Program Offices

There are six non-ORD program offices that support laboratories. These offices require analytical support to assist in regulatory development and enforcement.

National Enforcement Investigations Center

The National Enforcement Investigations Center, Office of Enforcement, has an Office of Laboratory Services which is located in Denver, CO. This laboratory provides, on a nation-wide basis, analytical services for all environmental media for enforcement case preparation and assists in assessing and developing information, evidence and technical testimony in support of EPA enforcement programs. The Division develops and improves analytical techniques and provides consultation services on these matters upon request to Headquarters, Regional Offices, and to the Office of Research and Development. It also maintains specialty expertise in the areas of laboratory instrumentation, mutagenicity testing, health and ecological effect analytical techniques, pesticide products formulation testing, and handling and processing of toxic and carcinogenic substances.

Office of Air Quality Planning and Standards

The Office of Air Quality Planning and Standards, Office of Air and Radiation, has a laboratory as part of its Emission Measurement Branch. The Emission Measurement Laboratory is located in Durham, NC. This laboratory contains analytical equipment to support in-house emission measurement capability, calibration of field sampling and analytical equipment, development and evaluation of new sampling and analytical methods, and training of staff for new methods and protocols.

Office of Ground Water and Drinking Water

The Office of Ground Water and Drinking Water, Office of Water, has a laboratory within its Technical Support Division, located in Cincinnati, OH. This laboratory supports the development and implementation of drinking water regulations, provides technical assistance to Regions, states and local entities. The laboratory obtains critical information required for the development of regulations, such as the occurrence of contaminants in ground water or drinking water. It also assists in regulation implementation by providing technical assistance to laboratories in analyzing water samples for regulated contaminants and by managing the drinking water laboratory certification implementation program.

Office of Mobile Sources

The Office of Mobile Sources, Office of Air and Radiation, supports the National Vehicle and Fuel Emissions Laboratory (NVFEL) in Ann Arbor, MI. This laboratory has as its primary function the testing of emissions from motor vehicles and engines under a variety of environmental and use conditions and using various fuels. NVFEL also supports the development of State Implementation Plans for ambient air quality, focusing on vehicle inspection and maintenance programs and transportation control programs. The laboratory administers the motor vehicle emissions certification and fuel economy programs. The laboratory also analyzes fuel and fuel additives in support of the fuels enforcement program, performs critical analyses of certain exhaust compounds, designs and conducts special fuel testing programs to support rule making, enforcement actions and test development.

Office of Pesticides Programs

The Office of Pesticides Programs, Office of Pesticides, Prevention and Toxic Substances, supports three laboratories, one in Bay St. Louis, MS, and two in Beltsville, MD. These laboratories provide analyses to detect pesticide traces in environmental media, and to characterize complex chemical formulations. They also determine contaminants in pesticide products for consideration in registration decisions, validate food tolerance methods and environmental chemistry methods prior to their adoption as residue methods or use as enforcement tools,

develop comprehensive methods and assurance capabilities for pesticides, and provide accurate chemical standards to support the testing needs of OPP and the Regions. There is also minimal laboratory capability to perform selected efficacy testing for antimicrobial pesticides.

Office of Radiation and Indoor Air

The Office of Radiation and Indoor Air, Office of Air and Radiation, supports two laboratories: the National Air and Radiation Environmental Laboratory (NAREL) in Montgomery, AL, and the Las Vegas Facility in Las Vegas, NV. NAREL has full radio analysis capability, including wet chemistry and counting equipment, capability for electromagnetic field measurement, and radon exposure chambers and radon detection and measurement capability. The Las Vegas Facility has site-assessment capability for radiation-contaminated sites, including mobile sampling and analyses capability, radon exposure chambers, radon detection and measurement capability and indoor air ventilation assessment capability. Both laboratories have fully transportable analytical and communications capability to support emergency response operations that are more proximate.

Regional Offices

The Agency has divided the country and territories into ten regions. Regional offices are responsible for the direct implementation or oversight of State implementation of the Agency's programs, e.g., drinking water, wastewater and hazardous waste permitting and compliance, ambient monitoring of air and surface waters, etc. Nine of these ten regions have analytical laboratories; the tenth has a facility under construction at this time. Although the organizational titles vary slightly, the laboratories are generally part of the Environmental Services Division (ESD).

The ESDs were originally established to provide the regions with the technical expertise necessary to carry out the environmental program mandated by Federal legislation. The ESDs have capability to conduct monitoring of the ambient environment; conduct compliance or oversight inspections and monitoring to determine conformance with regulations and permits; respond to environmental emergencies; collect samples, transport the samples, perform laboratory analyses and data evaluation; and provide policy guidance and technical assistance to other federal, state and local agencies. Within this structure of responsibilities, the ESDs have analytical laboratories that are relied on by the Agency to provide environmental data of the quality needed to sustain enforcement actions, verify compliance with permit conditions, and monitor the ambient environment.

Relationship to Contractor Laboratories

The Agency has a number of laboratories that can be utilized for varying tasks. However, the Agency laboratories are quite specialized in purpose, and are not designed as production laboratories, i.e., providing large volume, standardized analyses for a multitude of clients. Much of the analytical data produced for the Agency, particularly in the federal-lead Superfund program, is generated in laboratories to which EPA has only a contractual relationship. There is no current estimate of the total value of analytical work that is contracted; estimates for the Superfund approach $100M/year.

References

Office of Research and Development, *Workforce 91*, EPA/600/9-91-029.

National Academy of Public Administration, *EPA's Office of Research and Development: Leadership and Staff for a New Agenda, 1990.*

Office of Research and Development, *"Summary Analysis of Financial Activity FY 1989-1991"*

Chapter 4

Research Program Design and Accountability

For much of the past two decades, EPA was basically a "reactive" agency. EPA saw its mission largely as managing the reduction of pollution and, in particular, only that pollution that was defined in the laws that it administered. The tools EPA traditionally used to reduce pollution were limited, in general, to the emissions controls it could force polluters to apply through regulatory action.

This reactive mode, understandable when seen in its historical context, also guided research efforts of the Office of Research and Development (ORD). Over the last several years, however, ORD has made substantial changes in its research program to meet environmental challenges of the future and to respond to deficiencies identified in the past. Today, ORD's report card registers high marks for design, implementation and growth in new areas that have been identified as the major responsibilities of a science program in an environmental regulatory agency.

The research program has evolved over the years in response to changing problems and needs of the times. ORD's current goals respond to new problems and different priorities in light of 22 years of experience, data, and technology development. The major steps taken over the years to redesign the research program to make it more responsive to past needs have taken several forms that are described below.

ORD's First Planning System (EROS/ ROAPs)

ORD developed its first program planning and reporting system in 1972 to assist the Office in meeting the research requirements of the Agency and the Nation. A formal process, adapted from that used by NASA, was implemented to identify research needs, define specific research objectives, and develop detailed plans to accomplish these objectives. This system also addressed the establishment of priorities and assignment of resources and responsibilities for executing approved plans. It included a "needs system" for obtaining documented inputs of the regional and program offices' research requirements and their priorities and for assuring visibility of ORD's responsiveness to them.

The planning system was designed to meet the planning requirements of the Agency and special requirements of ORD with minimum burden. The basic principles upon which the system was designed were that:

- Candidate research objectives could be identified from many sources, including specific needs provided by other offices.
- Program objectives chosen for consideration could be explicitly defined with identifiable end points as Environmental Research Objective Statements (EROS).
- A specific plan to meet each objective, a Research Objective Achievement Plan (ROAP), could be developed.
- Each ROAP could be developed for complete attainment of the objective and would not have to be re-prepared annually—only the tasks to be completed in a given year would be included in a program plan.

The impetus behind this plan was to allow ORD to conduct its program planning in an open manner to provide adequate opportunity for the various

operating programs of the Agency to participate in the planning process. This allowed them, if necessary, to appeal any research decisions they considered unfavorable in light of their documented research requirements and priorities. This interaction was accomplished in several ways, beginning with participation in the development of ORD's Research Strategy documents. These documents corresponded to EPA's programs: water, air, pesticides, solid wastes, radiation, toxic substances and noise, and to two additional cross-cutting areas, monitoring and environmental management. The strategies made it possible to assess the degree to which the research program addressed the environment, both holistically and as made up of discrete media.

Fundamental to the development of the total research program was adherence to the concept of "Planning by Objective." Research objectives were determined by ORD Headquarters Division Directors, designated as Program Area Managers (PAMs) who were responsible for managing all activities within a program area. Research objectives were determined by PAMs through a structured process to identify needs. Needs were actively solicited from regional and headquarters personnel and from state and local environmental regulatory programs, but they had to be sponsored by senior Agency officials, i.e., Administrator, Deputy Administrator, Assistant Administrators and Regional Administrators, who prioritized and forwarded them to PAMs for consideration in ORD's program. Once selected, a detailed program plan describing how things would be accomplished, was developed by a Program Element Director (PED), the Director of the ORD field Laboratory that would perform the work.

Planning interaction occurred at four defined points of direct interface during each annual planning cycle: two at the policy level and two at the technical level. In addition to the points of direct planning interaction, the program planning system also incorporated an information "feedback" loop to program managers and regional administrators who depended on support activities from other program elements. Decisions relating to objectives, priorities, and timetables were made available to Agency and ORD managers and "need sponsors" on a periodic basis. Such "feedback" was to assist in assuring that ORD research activities were responsive to the needs and priorities of the Agency and that interrelated programs within ORD were effectively coordinated. It was firmly believed that Agency-wide scrutiny would help to produce the most effective, efficient, and responsive research program that was possible.

Limitations of the System

The research planning system proved to be cumbersome for the Agency to deal with. It was organized on the basis of broad media and provided no cross-linking with Agency programs. No cohesive description of the research in each major regulatory subject area existed because tasks were written from a disciplinary rather than regulatory perspective. There were no built-in mechanisms for mid-course corrections and no direct customer participation in determining research priorities.

Like the line management structure of ORD, the budget also was organized around scientific disciplines. It contained over 60 decision units, and because of its fragmentation and science discipline orientation it was not easily relatable to ORD's most important constituencies: the regulatory arms of the Agency, the Office of Management and Budget, or the Congress. The system eventually was criticized as being unresponsive to regulatory and Agency needs.

The Zero-Based Budget

The mid 1970s brought reorganization and, with a new administration in 1977, the advent of a new government-wide planning, budgeting and tracking system. Zero-Based Budgeting (ZBB) required that all government spending be justified from the zero percent level. Research planning, in reality, reversed from a top-down to a bottom-up system. Each year every dollar of every program had to be defended in five levels of funding: 0 to 75%, 75 to 85%, 85 to 100%, 100 to 110%, and 110% and above. New initiatives and new programs were inserted at the 100% level in increments as appropriate. The decision-making process entailed assembling all the

Office and Laboratory Directors to prioritize all projects by increment. The most attention and discussion were focused on the budget line for FTEs and dollars. Each office would defend /justify its items just above and just below the line with the ORD Assistant Administrator making decisions as the meeting progressed. Initiatives were identified as the segments just below the final line. As a consequence, most attention was directed to securing funds for existing programs at the expense of formulating and defending new initiatives.

Need for Change

In mid 1977, it had come to the attention of Congress that there was a problem with the relationship between ORD and EPA's regulatory arm. ORD's budget request was headed for trouble because of growing criticism that the research program was not sufficiently supportive of the regulatory effort. The Congress saw ORD as being unresponsive to the Agency's major mission. At that time, legislation was drafted that broke up ORD and moved the research function (and resources) to the regulatory program offices. After much discussion, ORD was granted a "stay of execution" with the proviso that an EPA-wide task force be formed to examine research planning and management and to propose means of making it more responsive to Agency needs.

Two intra-agency groups were formed to determine the causes of ORD's operational problems and to develop specific corrective measures to alleviate these problems and assure the most effective use of the Agency's research and development resources. Through the improved coordination among the many components of the Agency, a program was developed that both answered the most immediate research needs and allowed a significant expansion in longer-term anticipatory research.

Research Committee Planning System

The result was the Research Committee planning system. The planned programs for FY 79 and 80 reflected the best effort EPA had made during its first decade both to integrate research and regulatory programs and to provide for a longer-term anticipatory research program. A program of meetings was initiated between research personnel and the regulatory program office staffs to determine mutually-agreed-upon strategies, research needs, and the priorities of those needs. Final priorities, across all programs, were established through the ZBB system. The criteria used for ranking programs were considerations such as:

- The impact of the program on human health and safety.
- Its importance toward enabling the Agency to accomplish its mission.
- Its contribution to meeting legislative deadlines or court orders.
- Cost-effectiveness.

In its initial stages, the ZBB system was augmented by the creation of five pilot Research Committees charged with, among other things, providing input into the content of the EPA research program in five areas — drinking water, industrial wastewater, mobile source air pollutants, pesticides, and respirable particulates. Each of these committees included representatives from program offices, regional offices and ORD, and input was obtained from non-EPA individuals with scientific expertise in relevant fields. Although there were some questions about the means of conducting such joint planning efforts, a workable mechanism was evolving to improve planning of the research program.

The success of the pilot project led ORD to expand the number of committees from five to twelve. The budget was structured to consist of 12 decision units that corresponded to the 12 research committees that were established in 1979 (a thirteenth energy research committee was later created to address the portions of the energy program that were multimedia, such as synthetic fuels). Within each decision unit, sub-programs corresponded to ORD's line management structure and thus to broad scientific disciplines, e.g., health effects, engineering, environmental processes and effects, monitor-

ing and risk assessment. In addition, special subprogram line items were provided for high interest special programs like acid rain or the Chesapeake Bay Study.

Research Committees and Corresponding Program Offices (1979)

Office of Water and Waste Management

1. Municipal Wastewater and Spill Prevention
2. Industrial Wastewater
3. Water Quality
4. Drinking Water
5. Solid Waste

Office of Toxic Substances

6. Testing and Assessment
7. Pesticides

Office of Air, Noise, and Radiation

8. Radiation
9. Mobile Source Air Pollution
10. Oxidants
11. Gases and Particles
12. Hazardous Air Pollutants

Based directly on the research committee structure, the new budgetary format went a long way toward strengthening ties with the regulatory program and toward communicating effectively with those concerned with the research programs. It integrated research program presentations with those of EPA as a whole; provided a coherent, balanced mix of scientific activities for each major regulatory area; and provided for clear tracking and reporting by both regulatory subject area and scientific discipline. Consequently, it dramatically simplified the presentation of ORD programs to non-ORD people, and it simplified ORD's internal resource management and accounting.

The new structure, in place for preparation of the FY 82 budget, was well received by the rest of the Agency, OMB, and the Congress. The format integrated fully the ORD and the regulatory programs and demonstrated that, with good planning and management, ORD could conduct a research program that both supported and guided regulatory efforts and promoted and supported good science.

Cause for Change to Current System

Anticipatory Research

From its inception, EPA recognized a need to balance near-term research objectives in support of regulatory programs with a longer-term program to stimulate advances in environmental sciences. However, the Agency was driven by legislation to support short-term regulatory deadlines. Because of resource constraints and new legislative mandates, these regulatory responsibilities created an atmosphere that required a significant portion of the research program to be oriented toward short-term problems.

Reports of the National Academy of Sciences and the Congressional Office of Technology Assessment in the late 1970s focused attention on this problem. In reassessing the role of long-term research in EPA, it was recognized that all research and development activities needed to have some inherent long-term component and that the various stages of the research and development process, fundamental, applied and development activities must cross-fertilize and link with one another.

The problem has been recognized at least since 1978. At that time, several possible remedies were examined: federal contract research centers, a national laboratory system, and a "centers program" at selected academic institutions. The "centers program" and the exploratory grants program were implemented as solutions to the need for an adequate long-term research program.

Ten years later the same problems persisted. Mounting evidence suggested that we were facing a new generation of environmental problems—problems that threaten not just isolated areas, but global ecological resources; not just the health of certain individuals, but perhaps, even our ability to sustain life on this planet. Coping with these problems required a fundamental change in our approach to environmental protection. We needed to develop

our capabilities to anticipate and prevent pollution, rather than simply control and clean it up after it is generated.

Some of the basic scientific questions that we could not answer without fundamental changes in our national environmental research agenda included the following:

- What is happening to our ecosystems?
- How quickly are the changes occurring?
- Are we causing irreversible damage?
- What are the impacts of these ecological changes on human health?

EPA's Science Advisory Board in 1988 called research "the most fundamental of the tools that promote environmental quality." It recommended that EPA "reshape its strategy for addressing environmental problems in the next decade and beyond and plan, implement, and sustain a long-term research program" to support this new strategy.

Based on these recommendations, a major new core research program was established to generate knowledge essential to all areas of environmental decision-making, not just the immediate and individual regulatory needs of EPA's program offices. This core research program required not only strengthening and expansion of existing efforts, but substantial new initiatives in critical areas too long neglected. Also, it required a commitment to sustain long-term research projects that may take years to complete and to maintain a steady core of expertise and resources to provide the continuity essential for effective basic research.

Program Presentation

It became clear in the early 1990's that the research program could not be easily explained to all of ORD's constituencies. The traditional approach to research planning — oriented to organizational structure and scientific discipline — was not flexible enough to relate to emerging environmental concepts and cross-media concerns. Though the system was meaningful to researchers in the Agency it required additional translation to be understood by others. Equally perplexing were problems in communicating research priorities to constituents who weren't familiar with ORD's programs. The effects of such things as resource reductions or increases were not translatable to specific impacts on environmental protection. Thus, a common language was needed that had meaning to both ORD and non-ORD people.

Current Planning Process (Issue Planning)

There has been a convergence of thinking over the past few years about the directions science should take at EPA. The Agency's Science Advisory Board (SAB) has emphasized the role of science at EPA in two reports: *Future Risk: Research Strategies for the 1990's* (Sept. 1988) and *Reducing Risk: Setting Priorities and Strategies for Environmental Protection* (Sept. 1990). Most recently, the Expert Panel on the Role of Science at EPA, set up by Administrator William Reilly, explained the importance of sound science in its 1992 report, *Safeguarding the Future: Credible Science, Credible Decisions:*

> Science is one of the soundest investments the nation can make for the future. Strong science provides the foundation for credible environmental decision-making. With a better understanding of environmental risks to people and ecosystems, EPA can target the hazards that pose the greatest risks, anticipate environmental problems before they reach a critical level, and develop strategies that use the nation's, and the world's, environmental protection dollars wisely.

In response to these influences, the ORD has developed a strategic plan to guide its decisions about research. The plan focuses on broad, cross-media environmental issues and identifies seven goals for its research program:

1.) Forge a center of scientific excellence. Many of today's environmental problems are technically complex. Finding the appropriate solutions to protect

environmental quality requires a sound understanding of the underlying science. ORD is working to expand its role as a nationally and internationally recognized center of scientific excellence.

2.) Ensure that the research program reflects the highest risk areas. ORD is changing the process by which research is planned to ensure that efforts focus on those areas with the greatest probability of significant risk reduction or on those areas of high risk for which significant information or data are lacking.

3.) Improve methods for determining relative risks. Consistent and high-quality risk assessments are critical for setting priorities for national environmental policy as well as for controlling exposure to individual pollutants. ORD's risk assessment research will improve the science and knowledge base needed for reducing the uncertainty associated with risk assessments and will develop better methods for comparing different types of risks.

4.) Place greater emphasis on ecological research and ecological risk assessment. Currently, we understand relatively little about how pollution or other anthropogenic stressors affect complex ecosystems over time. ORD's research program will be restructured to emphasize work on understanding environmental impacts at the ecosystem level. ORD's Environmental Monitoring and Assessment Program (EMAP) is gathering information on the nation's ecological condition. This information, our "national ecological report card," is critical for the Agency's efforts on risk reduction projects that are focused on a geographic basis.

5.) Examine innovative approaches to risk reduction, both for pollution prevention and pollution control. Research in this area will improve our understanding of the fundamental mechanisms of pollution control, develop "order-of-magnitude" better innovative control technologies, and continue ORD's critical support for the Agency's pollution prevention program.

6.) Provide information to all segments of society. As part of the Agency's strategy for education and outreach, ORD will enhance its sharing of technical and research information to all segments of society, including industry, academia, states and local communities, the general public, and other countries.

7.) Collaborate with other federal agencies, industry, academia, and other countries. It is important for EPA to include the spectrum of experience and expertise that exists in the broad scientific community. In order to use this expertise most effectively, ORD will expand its cooperative research with other research organizations.

As ORD considered ways to achieve these seven goals, it became clear that a new way of planning research was needed. In the past, the kinds of environmental problems that EPA scientists studied were largely determined by the short-term regulatory needs of the Agency. As a result, the research was not easily adaptable to cross-media issues, to anticipating future problems, or to providing continuity for studying particularly difficult environmental problems. Therefore, ORD developed a new process for planning research that implements the new research goals while continuing to support research on regulatory priorities.

ORD's issue-based planning process is highly interactive. Each step of the process involves both ORD and EPA's Program and Regional Offices, as well as the scientific community outside of EPA. Strategic direction is provided by ORD senior management and the Research Strategy Council, made up of EPA's Assistant Administrators and chaired by the Deputy Administrator. Specific research areas and approaches are proposed by ORD laboratories in collaboration with scientific and technical staff from across EPA.

In identifying the set of topics that would constitute the research program, ORD aimed for an "environmental problem" orientation. Organizing the research program around specific environmental issues enables ORD to:

- Design research programs that focus on specific environmental problems.
- Increase focus on high-risk environmental problems.

- Support the Agency's new emphasis on comprehensive, multi-media approaches to environmental protection.
- Clearly communicate the research program to EPA's Program and Regional Offices, other federal agencies, Congress, the scientific community, and other interested individuals and organizations.
- Simplify the research planning process to improve the links between planning, budgeting, and implementing the research program.

The ORD research program is divided into 12 theme areas that together contain 38 specific research issues. The new research themes are different in concept than the previous structure of the research program, which used environmental statutes as the organizing framework. The new themes are multi-media and multi-disciplinary and provide an integrated research program to support EPA programs.

Many of the research issues address the high-risk environmental problems identified by the SAB in its Reducing Risk report. Additionally, many of the research issues focus on the knowledge gaps identified in ORD's strategic goals—ecological risk assessment methods, environmental monitoring and assessment, human health risk assessment, pollution prevention, innovative technologies, and technology transfer. Other research issues address needs of the regulatory programs, cross-cutting scientific issues, and the infrastructure for the research program.

ORD has developed an issue strategy to describe research goals and areas of research for each issue. Taken together, the strategies describe EPA's research agenda and ORD's entire program. The strategies are a framework for broad, open discussions about EPA's research agenda and the directions for that research program. The issue strategies have been reviewed both within the Agency and by the SAB. EPA will continue to refine these strategies over the next year.

Each issue strategy, developed by a senior ORD manager called an "issue planner," is to include consideration of fundamental research, applied research, technical assistance and technology transfer. The mix of these components will vary depending on the needs in each issue area. For example, some issues will carry on ORD's core research program of basic research in environmental science that EPA will need in the future to address environmental problems. Other issues will emphasize applied research and technical assistance in support of the Agency's regulatory programs. Each strategy discusses the following:

- Description of the environmental problem.
- EPA's strategic goals for the research.
- Status of current research efforts.
- Research topics to be addressed.

The strategies provide a framework for developing the research plans and enable ORD to better explain the substance of the research and how different pieces of the program fit together. As the strategies have been a mechanism for defining environmental research priorities within the Agency, it is hoped that they will do the same in the national and international environmental scientific communities.

With the strategies in place, the next step was to prepare five-year research plans for each issue. Agency-wide groups, which were led by the issue planners and included representatives from EPA programs and Regions, have developed draft plans. These plans expand the information in the research strategy and include detailed descriptions of the scientific questions needing research; the specific areas in which EPA will conduct research; products and schedules; and technology transfer activities.

The drafts are being reviewed widely—within the Agency, by the SAB, and by professional scientific societies. Reviewers have been asked to evaluate the plans for science quality, relevancy to the Agency's mission, how well they meet Congressional directives, and whether they can be implemented within given resources and time constraints.

This broad-based, open process for planning and implementing research links directly to the Agency's planning process and brings together all Agency offices. As it simplifies planning, the process also promotes better communication in order to include

the nation's best scientific thinking into the ORD research program.

Accountability

Accountability has been built into each of the planning processes described above as a way to communicate ORD's research agenda to its clients, track progress and accomplishments, and link the planning processes to the resource management processes. The goals of the various management systems, used in conjunction with the planning processes, generally were consistent through the years:

- Involve ORD clients in the planning process in order to solicit their research needs.
- Bridge the terminology and division of work among ORD's laboratories to the Program Office and Regional missions.
- Ensure that the research products that had been committed to were completed.
- Communicate to Congress how the research fit into the Agency's mission.

The hierarchy for ORD's first planning system (1972) divided the research into:

Environmental Research Objective
Research Objective Achievement Plan
Tasks

The hierarchy for the accountability system under the Research Committee process was:

Media (Decision Units)
Issue
Planned Program Accomplishment
Project

An application of this hierarchy might be:

Media = Air
Issue = Hazardous Air Pollutants
Planned Program Accomplishment = Health Assessment Documents for Coke Oven Emissions
Project = Exposure Assessment

The hierarchy for the accountability system under the Issue Planning System is:

Research Issue
Sub-issue
Project Area
Project
Products

An application of this hierarchy is:

Issue = Indoor Air
Sub-issue = Source Characterization
Project Area = Source Research
Project = Indoor Source Management Options
Products = Source Emission Model Organic Vapors

In all three instances resources were assigned to the lowest level of the hierarchy once the operating plan was in place. The hierarchy also enabled all parties involved, including laboratory staff and clients, to track progress.

Initially, under the Research Committee planning process, ORD used the Program Management System (PMS) to facilitate tracing of program monies. PMS was one of two major sub-systems of the ORD Information System (ORDIS). The other major sub-system was the Budget Tracking System (BTS). Each system was designed to organize budget data for different purposes: BTS financially, and PMS programmatically. During the 1980's the Agency established the Strategic Planning and Management System (SPMS) to track major products for all Agency AAships. The deliverables itemized for SPMS were also added to PMS as Project Descriptions. The combination of Research Committees, PMS, and Deliverables continued through to 1989 along with the Congressional reporting requirement of the "Research Outlook," an annual progress report on Issues from the Research Committee chairman .

Administrator Reilly de-emphasized deliverables, and as a result, the SPMS was abandoned as a Agency-wide management tool. ORD also de-emphasized deliverables. However, PMS was still used for internal management and the research committees continued functioning throughout this period. They remained the primary means of communication with research clients and the process by which resources and projects were tracked at microlevels. Through the individual committee process and interactions, ORD laboratories and program offices continued planning and budgeting for research at the working level.

During the Fall of 1990, ORD established a task force to consider ways to improve communications and accountability for ORD's research products and activities. Several steps, utilizing the Research Committees, were suggested for implementation that required the active support and commitment of staff at all levels and from many parts of the Agency. These recommendations were being implemented when ORD moved to the Issue Planning Process; and many of the Task Force's recommendations are being incorporated into the redesign of the Research Committee functions.

Under the Issue Planning System, there are two major efforts underway to improve communications and accountability of ORD's research program:

1.) Redesign of Research Committee functions.

2.) Consolidation of Allowance Holder.

Research Committees will be organized as before by media: air, water, toxics, and hazardous waste. The specific objectives include:

- Translating the results of multi-media research programs into media-oriented products for the programs and regions.
- Tailoring the design and delivery of specific products for the upcoming fiscal year to enhance the usefulness and effectiveness of research results.
- Communicating regularly with the programs and regions throughout the year to update them on research progress and completed products.
- Encouraging discussion within program and regional offices on their future research needs to ensure that each office is prepared for meetings of the Agency's Research Strategy Council.
- Recommending approaches for allocating Congressional or Administration budget reductions to minimize impacts on program and regional priorities.
- Reporting to senior management on the relevancy of the research issues to the needs of the programs and regions.

By consolidating allowance holders, ORD will be able to track *all* resources applied to research activities. As ORD executes the first year of Issue Planning, it will track and monitor resource, program, and management information essential for operations and planning. An integrated database is under development that will track resources from planning through expenditure to produce the information required for a single, open set of resource reports for Issue Planning, contract management and acquisition strategies. Included in plans for the system design are reports and tracking of financial information, a budget module for the operating plan, a planning module for the Issue Planning cycles, acquisition management plans and expenditures, off-budget plans, and research products planned and accomplished.

References

EPA Science Advisory Board, *Future Risk: Research Strategies for the 1990s*, Sept. 1988,

EPA Science Advisory Board, *Reducing Risk: Setting Priorities and Strategies for Environmental Protection*, Sept. 1990,SAB-EC-90-021.

Expert Panel on the Role of Science at EPA, *Safeguarding the Future: Credible Science, Credible Decisions*, March 1992, EPA/600/9-91/050.

Chapter 5

Extramural Program Strategy

ORD interacts extensively with the extramural research community and is committed to expanding and improving this interaction during the next few years. It is well understood within the organization that collaboration and cooperation among all interested research institutions is essential if answers are to be found to the complex and intractable environmental problems facing the world today. Traditionally, this interaction has taken several forms, including a competitive grants and centers program, personnel exchanges, interagency cooperation, sponsorship and active participation in conferences and workshops, on- and off-site contractor support, and laboratory-based cooperative agreements. This chapter describes the philosophies, operation, size, and organizational implications of these extramural programs.

As its responsibilities have evolved over the years, ORD has had to rely more on support from outside sources in its research efforts. Recognizing the need to maintain an appropriate balance between its intramural and extramural activities, ORD has initiated several actions, including a policy review of the management of ORD's extramural programs and establishment of an executive-level position to oversee acquisitions within the organization. These actions are discussed more fully later in the chapter.

The following table shows the distribution of ORD's extramural resources for FY'91, the most recent year for which data are available. Fund totals include resources received from other EPA programs.

Contracts		
On-site	$92,842,076	
Off-site	86,705,803	
Subtotal		$179,547,879
Grants/Cooperative Agreements		
On-site	$ 11,572,897	
Off-site	110,154,089	
Subtotal		$121,726,986
Interagency Agreements		
On-site	$ 4,133,442	
Off-site	18,373,988	
Subtotal		$22,507,430
Government Furnished Equipment		3,074,775
Total		$326,857,070

Support to Academia

Since its inception, EPA has provided support to the academic environmental research community through research grants and fellowships. Originally, all assistance awards to universities for research were managed by the ORD laboratories. In 1979, in response to Congressional urging, responsibilities for the award and management of research assistance agreements were split between ORD laboratories and a newly formed office whose mission was to provide long-term support to exploratory, anticipatory, and basic academic research on environmental

issues.

Office of Exploratory Research

In 1977, Congress formally expressed interest in dedicating a portion of EPA's research and development funds to support what has been variously termed long range, anticipatory, exploratory, fundamental, and basic research. Congress was concerned that with the continued pressure placed on ORD's laboratories to use their resources in support of projects with immediate applicability to the solution of current regulatory problems, there may be insufficient motivation within the laboratories to protect resources for either long-term studies of intractable environmental problems or exploratory research into fundamental concepts such as the thermodynamics of environmental or biological processes or physical, chemical, and biological mechanisms involved in the formation, transport, or fate of pollutants. The Senate Report accompanying ORD's authorization act for that year stated that:

> "...To assure a comprehensive anticipatory perspective, this bill would authorize $10 million and additionally would earmark 15 percent of all program-related research and development funds for long-range research by the Environmental Protection Agency ..."

In 1978, Congress expressed its desires in stronger terms, first by including its concerns in the authorization act itself and, second, by making establishment of a new program mandatory.

> "The Administrator of the Environmental Protection Agency shall establish a separately identified program to conduct continuing and long-term environmental research and development. Unless otherwise specified by law, at least 15 percent of any funds appropriated to the Administrator for environmental research functions created by subsection (a) of this section. [sic]"

EPA was slow to respond to this requirement so in the House Report accompanying the 1979 authorization act, the following language appeared:

> "Public Law 95-155 directed the Agency to establish a separately identified program of long-range research, and specified that at least 15 percent of the program-related research funds support long-range research. The Committee notes that such a program has not been identified. The Agency is requested to promptly identify the 15 percent that is to be in the long-term program and explain how it intends to manage this program. "

As a result of these requests, the Office of Exploratory Research (OER) was created in 1979. OER was established as an entity separate from the discipline-oriented ORD offices which support in-house laboratories, in order to protect long-term, innovative, and basic research. It was also charged with the responsibility for supporting only research grants that were selected through a competitive peer review process. With the establishment of OER, authority for the award of research grants became limited to that office. ORD's laboratories, which were still encouraged to support academic research, were henceforth precluded from authority to award grants and were limited to the award and management of cooperative agreements and contracts which are directly relevant to the mission of the laboratory.

There are two primary components to OER's research program, the competitive grants program and the environmental research centers program. The primary duties of the staff are to solicit for grant and center applications, conduct extramural peer reviews of applications, serve as project officers on all grants and centers, and prepare and disseminate annual reports, bibliographies, and related information.

Although not designed with this notion in mind, the competitive grants and centers programs provide an effective and positive link between EPA and the extramural research community, as well as with potential users of research. This linkage is accomplished both through representation on peer review panels and membership on center advisory committees. To be eligible to serve either as a peer reviewer

or advisory committee member, an individual must be well-known and respected in his or her technical field, and may be affiliated with an academic institution, industry, public interest group, private research or consulting organization, or state, local, or federal agency. Through these affiliations, researchers become familiar with EPA's needs and interests, meet EPA employees who have compatible technical interests, apprise EPA of activities or opportunities of interest, and serve as informal conduits to advertise EPA-sponsored activities.

Competitive Research Grants

The competitive investigator-initiated research grants program emphasizes research proposals that are innovative in approach and more basic in orientation than the Agency's regulatory support research efforts. Each year, a solicitation for applications is issued by OER and notices of grant availability are published in the *Federal Register*, *Science*, and selected trade publications. The solicitation is automatically mailed by ORD's Center for Environmental Research Information to approximately 4,500 university departments across the country. During the course of the year, OER sends out roughly an additional 12,000 copies of the solicitation.

Periodically, the Agency elects to target certain areas of research that may represent emerging environmental issues or might require considerable study before decisions can be made. In these cases, OER will issue a Request for Applications (RFA) that specifies the kind of research that will be funded. Examples of recent and pending RFA topic areas include: (1) effects of ultraviolet-A and ultraviolet-B radiation on human health and the environment, (2) *in situ* bioremediation techniques, and (3) ecological response indicators.

Under the general solicitation, research has traditionally been supported in five areas: health, environmental biology, air chemistry and physics, water and soil chemistry and physics, and environmental engineering. Beginning in FY'91, a new area, socio-economics, was added. Health research was eliminated as a general solicitation area in FY'92, although health-related topics may continue to be funded periodically under RFAs.

OER employs a peer panel system of review. Until 1993, reviews were conducted using panels convened by one of six review panel chairmen selected by EPA (corresponding to the six topical areas of research such as environmental biology, socio-economics, etc.). A panel chairman served for three years, during which time he was not eligible to receive any EPA resources other than his remuneration for selecting reviewers and conducting review meetings. All reviewers were chosen by the panel chairmen to serve on ad hoc panels, based on the reputations of the individuals and the skills mix required to provide sound review of the applications received.

Beginning in 1993, OER will conduct all of its peer reviews under contract arrangements. The contractors will have sole responsibility for recruiting panel chairmen and other reviewers, setting dates for meetings, making all logistical arrangements, providing secretarial and other clerical support, and preparing summaries of the panel's findings.

Typically, grants funded under the exploratory grants program do not exceed three years, with an average duration of just over two years. Funding levels range from approximately $40,000 to $250,000 annually, with average annual awards equalling approximately $100,000. After subtracting the resources needed to fund the second and third years of ongoing awards, OER generally has about $8 million each year to make available for new projects. During the first four years of the program, approximately 100 new grants were awarded annually through OER's Research and Development appropriation. Between 1984 and the present, the number of new grants each year has ranged from a low of only four in 1988 to over 150 in 1990. Over the lifetime of the program, the average number of new grants awarded per year is 70.

Each year, the grants program publishes a book of abstracts and a bibliography. Beginning in 1993, the abstracts will be keyworded and both abstracts

and bibliographies will be available electronically through the Exploratory Research Management Information System (ERMIS), maintained by OER.

Exploratory Environmental Research Centers Program

The Exploratory Environmental Research Centers (ERC) Program is one of two competitive research centers programs administered by OER. The purpose of the program is to provide stable, long-term support to research in key environmental areas in which there is a lack of understanding about basic mechanisms of action or for which serious technical obstacles persist in thwarting efforts at prevention or mitigation. The ERC program was initiated in 1979, as a result of negotiations within the Agency and between EPA and Congress. After consulting with Congress, EPA selected eight research themes and established university-based centers in those areas. Most of these centers were chosen competitively. The eight original centers and their topic areas were:

1.) The University of California at Los Angeles — intermedia transport of pollutants.

2.) Cornell University — ecosystem research.

3.) The University of Illinois — advanced environmental control technology.

4.) Illinois Institute of Technology — industrial waste elimination.

5.) Louisiana State University — hazardous waste research.

6.) The University of Pittsburgh — environmental epidemiology.

7.) The University of Rhode Island — marine ecology.

8.) Rice University (lead), The University of Oklahoma, Oklahoma State University — ground water research.

These centers were phased in over a two-year period beginning in 1979. Each center received annual base funding of approximately $540,000 from EPA that they were required to match with at least a 5% contribution from non-federal sources. Some centers also received periodic supplemental funding from EPA laboratories. All of these centers were phased out between July 1990 and January 1993.

Based on lessons learned from the first iteration of the centers program, as well as information gathered during an exhaustive review of other federally sponsored research center programs, OER overhauled the ERC program in 1990. The most significant changes are itemized below:

- Annual base funding increased to $1.0 million per center.
- Matching requirement raised to 20% of total center resources.
- EPA does not pre-determine research topic areas.
- All centers chosen competitively.
- Both administrative management and project officer responsibilities reside within OER.
- Increased emphasis on the importance of the center's external Science Advisory Committee.
- Coordination and dissemination functions of center emphasized.

Four new centers were established in 1992, following a rigorous peer review process. The four new centers are:

1.) *Center for Airborne Organics* — concentrating on the sources, atmospheric transformation, fate, and control of airborne organic pollutants

- Massachusetts Institute of Technology (lead)
- California Institute of Technology
- New Jersey Institute of Technology

2.) Multiscale Experimental Ecosystem Research Center — linking mathematical modeling and experimental approaches to identify and solve the problems of scale-dependent ecosystem responses to environmental perturbation

- University of Maryland.

3.) *Center for Clean Industrial and Treatment Tech-*

nologies—focusing on pollution prevention through identification of alternatives, balanced assessment, and targeted research and development

- Michigan Technological University (lead).
- University of Wisconsin.
- University of Minnesota.

4.) *Center for Ecological Health Research* — analyzing ecosystems under multiple stresses from toxic compounds and other anthropogenic influences

- University of California at Davis.

Recipients are strongly encouraged to use their base EPA funds as seed money to attract other contributors to the centers. Each center must establish a Science Advisory Committee (SAC) comprising a well-balanced mix of relevant technical disciplines, with members coming from the public and private sectors, academia, industry, and environmental groups, as appropriate. The EPA project officer is an active, but non-voting member of the SAC. The SAC meets at least twice annually and is charged with overseeing the technical direction and quality of all research supported by the center.

An annual report is published by OER which includes general information about the structure, mission, and direction of each center, key personnel, identities of advisory committee members, abstracts and status reports on all active projects, statistics on the number and kind of students involved in the center, and bibliographies. Beginning in 1993, the project abstracts and bibliographies will also be keyworded and indexed and will be available on ERMIS.

The peer review process for establishing centers begins in a similar fashion to that of the grants program. However, the centers selection process also requires that finalists be site visited. No new solicitations for centers are planned in the immediate future.

Hazardous Substance Research Centers Program

The second centers program administered by OER is the Hazardous Substance Research Centers (HSRC) Program, which was sanctioned by Congress in the 1986 re-authorization of Superfund. Five million dollars were provided in the 1988 Appropriation Act for EPA to establish five HSRCs, provided that they be competitively awarded, university based, and equitably distributed around the country. These centers perform basic and applied research on hazardous substance-related problems that are of significance in the geographic area in which the centers are located but which also have national importance. The research conducted by the five centers includes combustion, stabilization, bioremediation, and transport and remediation of contaminants in sediments, soils, and ground water. The centers are also charged with maintaining an active technology transfer program.

These centers were established through a peer review process similar to the one previously described for the ERCs and have identical funding requirements except that the HSRCs are obligated to devote 10-20% of their resources to technology training activities. Each center maintains an active Science Advisory Committee as well as a similarly involved Training and Technology Transfer Advisory Committee. Reporting requirements are the same as for the ERC program.

The five centers and their primary areas of specialization are:

1.) *Northeast Hazardous Substance Research Center* — focusing on thermal treatment and *in situ* treatment technologies.

- New Jersey Institute of Technology (lead).
- Massachusetts Institute of Technology.
- Princeton University.
- Rutgers University.
- Stevens Institute of Technology.
- Tufts University.
- University of Medicine and Dentistry of New Jersey.

2.) *Great Lakes and Mid-Atlantic Hazardous Substance Research Center*—bioremediation and supportive engineered systems.

- The University of Michigan (lead).

- Howard University.
- Michigan State University.

3.) *South and Southwest Hazardous Substance Research Center* — contaminated sediments research.

- Louisiana State University (lead).
- Georgia Institute of Technology.
- Rice University.

4.) *Great Plains/Rocky Mountains Hazardous Substance Research Center* — contamination of soils, especially by organic residues, metals, and mixed wastes.

- Kansas State University (lead).
- Montana State University.
- University of Iowa.
- University of Missouri.
- University of Montana.
- University of Nebraska.
- University of Utah.

5.) *Western Region Hazardous Substance Research Center* — ground-water cleanup and site remediation, with emphasis on biological systems.

- Stanford University (lead).
- Oregon State University.

ORD Laboratory Programs

As mentioned above, ORD laboratories have been providing support to the extramural environmental research community since the establishment of the Agency in 1970. For the last decade, this support has been largely in the form of on-site contracts for program support activities and cooperative agreements to nearby universities. Over time, each laboratory evolved its own policies and procedures regarding the use of cooperative agreements within the general legal framework provided by the EPA Assistance Regulations.

In March 1992, the Assistant Administrator for ORD announced a new policy regarding ORD's extramural resources. Effective the beginning of the 1993 fiscal year, all ORD laboratories established goals to reduce their reliance on level-of-effort contracts, particularly those that provide direct support to the in-house research programs, by approximately 35%. These resources were to be reallocated to competitively awarded off-site cooperative agreements or competitive contracts.

To ensure that all of the 12 laboratories employ the same procedures for competing cooperative agreements and that these procedures accomplish the goals of promoting fair and open competition among all eligible institutions, an ORD-wide policy was issued on October 1, 1992. This policy places particular emphasis on the competitive award of research cooperative agreements.

Near-Site Institutional Cooperation

Another activity which was addressed by the October 1, 1992, interim guidance is institutional cooperation between ORD laboratories and universities located nearby. All of ORD's laboratories are located in close proximity to institutions of higher education. In some cases the rationale for siting the laboratories where they are included the benefits that could be derived from collaboration and cooperation with these neighboring institutions.

Several such relationships have existed for years in ORD. One illustration of near-site cooperation involves the University of North Carolina, Chapel Hill (UNC) and the Clinical Studies Branch of ORD's Health Effects Research Laboratory in Research Triangle Park, NC. Many years ago, when it was determined that ORD should build expertise in human clinical studies, particularly on criteria air pollutants, an arrangement was made between EPA and UNC to locate the facility on the campus of the university near the medical school. This was a beneficial arrangement for all concerned. First, the facility could not easily have been accommodated within the limited space available in EPA's compound. Second, for safety reasons, it was prudent to have the inhalation facility located near the medical center in case of emergency. Third, being located on the campus made it easier to recruit young, healthy volunteers to participate in the controlled experiments needed by the Agency. Fourth, with its location proximal to the medical school, it was easy for UNC researchers and EPA scientists to develop collaborative projects or to establish chains of inde-

pendent projects that built upon each other's work. Other illustrations of such successful partnerships with nearby institutions exist.

With any such close relationship, however, it is necessary to guard against abuses by either party and to provide adequate and continuing project oversight. It is these aspects of institutional cooperation that are addressed in the interim guidance document. To ensure that ORD undertakes and continues only those long-term cooperative ventures that prove mutually beneficial and that represent advantageous uses of federal funds, the interim guidance establishes headquarters oversight of the establishment and maintenance of these relationships.

Support from Contractors

In its 1990 and 1991 reports required by the Federal Managers' Financial Integrity Act, ORD identified contract management as a major weakness and the Assistant Administrator began investigating options for improving ORD's contract management policies. In October 1991, the Assistant Administrator appointed an ORD Acquisition Executive charged with developing a comprehensive Acquisition Management Improvement Initiative. The initiative addresses the contract management practices of each ORD laboratory and identifies areas for improvement, including staff development needs.

Federal Interagency Arrangements

ORD has numerous formal cooperative relationships with other federal agencies, ranging from general policy agreements to individual projects that transfer human, financial, or technical resources between agencies. As with MOU's between EPA and non-federal agencies, federal MOU's are designed to articulate the level and kind of cooperation intended between the partners and to lay out any ground rules for cooperation and resource exchanges. They are not, themselves, vehicles for such exchanges and if resource exchanges are desired, the agencies must put an Interagency Agreement (IAG) in place. One illustration of an influential MOU exists between EPA and the Department of Energy, as a result of a mutual desire to share research and technological information and enhance collaboration. Several IAGs have resulted from the MOU with DOE. Other IAGs have different purposes. As mentioned earlier, EPA participates in personnel exchanges with both DOE and the National Oceanic and Atmospheric Administration through IAG arrangements.

ORD also enjoys numerous informal relationships with other federal agencies. For example, the National Science Foundation (NSF) and the Office of Exploratory Research (OER) regularly share information about grants awarded, changes in review procedures, and evaluation criteria. Representatives from these organizations are commonly invited to sit in on site evaluations and peer review sessions. Similar, though less extensive relationship also exist between OER and the Department of Defense (DOD) and the National Institute of Environmental Health Sciences (NIEHS).

ORD habitually consults with technical experts at other agencies, such as the National Oceanic and Atmospheric Administration, the National Air and Space Administration, and others. In addition, numerous *ad hoc* task groups have been formed over the years involving individuals from several federal agencies to assist ORD in refining, articulating, and accomplishing its goals. Similarly, ORD personnel are often called upon to serve on such committees to assist other agencies.

References:

Office of Research and Development, "Summary Analysis of Financial Activity FY 1989-1991"

Chapter 6

Management of Major Cross-Cutting Programs

The Environmental Monitoring and Assessment Program

The Environmental Monitoring and Assessment Program (EMAP) was established within the Office of Research and Development in response to a 1988 Science Advisory Board recommendation that the Agency initiate a program to monitor ecological status and trends and to identify, through scientific analysis, problems that pose the greatest environmental risk. The program has four strategic objectives:

1.) Estimate the current status, trends, and changes in selected indicators of the condition of the nation's ecological resources, on a regional basis, with a known confidence.

2.) Estimate the geographic coverage and extent of the nation's ecological resources with known confidence.

3.) Seek associations between selected indicators of natural and anthropogenic stresses and indicators of the condition of ecological resources.

4.) Provide annual statistical summaries and periodic assessments of the nation's ecological resources.

EMAP takes a holistic perspective of the environment to address basic questions about ecological conditions. This represents a major technical and administrative transformation in environmental protection by recognizing the importance of long-term monitoring to detect trends, observe chronic disorders, and examine subtle responses to both stress and mitigation. EMAP takes a multiple resource approach because species and ecological resources do not act in isolation; rather they interact with one another through complex associations. The EMAP approach provides an integrated perspective, incorporating air and deposition monitoring and landscape characterization with resource monitoring, to derive integrated assessments of resource condition across all regions of the nation.

The breadth of the program requires substantial internal Agency coordination. EMAP is a component of the Office of Modeling, Monitoring Systems and Quality Assurance, and receives support from the Office of Environmental Processes and Effects Research; eight laboratories from these offices are involved in the implementation of the EMAP monitoring efforts.

EMAP is progressing through all stages of sampling design, resource mapping, indicator development, building interagency coordination, and embarking on field pilots and demonstration projects to test monitoring and analysis methodologies. These activities are organized by the eight major ecosystem resource groups, with implementation schedules determined for each group by available EPA resources, commitments with cooperating institutions, and the ability to integrate the results with other EMAP activities. The eight ecological resources being assessed are:

1.) Near-Coastal Waters.
2.) Great Lakes.
3.) Inland Surface Waters.
4.) Wetlands.
5.) Forests.
6.) Arid Ecosystems.
7.) Agroecosystems.
8.) Integrated Landscapes.

EMAP is truly an interagency program, including the nation's best scientists from the federal government, states, and the academic community. Presently the program has the participation of 12 federal agencies, 35 states, and 40 universities. The active participation of personnel from other ecological research and monitoring programs provides a critical mass of expertise. Additionally, the close interaction among programs minimizes duplication of effort. The major interagency activities include:

- Department of Agriculture, Forest Service — EMAP efforts in forests and arid ecosystems.
- Department of Agriculture, Soil Conservation Service —coordination with terrestrial monitoring and soil indicators research.
- Department of Commerce, National Oceanic and Atmospheric Administration — EMAP efforts in Great Lakes and near coastal waters.
- Department of the Interior, Bureau of Land Management—monitoring activities and government-wide coordination.
- Department of the Interior, Fish and Wildlife Service — wetlands monitoring, landscape characterization, and wildlife indicator development.
- Department of the Interior, Geological Survey — landscape characterization, inland surface waters.

Global Climate Change Program

Global climate change is such an encompassing program that no agency or country can solve the problem alone. ORD is working closely with other federal agencies as part of the National Program for U.S. Global Change Research (USGCRP). The U.S. research program is the largest one in the world directed at the problem. The budget for FY'93 is $1.4 billion.

The central goal of the USGCRP is "to establish the scientific basis to support national and international policy making on natural and human-induced changes in the global Earth system". The USGCRP was established by a Presidential initiative in FY 1990 and became a National Program in 1992. An important feature of being a Presidential Initiative and a National Program is the development of an interagency coordinated budget for submission to the Office of Management and Budget.

The international and national management occurs through the following organizations:

- Office of Science, Technology, and Policy in the White House.
- Federal Coordination Committee for Science, Engineering, and Technology (FCCSET). The EPA Administrator is a member.
- FCCSET's Committee for Earth and Environmental Sciences (CEES). The EPA Assistant Administrator for ORD is a member.

The USGCRP was developed by the CEES, in cooperation with the U.S. and international scientific communities, through the National Academy of Sciences, and is linked internationally to other government agencies, to the relevant intergovernment organizations of the United Nations, and to other governmental and non-government organizations.

Subcommittee for Global Change Research (SCGR) coordinates the research program. The ORD Director of the Office of Environmental Processes and Effects Research (OEPER) is a member. Interagency program direction, monitoring, and reporting occurs through four work groups:

- Measurements and Monitoring Work Group
- Processes Work Group
- Modeling Work Group
- Assessment Work Group

Three OEPER science managers represent ORD on these four work groups.

The ORD Global Change Research Program (GCRP) is managed in headquarters by Dr. Courtney Riordan, who is the Director of OEPER. This program has a FY'93 budget of $26 million, which is 2% of the budget of the National Program. In headquar-

ters, Dr. Riordan has a staff director and three senior science managers to assist him in program management. The ORD program is not a stand-alone program; rather it is components of the federally coordinated program. However, ORD's program is within its areas of expertise and closely focused on the assessment activities of the Intergovernmental Panel for Climate Change (IPCC), especially the Second Assessment Report of 1995 and subsequent biannual assessments.

Laboratory participation in program planning and budgeting is obtained through an informal matrix management group of five "Technical Directors" who are responsible for the interlaboratory projects. These projects consist of multiple tasks, which are implemented through the various laboratory directors, with their oversight for attaining project goals, budget, quality assurance, and timeliness of results. The projects and tasks are assigned among ORD's laboratories in accordance with their missions and capabilities. The specific projects and assignments are:

- Anthropogenic methane/RITG emissions research.

  Assigned to AEERL, whose mission includes emissions research and inventories.

- Tropospheric chemistry; Stratospheric ozone depleting chemicals and chemical effects.

  Assigned to AREAL, whose mission includes atmospheric chemistry and modeling; AEERL is also involved in related emissions components.

- Assessment of Biospheric Carbon Pools and Fluxes; Climate-Induced Biospheric Feedbacks.

  Assigned to ERL-Athens, ERL-Corvallis, and ERL-Gulf Breeze whose missions include the dynamics of soils, forest/agro, and marine systems, respectively.

- Monitoring of forest conversion and biomass burning.

  Assigned to ERL-Corvallis and EMSL-Las Vegas, whose missions include dynamics of forest/agro-systems and analysis of space imagery. OEPER Headquarters also contributes through interagency agreement with NASA.

- Earth system modeling analysis research.

  Assigned to ERL-Athens, whose mission includes ecological dynamics. Includes participation of AREAL (atmospheric sciences) and ERL-Corvallis (forest dynamics).

- North American landscape characterization.

  Assigned to EMSL-LV, whose mission includes the analysis of space imagery.

- Effects of global changes on rice system yields.

  Assigned to ERL-Corvallis, whose mission includes agro-ecological dynamics.

- Micro- to macro-scale ecosystem responses to climate change.

  Assigned to ERL-Corvallis, ERL-Duluth, and ERL-Narragansett, whose missions include vegetative, freshwater, and marine ecosystem dynamics, respectively.

- UV-B monitoring for human exposure.

  Assigned to AREAL, whose mission includes atmospheric meteorology and chemistry.

- Early signal detection of global climate change.

  This initiative is presently being formulated.

The GCRP is organized to be strongly responsive to national and international global climate change assessment needs. Chief among these in the immediate future is to play a major role in developing the biospheric portion of the Second Assessment Report by the Intergovernmental Panel on Climate Change (IPCC). The IPCC, in developing its First Assessment Report for the negotiations leading to the Framework Convention on Climate Change (FCCC) signed at the Rio UNCED meeting by over 150 countries, was instrumental in helping to find a

consensus to start serious international consideration of climate change. The IPCC Second Assessment Report will play a major role in framing the negotiations among the signatory parties of the FCCC to develop concrete steps to combat global climate change. Preparing this second assessment report will be more challenging than the first because it is necessary to include within the second report a detailed understanding of biospheric effects to climate change and the feedbacks of the biosphere to the physical climate system. The GCRP will be contributing substantially to this process.

References

Our Changing Planet: The FY-1994-1998 Budget Recommendation. The U.S. Global Change Research Program (CEES, September, 1992).

U.S. EPA Global Change Research Program: Strategic Plan (August, 1992).

U.S. EPA Global Change and Stratospheric Ozone Research Programs: 1991 Annual Report (July, 1992).

Appendix A

Organizational Changes in the Research Program

(1970 - 1992)

1970 - As EPA was established, research was administered by a Deputy Assistant Administrator (DAA) for Research and Environmental Assessment and a DAA for Monitoring.

1971 - On August 17, 1971, the EPA Administrator established the first Assistant Administrator for Research and Monitoring (ORM) by consolidating the two DAA-ships and adding the research and monitoring functions from the Air, Water and Media Programs (Figure A-1).

1972 - By December 1972, headquarters staff at the division level was reorganized and renamed. A system of four National Environmental Research Centers (NERCs) was created to coordinate activities between the AA, ORM and the individual laboratories and field stations assigned to the Office (Figure A-2).

1973 - Another headquarters reorganization brought about a name change for the Office, from Research and Monitoring to Office of Research and Development (ORD). Additionally, the Washington Environmental Research (WERC) was created to better distinguish the planning, management, development and coordination functions of headquarters from operation of the laboratories. The Agency's Science Advisory Board was created and assigned to ORD in the AA's Office. The DAA-ship for Research was divided to create two new offices, Environmental Engineering (including a Technology Transfer Staff) and Environmental Sciences (Figure A-3).

1975 - A reorganization was approved in April 1975 to clarify lines of responsibility between headquarters and the laboratories. The NERC and the WERC were abolished so that labs reported directly to specific DAAs to improve responsiveness of the organization to environmental problems and program office needs. The four DAA-ships with programmatic responsibility were renamed to better reflect the environmental issues they addressed. A Regional Services Staff (RSS) was created to coordinate research needs of the regions (Figure A-4).

Later in 1975, an additional change was made when the Office of Technology Transfer was moved out of Washington to Cincinnati (the group was later renamed the Center for Environmental Research Information, CERI) and assigned to the Industrial Environmental Research Laboratory. In 1977, several changes took place: the Carcinogen Assessment Group was established in the Immediate Office of the Assistant Administrator (IOAA), all budget preparation and management functions were consolidated in the Office of Financial and Administrative

Services (OFAS), and the Office of Planning and Review (OPR) was created to unite all policy and planning activities.

1978 - OFAS and OPR were combined to form the Office of Research Program Management (ORPM). The Office of Health and Environmental Assessment (OHEA) was established to centralize responsibility for the Agency's health and ecological risk assessment.

1979 - A realignment of headquarters offices was initiated by the AA to group the labs and offices by scientific discipline and to split health from ecological effects, thus, improving organizational functioning and reducing a media and problem focus. The Office of Energy Minerals and Industry became Environmental Engineering and Technology; Air, Land and Water Use became Environmental Processes and Effects; and Health and Ecological Effects became the Office of Health Research. The DAAs for line offices were later retitled Office Directors (ODs). The Office of Exploratory Research (OER) was created to assume responsibility for the planning and implementation of long-term research (Figure A-5).

1985 - The Administrator created the Risk Assessment Forum and located the function in the OHEA. A regulatory support staff became part of the IOAA. This group was later renamed the Office of Regulatory Support and Scientific Analysis (ORSSA). In 1988, ORSSA, RSS, and CERI were included in the new Office for Technology Transfer and Regulatory Support (OTTRS). In 1988 and 1989, the Support Services Offices in Cincinnati and Research Triangle Park were reorganized to create offices for a Senior ORD Official (OSORDO) at each site, which reported to the IOAA in Washington.

1991 - The Risk Assessment Forum was moved out of OHEA and made part of IOAA to increase its visibility within EPA. July 1992 saw the creation of the Ecological Monitoring and Assessment Program (EMAP) as a organizational entity, which became part of the Office of Modeling, Monitoring Systems and Quality Assurance.

1992 - The current ORD organization is shown in Figure A-6. A chronology of key ORD events is listed in Table A-1, followed by a graphical summary of ORD total resources and personnel (1971 through 1992) in Figure A- 7. Table A- 2 provides a list of ORD total resources and personnel.

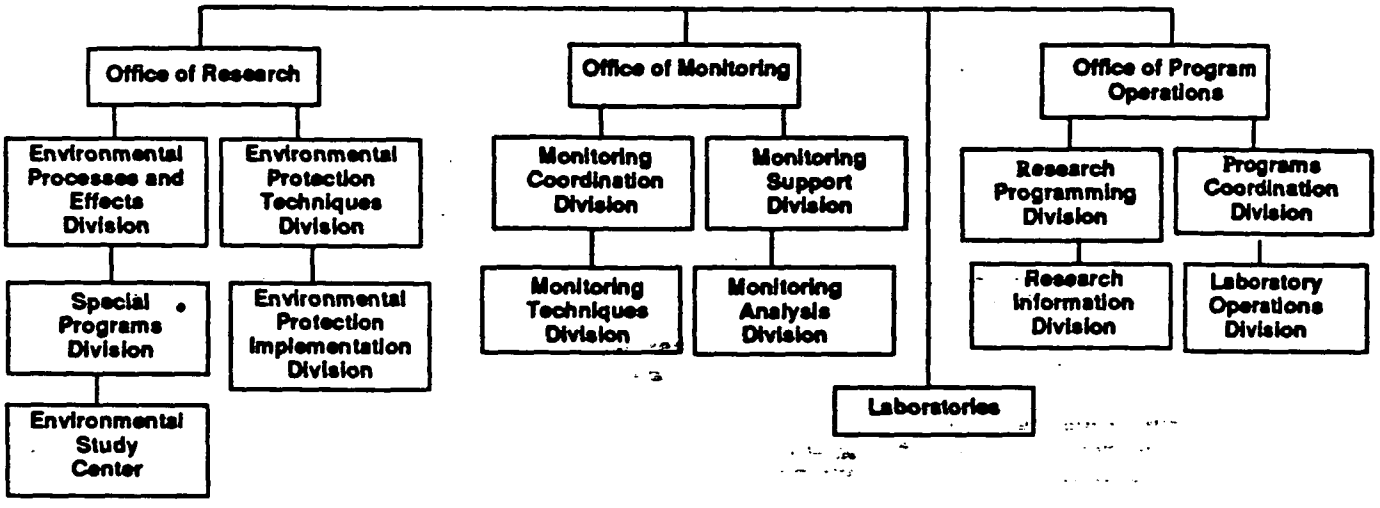


Figure A- 1. Immediate staff of assistant administrator for Research and Monitoring (8/7/71).

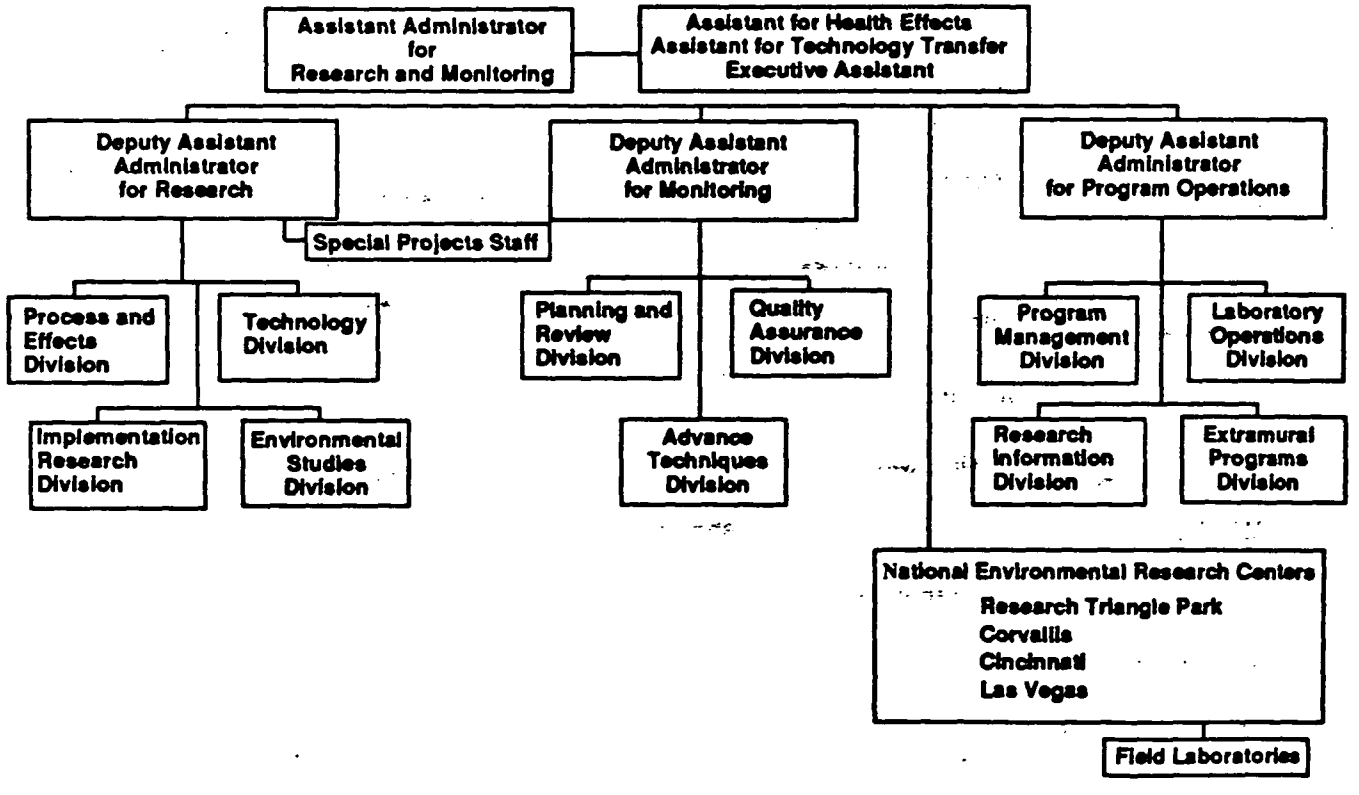


Figure A-2 . Organization chart for Office of Research and Monitoring (12/7/72).

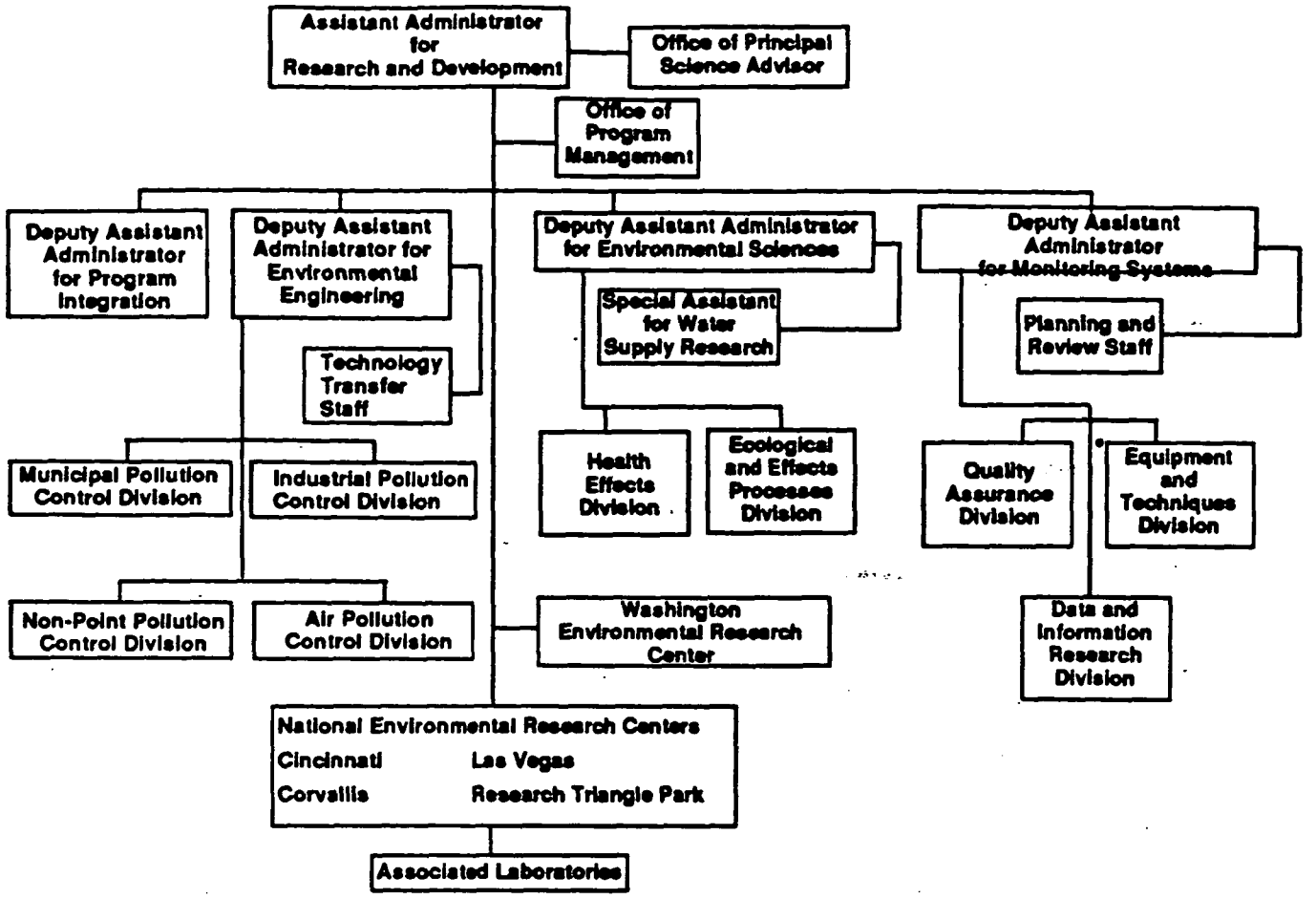


Figure A- 3. Immediate staff of assistant administrator for Research and Development (1973).

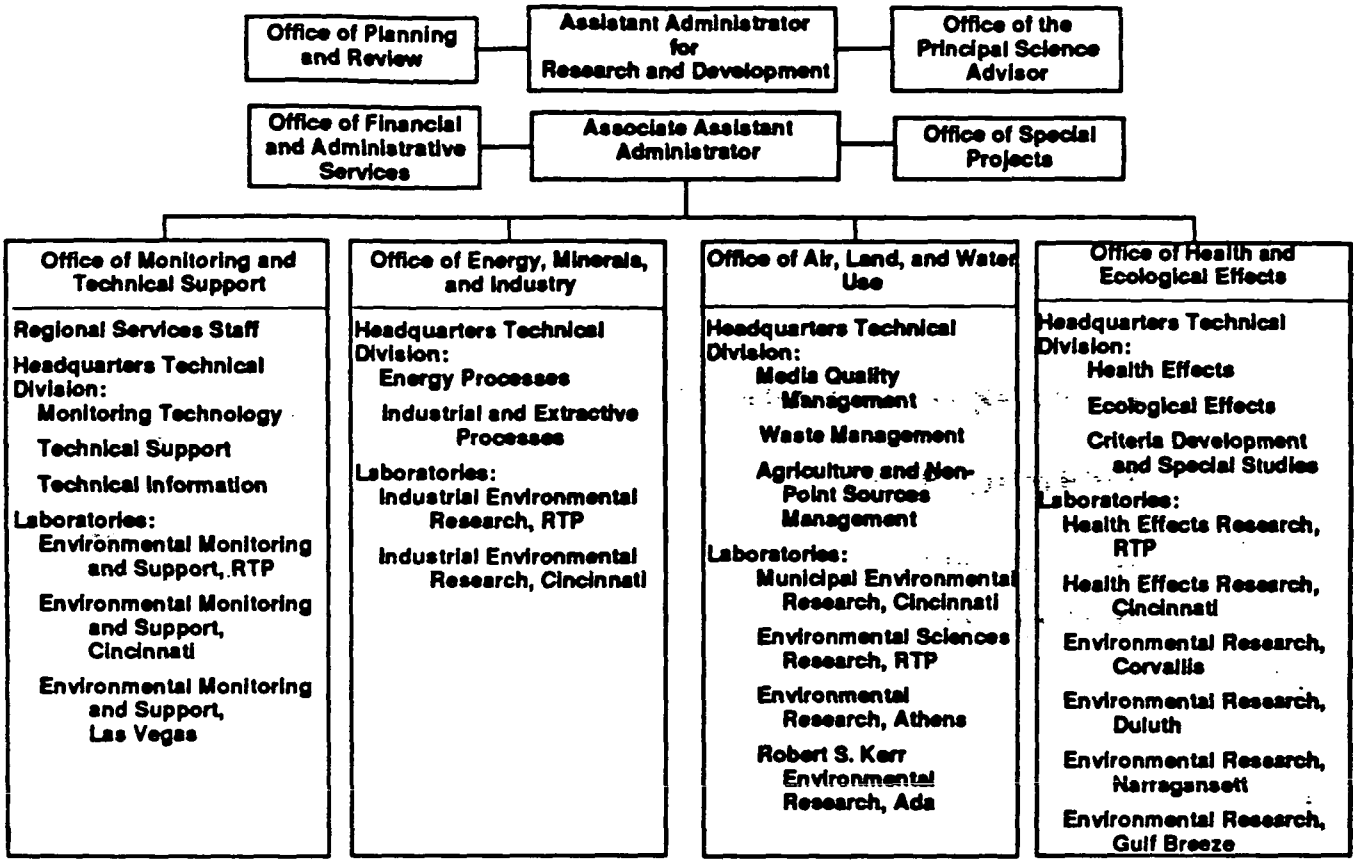


Figure A-4. Organization chart for Office of Research and Development (4/24/75).

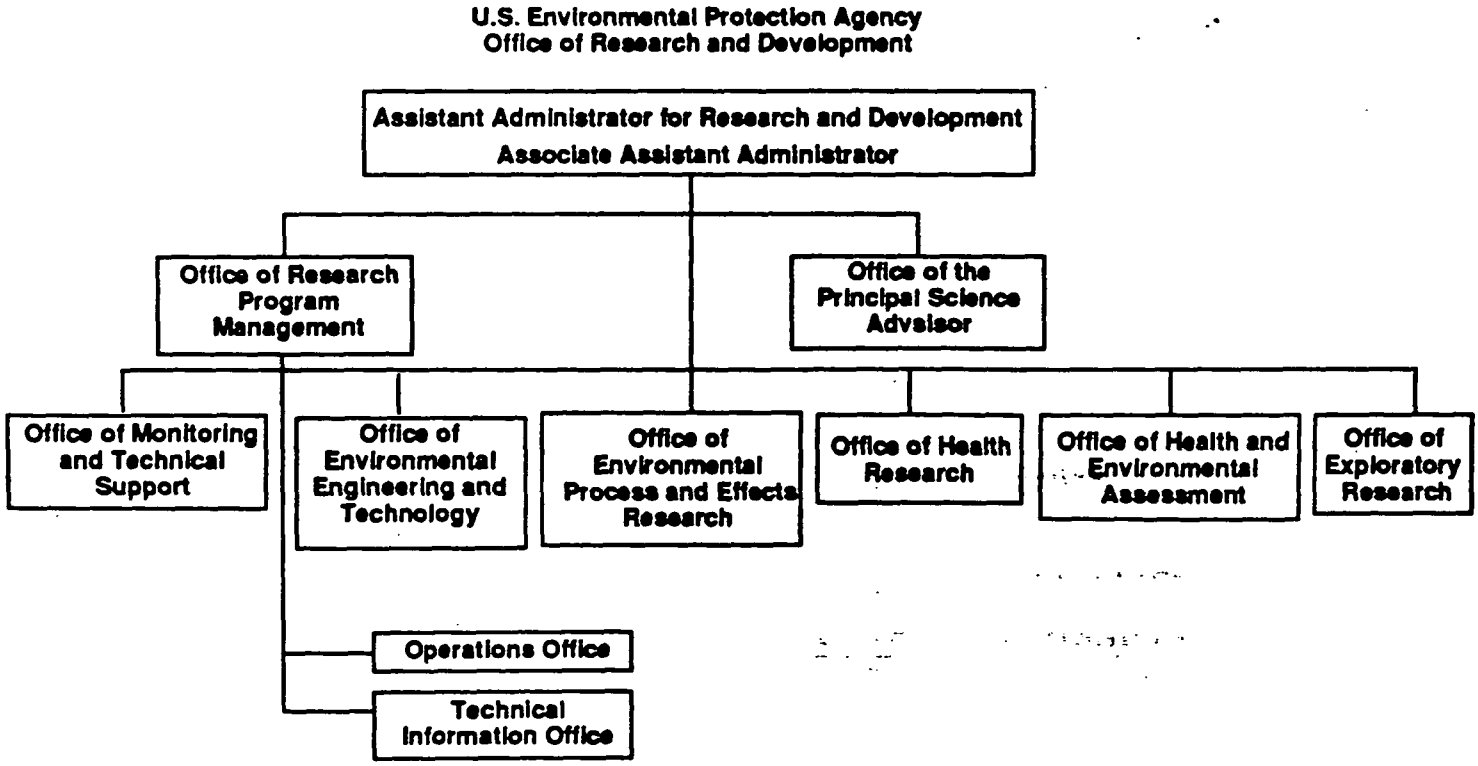


Figure A-5. Organization chart for Office of Research and Development (1979).

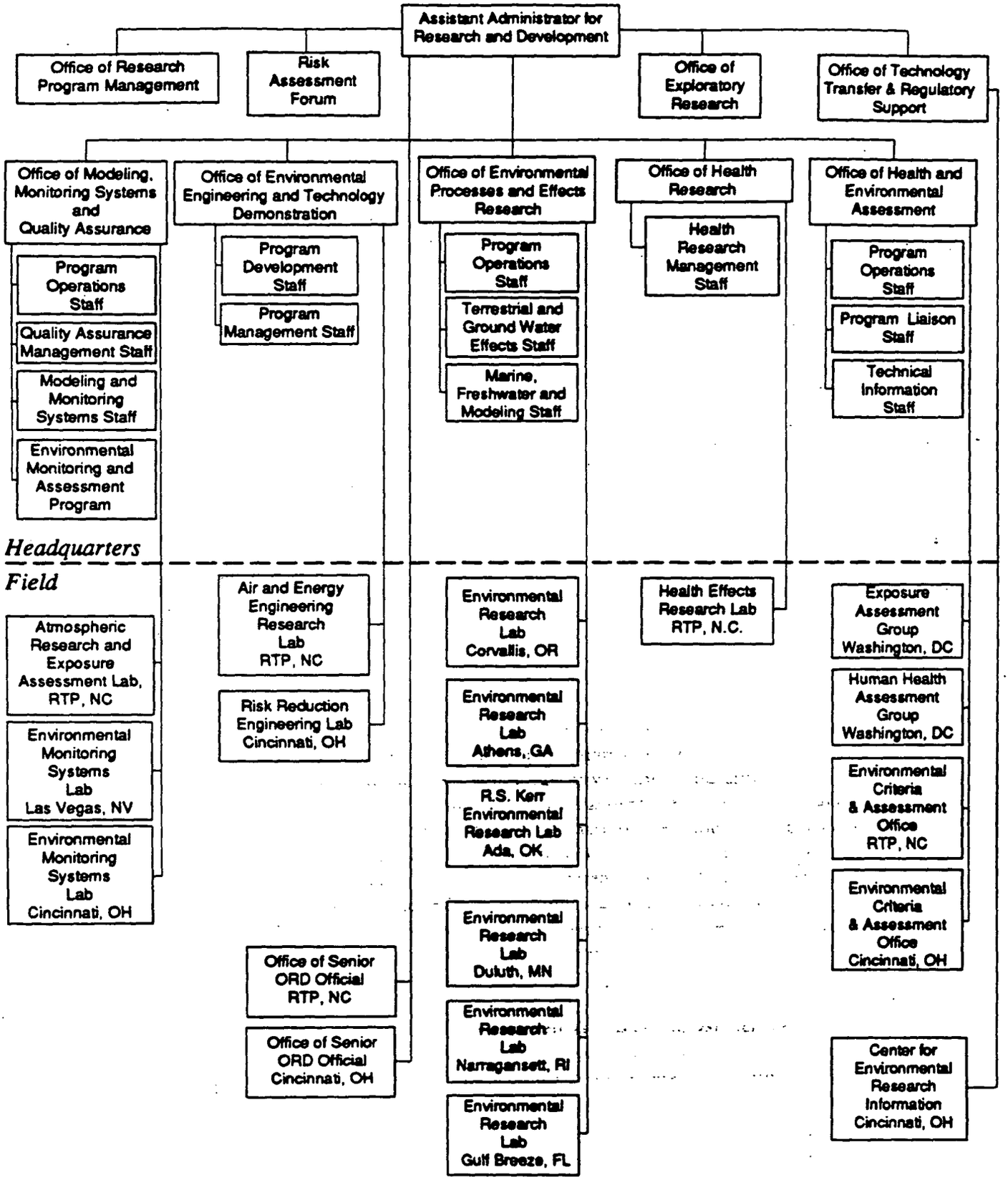


Figure A- 6. Organization chart for Office of Research and Development (1992).

Table A-1. Chronology of Key ORD Events

Year	Event	AA for R&D	Administrator	President
1970	EPA created	-	William Ruckelshaus	Richard Nixon
1971	AA for Research and Monitoring Created	Stanley Greenfield	William Ruckelshaus	Richard Nixon
1972	First HQ. reorganization; NERCs created	Stanley Greenfield	William Ruckelshaus	Richard Nixon
1973	ORM became ORD; WERC created; SAB created; DAAs for Engineering and Env. Sciences Created	Stanley Greenfield	William Ruckelshaus Russell Train	Richard Nixon
1974	WERC Reorganized	Albert Trakowski (Acting) Wilson Talley	Russell Train	Richard Nixon Gerald Ford
1975	NERC & WERC abolished; labs assigned to DAAs; DAAs Ofcs. renamed; Ofc. of Tech Transfer moved to Cincinnati	Wilson Talley	Russell Train	Gerald Ford
1976	-	Wilson Talley	Russell Train	Gerald Ford
1977	CAG established; Culver Committee Report	Wilson Talley Stephen Gage (Acting)	Douglas Costle	Jimmy Carter
1978	ORPM created; Research Committees created; OHEA created	Stephen Gage	Douglas Costle	Jimmy Carter
1979	OER created; Hq. DAAs realigned and renamed: DAAs named primary planning officials	Stephen Gage	Douglas Costle	Jimmy Carter
1980	-	Stephen Gage	Douglas Costle	Jimmy Carter
1981	-	Richard Dowd (Acting) Andrew Jovanowich (Acting) Courtney Riordan (Acting)	Anne Gorsuch	Ronald Reagan
1982	-	Courtney Riordan (Acting)	Anne Gorsuch	Ronald Reagan
1983	OADEMQA created	Courtney Riordan (Acting) Bernard Goldstein	Anne Gorsuch William Ruckelshaus	Ronald Reagan
1984	-	Bernard Goldstein	William Ruckelshaus	Ronald Reagan
1985	Regulatory Support Staff (ORSSA) began functioning in IOAA	Bernard Goldstein Donald Ehreth (Acting)	William Ruckelshaus Lee Thomas	Ronald Reagan
1986	RAF created	Donald Ehreth (Acting) Vaun Newill	Lee Thomas	Ronald Reagan
1987	-	Vaun Newell	Lee Thomas	Ronald Reagan

(continued)

Table A-1. Continued

Year	Event	AA for R&D	Administrator	President
1988	ORSSA, CERI RSS combined to form OTTRS; Acid Dep. moved to OEPER; OSORDO created for Cincinnati	Vaun Newell Erich Bretthauer (Acting)	Lee Thomas	Ronald Reagan
1989	OSORDO created for RTP	Erich Bretthauer (Acting)	William Reilly	George Bush
1990	-	Erich Bretthauer	William Reilly	George Bush
1991	-	Erich Bretthauer	William Reilly	George Bush
1992	Consolidation of financial allowance holders; revision of planning system	Erich Bretthauer	William Reilly	George Bush

Appendix B

The Chronological Changes in ORD Laboratories and Field Facilities

ORD Laboratories and Field Facilities in December 1972

NERC-Cincinnati

Advanced Waste Treatment Laboratory, Cincinnati, OH
Analytical Quality Control Laboratory, Cincinnati, OH
Blue Plains Pilot Plant, Washington, DC
Bureau of Air Pollution Sciences, Cincinnati, OH
Environmental Toxicology Research, Cincinnati, OH
Gulf Coast Marine Hygiene Laboratory, Dauphin Island, AL
Lebanon Pilot Plant, Lebanon, OH
Manassas Field Site, Manassas, VA
Marine Sea Resources (Gig Harbor) Laboratory, Purdy, WA
National Shellfish Sanitation Laboratory, Kingston, RI
Norton Pilot Plant, Norton, WV
Piscataway Field Site, Piscataway, VA
Pomona Pilot Plant, Pomona, CA
Radiation Research Laboratory, Cincinnati, OH
Robert A. Taft Water Research Laboratory, Cincinnati, OH
Solid Waste Research Laboratory, Cincinnati, OH
Water Quality Research, Edison, NJ (formerly Hudson-Delaware Basins Office)

NERC-RTP

Air Pollution Science and Technology (Twinbrook Lab), Rockville, MD
Atmospheric Sciences Research Laboratory, RTP
Bureau of Air Pollution Science, Durham, NC
Chamblee Toxicology Laboratory, Chamblee, GA
Eastern Environmental Radiation Laboratory, Montgomery, AL
Perrine Primate Laboratory, Perrine, FL
Wenatchee Research Station, Wenatchee, WA (part of Perrine Lab)

NERC-Corvallis

Alaska Water Laboratory, College, Alaska of Alaska
Bears Bluff Field Station, Johns Island, SC

NERC-Corvallis (continued)

Grosse Ile Field Station, Grosse Ile, MI
Gulf Breeze Laboratory, Gulf Breeze, FL
National Marine Water Quality Laboratory, Narragansett, RI
Newtown Field Site, Newtown, OH (under Duluth laboratory)
Pacific Northwest Water Laboratory, Corvallis, OR
Robert S. Kerr Water Research Center, Ada, OK
Southeast Water Laboratory, Athens, GA
Western Fish Toxicology Field Site, Corvallis, OR (under Duluth)

NERC-Las Vegas

Western Environmental Research Laboratory, Las Vegas Nevada

Changes in ORD Laboratories and Field Sites — 1971—1992

1971 Air research programs moved to RTP, Atmospheric Sciences Research Laboratory created

1972 Pomona Pilot Plant closed.

1973 Field sites at Dauphin Island, AL, Gig Harbor, WA, and Kingston, RI, closed; people moved to Cincinnati

Solid Waste Treatment Laboratory (Cincinnati) moved to Washington; some people transferred to Water Supply Research Laboratory (Cincinnati)

Perrine Primate Laboratory closed; people moved to RTP.

Monticello Field Station built; part of Duluth, MN, laboratory.

Environmental Photographic Interpretation Center established at Warrenton, VA

1975 NERC concept abolished.

Health Effects Research Laboratory (HERL)-Cincinnati formed from part of Water Supply Research Laboratory.

Analytical Quality Control Research Laboratory became Methods Development and Quality Assurance Laboratory at Cincinnati (MDQARL).

Municipal Environmental Research Lab (MERL) and an Industrial Environmental Research Laboratory (IERL) formed at Cincinnati.

Seven organizations under NERC-RTP organized into four laboratories: Quality Assurance and Environmental Monitoring Laboratory (QAEML), Environmental Sciences Research Laboratory, HERL-RTP, and IERL-RTP.

Names of laboratories at Ada, Athens, Corvallis, Duluth, Gulf Breeze, and Narragansett changed to Environmental Research Laboratories.

New Environmental Research Center dedicated in Cincinnati.

1975-6 Wenatchee, WA, field station closed; people transferred to RTP.

1976 Blue Plains Pilot Plant closed.

1977 Environmental Research Information Center moved to Cincinnati and named Center for Environmental Research Information.

1978	Alaska Water Laboratory closed; people moved to Corvallis; building given to University of Alaska.
1978-9	Two Environmental Criteria and Assessment Offices created, one in Cincinnati and one at RTP
1979-1980	QAEML became Environmental Monitoring Systems Laboratory at RTP and MDQARL became Environmental Monitoring and Support Laboratory at Cincinnati.
1980	Lebanon, OH, Pilot Plant closed; new Test and Evaluation Facility dedicated in Cincinnati.
	Marine division of Corvallis laboratory moved to Newport, OR.
1981	Bears Bluff field station closed; people transferred to Gulf Breeze. HERL-Cincinnati became division of HERL-RTP.
	Water Supply Research Laboratory became Water Engineering Research Laboratory.
1982	Newtown Field Station became part of EMSL-Cincinnati rather than ERL-Duluth
1984	IERL-Cincinnati and MERL were reorganized to form Water Engineering Research Laboratory and Hazardous Waste Engineering Research Laboratory.
	IERL-RTP became Air and Energy Engineering Research Laboratory.
	Function of Newport, OR, personnel transferred to ERL-Narragansett from ERL-Corvallis; personnel remained in Newport.
1986	Western Fish Toxicology Field Station closed.
1988	Risk Reduction Engineering Laboratory created from former Water Engineering Research Laboratory and Hazardous Waste Engineering Research Laboratory.
	HERL-Cincinnati division moved to RTP.
	EMSL-RTP and ESRL combined to form Atmospheric Research and Exposure Assessment Laboratory.
1990	New building constructed in Newport, OR.

ORD Laboratories and Field Facilities in December 1992

Environmental Research Center, Cincinnati, OH

Center for Environmental Research Information
Environmental Criteria and Assessment Office
Environmental Monitoring Systems Laboratory-Cincinnati
Risk Reduction Engineering Research Laboratory
Field Site: Releases Control Branch, Edison, NJ Office of Senior ORD Official

Environmental Research Center, Research Triangle Park, NC

Air and Energy Engineering Research Laboratory
Atmospheric Research and Exposure Assessment Laboratory
Environmental Criteria and Assessment Office

Health Effects Research Laboratory
Office of Senior ORD Official

Las Vegas, NV - Environmental Monitoring Systems Laboratory

Field Site: Environmental Photographic Interpretation Center, Warrenton, VA

Ada, OR - Environmental Research Laboratory-Ada

Athens, GA - Environmental Research Laboratory-Ada

Corvallis, OR - Environmental Research Laboratory-Ada

Duluth, MN - Environmental Research Laboratory-Ada

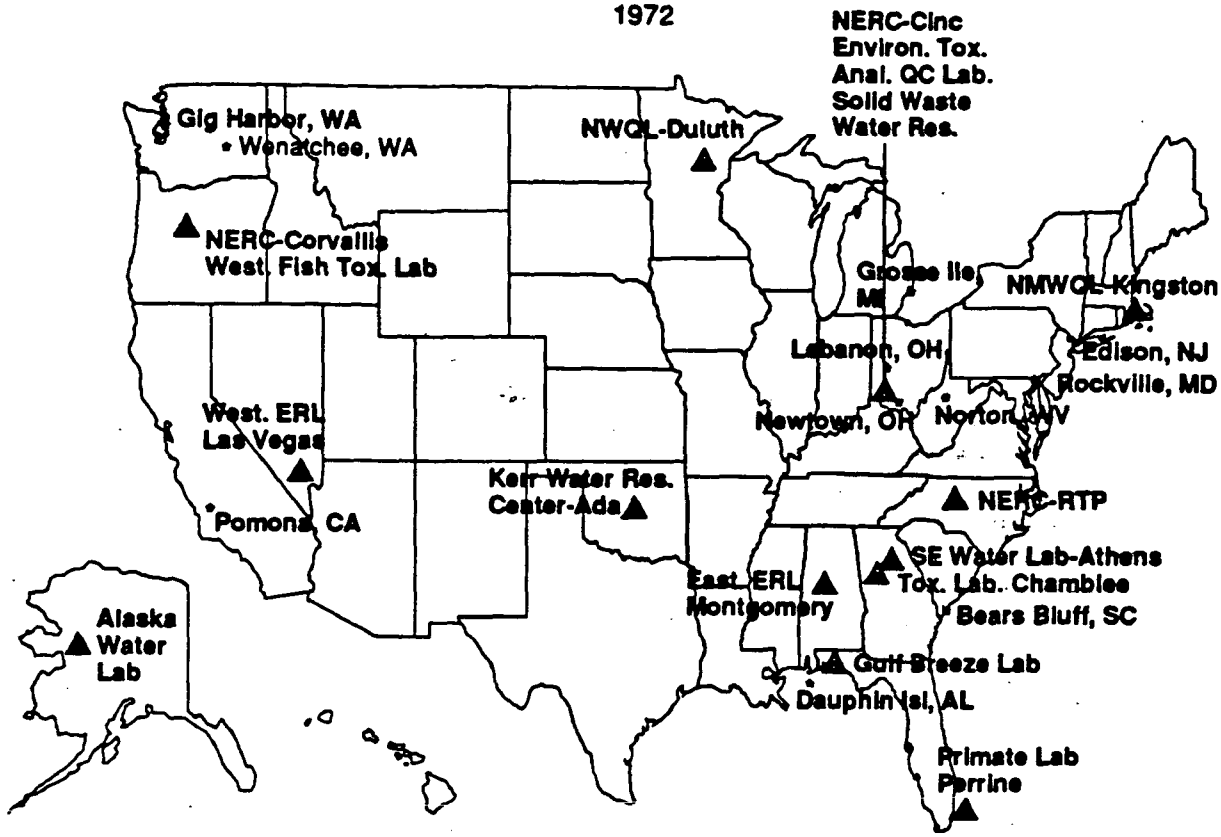
Field Site: Ecological Research Station, Monticello, MN

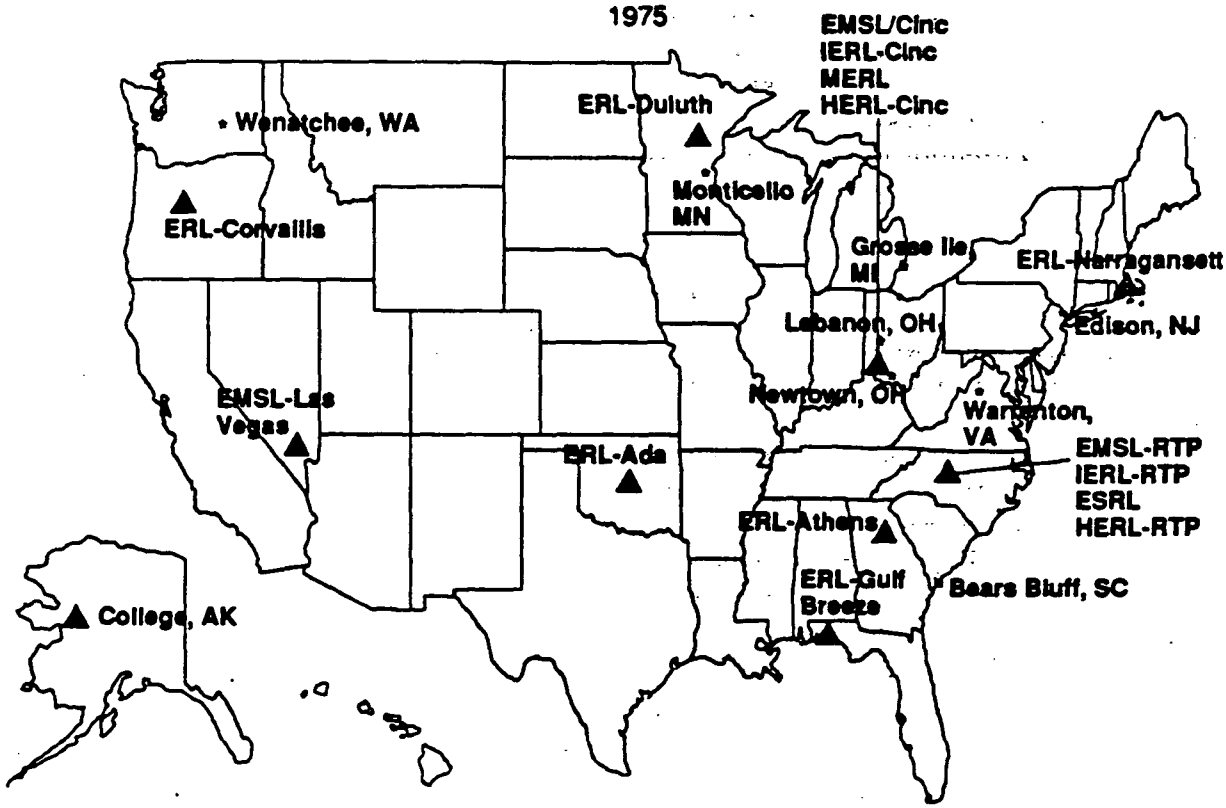
Field Site: Large Lakes Research Station, Grosse Ile, MI

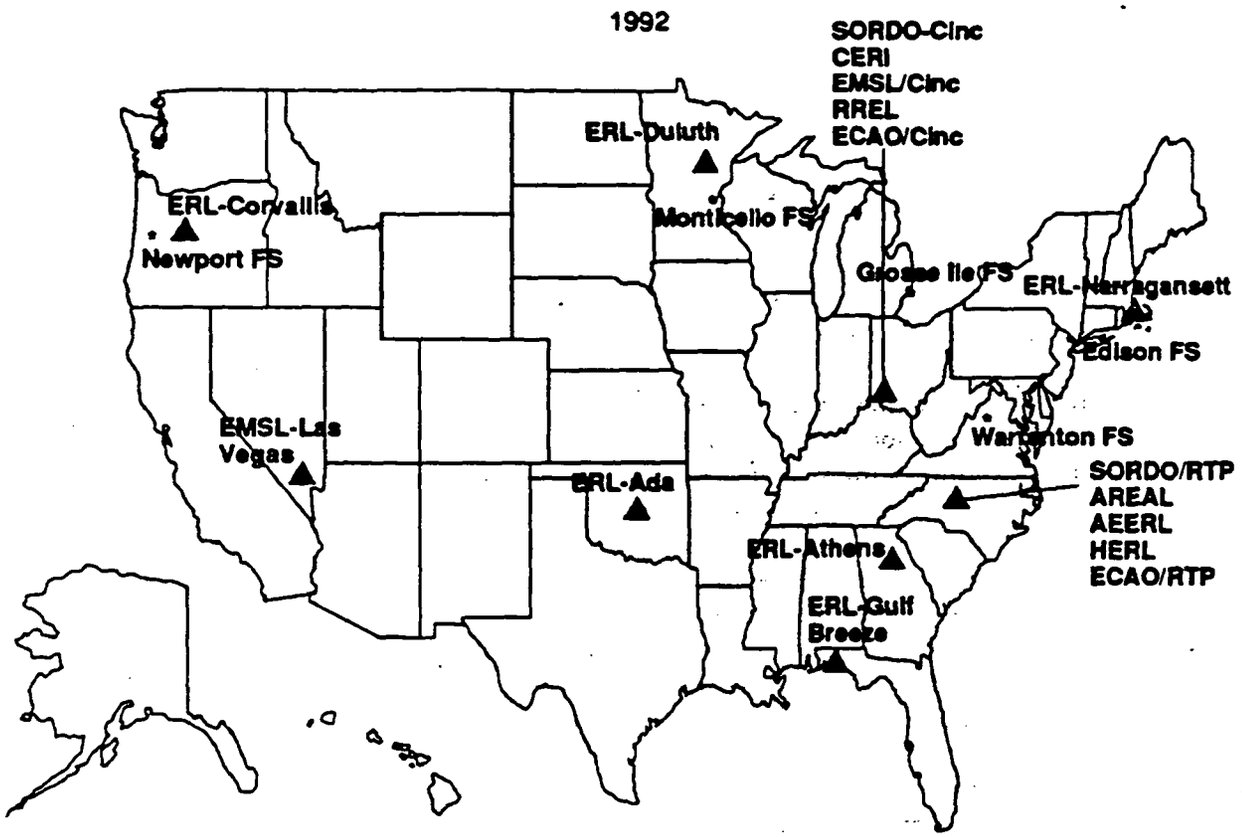
Gulf Breeze, FL - Environmental Research Laboratory-Ada

Narragansett, RI - Environmental Research Laboratory-Ada

Field Site: Pacific Ecosystems Branch, Newport, OR


1972
NERC-Cinc
Environ. Tox.
Anal. QC Lab.
Solid Waste
Water Res.
Gig Harbor, WA
Wenatchee, WA
NWQL-Duluth
NERC-Corvallis
West. Fish Tox. Lab
Grosse Ile, MI
NMWQL-Kingston
Lebanon, OH
Edison, NJ
Rockville, MD
Newtown, OH
Norton, WV
West. ERL
Las Vegas
Kerr Water Res.
Center-Ada
Pomona, CA
NERC-RTP
SE Water Lab-Athens
Tox. Lab. Chamblee
East ERL
Montgomery
Bears Bluff, SC
Alaska
Water
Lab
Gulf Breeze Lab
Dauphin Isl, AL
Primate Lab
Perrine


1975
EMSL/Cinc
IERL-Cinc
MERL
HERL-Cinc
Wenatchee, WA
ERL-Duluth
Monticello
MN
ERL-Corvallis
Grosse Ile, MI
ERL-Narragansett
Lebanon, OH
Edison, NJ
Newtown, OH
EMSL-Las
Vegas
Warrenton,
VA
ERL-Ada
EMSL-RTP
IERL-RTP
ESRL
HERL-RTP
ERL-Athens
ERL-Gulf
Breeze
Bears Bluff, SC
College, AK


1992
SORDO-Cinc
CERI
EMSL/Cinc
RREL
ECAO/Cinc
ERL-Duluth
ERL-Corvallis
Newport FS
Monticello FS
Grosse Ile FS
ERL-Narragansett
Edison FS
EMSL-Las Vegas
ERL-Ada
SORDO/RTP
AREAL
AEERL
HERL
ECAO/RTP
ERL-Athens
ERL-Gulf Breeze

Appendix C

ENVIRONMENTAL RESEARCH AND DEVELOPMENT

STRENGTHENING THE FEDERAL INFRASTRUCTURE

DECEMBER 1992

A Report of the

CARNEGIE COMMISSION
ON SCIENCE, TECHNOLOGY, AND GOVERNMENT

5
STRENGTHENING THE FEDERAL R&D INFRASTRUCTURE

Our federal environmental R&D system is broad, diverse, and highly decentralized. Led by the intramural programs of the Environmental Protection Agency and the U.S. Geological Survey, and complemented by the extensive extramural programs of the National Institute of Environmental Health Sciences and the National Science Foundation, the principal federal environmental R&D infrastructure is comprised of programs in numerous departments and agencies, each with a different mission and a different set of strengths and weaknesses. The recommendations below are aimed at strengthening the individual and collective R&D efforts of these organizations, as well as their ability to contribute to the evaluation and implementation of environmental policies.

■ **The federal environmental R&D infrastructure should be strengthened by improving and streamlining EPA's existing laboratory organization, by supporting a group of nonfederal Environmental Research**

Institutes, by organizing a new U.S. Environmental Monitoring Agency and a National Center for Environmental Information, and by enhancing R&D capabilities in several key federal agencies.

ENVIRONMENTAL PROTECTION AGENCY

NEW NATIONAL LABORATORIES

• *The Environmental Protection Agency's existing laboratory structure, now comprised of 12 laboratories, should be consolidated to create a National Ecological Systems Laboratory, a National Environmental Monitoring Systems Laboratory, a National Environmental Engineering Laboratory, and a National Health Effects Research Laboratory.*

The efforts of EPA's Office of Research and Development (ORD) are critical to achieving the nation's environmental protection objectives. Since its inception, EPA has struggled with the optimal organization of the research units within the ORD and the agency as a whole. Several years ago William D. Ruckelshaus, EPA's first administrator, described the challenges the agency faced when it was first organized in 1970:

> Our efforts to establish the scientific base presupposed by the environmental laws were hindered by the difficulties of managing the six different scientific establishments that EPA had inherited. Our scientific resources were housed in 56 separate laboratories scattered across the country. From the first, it was extremely difficult to convey to EPA's scientific cadre the urgency of our need for authoritative findings to support the regulations we were obligated to turn out to the beat of those timetables in the legislation.[43]

If a Department of the Environment is established, the conflict between the need for information to support regulatory needs and the necessity to support long-term basic and applied research will remain. It will be critically important to achieve the proper balance between the two. Our recommendations below were developed with this concern in mind.

In recognition of the need to improve the scientific basis of its regulatory decisions, EPA has recently taken a number of steps to enhance the quality of its R&D programs. In responding to a recent report by an expert advisory panel, EPA is working to develop a more coherent science agenda, expand the use of science advisors within the agency, attract and retain outstanding scientists and engineers, and improve its interactions with other agencies and with academic and industrial research organizations.[44] These are important initiatives, and we applaud and support them. However, we believe that organizational innovations are also needed to advance EPA's R&D efforts. In addition, funding for ORD remains a chronic problem.

In 1984, the leaders of ten major environmental organizations and the CEOs of five major chemical companies wrote to Congressman Edward P. Boland, Chairman of the House Appropriations Subcommittee on VA, HUD, and Independent Agencies and strongly urged him to increase the fiscal year 1985 budget to EPA's Office of Research and Development by $101 million more than the Administration's request. The group spoke of their "deep concern that the scientific base on which the agency's regulatory decisions are founded has been seriously eroded in recent years by severe cuts in the research and development budget of the EPA."[45] They pointed out that as measured in constant dollars, the ORD budget for FY 1985 was 15 percent less than in 1973 when ORD was created, even though Congress had passed several laws requiring additional R&D support during that period.

Today, severe funding constraints continue to limit ORD's effectiveness.[46] Despite substantial increases in R&D responsibilities ORD's budget, in constant dollars, has increased only modestly over the last decade, and because of severe limitations on full-time equivalents, a disproportionate share of the workforce at ORD laboratories is on-site contractors.[47] Although our report focuses on organizational issues, it is clear that organizational changes alone will not lead to improvements in the scientific capacity of EPA. Substantial funding increases will be required as well.

A National Ecological Systems Laboratory

An EPA National Ecological Systems Laboratory (NESL) should be formed by combining the six existing EPA R&D laboratories. A new headquarters site would be established for the national laboratory, with some of the existing laboratories continuing to operate as field sites under the direction of the national laboratory (see Figures 4 and 5, pages 66 and 67). The existing laboratories are located at Corvallis, Oregon; Duluth, Minnesota; Gulf Breeze, Florida; Narragansett, Rhode Island; Ada, Oklahoma; and Athens, Georgia.

This organizational arrangement would offer numerous advantages. First, it would create a critical mass of researchers and resources focused on understanding how environmental insults propagate through ecosystems. Research programs would be cross-media (air, water, terrestrial) and multidisciplinary in orientation.

Through the creation of such a national resource, EPA's Office of Research and Development should be able to attract a nationally prominent scientist-administrator to direct the laboratory. The director should report to the Assistant Administrator for Research and Development (or the Assistant Secretary for Research and Development in the proposed cabinet-level Department of Environment).

By creating this laboratory and attracting a prominent director, EPA

would bring into existence a powerful counterbalance to the constant pressure from the regulatory offices for continuous emergency response support. Given the critical needs of the regulatory offices in dealing with science- and technology-driven problems, it does not make sense to separate such a national laboratory from EPA or a Department of the Environment. It is necessary, however, to moderate the surges in demand for support from the regulatory offices.

Because of its critical mass and its perceived greater importance, a national laboratory should be better positioned to compete for limited resources. At this time, each of the six small R&D laboratories must compete individually for its funds and staff. Justification for increased support is difficult, given each laboratory's limited mission.

Finally, because of its improved stature, such a national laboratory would operate on a more equal footing with other major federal laboratories and leading scientific organizations.

The major disadvantage of combining the six EPA laboratories into a national ecological laboratory is the geographical distribution of the existing laboratories. This decentralization makes overall program management difficult, and it will take some time for the several parts of a new national laboratory to begin working in an integrated fashion. It will also require leadership to develop a vision of a truly national laboratory.

This problem goes to the heart of the nation's environmental dilemma—how to manage our national environmental resources while respecting the biodiversity encompassed in the nation. We think that it is more important to fashion an integrated ecological research program under a single administrative entity than it is to attempt to coordinate a highly decentralized system.

Some may argue that this experiment has already been conducted, and that the attempt failed. In 1973, EPA's Office of Research and Development reorganized all of its laboratories into three National Environmental Research Centers (NERCs). One NERC, placed under the direction of the Corvallis laboratory, encompassed most of the ecological effects and processes laboratories identified above. Communications and coordination among the laboratories and between the NERC headquarters and the Washington-based ORD headquarters were judged to be ineffective. In 1975, the NERCs were abolished, and the ORD laboratory structure returned to its present configuration.

In our opinion, the NERC experiment failed for several reasons. First, too much was attempted at one time, and the entire ORD organization was thrown into turmoil by the change. Second, the affected laboratories, which had previously operated quite autonomously under the Federal Water Pollution Control Administration, had not been prepared to function as

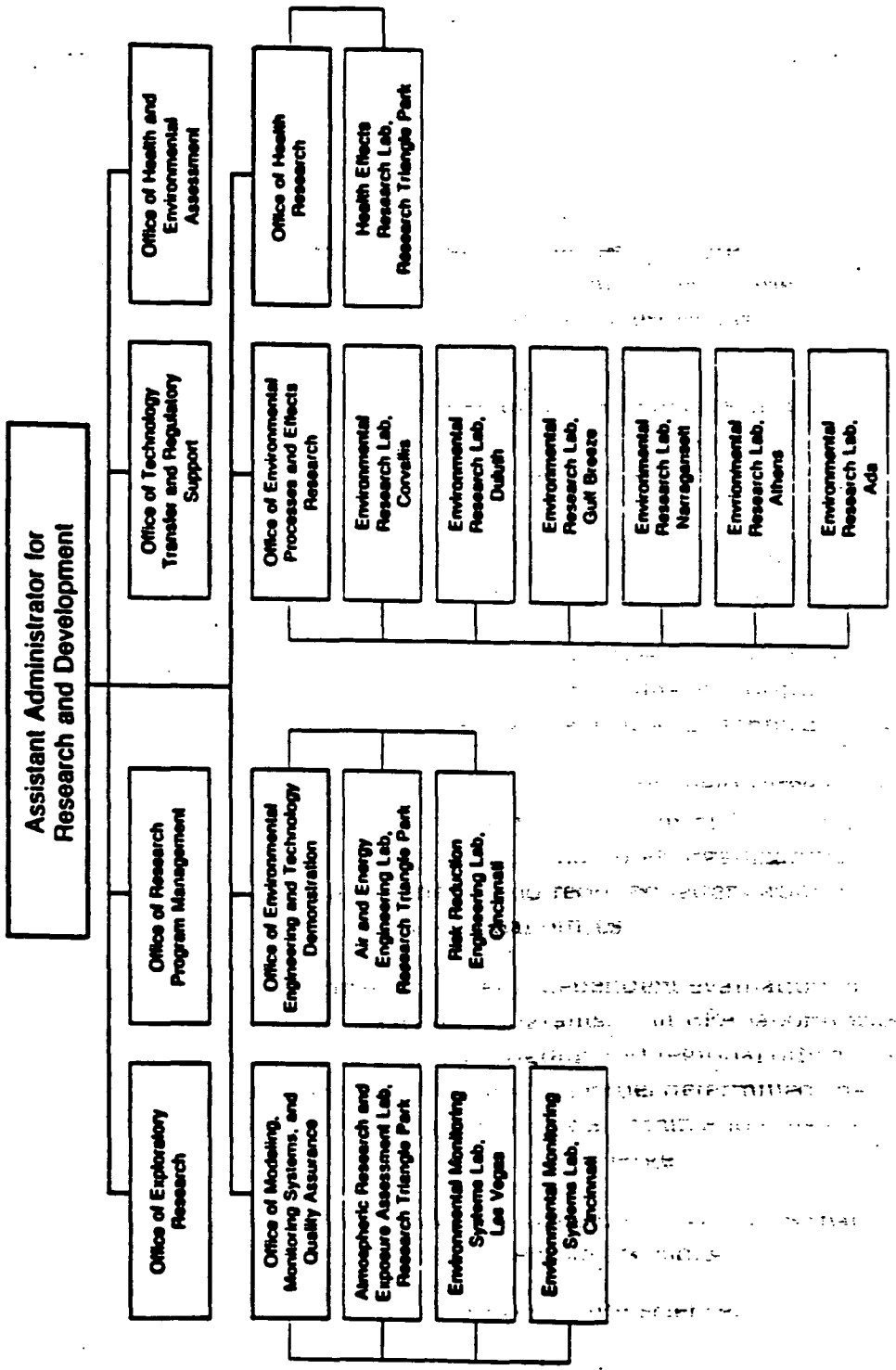


Figure 4. Current EPA Office of Research and Development Organization

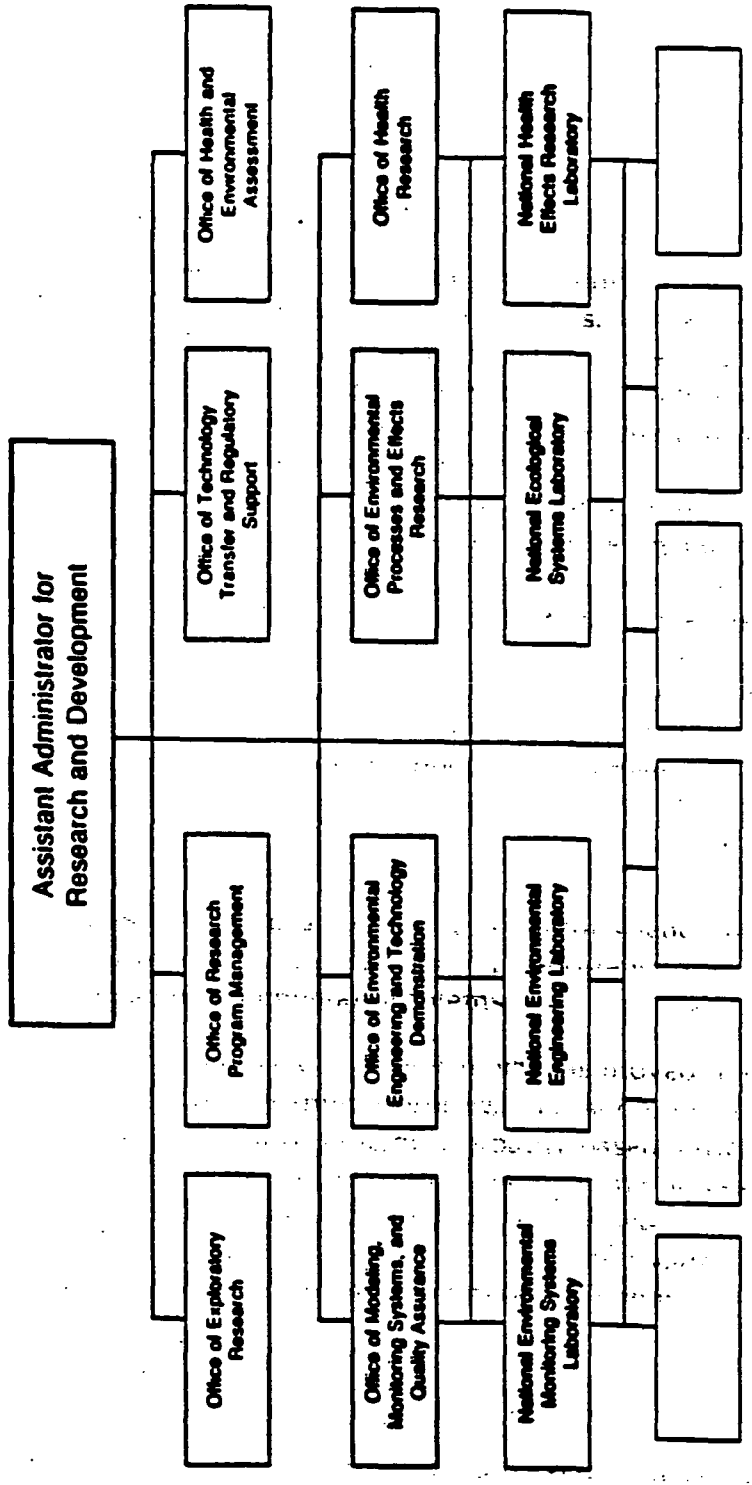


Figure 5. Recommended Future EPA Office of Research and Development Organization

a team. Third, appointing one of the "peer" laboratory directors as NERC director exacerbated the competitive tendencies in the laboratories. The proposal outlined above is designed to avoid these shortcomings, while trying to achieve an integrated program.

A National Environmental Monitoring Systems Laboratory

We propose that three laboratories in EPA's Office of Research and Development devoted to environmental monitoring be combined to form a National Environmental Monitoring Systems Laboratory (NEMSL). The three existing laboratories whose operations would be integrated are the Environmental Monitoring System Laboratories in Cincinnati, Ohio, and Las Vegas, Nevada, and the Atmospheric Research and Exposure Assessment Laboratory in Research Triangle Park, North Carolina. A headquarters site should be established for the NEMSL, with the existing laboratories continuing to operate as field sites under its direction.

The NEMSL would likely enjoy important synergies in monitoring technologies, analytical techniques, and statistical analysis, resulting in cost reductions, especially in cross-media monitoring efforts. The laboratory would also create a critical mass of researchers and resources focused on the technical foundations of environmental monitoring.

A significant challenge in combining the three EPA laboratories is overcoming the cultural differences among the three groups of scientists and engineers. Although the underlying chemistry is essentially the same, the groups evolved under separate air, water, and radiological pollution agencies. These differences can be overcome in time, with many synergies developing as operations are integrated. If a U.S. Environmental Monitoring Agency is established, as recommended later in this report, some or all of the activities of the NEMSL should be integrated with those of, or transferred to, the new agency.

A National Environmental Engineering Laboratory

We recommend that a single National Environmental Engineering Laboratory (NEEL) be established by combining the existing EPA Risk Reduction Engineering Laboratory in Cincinnati, Ohio, and the Air and Energy Engineering Laboratory in Research Triangle Park, North Carolina. The main laboratory, in North Carolina, would focus on air and energy engineering, and the Cincinnati component of the laboratory would focus on water-quality-related laboratory research and risk reduction. The NEEL should

work to advance the development of innovative environmental technologies and should forge relationships with industry in advancing toward common goals. The laboratory should work in conjunction with other federal departments and agencies to promote the development and diffusion of environmental technologies through a federal interagency Environmental Technologies Program discussed later in this report (see page 78).

A National Health Effects Research Laboratory

We recommend raising the EPA Health Effects Research Laboratory in Research Triangle Park, North Carolina, to the same status as the other three proposed EPA national laboratories. This would involve no significant change in the mission or staffing of this laboratory. The National Health Effects Research Laboratory should work closely with the National Institute of Environmental Health Sciences in planning and implementing research efforts.

Leadership and Cooperation

Each of the four proposed EPA national laboratories should be directed by an outstanding scientist or engineer of national stature who has the administrative skills necessary to direct programs of this scope. Every effort should be made to attract outstanding scientists, engineers, and other personnel to these organizations. Federal personnel should interact with individuals in the proposed Environmental Research Institutes (discussed in the next section) and in academia, nongovernmental organizations, and industry. In addition, it is essential that all four laboratories work closely with the proposed Institute for Environmental Assessment (see page 59) in evaluating environmental problems and alternative approaches to addressing them.

ENVIRONMENTAL RESEARCH INSTITUTES

■ ***EPA should establish and support up to six major Environmental Research Institutes (ERIs) associated with academic institutions and nongovernmental organizations across the country.***

Today, the U.S. Environmental Protection Agency provides support to a set of four university-based Environmental Research Centers, or "centers of excellence." Each center specializes in a particular research topic of interest to the agency, receiving about $1 million per year from EPA. The work of the centers is severely limited by inadequate funding. Furthermore, they

are typically organized as a component of a university or college, which presents both advantages and disadvantages.

EPA's Centers of Excellence program was initiated during the Carter administration, when zero-based budgeting was used to prepare EPA's budget submission to OMB. While there was some support for longer-term R&D in the regulatory offices, there was also intense competition for resources (both dollars and personnel) to meet the legislative requirements of the Toxic Substances Control Act and other laws and regulations. In addition, in the late 1970s no one in EPA was advocating larger centers. The regulatory offices viewed the use of funds for such centers as a diversion from the agency's mission, and R&D staff generally felt the centers program was diverting money away from the laboratories. The result was that the new centers initiative was approved but its budget was limited (about $3 million in 1979). This funding was then used to establish multiple centers. Until recently, EPA supported eight centers at a funding level of approximately $500,000 each.

In order for an environmental center of excellence to have significant impact, it must have adequate resources. Annual funding of $500,000 is woefully inadequate to support the high-quality research teams needed to attack what are complex problems requiring multidisciplinary investigations. Subcritical funding results in the all too typical university center model—a few part-time faculty researchers, a few postdoctoral researchers, and a few graduate students. There are generally no full-time researchers and technicians, and equipment and instrumentation are shared, not dedicated.

To ensure its effectiveness in addressing the major environmental challenges facing the nation and the world, funding for each ERI should gradually rise to the level of $10 to $15 million annually for at least five years. In areas that require extensive support equipment, such as a research ship or sophisticated analytical instruments, additional funding should be provided. A full-time director, with world class credentials, and full-time researchers and technicians should make up the core of the institute, with faculty, postdoctoral students, and graduate students supplementing the full-time core staff.

ERIs should operate as EPA's principal extramural research units and should be complemented by a strong, well-funded extramural grants program. The ERIs should cooperate with the four EPA National Laboratories described above. The ERIs should focus on problem-oriented themes that require multidisciplinary research efforts that cut across the missions of the intramural National Laboratories. The institutes would thus function as more flexible, problem-oriented, multidisciplinary components of a Department of the Environment, thereby complementing the structured, discipline-oriented intramural National Laboratories. We envision a two-way flow of

personnel between the National Laboratories and the ERIs. This would give government scientists, engineers, and social scientists an opportunity to benefit from the career growth and educational opportunities offered in the university and nongovernmental setting. It would also enhance the National Laboratories by bringing some of the best scientists and engineers in the nation into government laboratories for extended periods.

After considering the views of a full range of experts within and outside the federal government, the EPA Science Advisory Board (SAB) should make recommendations to the EPA Administrator regarding the missions of the Institutes. The SAB should examine other similar research organizations operating through the National Institutes of Health and the Department of Energy and should make recommendations to EPA's Office of Research and Development as to how the best features of these organizations can be incorporated into EPA's institutes. The ERIs should then be awarded through a merit-based competition.

The ERIs' charter and organization are critical to their success. Institutes of the size envisioned here cannot function as academic subunits. While it is important for the institutes to have a close affiliation with a university (or with several universities), it is essential that they not operate as a component of a university, especially not as a component of a single college or department. The institutes could report to the research vice presidents or to the presidents of universities, or affiliated but autonomous not-for-profit institutes could be established outside, but nearby, the universities.

A number of organizations have demonstrated that they can effectively operate research institutes staffed with full-time employees under research administrations separate from academic administrations. Faculty and students move back and forth from the academic side to the research institute once the rules and expectations are negotiated and understood. The success of this approach seems to be highly correlated with the culture of the individual university.

A more recent trend is the establishment of affiliated not-for-profit centers. Many of these organizations have been created in the last decade as states have expanded their support of technology-driven economic development. One distinct advantage of such centers is that proprietary work with industry is greatly facilitated in the autonomous centers. Faculty and students can still do nonproprietary work within these organizations, but they would recognize that if they choose to work on proprietary projects, publication of their work may be delayed or precluded. If an ERI's mission requires close cooperation with industry, then the not-for-profit approach can operate in a typical business fashion, rather than following university calendars and administrative procedures.

Appendix D

Safeguarding the Future:
Credible Science, Credible Decisions

The Report of the Expert Panel
on the Role of Science at EPA

to

William K. Reilly
Administrator
U.S. Environmental Protection Agency

March 1992

January 8, 1992

Mr. William K. Reilly
Administrator
U.S. Environmental Protection Agency
Washington, DC 20460

Dear Mr. Reilly:

Earlier this year, you asked us to help identify how EPA can meet the goal of using sound science as the foundation for the Agency's policy and program decisions. You asked us to recommend ways to: (a) ensure that EPA has up-to-date, objective scientific information for decisionmaking, (b) ensure that EPA's planning, resources, and leadership produce the knowledge base needed to achieve the Agency's new vision, (c) ensure that the research and scientific information needs of the programs and regions are met, and (d) enhance the stature of science within EPA and among the many constituencies with which EPA interacts.

To accomplish this task, we interviewed more than 30 individuals who have experience with these issues. We also held three public meetings that included individuals from various EPA offices and programs, other government agencies, industry, environmental groups, and other organizations. In addition, we requested written comments and received letters from more than 25 individuals, primarily from the EPA regional offices. We were impressed that so many people wished to help EPA find better ways to acquire and use sound scientific information.

A number of consistent themes emerged from the discussions and comments. Everyone who spoke with the Panel agreed that EPA needs its own strong science base to carry out its mission effectively. At the same time, the Agency needs to make certain structural changes to improve the quality of its science and the way science is used in decisionmaking. In this report, we have developed these themes as a series of findings and recommendations about science at EPA. Included are suggestions for both short- and long-term measures to enhance the use of sound scientific and technical information throughout the Agency.

We look forward to your serious consideration of these findings and recommendations and encourage you to take the necessary next steps as soon as possible. We appreciate the opportunity to be of assistance.

Sincerely,

Expert Panel on the Role of Science at EPA

Raymond C. Loehr, Chair
Bernard D. Goldstein
Anil Nerode
Paul G. Risser

Executive Summary

BACKGROUND

The mission of the U.S. Environmental Protection Agency (EPA) is to preserv and improve the quality of the environment, protect human health, and safeguard the productivity of natural resources on which all human activity depends. To achieve these aims, the Agency is committed to ensuring that "national efforts to reduce environmental risk are based on the best available scientific information communicated clearly to the public" (*Strategic Direction for the U.S. Environmental Protection Agency: EPA...Preserving Our Future Today*, 1991) EPA also is dedicated to "providing leadership in the nation's environmental science, research, and assessment efforts." This includes:

- Gathering and analyzing the data needed to evaluate environmental risks and trends, measure environmental results, and inform the choices of institutions and individuals throughout society.
- Promoting and supporting innovative technological solutions to environmental problems.
- Encouraging and conducting research that improves our understanding of health and ecological risks.
- Providing objective, reliable, and understandable information that helps build trust in EPA's judgment and actions.
- Sharing research findings and innovative technologies with other nations.

In addition, EPA must be able to anticipate environmental problems caused by new and existing technologies and by societal changes.

Several recent reports, including *Future Risk: Research Strategies for the 1990s* (198 SAB-EC-88-040) and *Reducing Risk: Setting Priorities and Strategies for Environmental Protection* (1990, SAB-EC-90-021), stressed that EPA must have a strong scienc base to accomplish these goals. Scientific knowledge has assumed an increasingly critical role as the environmental issues faced by the nation and the world grow in complexity and cut across all environmental media. The Agency must improv the scientific data and analytical methodologies needed to make sound decision to set risk-based priorities for protecting health and the environment; to support a new emphasis on protecting the health of the nation's ecosystems (such as forests, lakes, and wetlands); and to contribute to international environmental efforts.

THE EXPERT PANEL ON THE ROLE OF SCIENCE AT EPA

In early 1991, EPA Administrator William K. Reilly established the Expert Panel on the Role of Science at EPA as an independent advisory committee under the Federal Advisory Committee Act. The Expert Panel was charged with evaluating how EPA can meet the goal of using sound science as the foundation for Agency decisionmaking. The four members of the Panel were:

- Dr. Raymond C. Loehr (Chair of the Panel), H.M. Alharthy Centennial Chair in Civil Engineering, University of Texas.
- Dr. Bernard D. Goldstein, Director, Environmental and Occupational Health Sciences Institute, Rutgers University and University of Medicine and Dentistry of New Jersey—Robert Wood Johnson Medical School.
- Dr. Anil Nerode, Professor of Mathematics and Computer Science, Goldwin Smith Chair and Director, Mathematical Sciences Institute, Cornell University.
- Dr. Paul G. Risser, Provost and Vice President for Academic Affairs, University of New Mexico.

These individuals conduct extensive research programs and have had considerable experience with various EPA programs. In addition, they have served on national committees evaluating scientific and technical programs.

APPROACH

Over a period of four months, the Panel held three public meetings and interviewed more than 30 individuals from EPA, other government agencies, industry, environmental groups, and other organizations. The Panel also requested written comments and received letters from more than 25 individuals, primarily from the EPA regional offices.

The Panel performed no other independent evaluation of science at EPA; it did not review current research programs, visit EPA laboratories, or examine reports and data generated by EPA program and regional offices. Given the short time available for the Panel's review, the Panel determined that interviews and meetings with knowledgeable individuals within and outside EPA would be a more effective means of responding to its charge.

The meetings and discussions focused on five topics that are crucial to obtaining and using sound science for credible decisions:

- The mission and direction of EPA science.
- The quality of science at EPA.
- The quality of scientists at EPA.
- How the budget process affects science at EPA.
- How EPA uses science in decisionmaking.

The Panel defined science as encompassing a range of activities, including research and development, technical and regulatory support, monitoring, data collection, review and interpretation of technical studies, and assessments of health and environmental risk. The Panel intentionally included the science activities carried out in EPA program, policy, and regional offices, since such activities are part of the science EPA uses for decisionmaking. It also included th quantitative social sciences, such as economics, in addition to the physical, chemical, and biological sciences.

MAJOR FINDINGS AND RECOMMENDATIONS

The Panel found that several consistent themes and concepts emerged from the meetings, interviews, and letters. These are summarized in the findings and recommendations presented in subsequent sections of this report. Overall, the Panel affirms that EPA needs its own strong science base to provide the back ground required for effective environmental protection programs. Currently, EP science is of uneven quality, and the Agency's policies and regulations are frequently perceived as lacking a strong scientific foundation. To remedy these problems, the Panel recommends that EPA leadership undertake a deliberate an continuing effort to create the climate, culture, and incentives necessary to encourage superior science. The Panel recommends several specific structural changes to enable EPA to obtain and use the high-quality science it needs to realize its mission. These changes address science throughout the Agency, not only in the Office of Research and Development (ORD). The Panel's central findings and recommendations are listed below.

Overall, the Panel affirms that EPA needs its own strong science base to provide the background required for effective environmental protection programs.

1

FINDING: EPA does not have a coherent science agenda and operational plan t guide scientific efforts throughout the Agency and support its focus on relativel high-risk environmental problems.

RECOMMENDATION: The Agency has moved in the right direction with its new issue-based planning process. EPA should further develop this process wit the overall goal of producing a broadly based, rational plan to acquire and use the best scientific information. This planning process should apply to science throughout the Agency. Through this process, EPA can break from the past and shift toward the cross-media, anticipatory research needed to address complex, long-term, and global environmental problems.

2

FINDING: EPA has not clearly conveyed to those outside or even inside the Agency its desire and commitment to make high-quality science a priority.

RECOMMENDATION: EPA should send strong, clear signals to the scientific community and the public about its commitment to develop and use the best science for guidance and decisions. One immediate step to accomplish this coul

The Panel recommends that EPA leadership undertake a deliberate and continuing effort to create the climate, culture, and incentives necessary to encourage superior science.

be the initiation of regular science briefings for the Administrator by EPA and non-EPA scientists on topics of critical concern to the Agency.

3

FINDING: The science advice function—that is, the process of ensuring that policy decisions are informed by a clear understanding of the relevant science—is not well defined or coherently organized within EPA.

RECOMMENDATION: The Administrator should appoint a "science advisor" t ensure that credible scientific information for EPA guidance and decisions is available from both EPA scientists and the broader scientific community. The science advisor would implement a peer review and quality assurance program for all EPA's science-based products, improve the Agency's responsiveness to th science needs of EPA policymakers, play a key role in evaluating the professiona activities of all scientists at EPA, and provide scientific advice to the Administrator.

4

FINDING: In many cases, appropriate science advice and information is not considered early or often enough in the decisionmaking process.

RECOMMENDATION: EPA should take steps to ensure that science enters the decisionmaking process early and often. In regulatory development, EPA shoul implement a widely advertised, open process enabling the Agency to hear the scientific opinions of all parties. In addition, the Agency should analyze how it used science in developing one or more major regulations. The goal of this analysis would be to determine the type of scientific and technical information needed to ensure scientifically credible decisions, as well as the points in the regulatory process at which scientific input is most effective. The analysis shoul take into account the varying needs and decisionmaking processes of the different EPA program offices.

5

FINDING: The development and nurturing of human resources are central to improving science at EPA.

RECOMMENDATION: For ORD scientists, the Panel recommends continued attention to appropriate science and science management career tracks. For scientists in EPA program and regional offices, the Panel recommends establishing a science career track similar to that in place for those providing legal advice. The Agency also should enhance rotational opportunities that allo EPA scientists to participate in the broader scientific community and non-EPA scientists to work more closely with EPA's science programs.

6

FINDING: EPA requires that its scientific research products undergo peer revie However, the Agency does not have a uniform process to ensure a minimum level of quality assurance and peer review for *all* the science developed in support of Agency decisionmaking.

RECOMMENDATION: Quality assurance and peer review should be applied t the planning and results of *all* scientific and technical efforts to obtain data used for guidance and decisions at EPA, including such efforts in the program and regional offices. Such a requirement is essential if EPA is to be perceived as a credible, unbiased source of environmental and health information, both in the United States and throughout the world.

7

FINDING: A number of outstanding externally recognized scientists work at EPA. However, the Agency lacks the critical mass of externally recognized scientists needed to make EPA science generally credible to the wider scientific community.

RECOMMENDATION: EPA should recruit four to six research scientists or engineers with world-class reputations and provide them with a significant, long-term commitment of support. These individuals should be national and international leaders in scientific areas vital to the Agency's long-term strategy and direction. They would serve as mentors for developing scientists and provide access to networks of world-class scientists.

8

FINDING: For EPA to establish a reputation for having high-quality science to support its decisionmaking, its science activities must become more widely known. Academia, Congress, other federal agencies, industry, and the public generally are unfamiliar with the work of EPA scientists.

RECOMMENDATION: The Agency should undertake a communications, outreach, and education effort to publicize the activities and accomplishments o EPA scientists.

9

FINDING: EPA often does not evaluate the impact of its regulations. Implementation of an environmental policy or regulation provides a unique opportunity to study the environmental response to changes brought about by regulations, such as changes in the type and amount of pollutants.

RECOMMENDATION: The Agency should scientifically evaluate the environmental improvements brought about by the major regulations it promulgates. This will help EPA better understand the effectiveness of its regulatory strategies and how those strategies affect environmental processes.

10

FINDING: EPA science could benefit substantially from increased scientific contact and openness with other organizations.

RECOMMENDATION: The Agency should encourage increased participation its scientists in the activities of the scientific community. It should enhance relationships with other federal agencies and appropriate industrial and academic research organizations and promote the participation of EPA scientists in the technical activities of professional societies.

11

FINDING: EPA has not consistently enlisted the nation's best scientists to provide the research and technical information needed for decisionmaking. Problems in the Agency's approach to academic grants and centers have discouraged many university-based experts from working with EPA. In addition the program and regional offices and ORD laboratories often rely on contractual mechanisms that prevent EPA from obtaining the best outside scientists to work on EPA issues.

RECOMMENDATION: EPA should move quickly to bolster its grants and centers program. The Agency also should implement a long-term plan to replace contractual mechanisms that may be detrimental to obtaining the best possible scientific information.