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Assessment of the Scientific and Technical Laboratories and Facilities of the U.S. Environmental Protection Agency

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MITRE
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Assessment of the Scientific and Technical Laboratories and Facilities of the U.S. Environmental Protection Agency

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EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA) supports its regulatory mission through 39 laboratories and other technical facilities across the nation; activities at these facilities range from enforcement and technical services to development and fundamental research. The roles and missions of these organizational units have evolved over time as the focus on environmental problems has shifted from control of pollution from point sources within separate media to multimedia problems of national and international scope and to ecological and human health concerns. If EPA's mission is expanded beyond environmental protection to federal leadership of environmental science, the roles and responsibilities of its laboratories may have to be realigned and redirected. Recognizing a possible need for change, Congress directed EPA to "explore whether a consolidated laboratory structure would better enable the Agency to accommodate the need for integrated research and monitoring," and "should the study recommend the continuation of the current arrangement, the report should include a detailed justification for doing so." The MITRE Corporation was tasked to perform an independent assessment of EPA's laboratories for use by the Agency as one of the inputs in developing of its report to Congress. MITRE's study was guided by a Steering Committee, reporting to the Deputy Administrator, that was composed of EPA's science advisor and representatives from each of EPA's offices at the assistant or associate administrator level.

Based upon the broad roles and functions that were assigned to EPA when it was established in 1970 and upon the additional responsibilities that have been placed on it through environmental legislation enacted over the intervening years, the main scientific and technological functions of the EPA mission that are supported by the laboratories are application-directed research, fundamental research, development, enforcement/compliance, monitoring, quality oversight, technical assistance and services, technology transfer, analytical support, state and local oversight, and emergency and episodic response. Regardless of changes in the organizational structure, these functions must be maintained at an adequate level within EPA or acquired from other federal or state agencies or from other organizations.

The scientific and technological base within EPA, as well as other regulatory agencies, must be built upon four principles:

- Credibility through end-to-end quality assurance
- Timely response to regulatory needs
- Highly skilled and respected professional staff
- Commitment and sustained funding to expand the information base

In addition to reviewing published literature from previous studies, MITRE staff visited each laboratory to obtain current information on its missions, activities, and functions; to gain a sense of the status of facilities and equipment; and to discuss with management and staff operational issues, quality, and the use of the research results. In parallel with MITRE's efforts, EPA gathered detailed information on staff work activities, academic degrees, and employment levels through a questionnaire called Workforce '94. Some of the results of this survey are incorporated into this study. The entire results of Workforce '94 will be published as a separate report by EPA. Detailed information on expenditures of appropriated funds, planning, equipment, and facilities for each of the laboratories was provided to MITRE by offices at EPA's headquarters. Interviews were conducted with senior management throughout the Agency to ascertain their views on EPA's laboratories and the research program and also with some internal and external customers to discern how well the research products and services fulfill their needs.

Currently, EPA's laboratories are organized into three distinct groups:

- 12 laboratories, 4 assessment offices, and 4 field stations within the Office of Research and Development (ORD) that engage in fundamental research, application-directed research, development, and technical assistance on an as-needed basis

- 9 program office laboratories that support regulatory and short-term needs through laboratory analytical services, enforcement and compliance activities, monitoring, technical assistance and services, and a limited amount of development

- 10 regional environmental services organizations (ESOs) that are dedicated to the support of regional programs primarily through the provision of laboratory analytical support, quality oversight, and technical activities in support of enforcement and compliance

These laboratories vary widely in the number of staff (7-277) and the range of disciplines (with the dominant fields being chemistry, biosciences, and engineering). They are located in or near 24 cities throughout the country, and at EPA's headquarters in Washington. In some cases, facilities and equipment require significant upgrading. Intramural expenditures for the laboratories in fiscal year 1993 (FY93) were $138 million for ORD, $37.8 million for the program offices, and $47 million for the ESOs; total intramural and extramural expenditures in FY93 were $392.5 million, $65.7 million, and $49.4 million, respectively. Six assistant administrators and ten regional administrators are involved in laboratory administration and direction; this structure complicates research activities planning and in many cases separates the laboratories from their major internal customers or users.

With the guidance of the Steering Committee, MITRE identified many options that would encompass aspects of physical, organizational, or functional consolidation of EPA's laboratories. Five organizational and functional options were chosen for examination and assessment without and with physical consolidation:

- **Customer orientation**: focus on program offices as center for science and technology

- **Streamlining**: reduction in the number of senior staff, particularly at EPA headquarters

- **Carnegie Commission**: emphasize multimedia issues

- **Distinct environmental services organization (DESO)**: centralize responsibility for all technical support functions

- **Geographic location**: place-based orientation to environmental issues.

An assessment was made of the **changes** that could occur in the quality of the scientific and technological products and in the efficiency and effectiveness of the operations relative to the current situation. The following list of criteria jointly agreed upon by EPA and MITRE was used in the assessment:

- **Science quality/utility**: Does the option facilitate production of science of the highest quality throughout the Agency to support all facets of its environmental protection mission?

- **Stature/credibility**: Does the option provide potential for enhancement of the professional stature and credibility of the scientific and technological staff?

- **Concentration of resources**: Does the option permit sufficient concentration of specialized scientific and technological support resources (e.g., facilities, equipment, critical skills, critical mass of skills) to conduct high-quality research and support activities within EPA?

- **Geographic location**: Does the option provide for reasonable access to resources necessary to carry out the assigned mission?

- **Mission focus**: Does the option improve the laboratories' focus on their mission?

- **Customer satisfaction**: Does the option improve the ability to satisfy customer needs?

- **Use of intramural workforce**: Does the option maximize the effectiveness of the use of EPA's intramural workforce?

- **Multimedia approaches**: Does the option enhance the Agency's ability to address multimedia interdisciplinary issues?

- **Priorities**: Does the option ensure that resources and organizations are focused on the highest-priority environmental problems and Agency support needs?

- **Functional alignment**: Does the option ensure that resources and organizations are focused on Agency support needs by clarifying organizational responsibilities and reducing functional redundancy?

- **Operating costs**: Does the option provide potential cost savings?

- **Facilities and equipment**: Does the option provide for more efficient use of resources available for facilities and equipment?

- **Future investment**: Does the option lead to optimal future investments in facilities and equipment?

- **Locus of control**: Does the option resolve the locus of control issues raised in the study?

- **Use of human resources**: Could the option decrease the number of human resources required to achieve assigned tasks?

- **Implementation time**: Can the option be implemented in reasonable time with minimal disruption of key research and support functions?

- **Implementation cost**: Is the cost to implement and maintain the option reasonable?

Table ES-1 presents a summary of the option evaluations made by the MITRE staff who visited the laboratories, based upon their interviews with EPA personnel and their analysis of the laboratory data. The potential changes that could result from implementing an option are designated by the symbols in the table. The changes range from strongly

Table ES-1. Evaluation of Options

	EFFECTIVE USE OF AGENCY RESOURCES							EFFICIENT USE OF AGENCY RESOURCES								IMPLEMENTATION	
Option	Science Quality/Utility	Stature/Credibility	Concentration of Resources	Geographic Location	Mission Focus	Customer Satisfaction	Use of Intramural Workforce	Multimedia Approach	Priorities	Functional Alignment	Operating Costs	Facilities and Equipment	Future Investments	Locus of Control	Human Resources	Implementation Time	Implementation Cost
Customer Orientation w/o consolidation	O	O	O	O	+	++	O	O	++	+	O	O	O	O	O	O	O
Customer Orientation w/ consolidation	O	O	+	O	+	+	+	O	++	+	+	+	+	O	+	-	-
Streamline w/o consolidation	O	O	O	O	O	O	+	O	O	O	+	O	O	+	O	O	-
Streamline w/ consolidation	O	O	+	O	O	-	+	O	O	O	++	+	+	+	+	-	--
Carnegie w/o consolidation	O	+	O	O	+	O	O	+	+	O	-	O	O	+	O	-	O
Carnegie w/ consolidation	+	+	++	O	++	O	+	+	+	++	+	+	+	++	++	--	--
Distinct ESO (DESO) w/o consolidation	O	+	O	O	+	--	O	O	O	O	O	O	O	O	-	O	O
Distinct ESO (DESO) w/ consolidation	+	+	+	-	+	--	+	O	O	+	+	+	+	+	+	-	-
Geographic w/o consolidation	+	O	O	O	+	+	+	++	+	O	O	O	O	O	O	-	O
Geographic w/ consolidation	+	O	+	++	+	+	+	++	+	--	--	-	--	O	-	--	--

Explanation of symbols: -- strongly negative - negative o no effect + positive ++ strongly positive

Note: The relative importance among the criteria was not considered in the analysis.

positive, designated by a double plus symbol (++), to no discernible change or a balance between positive and negative change, designated by a zero (0), to a strongly negative change, designated by a double minus (--) symbol. The relative importance among the criteria was not considered in the assessment.

If the options are implemented without physical consolidation, the implementation time is short, since the changes from the current operations are mainly those of reporting relationships. Implementation costs would be expected to be substantial for physical consolidation of the laboratories, but no quantitative estimates of these costs have been made as yet by EPA or MITRE. Since the Carnegie Commission option affects only the ORD laboratories, and the DESO option affects only the ESOs, these options should not be compared.

Among the positive aspects of the options, the Carnegie Commission option with physical consolidation was evaluated more favorably than any of the other options that involve ORD. In the areas in which the Carnegie Commission with consolidation was strongly positive—human resources, mission focus, locus of control, functional alignment, and concentration of resources—none of the other options that would affect the ORD laboratories was as positive.

The strongly positive aspects of the Geographical Location option, including its multimedia approach resulting from place-based ecosystem orientation, could be implemented under other options as well. This is also true of the strongly positive aspects of the Customer Orientation option—customer satisfaction and focusing on the highest priorities of the Agency.

The Streamlining option was neutral for most of the criteria, although it could reduce operating costs. If the provisions of this option were implemented under either the Carnegie Commission or DESO option, similar savings could be effected.

The evaluation of the DESO option showed that it could have positive effects on the stature of the laboratories and the mission focus, although it is strongly negative with a large loss in customer satisfaction, an area in which the ESOs are now highly regarded. With consolidation, some savings would be seen in operating, facilities, and equipment costs, but other benefits are offset by the decline in customer satisfaction. The Geographic Location option would provide improvements in the area of customer satisfaction, where the DESO option was very weak.

The option judged to be most negative, Geographic Location with consolidation, would affect all three types of laboratories. This option was evaluated as strongly negative for functional alignment—a criterion for which the Carnegie Commission option with consolidation was judged strongly positive. In the Carnegie Commission option, consolidation reinforced the functional alignment, while the Geographic Location option did not. The alignment resulting from the Geographic Location option was perceived as expensive and not productive; it was seen as having the negative aspects of relocation—disruption and high costs—and few of the advantages of the Carnegie Commission option.

The assessments made by MITRE of the restructuring options have been useful in identifying the major controlling factors that must be addressed by EPA in making its report to Congress. However, there are further opportunities for EPA to improve the efficiency and effectiveness of its operations through management changes. Three changes appear reasonable to MITRE for eliminating the apparent duplications of facilities and equipment and to increase the disciplinary strengths of the human resource base:

- Consolidation of laboratories in the Office of Prevention, Pesticides, and Toxic Substances and the two laboratories under the Office of Radiation and Indoor Air
- Realigning and consolidating the ORD laboratories in the manner of the Carnegie Commission option
- Reducing the number of laboratories within the regional offices through consolidation to a few laboratories with national service focus.

These changes could be made over time as leases for current facilities expire or investment decisions on facility and major equipment upgrades are being made.

Five management improvements are recommended to bring about positive changes:

- Establish quality assurance as a visible high-level function
- Perfect the issue-based planning process
- Create a customer orientation throughout the Agency with a clearly focused and articulated mission statement
- Improve the information management system to increase the accessibility of managers to complete, consistent, and accurate data
- Delegate authority to the lowest level of management consistent with federal policies

Many of the findings and observations made in this report are consistent with those reported over the past 12 years in prior reports on EPA's research or laboratory functions. With the current emphasis on reengineering within public and private enterprises, it is a propitious time to build upon this broad base of experience and implement changes.

SECTION 1

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The U.S. Environmental Protection Agency (EPA) supports its regulatory mission through an array of laboratory and other technical facilities across the nation. These laboratories are operated by several offices:

- **Office of Research and Development (ORD):** 12 research laboratories, 4 assessment offices, and 4 field stations

- **Program Offices:** 9 laboratories operated by five program offices (Office of Administration and Resources Management [OARM]; Office of Air and Radiation; Office of Enforcement; Office of Prevention, Pesticides, and Toxic Substances; Office of Water)

- **Environmental Services Organizations (ESOs):** 10 ESOs comprised of 9 environmental services divisions and 1 environmental services branch

These laboratories perform a broad scope of scientific and technological activities that range from enforcement and technical services to developmental and fundamental research. The roles and missions of these facilities have evolved over time as the focus on environmental problems has shifted from control of point sources within separate media to multimedia problems and ecological and health impacts. The future portends greater attention to regional, national, and global environmental issues. As emphasis continues to shift from control and abatement to pollution prevention, additional changes in roles and missions can be expected. Many of the laboratory facilities are in need of significant repairs requiring substantial financial resources. Federal staffing within EPA has been constrained, resulting in heavy reliance on both on- and off-site contractor support and giving rise to concerns related to potential conflict of interest, personal services contracting, inappropriate performance of inherently governmental functions, and reduced ability of government employees to oversee contractors. The number of facilities and the geographical separation of the laboratories from one another—and often from their principal customers—also raise questions on the efficiency of the current research and technical operations. EPA is responding to these concerns by devising a new mode of operation, as shown by the current emphasis on strategic planning and the streamlining and self-study initiatives that have been undertaken.

The objectives of this study are (1) to develop a baseline description of all of EPA's laboratories and (2) to assess options to enhance the quality, effectiveness, and efficiency of laboratory operations in order to provide the institutional flexibility needed to respond to EPA's current and future roles and missions.

The genesis of this study was a budget request to Congress by the EPA Administrator for funding an external study of the ORD laboratories. The Senate Committee on Appropriations supported the Agency's request as long as it did not duplicate earlier efforts and included specific recommendations for change. The Committee required EPA to explore whether a consolidated laboratory structure would better enable the Agency to accommodate the need for integrated research and monitoring. The Committee indicated that continuation of the current arrangement could be considered an option if a detailed justification for doing so could be provided. Although Congress originally directed EPA to provide a report by 31 March 1994, the deadline was extended to 30 May 1994.

The Office of Research Program Management (ORPM) in ORD contracted with The MITRE Corporation for assistance in an assessment of the EPA scientific and technological laboratories. The study was guided by a steering committee that reported to the Deputy Administrator and was composed of EPA's science advisor and representatives from each of EPA's offices at the assistant or associate administrator level. The scope of the study includes EPA's major research and technical operations, including ORD headquarters offices, laboratories, assessment offices, and field stations; it also extends beyond ORD to include the ESOs and all laboratories operated by EPA program offices, including the National Enforcement and Investigation Center (NEIC). MITRE's study incorporates the results of recent internal studies of the ORD laboratories, as well as the results to date of the streamlining efforts now under way at EPA. MITRE has evaluated the availability of scientific and technological support to accomplish EPA's responsibilities for environmental protection and leadership and the processes required to fulfill these responsibilities. The assessment includes (1) a description of the current configuration and focus of scientific and technological support functions within EPA, (2) an evaluation of the efficiency, effectiveness, and quality of these functions, and (3) an evaluation of major options for potential functional or organizational realignment. No attempt has been made to discuss board policy issues such as what the Agency's emphasis should be between basic and applied research, or whether the mission of the Agency should be expanded from environmental protection to include environmental scientific leadership.

EPA employees have shown a high degree of interest and participation throughout the study. Their cooperation and assistance have been essential in establishing a meaningful and credible information base of current functions and operations. The ORPM and the OARM have been responsible for providing much of the data summarized in the tables appearing throughout this report.

In addition to the Steering Committee, MITRE received input from the National Academy of Public Administration (NAPA) and EPA's Science Advisory Board (SAB). These groups reviewed the Draft Study Plan and Draft Final Report, then provided their comments to the authors. In addition, the Draft Final Report was reviewed by numerous staff at EPA; to the extent practicable, their comments have been incorporated in the Final Report.

The directors of the ESOs formed a work group that provided the study team with both comments on the Draft Study Plan and materials to facilitate data collection. The structures of the ESOs vary among regions, with different functions assigned to the various organizations. To ensure consistent comparisons among the ESOs, the directors requested that, rather than focusing on just the laboratory, three core functions be used to define the ESOs. The three core functions—laboratory services, quality assurance and quality control, and field monitoring—are discussed at length in Section 4. Unless a specific distinction is made among these three functions, the term "ESO laboratory" will be used to describe them collectively and the data and information presented in tables and figures throughout the document will encompass all three core functions. In March, the ORD laboratory directors established a study team to review and comment on the draft study and to make a set of recommendations to the Assistant Administrator (AA) for ORD. Based on the MITRE study results, and the reports of NAPA, SAB, and the two internal groups, EPA's Steering Committee will formulate a separate set of recommendations, which will be forwarded to the Administrator, who will present the Agency's recommendations to Congress.

1.2 EPA ORGANIZATION

The EPA was formed in 1970 by consolidating a variety of programs from other government agencies. These elements included administrative, regulatory, and research activities. The laboratories associated with these activities were also incorporated into EPA. It is not surprising that, even 24 years later, the result reflects the rather disparate history of many of the EPA laboratory elements.

Laboratories are highly visible, easily identifiable entities, in part because the laboratory is often in a well-defined location that correlates to the work performed. The functions of laboratories are not always well understood, in part because of their technical nature, and in part because laboratory work covers such a wide range of characteristics from fundamental research to applied research to regulatory support work. As used in this report, "laboratory" may refer to the physical facility, including staff and equipment, that perform scientific, technical, and analytical work to further the goals of the Agency. The work of the laboratory may be controversial. Fundamental research may be directed to an issue having great commercial or political importance (e.g., dioxin), while regulatory and enforcement work may affect highly visible enforcement cases (e.g., hazardous waste remediation). There are also are a variety of valid ways to organize the laboratories in the conduct of their varied work. Different organizational arrangements and reporting systems may make sense depending on what work characteristics are being emphasized.

Finally, some of the historical debate regarding laboratory consolidation and organization may arise from a confusion regarding concepts. For example, some people may raise questions about laboratories, when the real issue of concern is the scientific and technological activities that are (or are not) being performed at the laboratories. Thus, it is important to remember that different laboratories have different purposes; some laboratories concentrate on performing analytical work, while others conduct fundamental or applied research. Issues of consolidation, reorganization, and mission are very different for each type of laboratory.

Since the formation of EPA, the laboratories have become organized into three distinct groups:

- **ORD laboratories:** ORD operates laboratories that engage in both fundamental and applied research. Each of the laboratories has its own area(s) of expertise, often reflecting the pre-EPA origins of the particular laboratory. The process used to set the different research priorities has undergone substantial change over the life of EPA. Currently, the research priorities are set through an "issue-based planning" process; however, the Streamlining Report (Foley, February 1994) suggests that additional changes may be made. Each laboratory director reports to an office director who, in turn, reports to the AA for Research and Development. Funding for ORD research derives from lump sums established in the priority and budget processes, as well as by a limited number of ad hoc agreements with program offices and interagency agreements with other federal agencies.

- **Program office laboratories:** Each major program office (except for the Office of Solid Waste and Emergency Response) maintains one or more laboratories that operate to support the regulatory and short-term research needs of the program. Generally, the program office laboratories reports to the program office director.

- **ESO laboratories:** Each EPA region has a laboratory dedicated to the support of regional programs and regulatory functions. ESOs vary in size and breadth of activity, reflecting their individual histories, the roles assigned to them by present and past regional administrators, the environmental needs of the region, and even the political history. The major activity of most ESOs is in analysis of samples, and to a lesser degree in field work to collect either monitoring or enforcement samples. Each regional laboratory is the major component of an ESO that is a located in each region. Each laboratory director has line supervision from the ESO, but must also satisfy his/her regional administrator and other regional customers.

While most fundamental and applied research in EPA is concentrated in the ORD laboratories, applied research in support of regulation writing is also performed in the program office laboratories. Analytical work in support of regulations is concentrated in the ESOs, although the program office laboratories conduct some of this work as well. EPA does only a fraction of the environmental research (fundamental and applied) performed for the federal government. Other agencies, among them the National Oceanic and Atmospheric Administration (NOAA), the National Institutes of Health (NIH), and the U.S. Department of Agriculture, carry out their own related research efforts.

Because the activity of laboratories is often highly visible (and expensive), it is important that the laboratories be organized to achieve a high degree of effectiveness in the expenditure of the public funds. There has been a long and continuing interest in the organization of the laboratories. Given the geographically dispersed nature of the EPA laboratories, an obvious and recurring question is whether consolidation of one form or another might improve effectiveness. Several types of laboratory consolidation are possible:

Physical Consolidation: As used in this study, physical consolidation of laboratories refers to physical closure of a laboratory facility and movement of the people and contents into another laboratory. A variation on physical consolidation is collocation—two or more laboratories might be placed on the same or nearby sites, with greater or lesser amounts of shared overhead. Laboratories sharing the same physical location might be under the same or different management.

Organizational Consolidation: Another type of reorganization or consolidation of laboratories would leave the laboratories geographically dispersed but combined at an organizational or management level. The present ORD laboratories are all in the same organization and thus are consolidated in the organizational sense. An alternative organizational consolidation might combine laboratories having similar characteristics. Such combinations might be by function (fundamental versus applied research), medium (water versus air), or customers (program offices versus regions).

Functional Consolidation: Consolidation could also be achieved by eliminating overlapping or redundant functions or activities conducted by several laboratories—for instance, the development of special analytical methods (e.g., dioxin)—or by eliminating of replication of special equipment or facilities that are not fully utilized.

1.3 ORGANIZATION OF THE DOCUMENT

The objectives of the laboratory study as defined by the Study Plan and EPA guidance are discussed in Section 2. Congress specified that the current study should make use of earlier studies and, accordingly, several of these are reviewed in Section 3. Section 4 addresses the Agency's mission and its scientific and technological needs; it also presents summary financial, facilities, human resources, and equipment data; detailed supporting information for each laboratory can be found in Appendix A, the second volume of this report. In the course of this study, interviews were held at every laboratory, and the principal recurring issues have been summarized in Section 5 for each of the three laboratory types—ORD, program office, and ESO; several state and non-EPA laboratories were also visited and the results of these reviews are included in Section 5 as well. Management improvements that could be applied with any structural option to improve quality, efficiency, and effectiveness are discussed in Section 6. The five structural options developed for evaluation and the distinguishing criteria are described in Section 7 and evaluated in Section 8. Section 9 presents three other federal models, and Section 10 evaluates alternative accountability models. The findings of the study are presented in Section 11, and a list of the previous studies reviewed for this study is located in Section 12. Highlights of the project schedule are given in Appendix B, and summaries of the 26 EPA executive interviews conducted to help direct the effort are in Appendix C.

SECTION 2

OBJECTIVES AND METHODOLOGY

2.1 OBJECTIVES

It is the primary purpose of this study to inform the discussion surrounding the performance of EPA's scientific and technological mission by examining the structure and functions of the Agency's laboratories. This study provides the following:

- An extensive set of current, relevant information on EPA's scientific and technological activities conducted through its laboratories

- A critical assessment of options for enhancing the quality and effectiveness of laboratory operations

The objectives of this study are as follows:

- Assemble an extensive description of the current scientific and technological missions, laboratory management and operations, human resources, facilities, and equipment by compiling existing information, reviewing prior studies, and visiting the laboratories.

- Identify and characterize EPA's needs for scientific and technological information and its role in providing environmental science products to other agencies and tiers of government using information gathered from published plans; interviews with EPA headquarters, program office, and regional management; and discussions with laboratory management and staff.

- Highlight any significant differences in perspectives of the laboratories of their missions and EPA's needs for scientific and technological information.

- Perform an objective, but not quantitative, evaluation of the quality of the laboratories' scientific and technological products, the effectiveness and efficiency of laboratory operations (human resources, equipment, and facilities), and the responsiveness of the laboratories' scientific and technological functions to EPA's needs.

- Identify apparent redundancies in the activities within the laboratory complex, as well as areas of overinvestment and underinvestment.

- Identify problem areas within the laboratory complex and provide benchmarks for options assessment.

- Identify and assess organizational options for the laboratory complex, taking into account current and future scientific and technological needs, federal staffing constraints, human resources profiles, financial resources constraints, prevailing contracting procedures, and the impact on current and proposed facilities.

2.2 METHODOLOGY

The approach to this study has three related phases, with the later phases building on the information and understanding developed in earlier phases. These phases logically begin with the information acquisition phase, followed by the information synthesis phase and the options development and analysis phase.

2.2.1 Information Acquisition

The information acquisition phase was designed to acquire the information needed to describe the scientific and technological laboratories within the Agency. During this phase, specific information on the laboratory mission, functions, products, services, and customers was obtained. This information helped establish an understanding of the laboratory's scientific and technological functions, why it is involved in those functions, and how well it performs those functions, including its interfaces with and relationships to other EPA organizations. A major element of this phase was the specification of information needs that provided a basis for determining how efficiently and how effectively a laboratory carries out its functions. The information also indicates whether the laboratory's products and services are of high quality as viewed by the laboratory and its customers.

Information acquisition began with the development of a descriptive framework that could be applied to the laboratories to aid in capturing their salient features and characteristics and to describe how the laboratory fits into a general laboratory program within the Agency. The purpose of the framework was to provide a basis for examining the characteristics of each of the three types of laboratories—those belonging to ORD, the program offices, and the regions. Senior executives of EPA were interviewed to identify issues to be examined in developing the framework. Summaries of these interviews are given in Appendix C.

Information was acquired through existing EPA documents and interviews at the EPA laboratories and regional offices, as well as state laboratories and private industrial laboratories. Prior to the visits, a set of discussion topics designed to elicit information was sent to laboratory personnel scheduled to be interviewed; these topics provided the interviewees an opportunity to consider their responses before the interview. Interviewers were aided in their information collection task by an "interview guide" that helped ensure consistency in the information acquisition process. The data collected from the office and laboratory visits contributed to defining the features and characteristics of each laboratory. The individual elements were interpreted and synthesized to develop a description of the EPA laboratory system as a whole. The descriptive information that was acquired is essential both for characterizing the state of the overall laboratory program and for estimating the impact that various options might have on the program's efficiency and effectiveness. While some of the information that was acquired might not be immediately applicable for the purposes of this study, it was important to EPA to have this consistent snapshot of all the laboratories at the same point in time.

All of the original data in the tables in Appendix A was obtained from EPA. Information on the demographic characteristics and work activities of the laboratory staff, including activity distributions, numbers and types of degrees, and age distributions, was obtained from the Workforce '94 database. (Workforce '94 was a survey of all laboratory and ORD Headquarters staff conducted independently by ORPM during the course of this study.) Numbers of full-time equivalent (FTE) staff were provided by ORPM for ORD laboratories and by individual laboratories for the program office laboratories and ESOs. The number of extramural work-years used by each laboratory was also provided from the Workforce '94 database, while facilities data was provided by the OARM Facilities Management and Services Division (FMSD) and by individual laboratories. Equipment data was provided by OARM through ORPM from the PPAYS equipment inventory database. The data in the activity/function matrices was provided by the individual laboratories. Laboratory financial data was provided by ORPM for ORD laboratories and by the individual laboratories for the program office laboratories and ESOs. FMSD provided OARM Buildings and Facilities (B&F) expenditures data.

2.2.2 Information Synthesis

During the second phase, information synthesis, a profile was obtained of the current laboratory situation in terms of its missions and functions, products, services, customers, and operational characteristics (including organization, management, staffing, and facilities). This profile provides a qualitative assessment of each laboratory's effectiveness and efficiency, as well as the quality of its products and services.

Data acquired through the laboratory visits was used to form a laboratory information database, which was structured to accommodate the elements of the descriptive framework as attributes. This structure facilitated synthesis of the information in aggregated form and aided in the evaluation of the current laboratory system. A great deal of information on the laboratories was gathered that is not included in this report. The information that did not directly relate to this study nevertheless provides EPA with contemporaneous information on all of the laboratories.

Activity/function matrices, developed by MITRE staff, were presented during the visits to the laboratories. These matrices were filled out with the percent or number of FTEs and extramural funds associated with each activity and returned to MITRE. The laboratories could add or delete any of the activities; each laboratory determined which of the functions the activities should be assigned to. The individual matrices are included with the laboratory descriptions in Appendix A, and summary tables are discussed in Section 4.

2.2.3 Options Development and Analysis

In the options development and analysis phase, options for organizational restructuring, functional realignment, and other management considerations were developed and analyzed. The laboratory profile or baseline, developed in the previous phase, served as the basis for comparing the options. Six options were described in the Study Plan for this effort; these options have been changed and recombined, and based on previous studies and other discussions, assumptions have been developed for each of the five options presented in this study. Issues discussed at each of the laboratories were consolidated into four major categories, as discussed in Section 5. The options were evaluated against criteria developed from these issues, as well as other criteria suggested by the Steering Committee to determine the impacts of implementing each option. EPA is preparing cost analyses for the options, and these will be considered, along with the option analysis, during the Agency's preparation of recommendations to Congress.

SECTION 3

RECENT STUDIES RELEVANT TO EPA RESEARCH OR LABORATORY FUNCTIONS

3.1 PAST STUDIES OF EPA LABORATORIES

Since EPA was created in 1970, a variety of internal and external groups have conducted numerous studies of EPA's research activity and laboratories. Some of these studies were the result of EPA initiative, while others resulted from Congressional or other outside direction. This section will summarize and discuss some of these studies.

While some of the previous studies focused on the physical condition of the laboratories and capabilities of the work force or on the fiscal benefits of consolidation, most have concentrated on how research priorities are set and whether the research mix of the laboratories is optimal. As a result, most of the studies and debates have centered on the ORD laboratories; however, it is important to remember that there are other laboratories present in EPA, and that, in addition to ORD laboratories, others do conduct applied research.

Table 3-1 shows a selection of the major studies of the EPA laboratories and/or research functions since 1982. To simplify the discussion, a "short name," often used by others in referring to the reports, has been designated. The full name and source of each study is given in the bibliography in Section 12. The studies are presented in reverse time sequence.

The only study that deals in detail with the issues surrounding physical consolidation of all three types of EPA laboratories is the 1982 consolidation study and its 1985 follow-up. These two studies evaluated the cost and program implications of a wide variety of possible consolidations, with the primary goal being to reduce costs. While some of the findings and recommendations were implemented, most were not. For example, although the study considered reducing the number of regional laboratories, in recent years, several of these laboratories have been upgraded, relocated, or expanded. The record does not offer precise reasons for these decisions, but it is apparent that a variety of program, policy, and political factors affected the decisions to provide a suitable laboratory for each EPA region.

Several studies have examined the broader issues related to the research and service balance and priorities in the EPA laboratories, especially in the ORD and program office laboratories. These studies include the National Institute for the Environment (NIE),

Table 3-1. Past Studies Affecting EPA Laboratory Activities and Organization

Short Name	Full Title	Date	Author	Coverage
Streamlining	Redesigning Research at EPA: Proposed Changes to Mission, Organizational Structure, and Streamlining in the Office of Research and Development	02/94	Foley/ORD	Review of ORD research organization and policy
Aging Laboratories	Federal Research: Aging Federal Laboratories Need Repairs and Upgrades	09/93	GAO	Review of U.S. government laboratory facilities including EPA
NIE	Reinventing our Environmental Research Enterprise	06/93	Committee for the National Institute for the Environment (NIE)	Proposal for National Institute for the Environment. Covers all federal, environmental research.
Fundamental Research	Report to Congress: Fundamental and Applied Research at the Environmental Protection Agency	02/93	EPA/ORD	Compilation of ORD resource expenditure
The Third Decade	EPA Organization for Environmental Research: The Third Decade (Report to Congress)	01/93	ORD	History of ORD
NRC	Research to Protect, Restore, and Manage the Environment	--/93	NRC	
Carnegie Report	Environmental Research and Development: Strengthening the Federal Infrastructure	12/92	Carnegie Commission	Review and recommendations on overall federal environmental research and organization
Expert Panel	Safeguarding the Future: Credible Science, Credible Decisions. Report of Expert Panel on the Role of Science at EPA	03/92	Expert Panel on the Role of Science at EPA	Review and recommendations on ORD research organization and policies
NAPA	EPA's Office of Research and Development: Leadership and Staff for a New Agenda.	07/90	NAPA	Review and recommendations on ORD research and work force policies
Future Risk	Future Risk: Research Strategies for the 1990s	09/88	Science Advisory Board	
Laboratory Organization	EPA Laboratory Organization (memo)	07/85		Internal EPA review of consolidation and reorganization issues
SAB	Science Advisory Board Annual Reports	00/94	Science Advisory Board	Annual reports of the SAB to the EPA Administrator
Consolidation Committee	Laboratory Consolidation Committee Draft Report (memo)	07/82	Consolidation Committee	Review and recommendations on consolidation alternatives for all EPA laboratories.

National Research Council (NRC), Carnegie Commission, Expert Panel on the Role of Science, and NAPA studies. Several of these studies are concerned with federal environmental research; EPA is only one component of these studies.

The SAB Annual Reports provide additional information. The SAB was established by Congress to advise the EPA administrator on scientific and policy issues. It reviews particular technical issues for EPA and also develops issues of its own. In general, its reports indicate a fairly high level of approval of the work of EPA, with occasional specific criticisms. However, in its Fiscal Year 1992 (FY92) report, the SAB reviewed the President's budget for ORD and concluded that "insufficient funds and FTEs pose a serious threat to the continued viability of the EPA research program." The SAB went on to raise some major concerns including (1) excessive reliance of on-site contractors for research, (2) attrition of federal career scientists, and (3) increasing obsolescence of equipment and facilities. These observations are relevant to the current study.

The previous studies have somewhat different findings and recommendations, but all show a high degree of concern with the present research priorities at EPA. Thus, taking into account the experience with the consolidation efforts in the early 1980s, the major concerns are not related to the marginal cost savings possible from consolidation, but rather to the issues of management and policy. Therefore, the laboratories cannot be evaluated without addressing the policy issues, nor from an evaluation of management in addition to structure.

To help establish the background for the present study, each of the earlier studies is described in some detail, and the findings and recommendations are summarized. These discussions and their supporting tables do *not* list all the findings and recommendations of the reports, only those that are most relevant to the present evaluation. In some cases, the reports and studies did not provide explicit listings of findings, or the findings were not directly related to recommendations. Where appropriate, findings have been inferred from the text or recommendations, and this fact is noted. In many cases, the findings or recommendations have been paraphrased so that they would be easier to compare. Quotes are used whenever extensive portions of the original text are provided. Finally, in a number of places, some interpretation of some of the findings has been provided, especially where they apparently conflict with another study or the present evaluation.

3.1.1 The Expert Panel Report

In May 1991, the EPA administrator appointed an expert panel to provide "a set of recommendations for how...[EPA]...can best meet the goal of using sound science for its decision making." The expert panel held public meetings, interviewed more than

30 individuals from EPA and other governmental and non-governmental agencies, and accepted more than 25 written comments.

The report states that it uses the term "science" broadly to include a wide range of technical activities such as research and development, as well as technical and regulatory support. This includes the "...scientific activities conducted by EPA program, policy, and regional offices...." However, because the report focuses on the role of science in EPA decision making, the report inevitably concentrates on ORD, while other parts of the EPA laboratory system receive less attention. For example, the interrelationship of the programs at the ORD and the program office laboratories, and the role of the ESOs receive less attention.

Tables 3-2a and 3-2b show a summary of selected findings and recommendations most relevant to the laboratory evaluation in the present report.

3.1.2 The National Academy of Public Administration Report

The NAPA Report was prepared by a panel in the National Academy of Public Administration. The report notes that in 1988 EPA's SAB recommended that EPA give "increased attention to longer-term issues relating to preventing and reducing environmental risk...and to reorient its [ORD] program to include more basic, long-term research not necessarily tied to the immediate regulatory needs of EPA's program offices...." This report, requested by ORD, was intended to provide a review of the progress on carrying out the recommendations. The panel met four times during the study. Panel members and staff interviewed over 100 individuals in EPA, visited 13 of the 15 laboratories and field sites and interviewed all laboratory directors, and met with a variety of other EPA staff, Human Resource Councils within EPA, and the chairperson of the SAB.

The NAPA Report found that many steps had been taken to implement their recommendations. However, it also found that impediments to progress had become apparent in some areas. The report found a substantial degree of confusion concerning the direction and mission of ORD, even though it found that substantial progress toward a stronger basic research program had been achieved.

One irony of the report is that these items of progress—improvement in the strength of the basic research program—are found to conflict several years later with the need for increased regulatory program responsiveness found in the Streamlining Report and in

Tables 3-2a and 3-2b. Safeguarding the Future: Credible Science, Credible Decisions Report of Expert Panel on the Role of Science at EPA, March 1992

#	Finding
1	"EPA does not have a coherent science agenda and operational plan to guide scientific efforts throughout the agency and support its focus on high-risk environmental problems."
2	"EPA has not clearly conveyed to those outside or even inside the Agency its desire and commitment to make high-quality science a priority [in decisions]."
3	"The development and nurturing of human resources are central to improving science at EPA."
4	"...[EPA] lacks the critical mass of externally recognized scientists needed to make EPA science credible to the wider scientific community."
5	"...Problems in the [EPA] approach to academic grants and centers have discouraged many university-based experts from working with EPA...[all EPA] laboratories often rely on contractual mechanisms that prevent EPA from obtaining the best outside scientists...."

#	Recommendation
1	"The [EPA] has moved in the right direction with its new issue-based planning process. EPA should further develop this process...[and] apply to science throughout [EPA]...."
2	"For ORD scientists, the Panel recommends continued attention to appropriate science and science management career tracks. For scientists in [other] offices...[establish] a science career track similar to that in place for those providing legal advice...[EPA] should enhance rotational opportunities...."
3	"EPA should recruit four to six world-class research scientists or engineers...."
4	"EPA should move quickly to bolster its grants and centers program. [EPA]...should implement a long-term plan to replace contractual mechanisms that may be detrimental to obtaining the best possible scientific information."

MITRE's interviews with potential ORD customers. Another irony is the observation that "even with the formalities required by the federal procurement regulations, EPA [ORD] laboratories have successfully integrated extramural and federal staff...." The results of the MITRE interviews showed widespread frustration with the contracting process only four years later. Similarly, the report found good morale in ORD, yet interviews several years later show a significant level of frustration in the staff. These apparent changes appear to result from a combination of different interview and data compilation techniques, changes in programs and policies in ORD in the interim, and new constraints under which staff members work (especially in procurement and contracting).

Tables 3-3a and 3-3b list a selection of the findings and recommendations of the NAPA Report that are relevant to the present study.

3.1.3 The Carnegie Report

The Carnegie Report was prepared by the Carnegie Commission on Science, Technology, and Government, and it was sponsored by the Carnegie Corporation of New York. The study considers the entire federal effort in environmental research. The Carnegie Commission worked with staff of the American Association for the Advancement of Science. The basis of the study included personal knowledge of the environmental research structure on the part of Commission and staff members, as well as fiscal and budget studies of federal environmental research. The study did not include extensive visits of EPA laboratories or extensive discussions with EPA staff.

The central concern of the study was that there should be sufficient, high-quality scientific knowledge to understand and respond effectively to the environmental challenges facing the United States and the world. The report advocates a stronger, more unified approach to identifying and responding to the nation's environmental issues. Because the report addresses overall federal environmental research and organizational structure, many of the recommendations apply outside EPA. The report did not explicitly evaluate either the program office or the ESO functions of EPA.

Table 3-4 shows selected recommendations from the Carnegie Report that are relevant to the present study.

3.1.4 The Streamlining Report

The Streamlining Report was prepared by ORD staff in response to a directive from the President, as administered by the EPA Administrator. The Streamlining Report reviewed for MITRE's study covered only ORD and does not reflect the internal concerns of the other EPA laboratory components (the program office and ESOs), nor does it

Tables 3-3a and 3-3b. ORD: Leadership and Staff for a New Agenda
The NAPA Report, July 1990

#	Finding
1	"[The ORD] is a confederation of office and research laboratories...[reflecting] its ancestry in...individual agencies...."
2	"The difficulties of conducting high quality research in a regulatory organization...[are very great]...research...requires a degree of isolation...[with]...a long-term focus...[but] a regulatory agency such as EPA operates in a political world of short-term mandates...."
3	"The individual nature of each [ORD] laboratory...creates a situation in which there is limited staff interest in moving among ORD components...The lack of staff mobility... militates against the creation of a common culture and operating style...."
4	"...ORD poses an exceptionally demanding set of leadership tasks. Administrators generally remain with the organization two years or less [i.e., the turnover rate of administrators is an especially serious problem]
5	"[staff turnover is very low]...and if anything, is seen as a significant [problem since it has]...prevented hiring new staff to replace an aging work force."
6	"High [leadership turnover] and longevity of [field] staff have...reinforced the view that continuing survival of [a particular] laboratory can best be attained though independent leadership and laboratory agenda setting...."
7	"Considerable differences [among the staff] still exist concerning future directions expressed by the [SAB report]."
8	"[staff expressed] criticism of the quality and coherence of ORD communications."

#	Recommendation
1	"...a...reappraisal [is needed] for the suitability of the current research committee function and process...."
2	"...a short, substantive statement [is needed] that broadly outlines the direction in which...ORD must move...."
3	"...initiate a full assessment of all ORD Planning Processes, with a goal of developing a concerted strategic planning effort that engenders scientific creativity and effective management...."
4	"...establish criteria for using extramural staff rather than continue the current ad hoc situation. These criteria should indicate that ORD will...always maintain in-house technical capability."
5	The panel had numerous recommendations regarding aggressive recruitment of minorities, improvement of in-house training and promotion, improved personnel appraisal systems, and the possible need to hire scientists of "national stature."
6	"...recommends that ORD institute a comprehensive 'visiting committee" evaluation of each laboratory on a two- to three-year cycle..."

Table 3-4. Environmental Research and Development
Carnegie Commission, December 1992

#	Recommendation
1	"An Institute for Environmental Assessment (IEA) should be established...to evaluate global and national environmental problems...the IEA could be located in the Executive Office,...EPA,...or a Department of Environment...."
2	"The EPA's existing [research] laboratory structure, now composed of 12 laboratories, should be consolidated to create: • National Ecological Systems Laboratory • National Environmental Monitoring Systems Laboratory • National Environmental Engineering Laboratory • National Health Effects Research Laboratory"
3	"EPA should establish...up to six major Environmental Research Institutes associated with academic institutions and non-governmental organizations."
4	"A new US Environmental Monitoring Agency (EMA)...combining National Oceanic and Atmospheric Administration and the U.S. Geological Survey...EMA would include a National Center for Environmental Information."

consider in detail interlaboratory relationships between ORD and program office laboratories. It does, however, discuss potential customer relationships of program offices with ORD in relation to setting research priorities. Related streamlining studies have been prepared for the various program offices, including the program office laboratories, but these studies have not been reviewed for the present evaluation. The purpose of this Streamlining Report was to identify methods of improving ORD's effectiveness and efficiency while reducing the number of supervisory staff. The ORD study was very much a grass-roots effort, involving committees and individuals throughout the ORD, both at headquarters and in the laboratories.

While potential supervisory staff reduction was a highly visible component and goal of the study, the study emphasized the additional steps needed to achieve a more desirable mix of fundamental and applied research within ORD. In addition, it suggested ways to improve the quality and quantity of research performed by the ORD staff through decentralization and empowerment techniques.

Tables 3-5a and 3-5b show a summary of the findings and recommendations most relevant to the present study. A summary is not able to communicate the high degree of detail and specificity reached in many of the findings and recommendations.

Tables 3-5a and 3-5b. Plan for Reinventing and Streamlining ORD
February 1994

#	Finding
1	"There is a strong sense that the ORD mission needs to be clarified...by people in ORD and...outside of ORD...."
2	"Since [EPA] was...established there has been a tension between the need to make immediate decisions about protecting the environment, and the need for adequate information on which those decisions could be based. Over the years, different views...have predominated...."
3	"The current administrative system is generally perceived to be inefficient and often ineffective, and not producing the desired results...staff feel increasingly hamstrung by excessive administrative requirements...."
4	"ORD has a unique opportunity..because of the number of people who are going to be eligible to retire in the next two years...and the contractor conversion process...."

#	Recommendation
1	"Consider replacing the current HQ ORD offices and replacing them with mega-labs, as recommended by the Carnegie Commission, or alternatively, eliminating the current Offices and having Laboratory Directors report directly to an Associate Administrator for R&D."
2	"Convert from "traditional division-branch-section structure...[to] project team[s]" [for both bench research and management]."
3	"[Establish] two...career tracks: one of in-house research, and one of extramural project management."
4	"Separate strategic [fundamental] research from program support research...."
5	"...develop a long-term strategic hiring plan...[to help implement many changes in staffing]."

3.1.5 The National Institute for the Environment Report

The NIE report (more accurately termed a "proposal") was prepared by the Committee for the National Institute for the Environment, a private body advocating the establishment of a national institute for the environment. This institute would be designed to "improve the decision making on environmental issues" through the administration and coordination of research into environmental issues. The proposal envisions the institute as a priority-setting coordination agency, rather than as an agency with its own laboratories and staff of researchers. It would not conduct, establish, or enforce regulation.

The NIE Report is relevant to the present study because it envisions a different mechanism for coordinating research and possibly allocating research funding. This approach could affect the fundamental research role of ORD, and possibly the applied research role of both ORD and the program office laboratories.

Tables 3-6a and 3-6b show a summary of the findings and recommendations of the NIE Report.

3.1.6 The National Research Council Report

In 1993, the Committee on Environmental Research of the NRC issued a report discussing federal environmental research programs. The study concentrated on the way science is used in environmental decision making and provided recommendations for improvements in environmental research and the use of the scientific knowledge obtained. In preparing the report, the committee consulted with federal officials, received briefings, and held a public hearing receiving testimony from over 100 persons.

The NRC Report recommends a series of "cultural" changes in the conduct and use of environmental science, and it presents alternative organizational "frameworks" to accomplish these cultural changes. The cultural changes recommended include both goal statements and certain organizational modifications. The alternative frameworks provide differing methods for implementing the remainder of the recommended changes. One of these frameworks is very similar to the NIE proposal discussed above.

Tables 3-7a and 3-7b show a summary of the findings and recommendations of the NRC Report.

3.2 CONCLUSIONS DRAWN BY PREVIOUS STUDIES

Previous studies of research by ORD, EPA, and the federal government have resulted in a variety of findings and recommendations. Some of the findings identified symptoms,

Tables 3-6a and 3-6b. Proposal for the National Institute for the Environment, August 1993

#	Finding
1	"...critical gaps in [environmental system] understanding continue to stymie decision making..."
2	"...federal environmental research structure...lacks an overall perspective that can answer our...needs for high-quality information...."

#	Recommendation
1	Establish the National Institute for the Environment with the mission to "improve the scientific basis for making decisions on environmental issues...."
2	The NIE should "manage four integrated functions: • Competitively sponsor credible research on key environmental problems • Continually assess current knowledge to identify deficiencies and set priorities • Actively facilitate access to information for policymakers, professionals, and the public • Innovatively educate...and train new types of scientists, engineers...."

Tables 3-7a and 3-7b. Research to Protect, Restore, and Manage the Environment National Research Council, 1993

#	Finding
1	"There is no comprehensive national environmental research plan to coordinate the efforts of...[the agencies].."
2	"The nation's environmental efforts have no clear leadership...the U.S. has lacked strong commitment to environmental research...."
3	"Bridges between policy, management, and science are weak...."
4	"Long-term monitoring and assessment of environmental trends and the consequences of...regulations are seriously inadequate...."
5	"Research on engineering solutions to environmental problems is seriously underfunded...."
6	"...the government operates in a strongly adversarial relationship with industry and the general public...."
7	"With exceptions in the NSF, NOAA, and USGS, most federal environmental R&D is narrow, supporting either a regulatory or a management function...."

#	Recommendation/Alternative Framework
1	A National Environmental Plan (NEP) should be developed to [coordinate] environmental research...of federal agencies.
2	A National Environmental Council (NEC) in the...office of the President should be established to provide leadership...."
3	An Environmental Assessment Center (EAC) must be established to assess large environmental issues that cross agency mission boundaries...."
4	A National Environmental Status and Trends Program...should be initiated...to inventory and monitor the status...of the nation's natural resources.
5	A National Environmental Data and Information System should be established to collect...[and disseminate]...data.
6	Separate research and regulatory functions within EPA
7a	Framework A: Maintain current organizational structures. Establish NEP and NEC. Enhance programs, and increase basic research with extramural projects
7b	Framework B: Create National Institute for the Environment (NIE) to focus solely on environmental research, assessment, information management, and higher education and training. NIE would NOT incorporate existing agencies.
7c	Framework C: Establish National Institute for Environmental Research (NIER) to focus on same issues as NIE. However, it WOULD subsume most of NOAA, part of NASA, and the research component of EPA.
7d	Framework D: Create Department of Environment, to include EPA, NOAA, USGS, and part of NASA. It would incorporate research (as with NIER) and regulatory activity.

while others focused more closely on underlying problems. Some recommendations in the studies described desired changes in end behaviors of organizations, while others gave more detailed descriptions of specific modifications to programs, priorities, or organizational structures to accomplish such changes.

However, in spite of the very different methodologies and orientations of the studies, all have contributed to an understanding of the problems and issues surrounding research at EPA and, to a lesser extent, laboratory operations themselves. The studies tended to focus either on fundamental research at ORD or on government-wide environmental research issues and policy. Few studies examined the non-ORD laboratory operations in detail or focused on details of the interrelationships among all of the laboratories. A number of the findings identified similar areas of concern although they provided very different recommendations for solutions.

The findings from the whole range of studies (not just those discussed above and in the tables) deemed most relevant to the present evaluation are summarized below. Many of the problem areas have been addressed by EPA and, at least in part, have been corrected in the past several years. However, it is clear that many areas remain subjects of concern by persons both inside and outside of EPA and that there continue to be significant differences of opinion regarding problems and solutions.

Research Balance. There was concern about the balance between short-term and long-term research, as well as the balance between fundamental and applied research and the relevance of the research in supporting EPA's mission. Findings include the following:

- Some studies believed that there is insufficient research on long-term issues and that work is biased by a "pollutant of the month" effect.

- Some studies viewed ORD as too independent (i.e., not sufficiently sensitive to regulatory needs), while others view ORD as not sufficiently independent (i.e., too dependent on regulatory needs to the detriment of the long-term research program).

- Research to support policy and regulatory decisions should be improved; the credibility and relevance of EPA science in these areas is questioned.

- The research committee structure is awkward and leads to rigid research priorities. (Note: The issue-based planning process has superseded the research committee; while eliminating some problems, it has created others.)

- EPA is not perceived to be committed to the best science in policy and decisions, especially early in the regulation-developing process.

Research Quality. Findings raised the following concerns about the quality of the research done:

- Peer-review processes are not uniform.
- There is a need to upgrade staff through exchange programs, cooperative programs, training, and so forth.
- Reduction in funding for staff, laboratory facilities, and equipment has reduced quality.
- Insufficient resources are available to maintain staff competence, especially for non-bench scientists.
- Quality and quantity of instrumentation are below industrial standards.
- Excessive extramural research has reduced stimulation and feedback of EPA staff.
- Results cannot be documented for review, forming the basis of regulatory challenges.

Multiple Laboratory Site Effects. Concerns have been raised about the use of multi-site laboratories. These include the following:

- There is concern that each of the ORD laboratories is in competition, leading to insufficient attention to long-term Agency-wide priorities.
- The ORD laboratories have a large variety of operating styles, including the balance of extramural and intramural research.
- The geographic distribution of the laboratories makes program management of the laboratories more complicated.

Extramural Issues. Concerns were raised about the balance of intramural and extramural research, including the types and quantity of the work. These concerns include the following:

- Too much extramural work is done, leading to weakness in the EPA staff.
- The EPA should expand the amount of extramural research.

- Recent studies appear to show serious problems with the procurement and contracting process. Procurement is found to be too complex and time-consuming, while contract administration has become too complex, reducing the productive time of scientists.

Human Resource Development. Several personnel policy issues were identified, including the following:

- ORD has a technical ladder. This needs to be enhanced, and other laboratories should institute such ladders for their scientific staff.

- The ORD has a low turnover rate and a high proportion of white male researchers. This implies a relatively low rate of introduction of new ideas and people. Many ORD laboratories have researchers in a relatively narrow age cohort, leading to concerns about loss of experience when the cohort retires.

- There is a lack of uniformity in application of personnel policy and procedures.

Compensation. One study found that compensation levels were not a major problem in the research area.

Leadership. One study identified the rapid turnover of ORD leadership, especially in the first 15 years of ORD, as a major contributor to organizational problems.

3.3 SUMMARY OF PREVIOUS STUDIES

A variety of studies have been conducted to evaluate the research quality and service delivery of the EPA laboratories; some of these studies have focused on EPA, while others have evaluated the overall federal environmental research effort. While all of the studies offer insights into the laboratory operations and research policies of EPA, none have had the direct focus of the present study—to evaluate all of the EPA laboratories, both from a policy and an operations point of view. The studies have widely varying major and minor findings and disparate recommendations; however, all indicate a high level of concern that the research and regulatory support policies of the EPA are not well balanced, and that there remains a relatively high level of confusion as to the most appropriate roles for the EPA laboratories.

SECTION 4

CURRENT LABORATORY MISSIONS AND OPERATIONS

4.1 SCIENTIFIC AND TECHNOLOGICAL MISSIONS

4.1.1 EPA's Mission

In the Message of the President, which accompanied Reorganization Plan No. 3 under which the EPA was established in 1970, the roles and functions of EPA were specified to include the following:

- The establishment and enforcement of environmental protection standards consistent with national environmental goals

- The conduct of research on the adverse effects of pollution and on methods and equipment for controlling it, the gathering of information on pollution, and the use of this information in strengthening environmental protection programs and recommending policy changes

- Assisting others through grants, technical assistance, and other means in arresting pollution of the environment

- Assisting the Council on Environmental Quality in developing and recommending to the President new policies for the protection of the environment

As part of the ongoing National Environmental Goals project, EPA's Office of Policy, Planning and Evaluation has conducted internal roundtables and has produced a draft analysis of EPA responsibilities in protecting the environment (U.S. EPA, Draft, 23 March 1994). This report summarizes 13 major statutes that form the legal basis for the EPA programs; the 13 statutes are summarized below:

- **Pollution Prevention Act** states that it is the policy of the United States that pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.

- **Clean Air Act** (CAA) gives the states specific deadlines for meeting the air quality standard and requires states and the federal government to make constant progress in reducing emissions. It requires technology controls on air toxics to be achieved within 10 years of enactment (2000). It requires a permanent 10-million-ton/year reduction in sulfur dioxide emissions from 1980 levels and a 2-million-ton/year reduction in nitrogen oxides from 1980 levels. It establishes dates for phasing out ozone-depleting substances: 2000 for chlorofluorocarbons, halon, and carbon tetrachloride; 2002 for methyl chloroform; 2030 for hydrochlorofluorocarbons.

- **Clean Water Act** has as its objective the restoration and the maintenance of the chemical, physical, and biological integrity of the nation's waters.

- **Ocean Dumping Act** declares that it is the policy of the United States to regulate the dumping of all types of materials into ocean waters and to prevent or strictly limit the dumping into ocean waters of any material that would adversely affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities.

- **Safe Drinking Water Act** directs EPA to develop national drinking water regulations for public water systems, underground injection control regulations to protect underground sources of drinking water, and groundwater protection grant programs for the administration of sole-source aquifer demonstration projects and for wellhead protection programs.

- **Solid Waste Disposal Act** (SWDA) and **Resource Conservation and Recovery Act** (RCRA) declare it to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste that is nevertheless generated should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment.

- **Comprehensive Environmental Response, Compensation, and Liability Act** (CERCLA) **(Superfund)** provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment and the cleanup of inactive hazardous waste disposal sites. The 1986 amendments to the Superfund law required EPA to begin physical, on-site cleanup of at least 175 new (after 1986) sites by 1989, and at another 200 sites within the following two years. There are no deadlines for finishing this work.

- **Emergency Planning and Community Right-to-Know Act** requires local planning to cope with chemical emergencies and ensures that responsible officials are provided with information from local businesses about their activities involving hazardous chemicals. This act mandates the development of a national inventory of releases of toxic chemicals from manufacturing facilities, which is called the Toxic Release Inventory (TRI). The purpose of the TRI is to provide information to the general public about chemicals to which they may be exposed.

- **Toxic Substances Control Act** (TSCA) states that authority over chemical substances and mixtures should be exercised in a manner that would not impede unduly or create unnecessary economic barriers to technological innovation while fulfilling the primary purpose of this act—to ensure that such innovation and commerce in such chemical substances and mixtures do not present an unreasonable risk of injury to health or the environment.

- **Federal Insecticide, Fungicide, and Rodenticide Act** (FIFRA) regulates the marketing of economic poisons and devices.

- **Environmental Research, Development, and Demonstration Authorization Act** authorizes all EPA's research and development (R&D) programs.

- **National Environmental Education Act** states that it is U.S. policy to establish and support a program of education on the environment through activities in schools, institutions of higher education, and related educational activities, and to encourage postsecondary students to pursue careers related to the environment.

- **National Environmental Policy Act** has four purposes: to declare a national policy that will encourage productive and enjoyable harmony between man and his environment; to promote efforts that will prevent or eliminate damage to the environment and biosphere and will stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the nation; and to establish a Council on Environmental Quality.

In summary, the provisions in these acts and the Reorganization Plan require EPA to do the following:

- Identify environmental and human health problems

- Understand fundamental natural processes controlling impacts on the environment and health

- Understand specific mechanisms of environmental or health damage
- Develop approaches to counter harmful influences or promote environmental enhancements
- Develop regulatory tools to implement environmental and health protection strategies
- Monitor progress and provide assurance that environment and health are adequately protected
- Share information with other organizations and institutions, and with the public

EPA's mission activities can be grouped into four broad elements, shown in Figure 4-1:

- Research
- Regulation
- Response to emergencies
- Information dissemination

These broad mission elements have been translated by legislation and court decisions into specific Agency roles and obligations, that together represent the working-level definition of the Agency mission. In Figure 4-1, designed by MITRE, the main elements of the EPA mission are reduced to operational components that must be supported by the offices and the staff of the Agency in order to accomplish the mission. These operational components define EPA's requirements for scientific and technological support in order to fulfill its mission. The EPA laboratories have stated missions that, it can be shown, support this hierarchy of mission elements.

Figure 4-1 places environmental protection as the highest purpose of EPA; subsidiary mission elements fall out from that. It has been suggested that the Agency mission ought to be expanded to include environmental scientific leadership along with environmental protection and certain suggestions for reorganizing the laboratories are aimed specifically at enhancing the Agency's scientific leadership role. The elements of EPA's mission might not be altered thereby, but the relative emphasis on them would change and presumably the allocation of resources as well.

The program offices, as a rule, are the main consumers of scientific and technological support within the Agency.

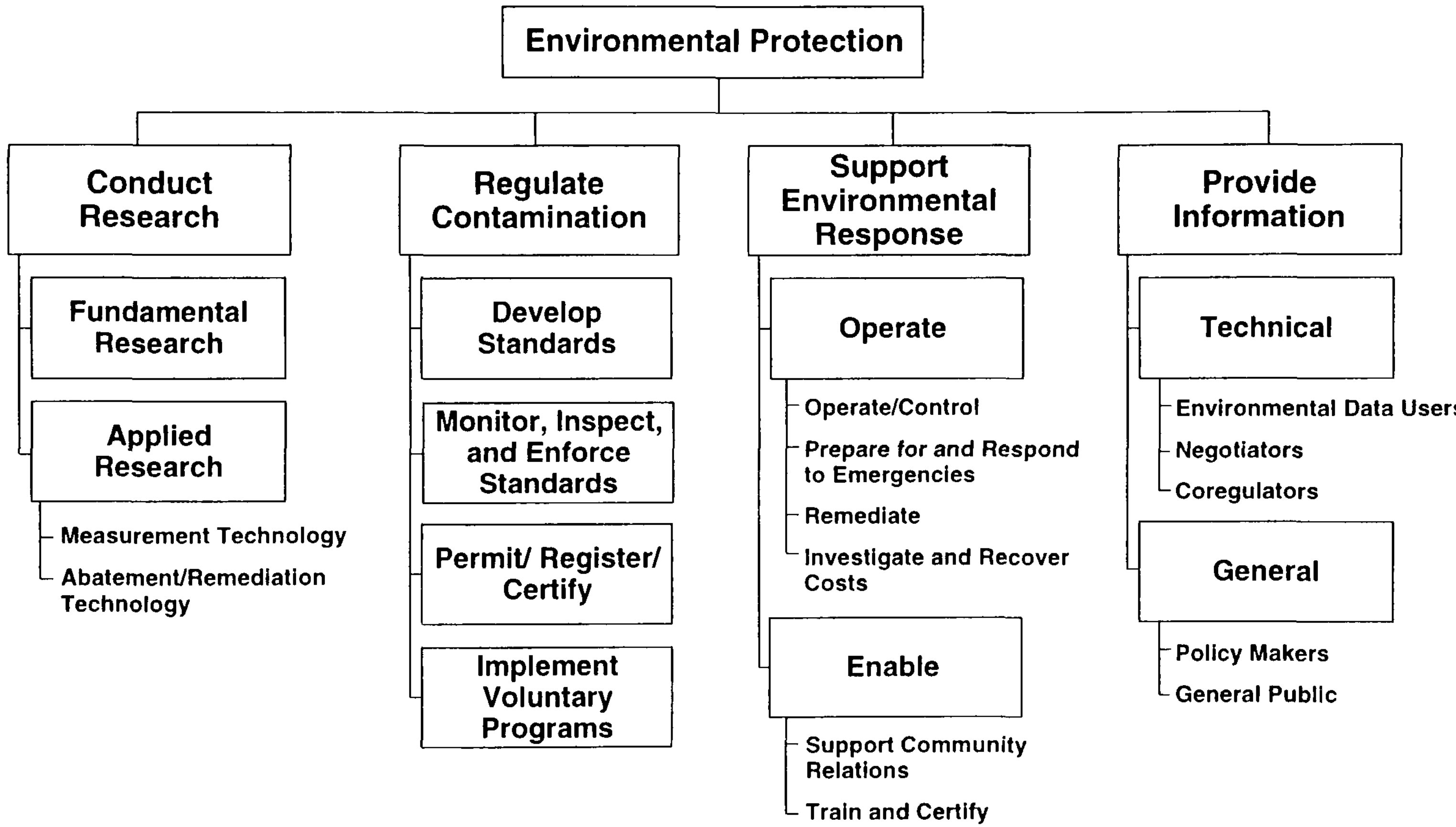


Figure 4-1. Mission of EPA, Showing Derivative Operational Components

4.1.2 Scientific and Technological Functions

EPA addresses its scientific and technological requirements through activities that can be grouped under a number of scientific and technological functions. These functions were identified and defined in the Study Plan and were agreed upon by the Steering Committee. The functions described below have been used throughout the study as the principal means to organize the information gathered with respect to the laboratories.

Application-Directed Research: Research directed to the solution of defined problems, based on existing scientific understanding, where such solutions may involve the creation of new processes, procedures, methodologies, or situations that will serve a practical or useful purpose.

Examples include construction of pollutant fate models, laboratory-scale characterization of pollutant degradation processes, formulation of ecological risk assessment frameworks, integration and evaluation of information on pollutant effects and exposure to estimate risks to human populations or ecosystems, and creation of new monitoring or measurement methods.

Fundamental Research: Theoretical or experimental investigations to advance scientific knowledge where such knowledge is relevant to understanding the environment, pollution, or human health, but immediate practical application is not a direct objective.

Examples include mechanisms of chemical carcinogenesis, functioning of ecosystems, biosensors for pollution monitoring, the use of computers and theoretical understanding to predict a chemical's fate in the environment, understanding and quantifying the reactions that determine the persistence of organic chemicals, pharmacokinetics, mechanisms of bioavailability, and clinical and animal studies of the mechanisms of toxicity.

Development: The work required to bring a new process, technique, methodology, or piece of equipment to the production or application stage.

Examples include field calibration and testing of models that predict movement of chemical constituents in the environment, field validation of monitoring methods, pilot/field optimization of sediment and aquifer remediation processes, and pilot-scale optimization of control technologies.

Enforcement/Compliance: Application of technical knowledge and methods to support enforcement/compliance activities to determine conformance with regulations and permits.

Examples include facility compliance inspections, compliance sampling inspections, criminal and civil enforcement investigations, emergency response support, and state and contractor oversight.

Monitoring: The application of skills, techniques, equipment, and facilities primarily for determining ambient conditions or status and trends of the environment, including quality assurance (QA) and quality control (QC) activities associated with monitoring.

Examples include sample plan design, collection, analysis, data validation and interpretation, data management, special studies, contract management, and report preparation.

Quality Oversight: This function consists of QA and QC.

- **Quality Assurance** is an integrated system or program of activities involving planning, quality control, quality assessment, reporting, and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

  Examples include auditing processes to ensure that planning, implementation, and assessment activities are conducted according to approved documentation.

- **Quality Control** is an overall system of routine technical activities for the purpose of measuring and controlling the quality of a product or service so that it meets the needs of the user.

  Examples include development of data quality objectives, definition of sample collection protocols, definition of the number of QC/reference samples to be incorporated into the analytical runs, laboratory and field audits and inspections, and sample analysis.

Technical Assistance and Services: Transferral of technical information to customers such as EPA program offices, other federal agencies, states, tribes, foreign governments, international agencies, academia, the general public, and others.

Examples include interpretation and application of existing knowledge to rule-making activities, answers to policy questions, expert testimony, experimental design, expert/peer review and comment, training, and response to environmental emergencies; removal programs under the Superfund program; special-purpose environmental assessments that address problems within a region; and assisting state and local agencies in enhancement of their abilities to accept delegated authority.

Technology Transfer: Technical activities that involve dissemination of new technological information to (1) potential users at the regional, state, local, and international levels, (2) the general public, and (3) the regulated community. This may include technical document editing or production.

Examples include technology demonstrations and support of licensing of intellectual property.

Analytical Support: Full spectrum of routine and special analytical testing services that support specific media program activities, inherently governmental functions, and regional management priorities using Agency-approved methodologies.

Examples include analytical services that measure physical, chemical, microbiological, and biological parameters mandated by SWDA; Clean Water Act/Water Quality Act; Marine Protection, Research, and Sanctuaries Act; CAA; FIFRA; RCRA; TSCA; and CERCLA/Superfund Amendments and Reauthorization Act in all types of media.

State and Local Oversight: Review and management of state and local grants and cooperative agreements and contracts in support of Agency-wide monitoring and cleanup programs.

Examples include oversight of State 105/106/305B/319 grants, Superfund Contract Laboratory Program, Superfund contractors, interagency agreements, and Superfund and RCRA data validation activities.

Emergency and Episodic Response: In-house, multi-disciplinary scientific and technological capabilities necessary to provide quick, flexible responses to a broad range of media program priorities and hazardous episodes.

Examples include rapid deployment of emergency and investigation personnel and on-site laboratory support providing quick analytical turnaround.

Table 4-1 illustrates the relationship of these scientific and technological capabilities to the mission of the Agency. Supporting the four broad mission elements are the operational components, each component requiring scientific and technological support. This table was derived by asking which scientific and technological functions are necessary to successfully perform each mission element. The scientific and technological support needs for each of the four broad mission areas and the subsidiary mission elements are briefly outlined below; scientific and technological functions are indicated by italics.

Table 4-1. EPA Mission Elements Linked to Scientific and Technological Functions

Scientific & Technological Functions	EPA Mission Elements													
	Conduct Research		Regulate Contamination				Support Environmental Response						Provide Information	
	Funda-mental	Applied	Develop Standards	Monitor, Inspect, and Enforce Standards	Permit/ Register/ Certify	Implement Voluntary Programs	Operate/ Control	Prepare for and Respond to Emer-gencies	Remediate	Investigate and Recover Costs	Support Community Relations	Train and Certify	Envir Data Users, Negotiators, Coregulators	Policy Makers, General Public
Application-Directed Research		X	X	X	O			X	X	O				
Fundamental Research	X	X	X						X					
Development			X	X	O	O		X	X	X		X		
Enforcement/ Compliance				X	X									
Monitoring	X	X		X				X	X	X	X			
Quality Oversight	X	X	X	X	X	O			X	X		X		
Technical Assistance & Services		X	X	X	X	X		X	X	X	X	X	X	X
Technology Transfer		X				X		X	X		X	X	X	X
Analytical Support	X	X		X	X			X	X	X	X			
State/Local Oversight				X	X				X			X		
Emergency & Episodic Response				X				X			X	X		

X Major Requirement
O Minor Requirement

Conduct Research

EPA's environmental research includes **fundamental research** to explore open issues regarding fundamental processes, measurement concepts, and impacts of contamination on human health and the environment; conducting fundamental research requires a *fundamental research* capability in terms of staff qualifications, facilities, work environment, and budgetary timeframe. Other scientific and technological needs for supporting fundamental research include *quality oversight* (for internal and external peer review of the scientific product) as well as *monitoring* and *analytical support* capabilities for those research projects requiring data collection and/or sample analysis.

Applied research is needed to ensure that the measurement and remediation/abatement technologies that could logically flow from conducting fundamental research are realized. A strong applied research program benefits from direct access to the *fundamental research* capability that can provide a fundamental understanding of the basic science issues underlying the application. *Quality oversight* is needed for internal and external peer review, while *monitoring* and *analytical support* capabilities are essential scientific and technological functions for those applied research projects needing them. *Technical assistance and services* needed for support of applied research include inter- and intra-laboratory communications for providing access to the basic researchers. Effectiveness of applied research requires that some *technology transfer* process be in place to ensure that the resulting technology is publicized and made available.

Regulate Contamination

In its role as regulator of contamination and the processes and practices that lead to contamination, EPA carries out four basic activities, each calling for a range of scientific and technological support. In conducting its mission to **develop standards,** EPA requires access to *fundamental* and *applied research* capabilities to provide the scientific and technological basis for creating a new standard. *Fundamental research* is likely to be of major importance when dealing with standards affecting human health; *applied research* is needed to ensure the feasibility of measuring the targeted species in the regulated environment. *Development* capabilities ensure the availability of the instrumentation, test facilities, and models needed to implement and enforce the standard. A *quality oversight* capability is needed to ensure an accurate and credible quantitative analysis when developing new standards. Access to *technical assistance and services* capabilities is needed to provide the necessary scientific and technological feasibility assessments.

The part of EPA's mission calling for the Agency to **monitor, inspect, and enforce standards** calls for availability of a wide range of scientific and technological services. Both *application-directed research* and *development* capabilities are needed to provide this mission element with the measurement methods needed to enforce new regulations. *Monitoring* capability is needed to support enforcement, while *quality oversight* support is needed to sustain challenges to enforcement actions. The need for expert testimony exemplifies the need for *technical assistance & services*, while regional enforcement activities require *analytical support. State and local oversight* support is needed for dealing with programs delegated to local governments, while *emergency & episodic support* may be useful if information gathered during such support activities could be useful in subsequent legal actions.

Regulating contamination requires that EPA **permit/register/certify** operations, processes, and personnel involved in regulated activities and operations. To sustain this mission element, EPA requires access to *application-directed research* and *development* capabilities to support the development of measurement and certification tools—for example, the development of instrumentation and test procedures to support automotive emissions testing. *Enforcement and Compliance* capabilities are required for a host of compliance monitoring and testing functions (e.g., automotive emissions testing). There is a need for a *quality oversight* capability to certify the quality of data submitted by regulated parties (e.g., data furnished by the states to show that the Air Quality Control Regions meet National Ambient Air Quality Standards) and for a *technical assistance and services* capability to address questions and issues raised by permit writers and applicants. The need for *analytical support* capability arises from the requirements for testing samples to ascertain violations and/or health threats. *State and local oversight* capability is needed for dealing with cooperative agreements and shared/delegated responsibilities.

To **implement voluntary programs**, EPA may need access to its *development* capabilities for such purposes as sustaining the technological basis for the programs. *Quality oversight* can provide assurances to the public of the quality of the volunteer program (e.g., the quality of Radon detectors). *Technical assistance and services* capabilities could be employed to provide expert consultation on the voluntary programs, while *technology transfer* capability might be called for in the joint publication of voluntary program products.

Support Environmental Response

Under this mission area, EPA must **prepare for and respond to emergencies**. Both *application-directed research* and *development* capabilities are needed to support the preparation for rapid and effective response to potential emergencies. *Monitoring* capabilities are needed to track, assess, assure safety, etc., during emergency episodes. EPA needs *technical assistance and services* capabilities to provide technical support to all the other involved parties in an episode, including state and local governments and the public. *Technology transfer* capability is needed to assist with the transfer of technical information and expertise within the response teams, to outside technical organizations, and to governmental and public organizations. The rapid turnaround of test results required to characterize an emergency demands the availability of a dependable *analytical support* capability.

Supporting environmental response calls for an EPA capability to **remediate** environmental problems. To sustain a remediation capability, the Agency requires a *fundamental research* capability to establish basic understanding of environmental processes and effects, including ecological and human risk. Both *application-directed research* and *development* capabilities are needed to build the methods, techniques, tools and procedures needed to effect the remediation. *Monitoring* and *quality-assurance* capabilities are needed to support planning, measurement of progress, and assurance of safety. The *technical assistance and services* capability supports contractors, PRPs, and others, and provides expert testimony associated with the remediation aspects of and environmental response. EPA must be able to disseminate techniques, technologies, and methods, and must be able to communicate its actions to the general public, all of which calls for a strong *technology transfer* capability. There is a need for routine *analytical services* capability to support every phase of the remediation effort. A *state/local oversight* capability is required for dealing with situations involving delegated programs.

Another aspect of EPA's mission element to support environmental response is the requirement that EPA be in a position to **investigate and recover costs**. To fulfill this mission element, the Agency needs access to both *application-directed research* and *development* capabilities to provide essential field and laboratory techniques, tools, and procedures for fingerprinting wastes and disposers. Strong *monitoring* and *quality oversight* capabilities and needed to support the investigation of recovery cases and to ensure legal defensibility. A *technical assistance and services* capability may be needed to support expert witnesses while an *analytical services* capability serves to support the investigation and building of cases.

A key element for success in this mission area is EPA's ability to **support community relations**. To support this activity, EPA needs a *monitoring* capability to enable it, with accuracy and credibility, to inform and reassure the public. *Technical assistance and services* and *technology transfer* capabilities serve to facilitate the transfer of scientific information, methods, and interpretations to community agencies, groups, and the public, while an *analytical support* capability enables EPA to inform and reassure the community. An *emergency and episodic response* capability is required to provide the public with essential and credible information in a timely manner.

EPA must be able to **train and certify** personnel and contractors who are to be involved in environmental response efforts. The need for training tools and methods requires EPA access to a *development* capability. A *quality oversight* capability is needed to support laboratory certification. *Technical assistance and services* and *technology transfer* capabilities are needed to support the flow of information needed for training, both within and outside the Agency. *State and local oversight* capability is needed to support EPA's training and certifying of state laboratories and technicians. To support the development of training courses for emergency response, EPA needs access to an internal *emergency and episodic response* capability.

Provide Information

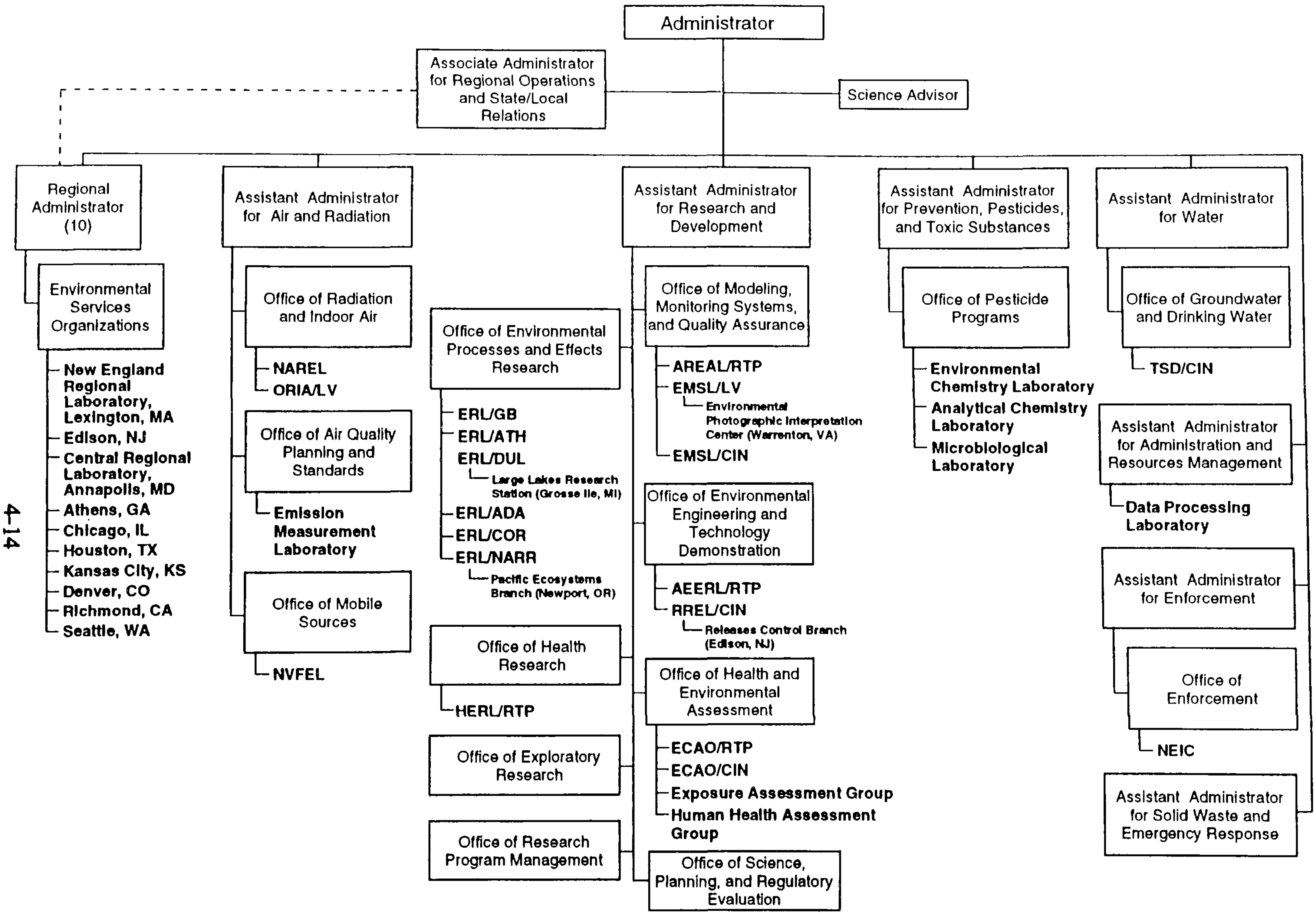
The Agency is called on to provide **technical** and **general** information to a varied audience. Technical information is needed by coregulators (state and local officials), contractors, negotiators, and policy makers, while general information is needed to inform and reassure the public. To support this information dissemination mission element, EPA needs access to *technical assistance and service* and *technology transfer* capabilities to provide the desired information in a credible, understandable, and timely manner.

Table 4-1 illustrates the linkage between top-down analysis of the Agency mission and the bottom-up enumeration of actual activities since both are tied explicitly to the list of scientific and technological requirements. While there are no surprises in this table, it does illustrate that the scientific and technological activities performed by the laboratories respond to legitimate Agency needs. It does raise some interesting questions, however. How are these scientific and technological requirements being met now? Are needs being met in each environmental medium? Can they be met in the future, given staff and budget erosion? Could some or many of them be met better or at lower cost by extramural sources? To what extent are the laboratories already aligned according to these scientific and technological requirements, and could they be better aligned? Could fewer laboratories accomplish the same functions adequately?

4.2 EPA'S LABORATORY ORGANIZATION

4.2.1 Current Organization

The EPA laboratories—some inherited when former government agencies were combined to create EPA and some created under EPA itself—support the execution of these mandates described above. The current laboratory structure is illustrated in Figure 4-2, where it is apparent that the management and reporting relationships are widely distributed throughout the Agency. The total number of FTEs in the ORD laboratories is shown in Figure 4-3, while the total number of FTEs in the program offices



Note: Laboratories are shown in bold type

Figure 4-2. Current Laboratory Structure

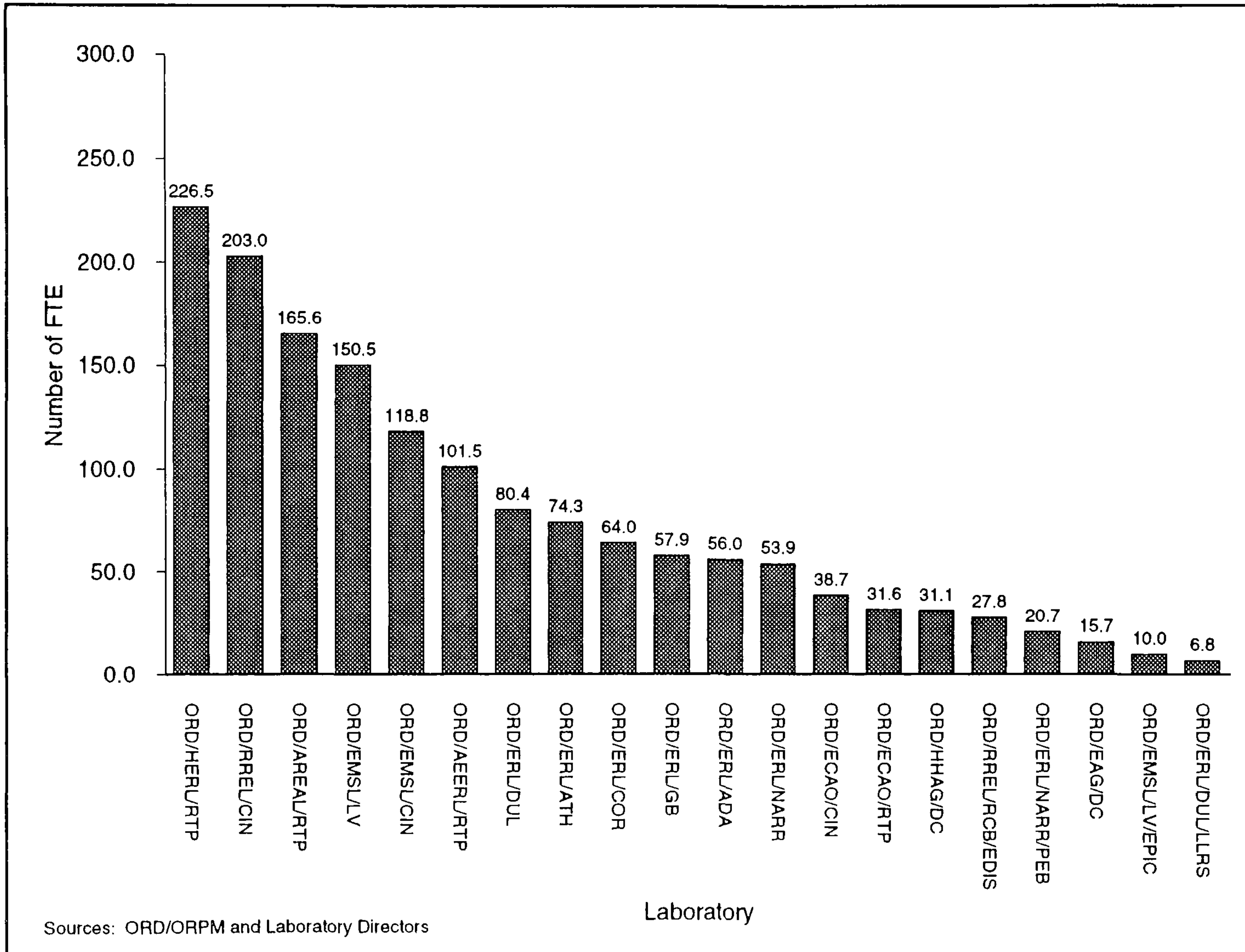


Figure 4-3. Number of FTE Staff (FY94)
ORD Laboratories

and ESOs is shown in Figure 4-4. The number of employees at the laboratories ranges from several hundred in a few of the laboratories to less than fifty in about half of the laboratories.

While the laboratory reporting structure for program offices and ESOs is fairly direct, the reporting structure for ORD is far more complex. The program offices report to their respective headquarters functions directly, and the chain of command is straightforward. ESO laboratories vary slightly from region to region, but, for the most part, reporting is done through the Environmental Services Division to a regional administrator. ORD has a complex reporting structure at the headquarters level that is described below.

The AA for R&D is responsible for the development, direction, and conduct of a national program of research, development, and demonstration. Within that office are located the following organizations:

- Office of Research Program Management (ORPM) has primary responsibility for budgeting, accountability, financial planning and review, management of human and other resources, and policy development and analysis. In 1994, 61.5 FTEs were assigned to this office, with the effort split mainly between the activities of research program planning and management, and administrative support.

- The Office of Science, Planning and Regulatory Evaluation (OSPRE) acts as an integrator and disseminator of ORD information products to the program offices, regional office, and other users inside and beyond the Agency. OSPRE manages the issue-based research planning process, and has a current FTE ceiling of 32.9.

- The Office of Exploratory Research (OER) manages the Agency's anticipatory and extramural grant research effort. OER identifies the Agency's long term environmental research concerns; forecasts emerging and potential environmental problems and manpower needs; and reviews, awards, and manages grants. The 1994 FTE ceiling for OER is 20.4.

- The AA's office also includes two Offices of the Senior Official for R&D, one for Research Triangle Park (RTP) and another for Cincinnati (CIN). The primary role of these offices is coordination and outward communication for ORD laboratories located in those geographic areas. These offices have 1994 FTE ceilings of 8.6 (CIN) and 9.0 (RTP).

- The Risk Assessment Forum is allocated a ceiling of 8.8 FTEs

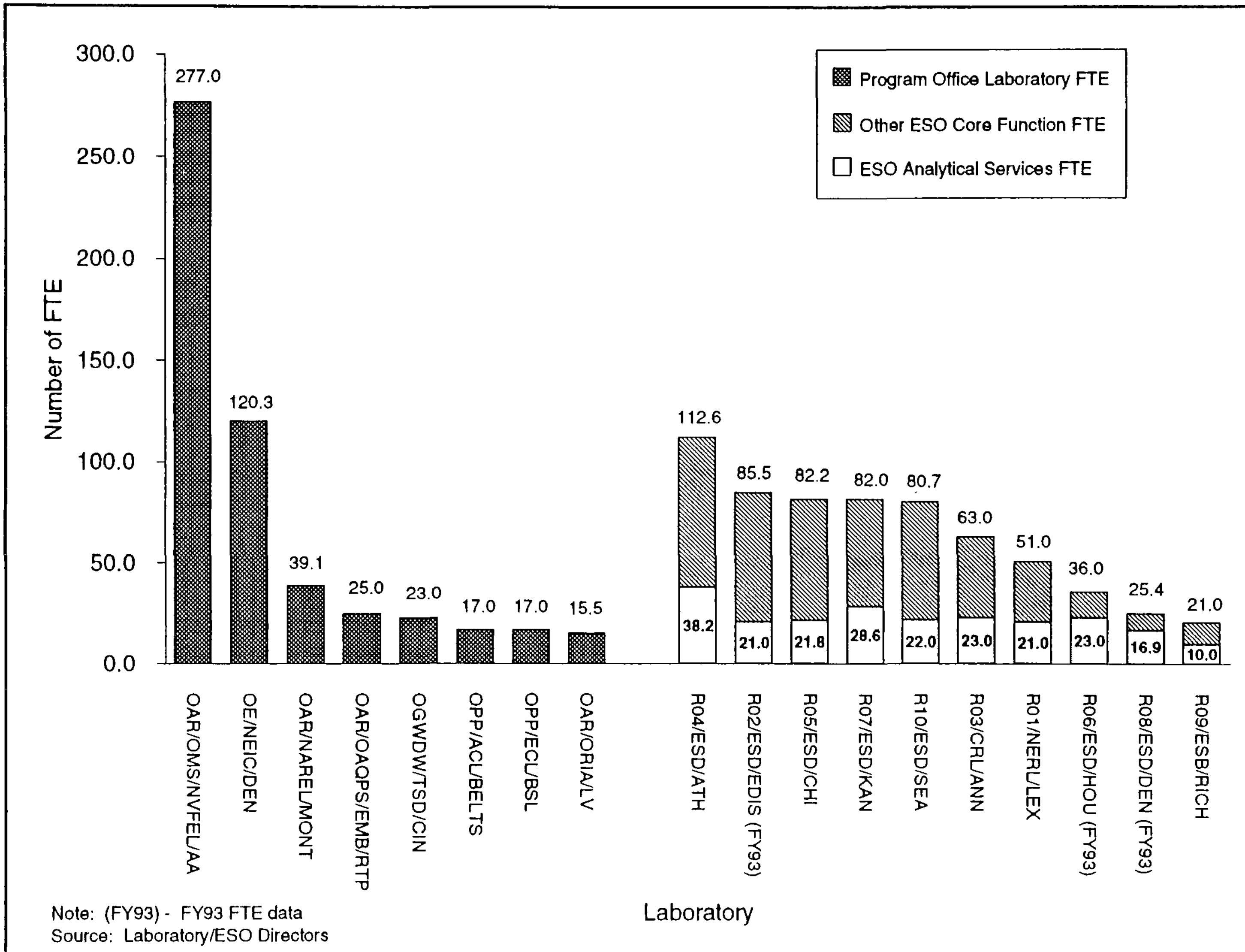


Figure 4-4. Number of FTE Staff (FY94)
Program Office Laboratories and Environmental Services Organizations

The total ceiling associated with these offices is 168.4 FTEs.

The ORD laboratories and assessment offices report to the AA for R&D through an additional five offices. These offices typically perform a full range of functions required to manage the laboratories under them: needs identification, priority setting, resource allocation, planning and budgeting support, and quality reviews. These five offices are as follows:

- The Office of Modeling, Monitoring Systems and Quality Assurance (OMMSQA) includes a Quality Assurance Management Staff, responsible for Agency-wide quality assurance policies; a Modeling and Monitoring Systems Staff; and a Program Operations Staff. These oversee and support the Atmospheric Research and Exposure Assessment Laboratory at RTP and the Environmental Monitoring Systems Laboratories at Cincinnati and Las Vegas. OMMSQA also manages the Environmental Monitoring and Assessment Program (EMAP). For 1994, the headquarters FTE ceiling is 30.

- The Office of Environmental Engineering and Technology Demonstration (OEETD) is responsible to the Assistant Administrator to ensure the timely availability of pollution control technology. OEETD includes a Program Development Staff and a Program Management Staff, with a ceiling of 28 FTEs. These oversee the Air and Energy Engineering Research Laboratory at RTP and the Risk Reduction Engineering Laboratory in Cincinnati.

- The Office of Environmental Processes and Effects Research (OEPER) includes a Program Operations Staff, a Terrestrial and Ground Water Effects Staff, and a Marine, Freshwater, and Modeling Staff, with a ceiling of 24.5 FTEs in 1994. OEPER oversees the efforts at the Environmental Research Laboratories at Athens, GA; Duluth, MN; Narragansett, RI; Ada, OK; and Gulf Breeze, FL.

- The Office of Health Research (OHR) includes a Health Research Management Staff, with a ceiling of 11.7 FTEs in 1994. These provide headquarters management of the Health Effects Research Laboratory in RTP.

- The Office of Health and Environmental Assessment (OHEA) manages the activities of the Environmental Criteria and Assessment Offices at Cincinnati and RTP, and provides a concentration of assessment resources under one organizational umbrella. The 1994 ceiling for OHEA is 17.6 FTEs

The total 1994 FTE ceiling allocated to these five offices is 111.8. The total FTE ceiling for the headquarters functions of the AA for R&D is 280.2 FTEs.

4.2.2 Missions of the Laboratories

The mission statements of the individual laboratories are provided in Appendix A. The missions of the ORD laboratories apply to carrying out R&D needs for the EPA program offices and an integrated R&D program for the Agency. ORD participates in the development of EPA policy, standards, and regulations. It provides for dissemination of scientific and technological knowledge, including analytical methods, monitoring techniques, and modeling methodologies. It serves as coordinator for EPA's policies and programs concerning health and environmental effect and ensures appropriate quality control and standardization of analytical measurement and monitoring techniques used by EPA.

The individual ORD laboratories carry out these missions, with particular emphasis on the regulatory and scientific aspects of the missions. The dichotomy of the mission focus, and the question of which is paramount, is one of the major issues for the ORD laboratories. Since the ORD laboratories are charged with providing R&D for the program offices, although they do not report directly to the program offices, the linkages between the missions of the laboratories and the missions of their clients, the program offices, may not be distinct.

The basic mission of the program office laboratories is to provide technical support to assist in regulatory development and enforcement in the mission areas of their parent program offices. Because the program office laboratories receive direction from clients who are in their chain of command, the understanding of their missions is very clear.

Each of the ten EPA regions has a laboratory to provide analytical services and technical support to the regional program offices and their customers. In addition to the laboratories, the scientific and technological functions within the ESOs include quality assurance and quality control, and field monitoring functions that are essential to the Agency's mission. Unless otherwise qualified in the text, the term ESO will include all three functions.

To a great extent, the current organizational (ORD, program office, and ESO) groupings of EPA laboratories reflect a focus of their resources on different scientific and technological functions. To illustrate this point, Figure 4-5 shows the distribution of laboratory activities, measured in FTEs, among the scientific and technological functions. A further breakdown of FTEs by function in the ORD laboratories is shown in Figure 4-6 and Table 4-2, in program office laboratories in Figure 4-7 and Table 4-3, and in ESOs in Figure 4-8 and Table 4-4.

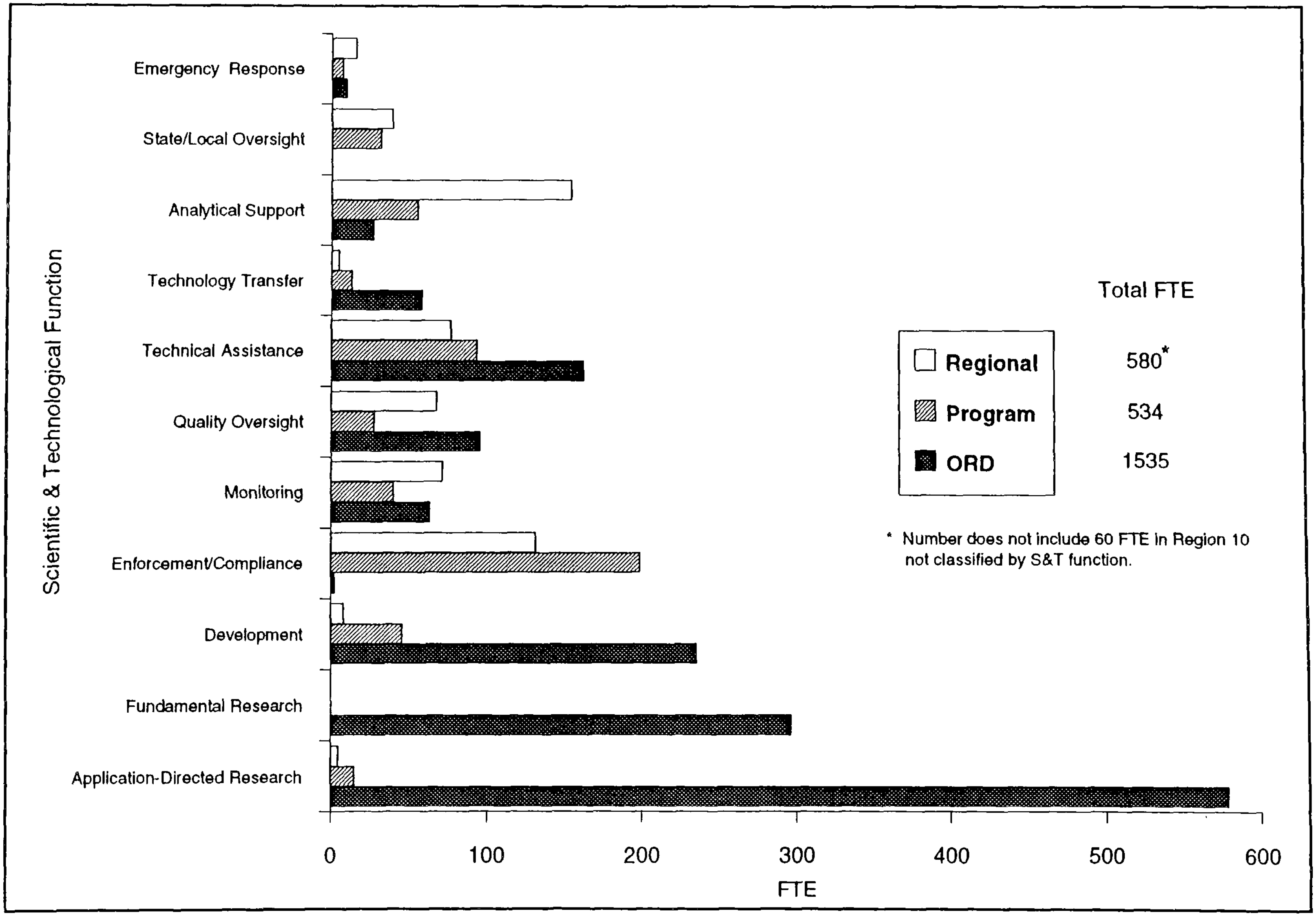


Figure 4-5. FTE by Scientific and Technological Function by Laboratory Type

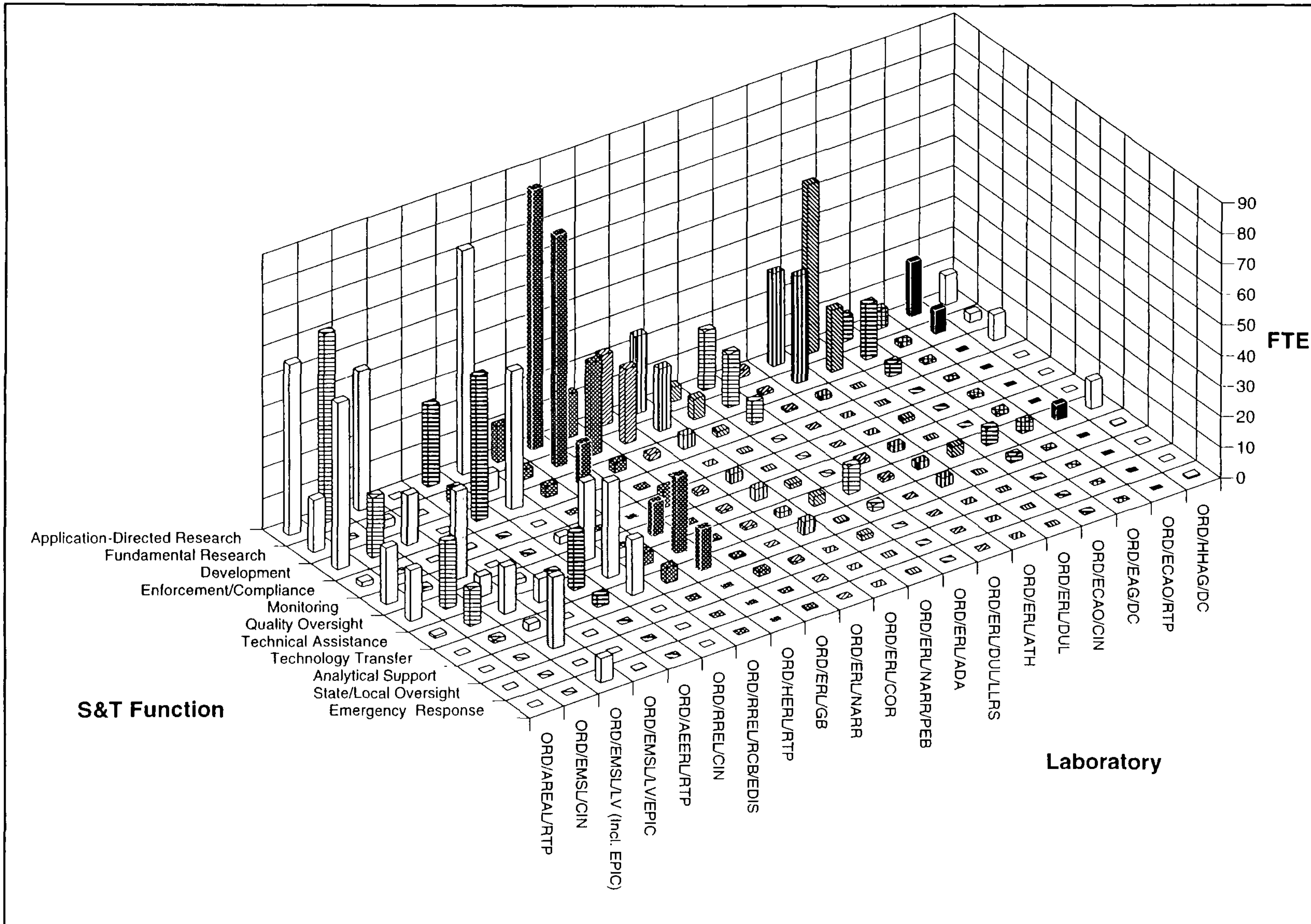


Figure 4-6. FTE by Scientific and Technological Function
ORD Laboratories

Table 4-2. Function Distribution of EPA Laboratories
ORD Laboratories

Laboratory	Function Distribution of Work Program (1)										
	Application-Directed Research	Fundamental Research	Development	Enforcement/Compliance	Monitoring	Quality Oversight	Technical Assistance	Technology Transfer	Analytical Support	State/Local Oversight	Emergency Response
ORD/AREAL/RTP	34%	10%	33%	1%	11%	10%	0%				
ORD/EMSL/CIN	52%		17%		1%	19%	10%	1%			
ORD/EMSL/LV (Incl. EPIC)	30%	2%	11%		19%	4%	10%	2%	16%		5%
ORD/EMSL/LV/EPIC				3%		17%	78%				2%
ORD/AEERL/RTP	26%	5%	47%				19%	4%			
ORD/RREL/CIN	36%	3%	22%		1%	13%	16%	9%			
ORD/RREL/RCB/EDIS	42%	11%	13%				15%	19%			
ORD/HERL/RTP	38%	34%	6%			5%	11%	6%			
ORD/ERL/GB	25%	53%	6%	1%	10%		1%	1%	3%		1%
ORD/ERL/NARR	44%	46%	4%		2%	1%	2%		1%		
ORD/ERL/COR	40%	32%	7%		5%	6%	3%	7%			
ORD/ERL/NARR/PEB	23%	33%	8%	1%		7%	15%	2%	8%		1%
ORD/ERL/ADA	35%	32%	14%				16%	4%			
ORD/ERL/DUL/LLRS	37%	13%	11%			21%	18%				
ORD/ERL/ATH	41%	47%	2%			3%	3%	4%			
ORD/ERL/DUL	69%	25%			2%		4%				
ORD/ECAO/CIN	21%	46%	11%		0%		14%	6%			1%
ORD/EAG/DC	39%	10%	5%	3%	7%	10%	23%	2%			
ORD/ECAO/RTP	58%	25%					17%				
ORD/HHAG/DC	31%	9%	27%				30%	1%			2%

(1) FTE-weighted average of laboratory activity/function data. See Appendix A, Table 1 (each laboratory).
Source (original data): Laboratory Directors

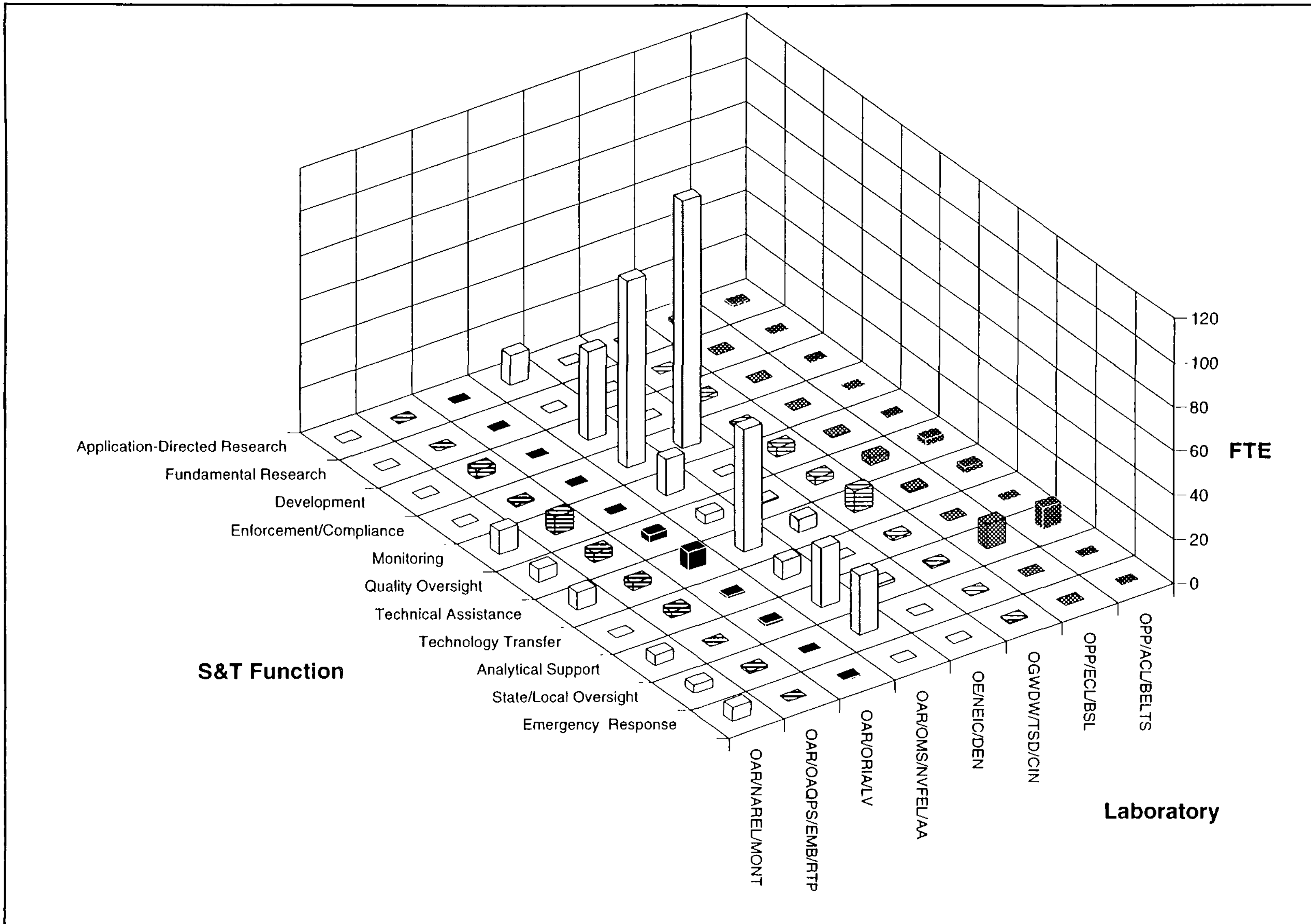


Figure 4-7. FTE by Scientific and Technological Function
Program Office Laboratories

Table 4-3. Function Distribution of EPA Laboratories
Program Office Laboratories

Laboratory	Function Distribution of Work Program (1)										
	Application-Directed Research	Fundamental Research	Development	Enforcement/Compliance	Monitoring	Quality Oversight	Technical Assistance	Technology Transfer	Analytical Support	State/Local Oversight	Emergency Response
OAR/NAREL/MONT					28%	15%	20%		12%	9%	16%
OAR/OAQPS/EMB/RTP			16%	3%	33%	18%	13%	12%		5%	
OAR/ORIA/LV						23%	54%	8%	9%	1%	5%
OAR/OMS/NVFEL/AA	5%		15%	31%	6%	1%	20%	3%	10%	10%	
OE/NEIC/DEN				93%		1%	5%		1%		
OGWDW/TSD/CIN	1%		8%	5%	19%	13%	42%	5%	3%	2%	3%
OPP/ECL/BSL	6%	0.4%			2%	19%	5%	1%	66%		
OPP/ACL/BELTS	6%		1%	1%	1%	18%	16%		58%		

(1) FTE-weighted average of laboratory activity/function data. See Appendix A, Table 1 (each laboratory).
Source (original data): Laboratory Directors

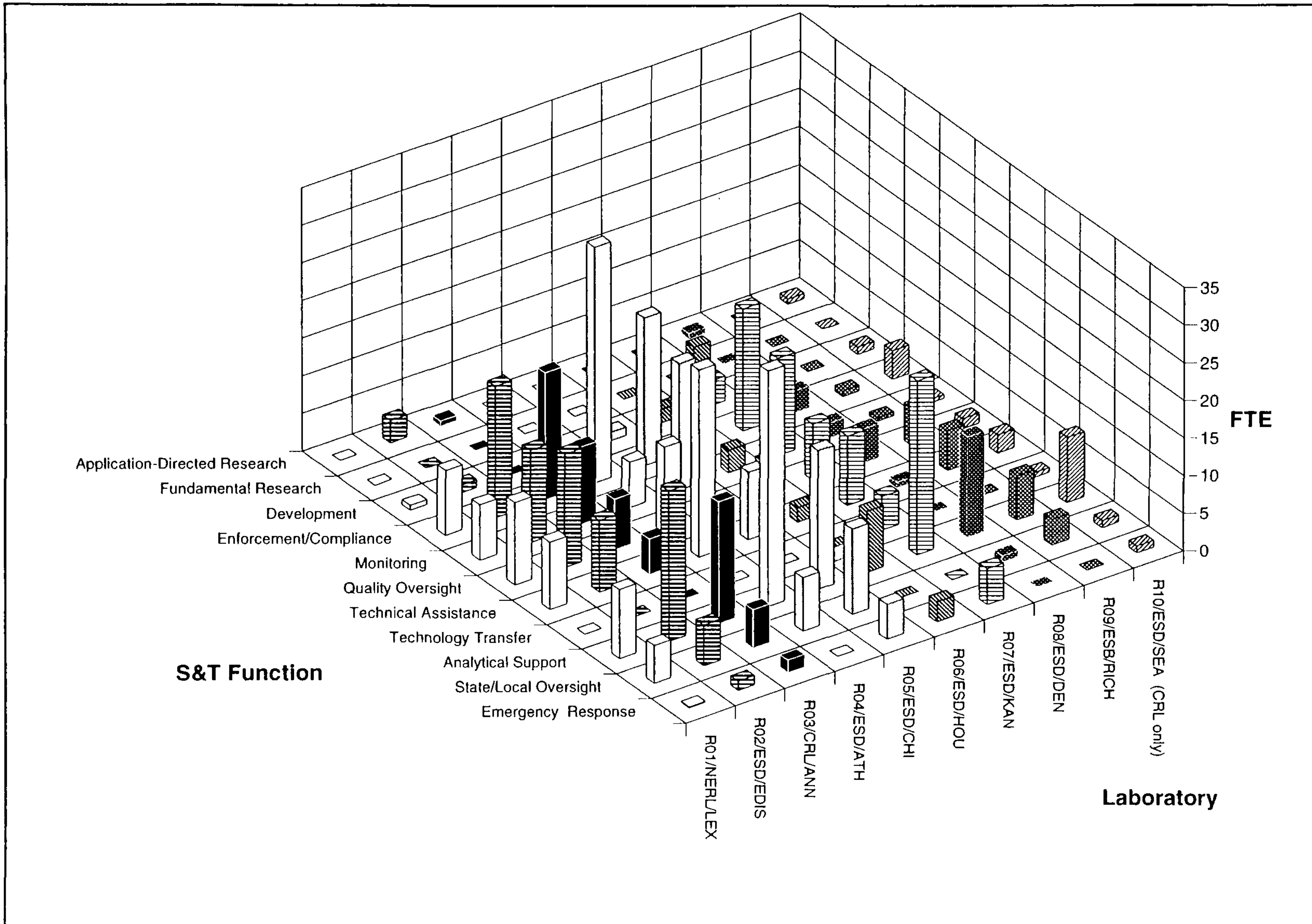


Figure 4-8. FTE by Scientific and Technological Function
Environmental Services Organizations

Table 4-4. Function Distribution of EPA Laboratories Environmental Services Organizations

Laboratory	Function Distribution of Work Program (1)										
	Application-Directed Research	Fundamental Research	Development	Enforcement/Compliance	Monitoring	Quality Oversight	Technical Assistance	Technology Transfer	Analytical Support	State/Local Oversight	Emergency Response
R01/NERL/LEX			1%	17%	14%	22%	18%		18%	10%	0%
R02/ESD/EDIS	4%		1%	21%	14%	18%	11%		24%	6%	1%
R03/CRL/ANN	1%			27%	17%	11%	8%		26%	8%	3%
R04/ESD/ATH				28%	5%	10%	22%		28%	6%	
R05/ESD/CHI			1%	24%	21%	1%	11%		23%	14%	6%
R06/ESD/HOU			5%	38%	8%	13%	6%		23%		8%
R07/ESD/KAN			4%	20%	16%	9%	11%	6%	28%		6%
R08/ESD/DEN	3%			12%	8%	18%	3%		53%	4%	
R09/ESB/RICH				4%	2%	24%	25%		28%	16%	
R10/ESD/SEA (CRL only)	3%		5%	18%	2%	6%	12%	3%	42%	5%	4%

(1) FTE-weighted average of laboratory activity/function data. See Appendix A, Table 1 (each laboratory).
Source (original data): ESO Directors

ORD's FTEs focus on application-directed research, fundamental research, and development. Most of the development and application-directed research functions are dominated overwhelmingly by the ORD laboratories, and all fundamental research is conducted by the ORD laboratories. As Figure 4-6 illustrates, this is a consistent picture across almost all ORD laboratories, and the sum of these application-directed research and development activities exceeds the resources devoted to fundamental research.

Within the program office laboratories, the highest level of effort is devoted to enforcement/compliance, technical assistance, and analytical support. Apart from a smaller scale of activities, the pattern of program office laboratory activities looks remarkably similar to that of the ESOs. The pattern is fairly consistent across all of the program office laboratories. Only the Office of Mobile Sources' National Vehicle Fuel Emissions Laboratory (NVFEL) at Ann Arbor and the Office of Ground Water and Drinking Water's (OGWDW's) Toxic Substances Division in Cincinnati report a significant fraction of their effort in development or application-directed research. Taken together, these data suggest that many common scientific and technological functions are performed by two distinct laboratory types, focusing perhaps on different aspects of the mission, but nonetheless reporting to a large variety of independent organizations, the associated program offices, and the ten regions.

To execute its mission as defined by new legislative mandates, the Agency typically must translate generalized health, ecological, and welfare goals into quantitative and enforceable standards, and must back those up with data, analysis, methods, technologies, and procedural guidelines. The offices charged with these tasks require direct, close support from the best scientific and technological assets of the Agency. This support is required to evaluate current scientific understanding of a problem and to assess the capabilities of current technologies to measure and control the target phenomenon. The development, application-directed research, and fundamental research functions are the source of this support.

The scientific and technological functions associated most closely with the development phase of mission execution are technical assistance (to the program offices), monitoring, development, and application-directed research. Referring to Figure 4-7, it may be seen that the program office laboratories devote resources to the first two categories (in some degree as part of implementation), but devote almost none of their resources to development and application-directed research.

The three functions showing the highest number of FTEs within the ESOs are analytical support, enforcement/compliance, and technical assistance. It should be noted that ORD laboratories provide as much technical assistance as the ESOs and program office laboratories combined. A consistent clustering may be seen among the scientific and technological functions other than fundamental research, application-directed research, and development. The only exceptions are small amounts of effort in Regions 2, 5, and 10 devoted to application-directed research and to development, much of which is devoted to the methods development required to adapt generalized methods and practices to local situations. There is no real pattern in the distribution of effort among the scientific and technological functions across the ESOs.

It is reasonable to expect that the laboratory missions and their activities can be justified directly by support to the mission of the Agency, as translated from legislative mandates into an array of scientific and technical requirements. Even for fundamental research, the customer could be regarded as the program office or other organization charged with meeting a specific legislative mandate. MITRE's interviews with the ESOs and the program office laboratories consistently revealed a consensus in line with this view—the most important customer is the program office or regional program office that is attempting to execute the Agency mission. However, some interviews with the ORD laboratories offered a very different view. ORD scientists consider the scientific community, academia, and the general public as a whole to be clients with at least as much importance as the program offices that are implementing the laws.

The lack of ORD laboratory focus on program office needs, where it exists, can be explained by two observations from the MITRE data collection effort. First, the work and clientele of many of the ORD laboratories is varied; this works against strong partnerships with program offices. Second, some ORD scientists expressed what may be a common opinion that they, as senior scientists, know much better than program office personnel or particular issue planners what type of research needs to be conducted for the best long-term benefit of the Agency mission.

Thus, scientific and technological functions that are vital to the program offices are provided by laboratories that answer to an independent chain of command, and include the competing long-term research function. This approach of organizing activities under an independent chain of command could be effective, if that organization served to identify and meet the needs of program office customers as precisely, directly, and inexpensively as feasible. If, on the other hand, that organization has a view of itself as an independent R&D organization planning and executing its program in response to its own conception of the work that needs doing, it will inadvertently introduce barriers between the program office clientele and the close-support science resources that the program offices require to do their job. This will be exacerbated if the R&D organization answers to another clientele for important functions.

It was noted above that MITRE has found concern in the program offices with the focus of ORD laboratory activities intended to support their regulatory development functions. This may be predicted from the above, since ORD management attempts to mediate the demands of program offices on its laboratories by inserting the issue-based planning process. That process encompasses, under the issues, work both in support of the program offices and the long-term research phase (aimed at a more universal scientific clientele, and perhaps more highly valued by the scientists on staff). Further, the issue-based planning process is longer term in its perspective than the day-to-day scientific and technological support needs of the program offices frequently are. These circumstances can be expected to inhibit the direct service ORD laboratories can provide to their program office customers, and thus to the Agency's execution of the development phase of its mission.

4.2.3 Laboratory and Mission Alignment

The linkage between EPA's missions and the scientific and technological functions was discussed in Section 4.1 and the results are shown in Table 4-1. Information obtained from the laboratories permits identification of the linkages between the scientific and technological functions addressed by the laboratories and the environmental problems encompassed by EPA's mission. These linkages are shown in Table 4-5. Most of the environmental problems are being addressed by at least one laboratory and in some cases a number of laboratories are actively engaged. It is noteworthy that no laboratory is performing application-directed research on multimedia problems, and that none of the laboratories are engaged in application-directed research or fundamental research, or provide state and local oversight on pesticides.

4.3 ACTIVITY PLANNING

Within the functions described in Section 4.1 lie the individual projects and tasks performed by the various laboratories and core ESOs. Planning for and assignment of these projects and tasks varies among the three types of laboratories.

4.3.1 ORD and Issue-Based Planning

The process differs greatly for the ORD laboratories. Their projects and tasks now originate from a planning process conducted within EPA known as issue-based planning. Beginning with an overall strategic planning effort, ORD has established a three-tiered approach to planning its research efforts, beginning with a strategic plan for ORD for the next five to ten years. This plan focuses research into six areas including the following:

- Research that addresses questions related to defining or ameliorating high-risk areas

Table 4-5. Distribution of Laboratory Functions by Environmental Problem

Environmental Problem	Scientific and Technological Functions										
	Analytical Support	Application-Directed Research	Development	Emergency/ Episode Response	Enforcement/ Compliance	Fundamental Research	Monitoring	Quality Oversight	State/ Local Oversight	Technical Asst & Service	Technology Transfer
Air	ESO NVFEL/AA	AEERL/RTP AREAL/RTP ERL/ATH ERL/COR ECAO/RTP HERL/RTP	AEERL/RTP AREAL/RTP EMB/RTP ESO NVFEL/AA	ESO	NEIC/DEN ESO NVFEL/AA	AREAL/RTP AEERL/RTP ERL/COR	AREAL/RTP EMB/RTP ESO	AREAL/RTP EMB/RTP ESO	ESO NVFEL/AA	AEERL/RTP ECAO/RTP EMB/RTP ESO NVFEL/AA	AEERL/RTP EMB/RTP ESO
Radiation	EMSL/LV NAREL/MON ORIA/LV ESO	EMSL/LV NAREL/MON	EMSL/LV ERL/ADA	NAREL/MON ORIA/LV	NEIC/DEN ESO		EMSL/LV ESO NAREL/MON	EMSL/LV NAREL/MON	NAREL/MON	EMSL/LV NAREL/MON ORIA/LV	ORIA/LV
Soils/Terrestrial	ESO RREL/CIN	EMSL/LV ERL/ADA ERL/ATH ERL/COR ERL/NAR RREL/CIN	ERL/ADA ERL/ATH RREL/CIN ESO	ESO	NEIC/DEN ESO	ERL/ADA ERL/ATH ERL/COR RREL/CIN	EMSL/LV ESO	ESO	ESO	ERL/ADA RREL/CIN ESO	ESO
Marine/Estuarine Water	ESO	ERL/ATH ERL/GB	ERL/GB ERL/NARR	ESO	NEIC/DEN ESO	ERL/GB ERL/NARR	ERL/GB ESO	ESO	ESO	ERL/NARR ESO	ERL/GB ESO
Fresh Water/ Ground Water	ESO	RREL/CIN ERL/ADA ERL/ATH ERL/COR ERL/DUL	RREL/CIN ERL/ADA ESO	ESO	NEIC/DEN ESO	ERL/ADA ERL/ATH ERL/COR ERL/DUL	ESO	ESO	ESO	ERL/ADA ERL/ATH ESO	ERL/ADA ERL/ATH ESO
Drinking Water	ESO RREL/CIN	EMSL/CIN RREL/CIN TSD/CIN	EMSL/CIN RREL/CIN TSD/CIN	TSD/CIN ESO	NEIC/DEN ESO	RREL/CIN	TSD/CIN ESO	EMSL/CIN TSD/CIN ESO	ESO	EMSL/CIN RREL/CIN TSD/CIN	EMSL/CIN RREL/CIN TSD/CIN ESO
Solid/ Hazardous Waste	ESO	AEERL/RTP AREAL/RTP RREL/CIN EMSL/CIN EMSL/LV ERL/ATH	AEERL/RTP RREL/CIN AREAL/RTP ESO	ESO	NEIC/DEN ESO	AEERL/RTP RREL	EMSL/LV ESO	EMSL/LV RREL/CIN ORIA/LV ESO	ESO	AEERL/RTP AREAL/RTPRRREL/ CIN	RREL/CIN ORIA/LV ESO
Multimedia	ESO	ERL/ATH ERL/COR	ESO	ESO	NEIC/DEN ESO	AREAL/RTP ERL/COR ERL/GB	ESO	ESO	ESO	ERL/ADA ESO	ERL/ADA ESO
Human Health		ECAO/CIN HERL/RTP HHAG/DC	HHAG/DC	ESO	NEIC/DEN ESO	ECAO/CIN HERL/RTP HHAG/DC	ESO	HERL/RTP	ESO	ECAO/CIN HERL/RTP HHAG/DC ESO	HERL/RTP HHAG/DC ESO
Risk Assessment	ESO RREL/CIN	ECAO/CIN EAG/DC ERL/ATH	ECAO/CIN			ECAO/CIN ECAO/RTP EAG/DC ERL/ATH	EAG/DC	EAG/DC		ECAO/CIN EAG/DC	ESO
Pesticides	ACL/BEL ECL/BSL ESO		ESO	ESO	NEIC/DEN ESO		ESO	ECL/BSL ACL/BEL		ECL/BSL ACL/BEL	ESO
Math Modeling		AREAL/RTP ERL/DUL/LLRS ERL/ATH ERL/COR								ERL/ATH	ERL/ATH

- Improving human health risk assessment capabilities
- Understanding human-induced risk to complex ecological systems
- Innovative risk reduction and pollution prevention
- Technology transfer
- Maintaining and enhancing scientific excellence

Goals are established in collaboration and consultation with EPA program offices, the SAB and, in some cases, other federal agencies.

The second stage of the process involves development of three- to five-year research plans for each of the goals. These plans contain the 36 issues that give rise to the phrase "issue-based planning" used to describe the entire ORD research planning process. Each of the 36 issues is assigned an issue planner who, supported by an issue-planning group consisting of ORD laboratory scientists, ORD headquarters staff, and program office and regional representatives, is responsible for managing the research plan for a particular issue.

In the final step, the issues are developed into projects and tasks to be implemented at the laboratories. Each of the ORD laboratories prepares a Laboratory Implementation Plan detailing the activities at that laboratory. Preliminary results of this process can be seen in Table 4-6, which shows the distribution of work conducted for each of the issues among the various ORD laboratories. ORD laboratories submitted their first Laboratory Implementation Plans in early 1994. These draft plans are now under review and, once finalized, they will be used to integrate individual laboratory tasks and projects into the larger ORD-wide issue research plans.

With few exceptions, each ORD laboratory is participating in 6 to 14 issues, and each issue is distributed over 3 to 8 laboratories. While it may be necessary to partition the issues among the laboratories to encompass the full range of expertise needed, it places management burdens on the laboratory director to control the resources appropriately and upon the issue planner to integrate the results. Further examination of the situation could indicate how laboratories might be consolidated or how the issues could be better defined.

Table 4-6. FTE From 1994 Laboratory Implementation Plans

Laboratory	Coastal and Marine	Large Lakes and Rivers	Wetlands	Contaminated Sediments	Aquatic Ecocriteria	Nonpoint Sources	Ecorisk Assessment	Habitat Biodiversity	Biotechnology	EMAP	Global Climate	Stratospheric Ozone	Acid Deposition	Air Toxics	Criteria Air Pollutants	Motor Vehicles	Indoor Air
ORD/AEERL/RTP											8.8	8.4	2.9	8.7	13.0		10.8
ORD/AREAL/RTP										9.7	4.0	2.1	6.8	16.4	35.5	12.5	8.3
ORD/EAG/DC					0.1									0.2			
ORD/ECAO/CIN					2.0		19.0							1.3			
ORD/ECAO/RTP														4.2	3.0	1.0	0.2
ORD/EMSL/CIN				0.2						4.8				0.5			4.0
ORD/EMSL/LV						0.4		0.6	0.2	11.2	4.6						
ORD/ERL/ADA						1.5											
ORD/ERL/ATH		0.5		2.5	*	8.0	7.0				7.5	0.5					
ORD/ERL/COR			4.0		3.6	0.5	5.2	1.0	5.0	6.3	11.4		2.0		11.0		
ORD/ERL/DUL		8.3	2.6	10.9	16.2	1.5	11.4		2.0	2.9	1.0						
ORD/ERL/GB	0.5		1.1		14.0		5.9		10.4	2.6	0.5						
ORD/ERL/NARR	21.1			15.6	4.0		3.3			4.5	1.0	3.0					
ORD/HERL/RTP									5.3			0.2		11.5	20.1	2.6	3.7
ORD/HHAG/DC																	
ORD/RREL/CIN			1.1	*					0.1								0.3
Total	21.6	8.8	8.8	29.2	39.9	11.9	51.8	1.6	23.0	42.0	38.8	14.2	11.7	42.8	82.6	16.1	27.3

Notes: 1. Two issues, Infrastructure and Cross Program, were not included in the table.
2. (*) *indicates that no FTE were allocated, but that the lab did plan for dollar expenditures.*

Table 4-6. FTE From 1994 Laboratory Implementation Plans (Concluded)

Laboratory	Drinking Water Pollutants	Groundwater	MSW	Hazardous Waste	Sludge / WW	Surface Cleanup	Bioremediation	Heavy Metals	Human Exposure	Health Effects	Risk Assessment Methods	New Chemicals	Pollution Prevention	Innovative Technology	Environmental Education	Technology Transfer	Grants / Centers
ORD/AEERL/RTP			2.6	1.3									3.6	5.9			
ORD/AREAL/RTP				1.1		2.5		4.3	10.4								
ORD/EAG/DC				1.0				0.4	1.1		9.2	0.1				0.5	
ORD/ECAO/CIN	4.6			7.6							11.34						
ORD/ECAO/RTP								0.6			0.8						
ORD/EMSL/CIN	38.6			3.2	8.4	4.4		6.0	3.0		1.0					*	
ORD/EMSL/LV		7.0		11.9		20.2		0.5	6.9			0.1	*				
ORD/ERL/ADA	*	39.7					0.5										
ORD/ERL/ATH		8.5					7.0	1.7	*			6.3	1.0				
ORD/ERL/COR																	
ORD/ERL/DUL										11.6		5.2					
ORD/ERL/GB							5.9										
ORD/ERL/NARR																	
ORD/HERL/RTP	14.4						*		*	23.4	10.8	26.8					
ORD/HHAG/DC									1.0	1.7							
ORD/RREL/CIN	38.8	3.0	9.7	26.6	8.8	36.6	14.1	3.0				1.0	14.2	4.0			
Total	96.4	58.2	12.3	52.7	17.2	63.7	27.5	16.5	22.4	36.7	33.1	39.5	18.8	9.9	0.0	0.5	0.0

Notes: 1. Two issues, Infrastructure and Cross Program, were not included in the table.
2. (*) indicates that no FTE were allocated, but that the lab did plan for dollar expenditures.

4.3.2 Program Office Laboratories and ESOs

Planning for activities at the program office laboratories and for the ESOs is built upon the closer organizational alignment between these units and their primary customers. Program office laboratory activities are defined and priorities are set by the Assistant Administrator for the program offices through coordination within the specific programs and are based upon the recommendations of program-specific research committees. Core environmental service activities are determined through an annual planning process involving the regional program offices and the ESOs within each region. The nature of these discussions varies from region to region, but some regions go so far as to negotiate formal agreements between environmental services and individual regional program offices.

4.4 FINANCES

Table 4-7 shows EPA's FY93 and FY94 appropriations, as passed by the U.S. Congress. For FY93, the total for ten appropriations was about $6.9 billion. However, about $2.5 billion of the total was appropriated for water infrastructure/state revolving funds, which are primarily grants to the states for water and wastewater projects. A better figure for EPA's actual operating budget is about $4.3 billion, which is the total appropriations less the water revolving funds. The R&D FY93 appropriation, which is ORD's primary source of funding, represents about 7.5 percent of the FY93 total appropriations less revolving funds. Funding for laboratory operations of all types is derived from eight of the ten appropriations, including R&D (ORD only); program and research operations (PRO) (personnel compensation and benefits and travel expenses); abatement, control, and compliance (AC&C); buildings and facilities (B&F); hazardous substance Superfund (SF); leaking underground storage tank trust fund (LUST) and oil spill response.

Table 4-8 gives an overview of the total FY93 financial expenditures for each laboratory type. The individual laboratory expenditures data for FY91, FY92, and FY93 are provided in Appendix A, Table 2. ORD headquarters expenditures are not included in Table 4-8 unless reported by an ORD laboratory. For ORD, the interagency agreements (funds-in) and other funds-in (FTTA and IGA) are included in the extramural subtotal as well as being shown separately. It should be noted that funds for analytical services in support of Superfund are not included in the regional expenditures listed in Table 4-8. Under the program offices, all of the expenditures of the Office of Mobile Sources are included, not just the laboratory portion. For the program office laboratories, the interagency agreements and other funds-in are not included in the extramural subtotal and therefore have been included in the total.

Table 4-7. EPA Appropriations

Appropriation	FY1993 (1)	FY1994 (2)
Research and Development (R&D)	$323,000,000	$338,701,000
Abatement, Control, and Compliance (AC&C)	$1,318,965,000	$1,352,535,000
Abatement, Control, and Compliance Loan Program Account	$31,225,000	
Program and Research Operations (PRO)	$823,607,000	$850,625,000
Office of Inspector General (3)	$42,799,000	$44,595,000
Buildings and Facilities (B&F)	$134,300,000	$18,000,000
Hazardous Substance Superfund (SF)	$1,573,528,000	$1,465,853,000
Leaking Underground Storage Tank Trust Fund (LUST)	$75,000,000	$75,379,000
Oil Spill Response	$20,000,000	$21,239,000
Water Infrastructure/State Revolving Funds	$2,550,000,000	$2,477,000,000
Total:	$6,876,044,000	$6,643,927,000
Total w/o Water Infrastructure/State Revolving Funds:	$4,326,044,000	$4,166,927,000

Notes:

(1) Source: H.R. 5679, Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1993 (Pub. L. 102-389, approved 10/06/92) [H.Rept. 102-902]

(2) Source: H.R. 2491, Departments of Veterans Affairs and Housing and Urban Development, and Independent Agencies Appropriations Act, 1994 (Pub. L. 103-124, approved 10/28/93) [H.Rept. 103-273]

(3) A portion of OIG funds are derived from Superfund and LUST trust funds and these amounts are not counted in the total.

Table 4-8. EPA FY93 Laboratory Financial Data Summary

Category	ORD	Program Office (1)	ESO	EPA Total
Personnel Costs	$97,486,564	$29,365,525	$34,504,834	$161,356,923
Travel Expenses	$3,936,793	$704,562	$1,547,707	$6,189,062
Facility Maintenance and Operations	$7,097,964	$2,622,088	$2,137,710	$11,857,762
Facility Repair and Improvement	$1,051,027	$114,927	$67,414	$1,233,368
Administrative Equipment	$6,160,124	$323,060	$319,564	$6,802,748
Scientific Instrumentation	$7,756,766	$1,288,748	$6,858,983	$15,904,497
Administrative Services	$8,711,780	$2,089,298	$1,530,508	$12,331,586
Misc. and Other Intramural Operating Costs	$5,813,117	$1,296,640		$7,109,757
Intramural Subtotal:	$138,014,135	$37,804,848	$46,966,720	$222,785,703
Extramural Contracts	$120,562,127	$22,899,482	$1,925,542	$145,387,151
Grants	$13,131,947	$2,465,040		$15,596,987
Cooperative Agreements	$84,997,593	$655,000		$85,652,593
Interagency Agreements (Funds-Out)	$35,809,773	$924,105	$513,986	$37,247,864
Extramural Subtotal:	$254,501,440	$26,943,627	$2,439,528	$283,884,595
Interagency Agreements (Funds-In) (2)	($17,576,359)	$960,500		$18,536,859
Other Funds-In (FTTA and IGA) (2)	($500,551)			$500,551
Funds-In Subtotal:	($18,076,910)	$960,500	$0	$19,037,410
Total:	$392,515,575	$65,708,975	$49,406,248	$507,630,798
Percent of EPA Total:	77%	13%	10%	

Sources: ORD/ORPM (ORD data) and Laboratory/ESO Directors (Program Offices and ESOs)

Notes:

(1) Data were not available for the program office laboratory in Bay City, MI.

(2) ORD Funds-In are included in Intramural and Extramural expenditures.

Of the three laboratory types, ORD represents the largest operation by a substantial margin, accounting for about 77 percent of EPA's laboratory expenditures. The program office and Environmental Services laboratories are roughly equal in terms of expenditures at 13 percent and 10 percent, respectively.

Figure 4-9 shows the intramural and extramural expenditures of the ORD laboratories, which are highly leveraged with regard to extramural contracts, grants, and cooperative and interagency agreements. In 14 of ORD's laboratories, 50 percent or more of the expenditures are extramural. Overall, in FY93, ORD spent about 1.8 times more on extramural contracts and agreements than it did on intramural operations.

Figure 4-10 shows the intramural and extramural expenditures of the program office laboratories and ESOs (core functions of laboratory services, QA/QC, and field monitoring). NVFEL has the largest total expenditure, of which 45 percent is extramural. The extramural expenditures of ESOs appear to be low or nonexistent, but additional extramural support may be obtained through the Contract Laboratory Program, which is not included here.

In addition to direct expenditures made by the laboratories, OARM expends funds on the buildings and facilities of the laboratories; these are not included in the laboratories' budgets. Table 4-9 details such expenditures made by OARM in FY93 for construction, repair, improvement, alteration, and purchase of fixed equipment, buildings, and facilities (B&F); rents at certain facilities; and utilities costs at certain facilities. In total, these expenditures amounted to about $25 million for FY93, which is approximately equal to 5 percent of total laboratory expenditures. OARM B&F expenditures on a laboratory or group of laboratories usually greatly exceed repair and improvement (R&I) expenditures made by the individual laboratories (see Table 4-11 F&E Expenditures Summary).

In Table 4-10, EPA's FY93 laboratory expenditures are compared to EPA's FY93 appropriations. In this table, "funds-in" have been subtracted from the laboratory expenditures because they represent funds from outside of the Agency. Also, OARM B&F expenditures have been added to the laboratory expenditures because they are funds expended by the Agency to maintain and operate the laboratory system, even though they do not appear in individual laboratory budgets. At the bottom of the table, FY93 laboratory total expenditures are shown as a percentage of the FY93 appropriations, both with and without state revolving funds and by laboratory category. Overall, EPA spent approximately 12 percent of its FY93 operating budget (appropriations less revolving funds) on its laboratory system and operations.

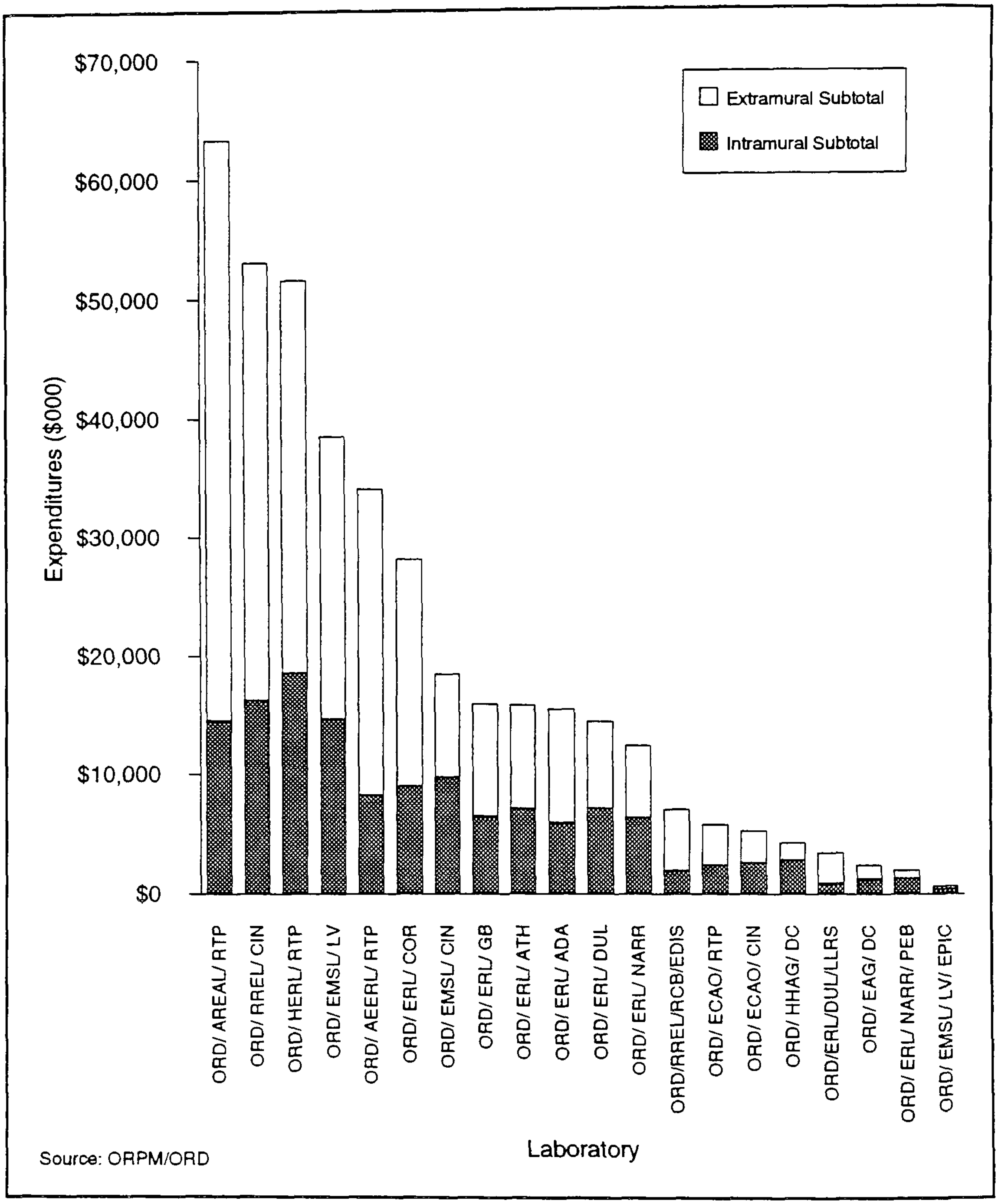


Figure 4-9. FY93 EPA Laboratory Expenditures
ORD Laboratories

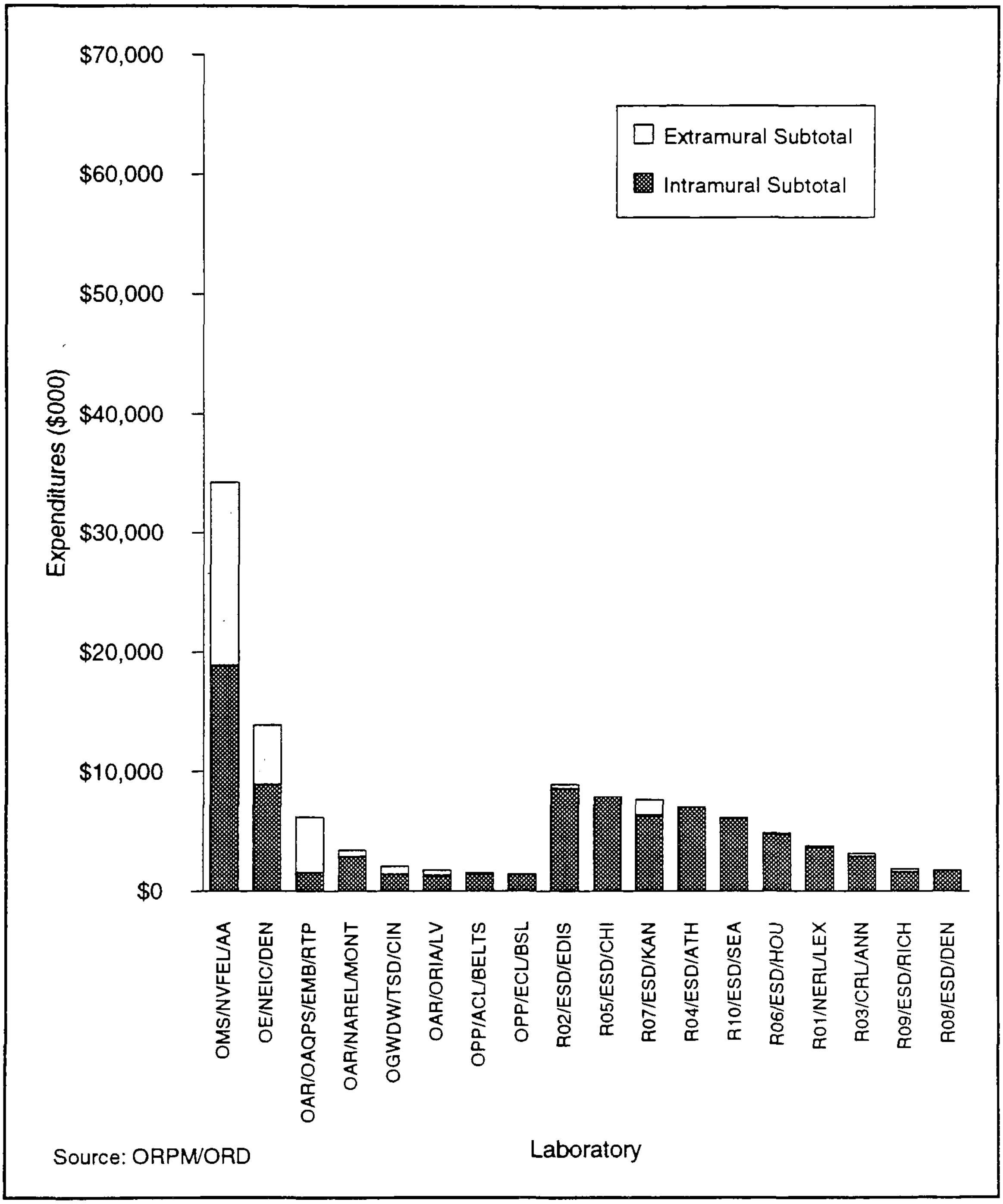


Figure 4-10. FY93 EPA Laboratory Expenditures
Program Office Laboratories and Environmental Services Organizations

Table 4-9. FY93 OARM Expenditures On Behalf of Laboratories (B&F, Rents, and Utilities)

Laboratory Location	B&F	Rent	Utilities	Total
ORD				
RTP (w/o OAQPS)	$1,023,450	$6,333,059		$7,356,509
Las Vegas	$95,764	$879,786	$430,000	$1,405,550
Cincinnati	$1,311,489			$1,311,489
Gulf Breeze	$183,033			$183,033
Athens (ERL)	$179,064			$179,064
Duluth	$93,743			$93,743
Ada	$1,701,819			$1,701,819
Covallis	$49,465			$49,465
Narragansett	$390,000			$390,000
Vint Hill	$2,230	$138,620		$140,850
Grosse Ile	$80,000			$80,000
ORD Subtotal:	$5,110,057	$7,351,465	$430,000	$12,891,522
Program Office				
RTP (OAQPS/EMB)		$91,631		$91,631
Denver		$1,092,703		$1,092,703
Bay St. Louis		$243,000		$243,000
Beltsville		$232,604		$232,604
Program Office Subtotal:		$1,568,307		$1,568,307
ESO				
Lexington	$4,550	$1,065,500		$1,070,050
Edison (R2 ESO)	$467,281			$467,281
Annapolis	$13,266	$1,251,458		$1,264,724
Wheeling (R3 ESO)		$223,741		$223,741
Athens	$546,812	$110,115		$656,927
Westlake (R5 ESO)		$378,065		$378,065
Chicago (lab only)		$1,268,607		$1,268,607
Houston		$880,177	$325,000	$1,205,177
Kansas City		$589,784		$589,784
Denver	$694,021	$178,513		$872,534
San Francisco		$180,511		$180,511
Manchester	$280,159			$280,159
ESO Subtotal:	$2,006,089	$6,126,471	$325,000	$8,457,560
Nationwide Projects:	$2,336,000			$2,336,000
EPA Total:	$9,452,146	$15,046,243	$755,000	$25,253,389

Source: OARM/FMSD

Table 4-10. EPA FY93 Laboratory Expenditures as a Percentage of EPA FY93 Appropriations

Category	ORD	Program Office	ESO	EPA Total
Laboratory Expenditures (less "Funds-In"):	$374,438,665	$64,748,475	$49,406,248	$491,515,490
OARM Expenditures On Behalf of Laboratories (B&F and Rents):	$12,891,522	$1,568,307	$8,457,560	$25,253,389
Total EPA Expenditures on Laboratories:	$387,330,187	$66,316,782	$57,863,808	$516,768,879
EPA Appropriations (less Revolving Funds):				$4,326,044,000
Total EPA Appropriations				$6,876,044,000
Laboratory Expenditures (including OARM Expenditures) as Percentage of EPA Appropriations (less Revolving Funds)	9%	2%	1%	12%
Laboratory Expenditures (including OARM Expenditures) as Percentage of Total EPA Appropriations:	6%	1%	1%	8%

Sources: See Tables 4-6, 4-7, and 4-8

4.5 FACILITIES AND EQUIPMENT

Collectively, ORD's expenditures for facilities maintenance and operations, and for administrative equipment and scientific instrumentation were $22,065,881 in FY 93 (Table 4-8). The combination of the four categories are referred to hereafter as facilities and equipment (F&E) costs. These costs for ORD were 16 percent of all intramural expenditures by the laboratories and 2.8 percent of their total expenditures (intramural, extramural, interagency, and other funds). A three-year profile of these costs for each of the laboratories is presented in Appendix A and a summary of the total F&E costs in descending order by laboratory is presented in Table 4-11. Average annual expenditures per unit work year are shown in Figure 4-11. The wide variation within the ORD laboratories and the ESOs that occur if only FTEs are included tend to disappear, as would be expected, when the total work force is included.

On a three-year basis, F&E costs ranged from 2 percent (Releases Control Branch [RCB] and Human Health Assessment Group [HHAG]) to 40 percent (Gulf Breeze) of intramural expenditures, and from 1 percent (RCB, HHAG, Environmental Assessment Group [EAG], and Environmental Photographic Investigation Center [EPIC]) to 19 percent (Gulf Breeze) of the total costs over a three-year period as shown in Table 4-11. The largest costs for the total of F&E over the past three years have been incurred at Gulf Breeze and Health Effects Research Laboratory (HERL), followed by Corvallis, Atmospheric Research and Exposure Assessment Laboratory (AREAL), Environmental Monitoring Systems Laboratory/Las Vegas (EMSL/LV), and Narragansett. Based on facilities and maintenance costs alone, the largest costs have been incurred at Narragansett, Corvallis, Athens, and Gulf Breeze. Even so, the condition of these facilities reported in Table 4-12 is only medium; they have not been upgraded to a good condition. The largest investments in scientific instrumentation and administrative equipment have been made at HERL, AREAL, EMSL/LV, and Corvallis, followed by Risk Reduction Engineering Laboratory (RREL), Gulf Breeze, EMSL/Cincinnati (CIN) and Air and Energy Engineering Research Laboratory (AEERL).

In the program office laboratories, $4,348,823 was expended in FY93 for the total of F&E categories. These costs represented 11.5 percent of the intramural expenditures and 6.6 percent of the total of the intramural and extramural expenditures. In both cases, the F&E costs aggregated across the program office laboratories is about the same portion of their total expenditures as is the case in ORD's laboratories. A three-year profile of these costs for each of the program office laboratories is presented in Appendix A and a summary of the total F&E costs by laboratory is presented in Table 4-11.

On a three-year basis, F&E costs ranged from 1 percent (Office of Air Quality Planning and Standards [OAQPS]) to 28 percent (Environmental Chemistry Laboratory

Table 4-11. Facilities and Equipment (F&E) Expenditures Summary (Ordered By Total F&E Expenditures)

Laboratory	Facility and Maintenance Operations Expenditures (3 Years) (1) (2)	OARM Buildings and Facilities (B&F) Expenditures (3 Years) (3)	Facility Repair and Improvement Expenditures (3 Years) (2)	Scientific Instrumentation and Administrative Equipment Expenditures (3 Years) (2)	Total Facilities and Equipment (F&E) Expenditures (3 Years)	Total Intramural + B&F (I/BF) Expenditures (3 Years) (2) (3)	Total Intramural + Extramural + B&F (I/E/BF) Expenditures (3 Years) (2) (3)	F&E Expenditures as Percent of Total I/BF Expenditures	F&E Expenditures as Percent of Total I/E/BF Expenditures	Number of FTEs (4)	Total On-Site Workforce (Intramural and Extramural) (4) (5)	Average Annual F&E Expenditures Per Unit Work-Year (EPA FTE Only)	Average Annual F&E Expenditures Per Unit Work-Year (Total Workforce)
ORD/ERL/GB	$2,407,581	$2,970,130	$176,078	$2,760,538	$8,314,327	$20,770,515	$43,973,111	40%	19%	58	189	$47,866	$14,640
ORD/HERL/RTP	$575,814	$873,283	$130,190	$6,643,313	$8,222,600	$55,531,812	$149,235,750	15%	6%	227	483	$12,101	$5,674
ORD/ERL/COR	$3,797,087	$343,519	$211,504	$3,490,211	$7,842,321	$25,135,485	$81,031,659	31%	10%	64	265	$40,845	$9,863
ORD/AREAL/RTP	$349,956	$958,695	$184,325	$4,923,304	$6,416,280	$42,295,016	$163,115,611	15%	4%	166	346	$12,915	$6,185
ORD/EMSL/LV	$738,428	$202,651	$873,690	$4,273,685	$6,088,454	$42,497,047	$112,700,368	14%	5%	151	268	$13,485	$7,564
ORD/ERL/NARR	$4,226,436	$426,302	$8,507	$1,387,078	$6,048,323	$18,360,569	$35,203,975	33%	17%	54	170	$37,405	$11,866
ORD/ERL/ADA	$1,618,189	$1,959,393	$29,978	$1,802,779	$5,410,339	$18,317,830	$42,107,703	30%	13%	56	129	$32,204	$14,035
ORD/RREL/CIN	$726,031	$1,646,370	$33,136	$2,893,229	$5,298,766	$47,957,884	$175,666,501	11%	3%	203	304	$8,701	$5,812
ORD/ERL/ATH	$2,469,502	$290,978	$121,087	$1,918,292	$4,799,859	$20,668,608	$46,390,403	23%	10%	74	132	$21,534	$12,084
ORD/AEERL/RTP	$211,452	$986,715	$421,070	$2,269,372	$3,888,609	$24,575,086	$96,063,678	16%	4%	102	178	$12,770	$7,282
ORD/ERL/DUL	$1,842,338	$475,252	$93,163	$1,120,788	$3,531,541	$20,270,991	$40,275,581	17%	9%	80	149	$14,642	$7,906
ORD/EMSL/CIN	$330,120	$516,327	$2,886	$2,589,746	$3,439,079	$26,537,932	$49,793,597	13%	7%	119	226	$9,649	$5,074
ORD/ERL/NARR/PEB	$785,246	$175,179	$0	$234,000	$1,194,425	$5,300,969	$8,072,369	23%	15%	21	42	$19,234	$9,401
ORD/ERL/DUL/LLRS	$542,608	$169,190	$45,295	$260,861	$1,017,954	$2,554,281	$9,546,677	40%	11%	7	30	$49,900	$11,199
ORD/ECAO/CIN	$56,814	$82,398	$71,571	$215,702	$426,485	$7,477,741	$14,867,160	6%	3%	39	52	$3,673	$2,739
ORD/ECAO/RTP	$30,503	$0	$0	$318,765	$349,268	$6,955,437	$16,857,409	5%	2%	32	45	$3,684	$2,564
ORD/HHAG/DC	$27,106	$0	$0	$133,866	$160,972	$8,053,872	$13,297,021	2%	1%	31	36	$1,725	$1,486
ORD/EMSL/LV/EPIC	$14,945	$59,832	$0	$75,865	$150,642	$1,341,092	$10,603,617	11%	1%	10	24	$5,021	$2,137
ORD/RREL/RCB/EDIS	$0	$51,401	$0	$92,500	$143,901	$5,865,601	$21,738,801	2%	1%	28	36	$1,725	$1,340
ORD/EAG/DC	$10,118	$0	$0	$108,518	$118,636	$3,533,709	$8,292,650	3%	1%	16	19	$2,519	$2,115
ORD Subtotal:	$20,760,274	$12,187,615	$2,402,480	$37,512,412	$72,862,781	$404,001,477	$1,138,833,641	18%	6%	1535	3123	$15,825	$7,778

Notes:

(1) 3 Years: FY91 - FY93
(2) Source: Appendix A, Table 2. (each laboratory)
(3) Source: Appendix A, Table 3. (each laboratory) (OARM/FMSD)
(4) Source: ORD/ORPM (ORD only), Laboratory Director, Environmental Services Director, or Branch Chief (as appropriate)
(5) Source: Appendix A, Table 7. (each laboratory) (Workforce '94)

Table 4-11. Facilities and Equipment (F&E) Expenditures Summary (Concluded)
(Ordered By Total F&E Expenditures)

Laboratory	Facility and Maintenance Operations Expenditures (3 Years) (1) (2)	OARM Buildings and Facilities (B&F) Expenditures (3 Years) (3)	Facility Repair and Improvement Expenditures (3 Years) (2)	Scientific Instrumentation and Administrative Equipment Expenditures (3 Years) (2)	Total Facilities and Equipment (F&E) Expenditures (3 Years)	Total Intramural + B&F (I/BF) Expenditures (3 Years) (2) (3)	Total Intramural + Extramural + B&F (I/E/BF) Expenditures (3 Years) (2) (3)	F&E Expenditures as Percent of Total I/BF Expenditures	F&E Expenditures as Percent of Total I/E/BF Expenditures	Number of FTEs (4)	Total On-Site Workforce (Intramural and Extramural) (4) (5)	Average Annual F&E Expenditures Per Unit Work-Year (EPA FTE Only)	Average Annual F&E Expenditures Per Unit Work-Year (Total Workforce)
OAR/OMS/NVFEL/AA	$2,938,000	$143,045	$325,000	$2,664,300	$6,070,345	$53,772,345	$105,122,345	11%	6%	277	365	$7,305	$5,550
OE/NEIC/DEN	$1,084,574	$552,667	$342,515	$2,613,659	$4,593,415	$26,745,724	$50,043,123	17%	9%	120	173	$12,728	$8,861
OAR/NAREL/MONT	$568,400	$18,672	$87,200	$1,040,500	$1,714,772	$8,522,472	$10,957,772	20%	16%	39	59	$14,619	$9,771
OPP/ECL/BSL	$701,077	$0	$0	$544,084	$1,245,161	$4,447,380	$4,967,380	28%	25%	17	19	$24,415	$22,315
OPP/ACL/BELTS	$699,782	$6,802	$0	$221,918	$928,502	$4,162,587	$4,262,587	22%	22%	17	17	$18,206	$18,206
OAR/ORIA/LV	$110,300	$0	$1,000	$289,700	$401,000	$3,735,600	$4,735,000	11%	8%	16	26	$8,624	$5,201
OGWDW/TSD/CIN	$43,324	$228,435	$0	$50,140	$321,899	$4,342,475	$7,366,001	7%	4%	23	32	$4,665	$3,396
OAR/OAQPS/EMB/RTP	$7,000	$0	$1,000	$32,000	$40,000	$4,569,900	$17,785,200	1%	0%	25	25	$533	$529
Program Office Subtotal:	$6,152,457	$949,621	$756,715	$7,456,301	$15,315,094	$110,298,483	$205,239,408	14%	7%	534	714	$9,562	$7,150
R02/ESD/EDIS	$4,502,202	$748,545	$0	$3,119,125	$8,369,872	$25,341,400	$26,422,400	33%	32%	86	93	$32,631	$30,000
R10/ESD/SEA	$1,147,300	$919,071	$22,000	$2,311,200	$4,399,571	$18,557,421	$18,820,171	24%	23%	81	140	$18,173	$10,498
R04/ESD/ATH	$140,764	$546,812	$50,000	$2,886,626	$3,624,202	$21,230,889	$21,230,889	17%	17%	113	146	$10,729	$8,297
R07/ESD/KAN	$22,000	$369,078	$0	$2,908,128	$3,299,206	$18,369,113	$23,121,302	18%	14%	82	120	$13,411	$9,164
R05/ESD/CHI	$267,149	$9,475	$30,277	$2,543,435	$2,850,336	$11,641,212	$11,653,212	24%	24%	82	144	$11,559	$6,589
R06/ESD/HOU	$0	$43,767	$9,500	$2,554,759	$2,608,026	$14,389,009	$14,429,109	18%	18%	36	67	$24,148	$12,975
R01/NERL/LEX	$0	$480,396	$196,044	$1,818,505	$2,494,945	$11,240,291	$11,479,956	22%	22%	51	61	$16,307	$13,634
R03/CRL/ANN	$116,658	$50,522	$4,382	$2,169,314	$2,340,876	$8,293,255	$9,105,832	28%	26%	63	131	$12,386	$5,960
R08/ESD/DEN	$51,900	$943,286	$35,700	$1,015,000	$2,045,886	$6,020,236	$6,031,236	34%	34%	25	42	$26,849	$16,084
R09/ESB/RICH	$0	$7,555	$0	$1,066,600	$1,074,155	$4,648,553	$5,386,453	23%	20%	21	48	$17,050	$7,459
ESO Subtotal:	$6,247,973	$4,118,507	$347,903	$22,392,692	$33,107,075	$139,731,379	$147,680,560	24%	22%	639	992	$17,259	$11,127
EPA Total:	$33,160,704	$17,255,743	$3,507,098	$67,361,405	$121,284,950	$654,031,339	$1,491,753,609	19%	8%	2708	4828	$14,929	$8,373

Notes:

(1) 3 Years: FY91 - FY93
(2) Source: Appendix A, Table 2. (each laboratory)
(3) Source: Appendix A, Table 3. (each laboratory) (OARM/FMSD)
(4) Source: ORD/ORPM (ORD only), Laboratory Director, Environmental Services Director, or Branch Chief (as appropriate)
(5) Source: Appendix A, Table 7. (each laboratory) (Workforce '94)

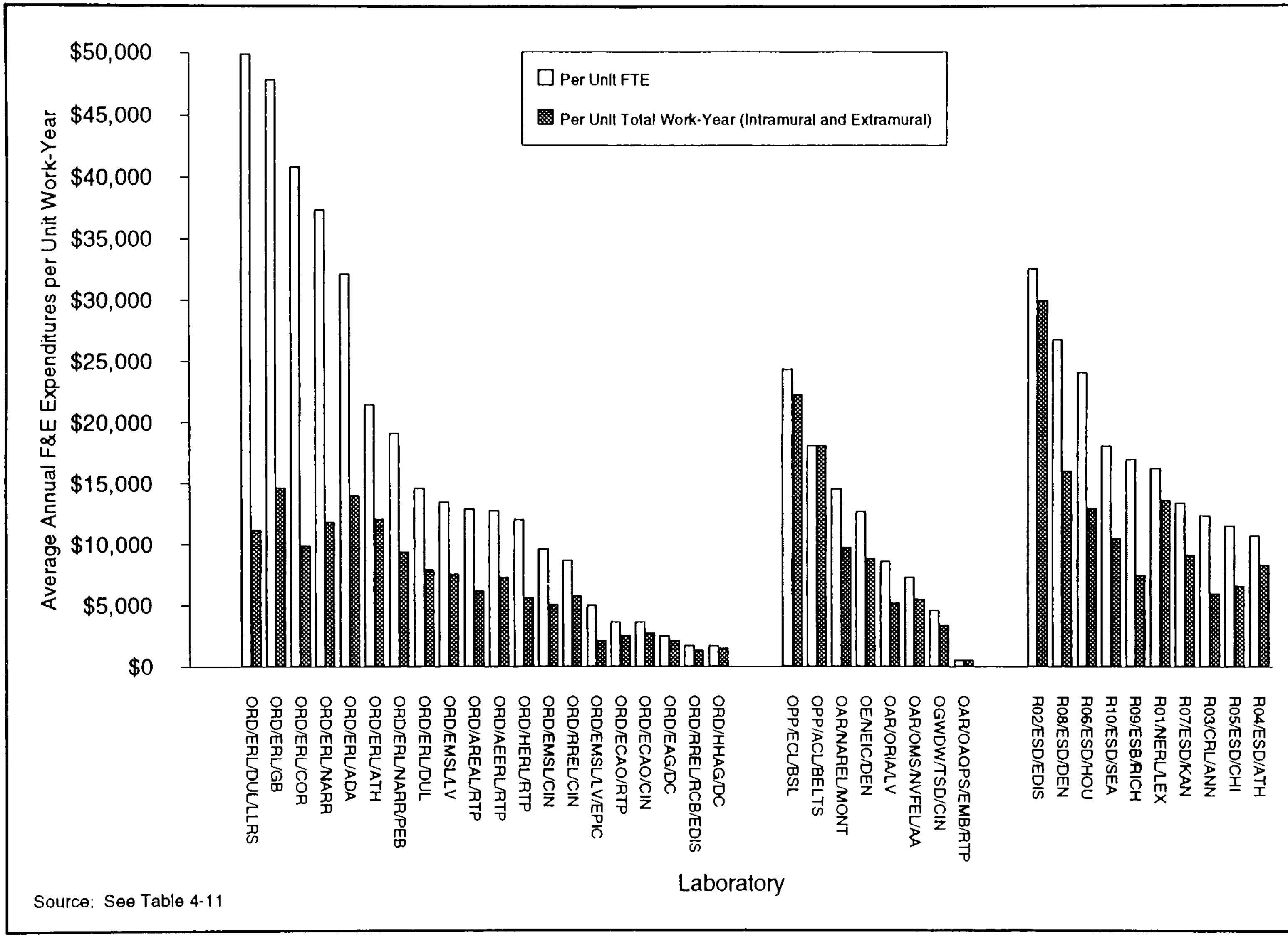


Figure 4-11. Average Annual Facilities and Equipment Expenditures per Unit Work-Year (FY93)

Table 4-12. Laboratory Space Summary

Laboratory	Location	Approx. Total On-site Workforce (1)	Number of Buildings	Space Summary (net sf)				Lease/Own Status		Costs		Condition		
				Office	Laboratory	Other (2)	Total	Status (3)	Lease Expiration	Annual Lease Cost	3-Year Buildings and Facilities (B&F) Expenditures (FY91 - FY93)	Oldest Building	Newest Building	General Condition (4)
<u>ORD</u>														
ORD/AEERL/RTP	RTP NC	178	1	21,610	33,853		55,463	E-L	Mar-98	$1,061,143	$986,715	1969	1969	M
ORD/AREAL/RTP	RTP NC	346	5	92,082	55,049	22,600	169,731	E-L	Feb-94	$2,294,701	$958,695	1966	1983	M
ORD/EAG/DC	Washington DC	19	1	1,500			1,500							
ORD/ECAO/CIN	Cincinnati OH	52	1	7,610	1,150	1,146	9,906	E-O			$82,398	1976	1976	G
ORD/ECAO/RTP	RTP NC	45	1	10,598		2,703	13,301	E-L	Aug-96	$209,496				G
ORD/EMSL/CIN	Cincinnati OH	226	3	18,328	56,989	12,426	87,743	E-O			$516,327	1976	1989	G
ORD/EMSL/LV	Las Vegas NV	268	8	50,000	25,000	25,000	100,000	E-L	Sep-96	$964,800	$202,651	1966	1984	M
ORD/EMSL/LV/EPIC	Warrenton VA	24	1	7,360	4,958	5,631	17,949	E-L	Annually	$138,620	$59,832	1957	1957	M
ORD/ERL/ADA	Ada OK	129	5	23,726	13,449	14,183	51,358	E-O			$1,959,393	1965	1992	M
ORD/ERL/ATH	Athens GA	132	11	14,168	11,589	12,642	38,399	E-O			$290,978	1964	1988	M
ORD/ERL/COR	Corvalis OR	265	17	32,102	29,634	33,665	95,401	E-O			$343,519	1967	1990	M
ORD/ERL/DUL	Duluth MN	149	10	14,002	22,696	11,618	48,316	E-O			$475,252	1967	1984	M
ORD/ERL/DUL/LLRS	Grosse Ile MI	30	5	8,511	4,359	10,865	23,735	E-O			$169,190	1977	1977	P
ORD/ERL/GB	Gulf Breeze FL	189	53	15,426	28,208	28,264	71,898	E-O			$2,970,130	1910	1990	M
ORD/ERL/NARR	Narragansett RI	170	9	17,177	18,696	20,416	56,289	E-O			$426,302	1963	1990	M
ORD/ERL/NARR/PEB	Newport OR	42	3	9,500	22,200	11,650	43,350	E-O			$175,179	1990	1990	G
ORD/HERL/RTP	RTP NC	483	4	49,164	65,717	60,454	175,335	E-L	Mar-98	$6,377,977	$873,283	1966	1994	M
ORD/HHAG/DC	Washington DC	36		3,600		975	4,575							
ORD/RREL/CIN	Cincinnati OH	304	5	42,077	56,707	13,345	112,129	E-O			$1,646,370	1967	1978	G
ORD\RREL\RCB\EDIS	Edison NJ	36	1	6,000			6,000	E-O			$51,401	1943	1943	P
ORD Totals:		3123	144	444,541	450,254	287,583	1,182,378			$11,046,737	$12,187,615			

Sources: USEPA/OARM/FMSD and individual laboratories

Notes:

(1) Based on sum of intramural FTE and extramural work-years.

(2) Includes storage, shops, loading docks, conference rooms, and other special purpose facilities.

(3) E-L: EPA-leased; E-O: EPA-owned; G-L: GSA-leased for EPA; G-O: GSA-owned/leased to EPA.

(4) OARM/FMSD assessment.

Table 4-12. Laboratory Space Summary (Concluded)

Laboratory	Location	Approx. Total On-site Workforce (1)	Number of Buildings	Space Summary (net sf) Office	Laboratory	Other (2)	Total	Lease/Own Status: Status (3)	Lease Expiration	Costs: Annual Lease Cost	3-Year Buildings and Facilities (B&F) Expenditures (FY91 - FY93)	Condition: Oldest Building	Newest Building	General Condition (4)
Program Office														
OAR/NAREL/MONT	Montgomery AL	59	1	13,538	15,500	5,825	34,863	E-O			$18,672	1990	1990	G
OAR/OAQPS/EMB/RTP	RTP NC	25	1	3,568	1,865	3,265	8,698	G-L	Apr-94	$91,631		1983	1983	G
OAR/OMS/NVFEL/AA	Ann Arbor MI	365	1	40,867	110,377	2,390	153,634	E-O			$143,045	1971	1971	M
OAR/ORIA/LV	Las Vegas NV	26	2	4,441	4,315	1,800	10,556	E-L	Sep-96			1965	1977	M
OGWDW/TSD/CIN	Cincinnati OH	32	1	3,910	4,164	1,023	9,097	E-O			$228,435	1976	1976	G
OE/NEIC/DEN	Denver CO	173	13	25,194	11,439	28,003	64,636	G-O		$1,092,703	$552,667	1941	1941	P
OPP/ACL/BELTS	Beltsville MD	17	5	2,087	8,189	2,103	12,379	E-L	Annually	$232,604	$6,802			P
OPP/ECL/BSL	Bay St. Louis MS	19	4	1,080	8,628	3,142	12,850	E-L	Annually	$243,000				P
Program Office Totals:		714	28	94,685	164,477	47,551	306,713			$1,659,938	$949,621			
ESO														
R01/NERL/LEX	Lexington MA	61	1	13,429	12,031	7,094	32,554	G-L	Dec-95	$1,073,195	$480,396			M
R02/ESD/EDIS	Edison NJ	93	1	34,540	21,000	22,000	77,540	E-O			$748,545	1918	1918	P
R03/CRL/ANN	Annapolis MD	131	3	23,201	13,986	15,806	52,993	G-L	Apr-95	$1,251,458	$50,522	1980	1980	P
R04/ESD/ATH	Athens GA	146	6	12,007	9,011	13,000	34,018	E-O		$171,391	$546,812	1964	1966	M
R05/ESD/CHI	Chicago IL	144	3	42,885	22,565	17,114	82,564	G-O		$1,646,672	$9,475	1912	1978	P
R06/ESD/HOU	Houston TX	67	1	10,554	15,948	3,240	29,742	E-L	May-10	$880,177	$43,767	1990	1990	G
R07/ESD/KAN	Kansas City KS	144	1	17,171	11,052	8,103	36,326	G-L	Jul-97	$589,784	$369,078			M
R08/ESD/DEN	Denver CO	42	5	5,191	10,354	10,305	25,850	G-O		$178,513	$943,286	1949	1949	P
R09/ESB/RICH	Richmond CA	48	2	6,999	14,163	12,492	33,654	E-L	Sep-13	$1,808,760	$7,555	1993	1993	G
R10/ESD/SEA	Manchester WA	140	3	8,962	12,599	11,592	28,353	E-O			$919,071	1979	1994	G
ESO Totals:		1016	26	174,939	142,709	120,746	433,594			$7,599,950	$4,118,507			
EPA Totals:		4853	198	714,165	757,440	455,880	1,922,685			$20,306,625	$17,255,743			

Sources: USEPA/OARM/FMSD and individual laboratories

Notes:

(1) Based on sum of intramural FTE and extramural work-years.

(2) Includes storage, shops, loading docks, conference rooms, and other special purpose facilities.

(3) E-L: EPA-leased; E-O: EPA-owned; G-L: GSA-leased for EPA; G-O: GSA-owned/leased to EPA.

(4) OARM/FMSD assessment.

[ECL\BSL]) of the intramural costs, and from less than 1 percent (OAQPS) to 25 percent (ECL\BSL) of total costs by laboratory over a three-year period as shown in Table 4-11. The largest costs for the total of F&E over the past three years have been incurred at NVFEL and NEIC. Based on facilities and maintenance costs only, the largest costs have been incurred by NVFEL and NEIC. It should be noted that the condition of NEIC as reported in Table 4-12 is poor and the condition of NVFEL is medium. The largest investments in scientific instrumentation and administrative equipment have been made at NVFEL, NEIC, and National Air and Radiation Environmental Laboratory (NAREL). A request for additional equipment to permit NVFEL to conduct the testing required by the CAA Amendments has been made, but it is not yet fully funded.

In the ESOs, $9,383,671 was expended in FY93 for the total of F&E. These costs were 18.9 percent of the total intramural costs and 9.9 percent of the intramural, extramural, and interagency agreement funds. A three-year profile of these costs for each of the laboratories is presented in Appendix A, and a summary of the total F&E costs by laboratory is presented in Table 4-11.

Viewed on a three-year basis, F&E costs ranged from 17 percent (Region 4) to 34 percent (Region 8) of the intramural costs, and 14 percent (Region 7) to 34 percent (Region 8) of the total intramural and extramural costs. In both cases, the percentage of costs is in the same range as that reported for the ORD and program office laboratories. The largest total F&E costs have been incurred by Regions 2, 10, and 4. Based on facilities and maintenance costs only, the largest costs have been incurred in Region 2 and 10. In Table 4-12, the condition of Region 2 facilities has been rated as poor and Region 10 as good. The largest investments in scientific instrumentation and administrative equipment have been made in Region 2, 7, 4, 6, 5, and 10.

Summaries of scientific equipment purchases with costs in excess of $50,000 per item are presented in Tables 4-13, 4-14, and 4-15 for ORD, program offices, and ESOs, respectively. With only a few exceptions, in the ORD laboratories and the program office laboratories for which there are data, most of the equipment costing more that $50,000 is less than eight years old. In the ESOs that are reported, two have less than 50 percent of their equipment that is less than eight years old and one laboratory that is only slightly above 50 percent. These data also give an indication of the amount of major equipment investments that must be made each year to keep the laboratories at or near the state of the art. Investment patterns for FY87 through FY94 can be used for an estimate, if it is assumed that the useful life of scientific equipment is seven to ten years. For ORD laboratories, total investments of at least $2 million to $3 million per year are needed in the $50,000 and above categories. For the limited number of program office laboratories with data reported, the total is in the $500,000 to $700,000 level. For the ESOs, total

Table 4-13. Equipment Inventory Summary (Purchase Price >$50,000)
ORD Laboratories

Purchase Year	ORD/AEERL/RTP	ORD/AREAL/RTP	ORD/EAG/DC	ORD/ECAO/CIN	ORD/ECAO/RTP	ORD/EMSL/CIN	ORD/EMSL/LV	ORD/EMSL/LV/EPIC	ORD/ERL/ADA	ORD/ERL/ATH
94	$326,161		(1)	(1)	(1)		$104,970	(2)		
93	$193,891	$161,547				$55,909	$437,150		$60,680	$109,969
92		$737,013				$264,380	$305,186		$509,622	$718,095
91	$179,544	$222,611				$386,940	$487,943		$79,026	
90	$50,825	$89,540				$540,614	$220,308			
89	$59,770					$58,661	$560,898			$536,353
88	$104,000	$722,608					$545,713		$215,000	$624,787
87	$90,000	$333,072				$310,580	$165,645			$111,460
Subtotal:	$1,004,191	$2,266,391	$0	$0	$0	$1,617,084	$2,827,813		$864,328	$2,100,664
Percent of Total:	*46%*	*60%*				*94%*	*63%*		*62%*	*85%*
86	$136,861	$131,554					$64,534			
85		$158,260					$97,000			
84	$272,003									$179,360
83		$149,832							$283,684	
82										$150,000
81							$625,434			
80	$55,000	$95,308								
79	$313,057	$112,200				$104,267			$148,085	
78	$404,004						$119,048		$88,963	
77		$191,475					$776,870			
76										$50,000
75		$435,231								
74		$165,000								
73		$92,529								
72										
71										
70										
69										
Subtotal:	$1,180,925	$1,531,389	$0	$0	$0	$104,267	$1,682,886		$520,732	$379,360
Percent of Total:	*54%*	*40%*				*6%*	*37%*		*38%*	*15%*
Total:	$2,185,116	$3,797,780	$0	$0	$0	$1,721,351	$4,510,699		$1,385,060	$2,480,024

Note: Yearly sums are expressed in purchase year dollars, they have not been inflated to current year dollars.

(1) Laboratory has no equipment with a purchase price greater than $50,000.

(2) Equipment inventory is included in parent laboratory inventory.

Table 4-13. Equipment Inventory Summary (Purchase Price >$50,000) ORD Laboratories (Concluded)

Purchase Year	ORD/ERL/COR	ORD/ERL/DUL	ORD/ERL/DUL/LLRS	ORD/ERL/GB	ORD/ERL/NARR	ORD/HERL/RTP	ORD/HHAQ/DC	ORD/NARR/PEB	ORD/RREL/CIN	ORD/RREL/EDIS	ORD Total
94			(2)				(1)	(2)	$56,212	(2)	$487,437
93	$325,489	$55,420				$130,102					$1,530,250
92	$110,904			$147,793		$601,797			$759,263		$4,154,145
91		$254,037		$380,996		$825,023			$378,037		$3,194,248
90		$57,819		$550,904	$483,525	$88,295					$2,081,920
89	$100,000	$83,873		$60,507							$1,460,151
88	$225,000			$113,795		$50,000			$702,685		$3,303,676
87		$88,237			$139,115						$1,238,196
Subtotal:	$761,393	$539,386		$1,253,995	$622,640	$1,695,217	$0		$1,896,197		$17,449,299
Percent of Total:	*83%*	*27%*		*81%*	*69%*	*75%*			*83%*		*67%*
86				$236,406	$208,960	$66,434			$148,289		$993,124
85		$409,746				$164,130					$829,221
84		$58,210				$54,033					$563,690
83	$153,500	$607,957				$159,335					$1,354,391
82		$134,502		$62,570	$74,434						$421,588
81											$625,515
80									$70,000		$220,388
79											$677,688
78		$148,574							$168,863		$929,530
77											$968,422
76											$50,076
75											$435,306
74		$60,775				$126,917					$352,766
73											$92,602
72											$72
71											$71
70		$56,000									$56,070
69											$69
Subtotal:	$153,500	$1,475,764		$298,976	$283,394	$570,849	$0		$387,152		$8,569,194
Percent of Total:	*17%*	*73%*		*19%*	*31%*	*25%*			*17%*		*33%*
Total:	$914,893	$2,015,150		$1,552,971	$906,034	$2,266,066	$0		$2,283,349		$26,018,493

Note: Yearly sums are expressed in purchase year dollars, they have not been inflated to current year dollars.
(1) Laboratory has no equipment with a purchase price greater than $50,000.
(2) Equipment inventory is included in parent laboratory inventory.

Table 4-14. Equipment Inventory Summary (Purchase Price >$50,000) Program Office Laboratories

Purchase Year	OAR/NAREL/MONT	OAR/OAQPS/EMB	OAR/NVFEL/AA	OAR/ORIA/LV	OE/NEIC/DEN	OGWDW/TSD/CIN	OPP/ACL/BELTS	OPP/ECL/BSL	Program Office Total
94					$151,880	(3)	(3)	(3)	
93			$62,560		$207,730				$270,290
92	$562,266				$75,150				$637,416
91	$675,345	$95,375							$770,720
90			$55,474						$55,474
89			$56,705		$600,613				$657,318
88	$351,000				$66,100				$417,100
87				$97,605	$186,786				$284,391
Subtotal:	$1,588,611	$95,375	$174,739	$97,605	$1,288,259				$3,244,589
Percent of Total:	*90%*	*100%*	*10%*	*60%*	*84%*				*61%*
86			$164,638						$164,638
85	$170,396				$161,500				$331,896
84									
83									
82					$84,577				$84,577
81				$64,254					$64,254
80			$75,000						$75,000
79									
78									
77			$188,173						$188,173
76									
75									
74			$240,000						$240,000
73			$76,000						$76,000
72									
71			$671,500						$671,500
70									
69			$214,000						$214,000
Subtotal:	$170,396		$1,629,311	$64,254	$246,077				$2,110,038
Percent of Total:	*10%*		*90%*	*40%*	*16%*				*39%*
Total:	$1,759,007	$95,375	$1,804,050	$161,859	$1,534,336				$5,354,627

Note: Yearly sums are expressed in purchase year dollars, they have not been inflated to current year dollars.

(1) Laboratory has no equipment with a purchase price greater than $50,000.

(2) Equipment inventory is included in parent laboratory inventory.

(3) No data provided.

Table 4-15. Equipment Inventory Summary (Purchase Price >$50,000) Environmental Services Organizations

Purchase Year	R01/NERL/LEX	R02/ESD/EDIS	R03/CRL/ANN	R04/ESD/ATH	R05/ESD/CHI	R06/ESD/HOU	R07/ESD/KAN	R08/ESD/DEN	R09/ESB/RICH	R10/ESD/SEA	ESO Total
94	$74,640			(3)							$74,640
93	$79,650	$303,188			$126,483					$181,924	$691,245
92	$100,000		$187,104			$160,000		$216,633		$959,255	$1,622,992
91	$51,902	$66,095					$165,981	$64,085	$192,016	$128,075	$668,154
90	$168,769				$51,987		$220,616	$92,173			$533,545
89	$135,259	$148,135	$105,000		$374,885		$280,004	$54,357	$141,078		$1,238,718
88		$212,942	$236,011		$233,510		$266,828	$393,250	$87,815	$147,861	$1,578,217
87		$68,288	$77,500		$351,964			$56,086	$122,713		$676,551
Subtotal:	$610,220	$798,648	$605,615		$1,138,829	$160,000	$933,429	$876,584	$543,622	$1,417,115	$7,084,062
Percent of Total:	75%	62%	53%		85%	29%	42%	100%	61%	83%	66%
86		$263,986				$140,000	$149,580			$145,000	$698,566
85	$200,000	$62,571				$250,000	$751,670		$204,252		$1,468,493
84											
83			$216,170				$209,500			$141,504	$567,174
82											
81									$145,824		$145,824
80			$251,400								$251,400
79			$66,782				$85,000				$151,782
78					$54,900						$54,900
77					$100,000		$70,000				$170,000
76					$50,000						$50,000
75											
74											
73											
72											
71											
70											
69		$172,916									$172,916
Subtotal:	$200,000	$499,473	$534,352		$204,900	$390,000	$1,265,750		$350,076	$286,504	$3,731,055
Percent of Total:	25%	38%	47%		15%	71%	58%		39%	17%	34%
Total:	$810,220	$1,298,121	$1,139,967		$1,343,729	$550,000	$2,199,179	$876,584	$893,698	$1,703,619	$10,815,117

Note: Yearly sums are expressed in purchase year dollars, they have not been inflated to current year dollars.

(1) Laboratory has no equipment with a purchase price greater than $50,000.

(2) Equipment inventory is included in parent laboratory inventory.

(3) No data provided.

investments of $800,000 to $1,000,000 are required.

Figures 4-12, 4-13, 4-14, and 4-15 provide additional information regarding the space and occupants of the laboratory facilities.

All of the figures used for equipment costs came from EPA's database. The inventory was not checked during visits to the laboratories, but some equipment was identified that was not included in the inventory. Some laboratories had prepared more detailed inventories for developing specifications for new buildings, but as these were not available for all laboratories, the agency's official inventory was used. An updated or reengineered system including data entry procedures may be required to ensure valid data Agency-wide.

4.6 HUMAN RESOURCES

4.6.1 Intramural Resources

During the course of this study, the Agency conducted a companion study referred to as Workforce '94. Agency employees working in the laboratory organizations were asked for data such as their degrees, employment level, and the activities they perform. A separate report will present the complete data set, but excerpts from that data set have been included in this laboratory study to support the option evaluation.

Figure 4-16 presents the academic degrees reported from GS 9 and above at the ESO and program office laboratories combined. In the Workforce '94 questionnaire, individuals were asked to report all of the academic degrees that they have earned. While the data do not precisely show what skills a person is currently using, they do give an indication of the expertise resident at a laboratory. The professional profiles for both laboratory types are similar, with more variety among the program office laboratories, but nonetheless a common concentration of engineering, biological sciences, and chemistry degrees. That is, there is no clear differentiation among these two laboratory types to be made on the basis of their professional staffing. A nearly identical pattern is found for the ORD laboratories, as shown in Figure 4-17.

The age distribution for staff has been compiled in three different grade groupings and is shown in Figures 4-18, 4-19, and 4-20. GC1 includes Senior Executive Service (SES) and GM/GS levels 14 and above (managerial grades); GC2 includes GM/GS grades 9 through 13 (scientists and engineers); and GC3 is less than GM/GS grade 9 (technical and administrative support). The distribution in each of the three grade groupings are generally similar; a significant fraction of the staff is in the upper age brackets. Similar figures prepared for each laboratory appear in Appendix A. The distributions vary greatly from

FIG4-12.XLS Chart 1 - 5/27/94

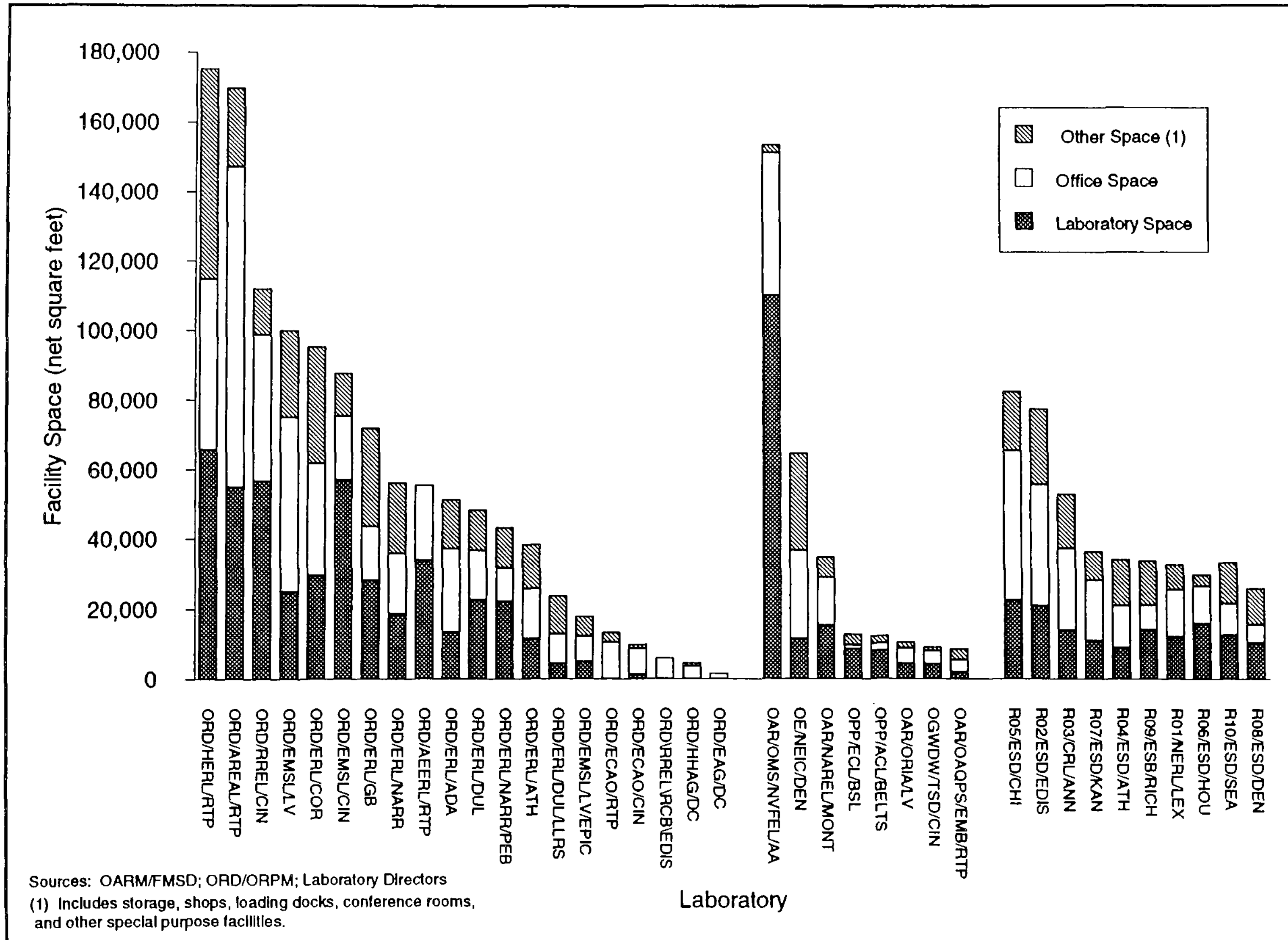


Figure 4-12. Facility Space by Laboratory

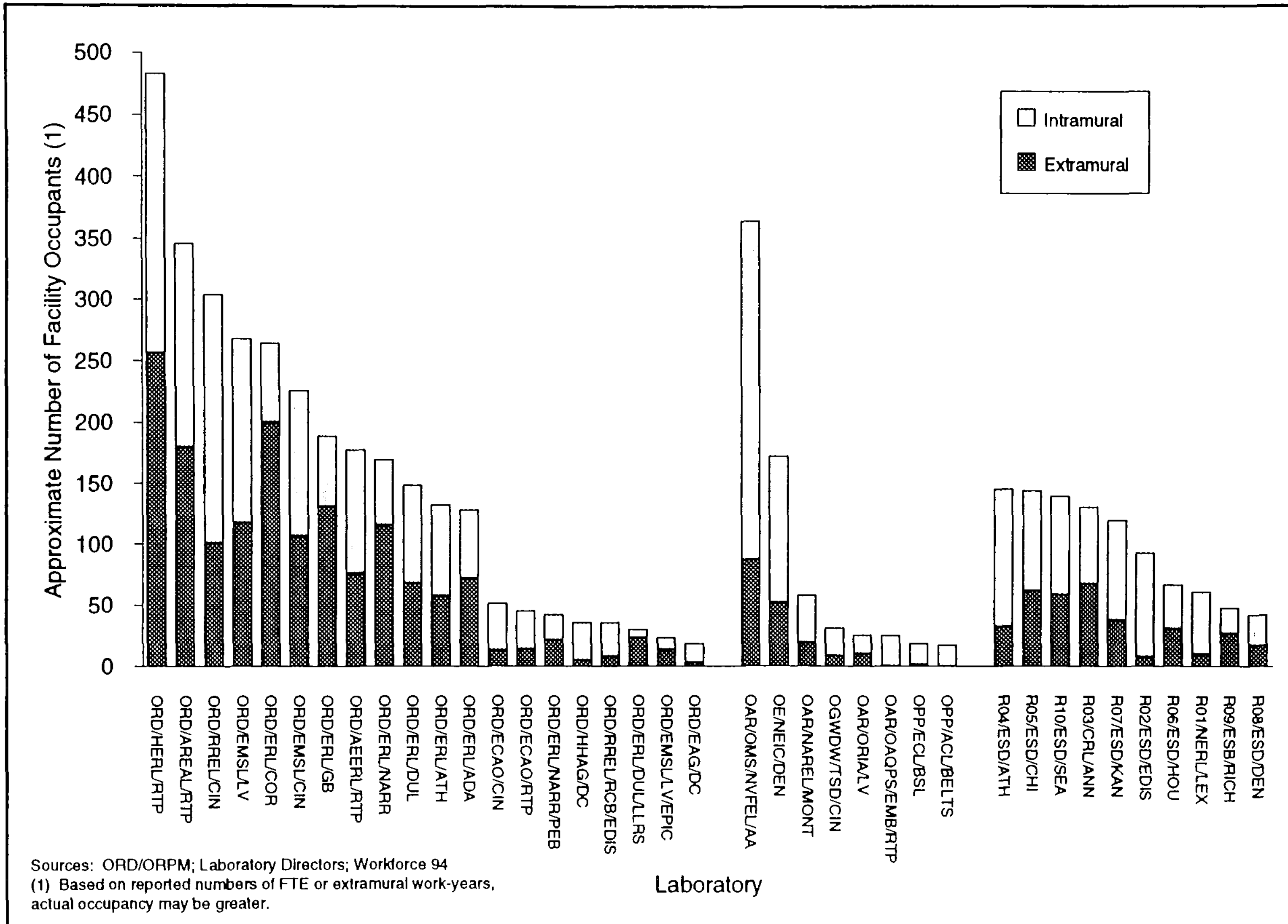
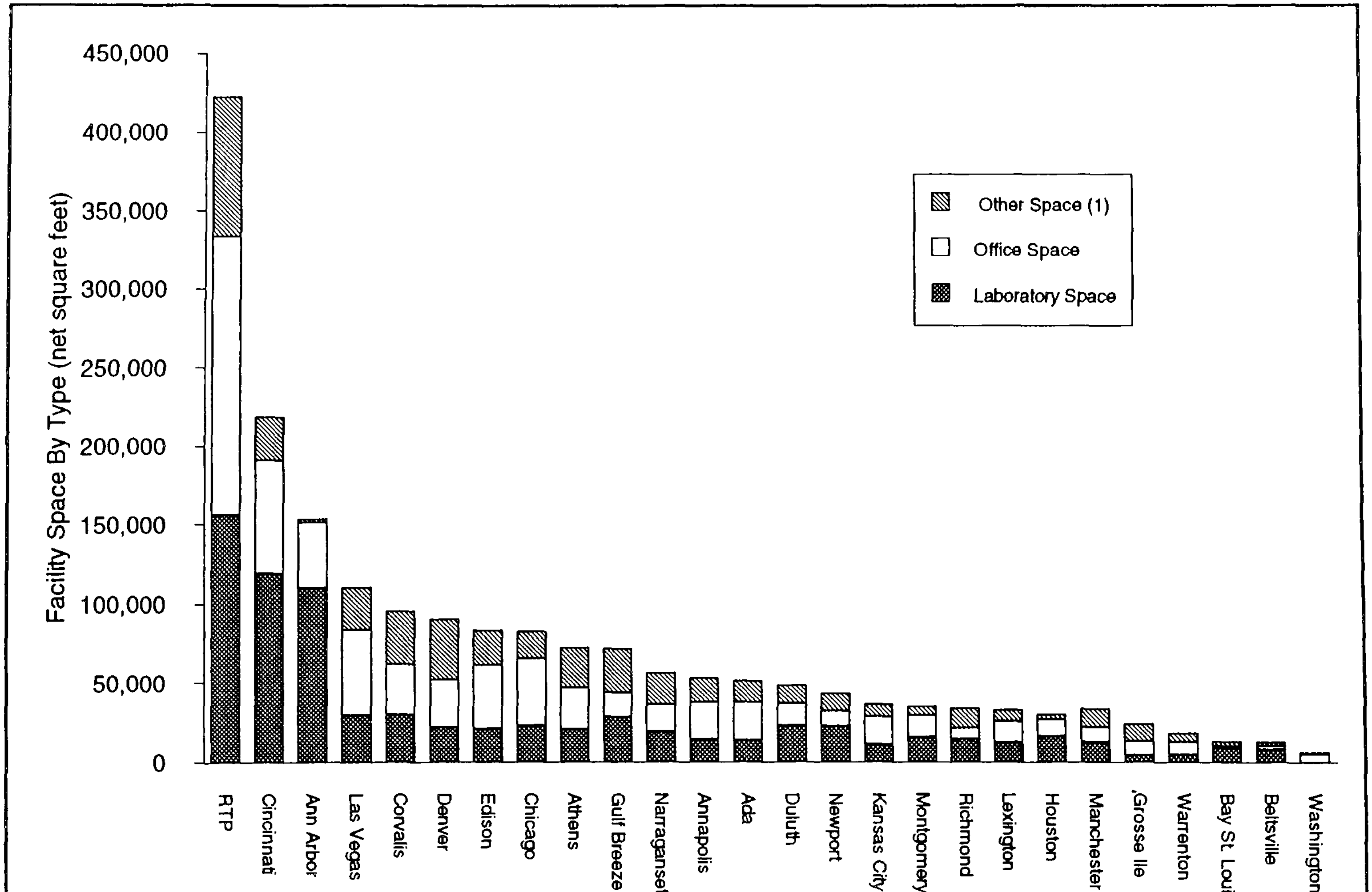


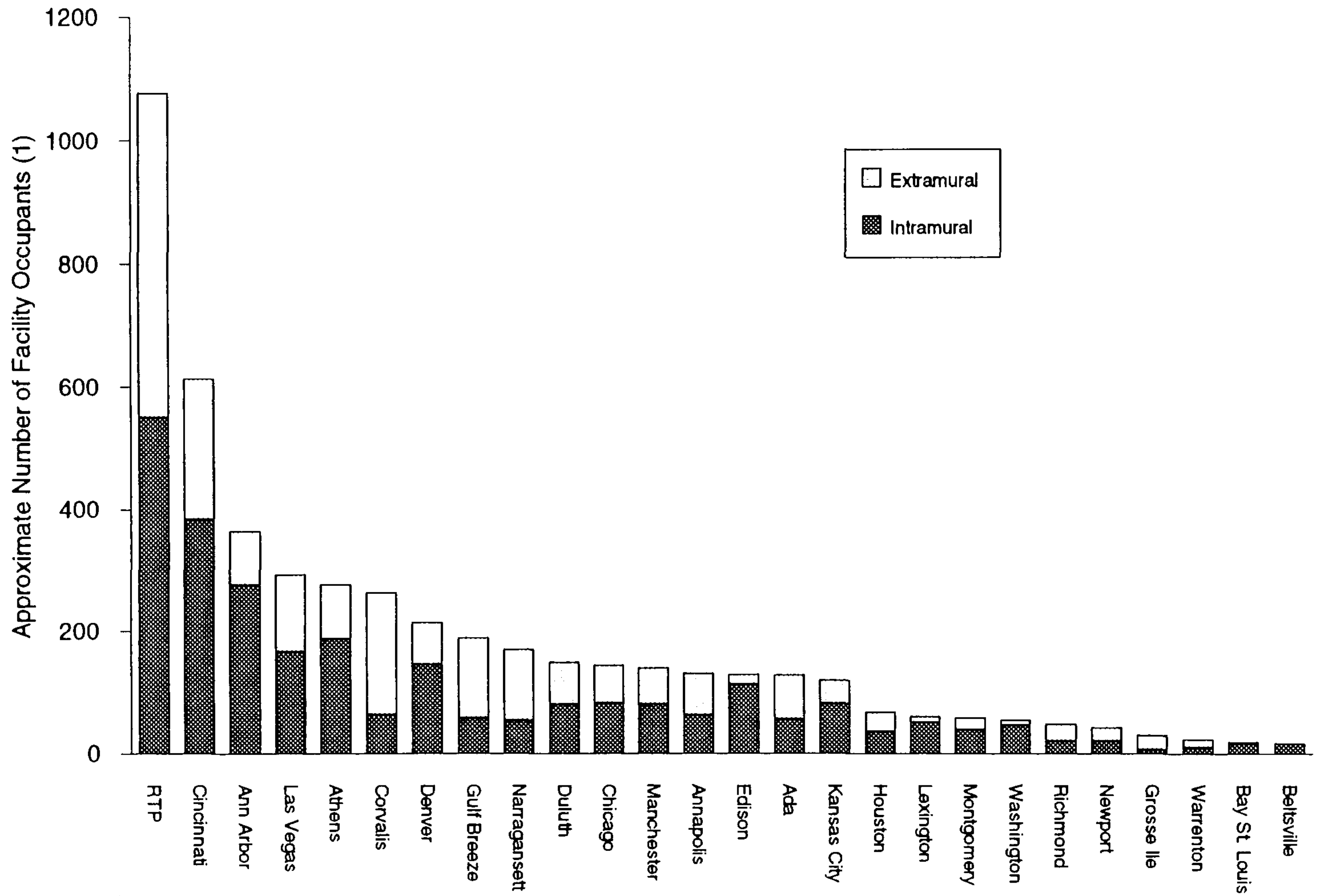
Figure 4-13. Approximate Number of Facility Occupants (Based on Workforce Data)



Source: See Table 4-12

(1) Includes storage, shops, loading docks, conference rooms, and other special purpose facilities.

Figure 4-14. Total Facility Space By Location



Source: See Table 4-12
(1) Based on reported numbers of EPA FTE and extramural work-years; actual occupancy may be greater.

Figure 4-15. Approximate Total Facility Occupants By Location

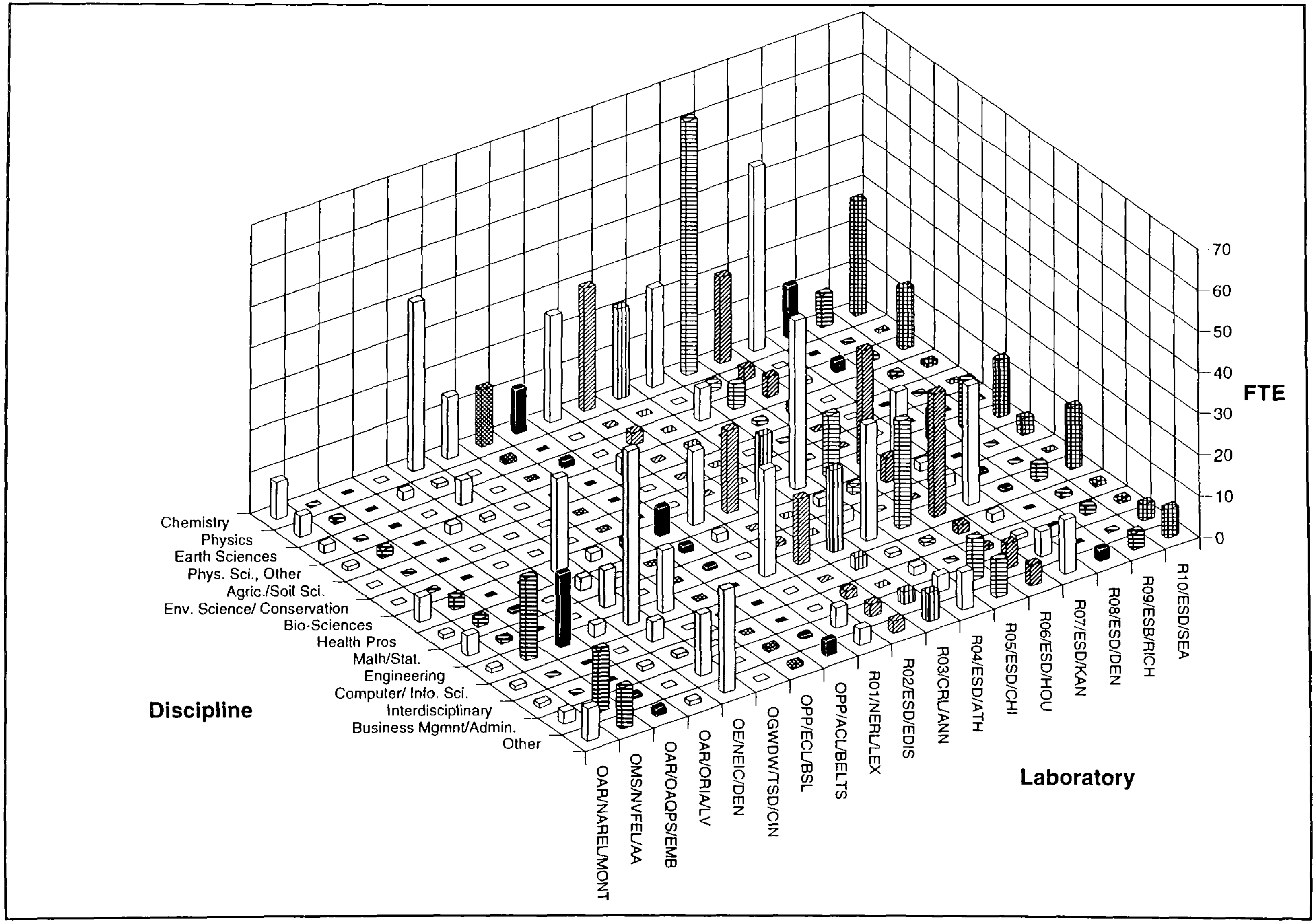


Figure 4-16. FTE by Discipline (Degrees) for Program Office Laboratories and Environmental Services Organizations for all Grades GS9 and Above

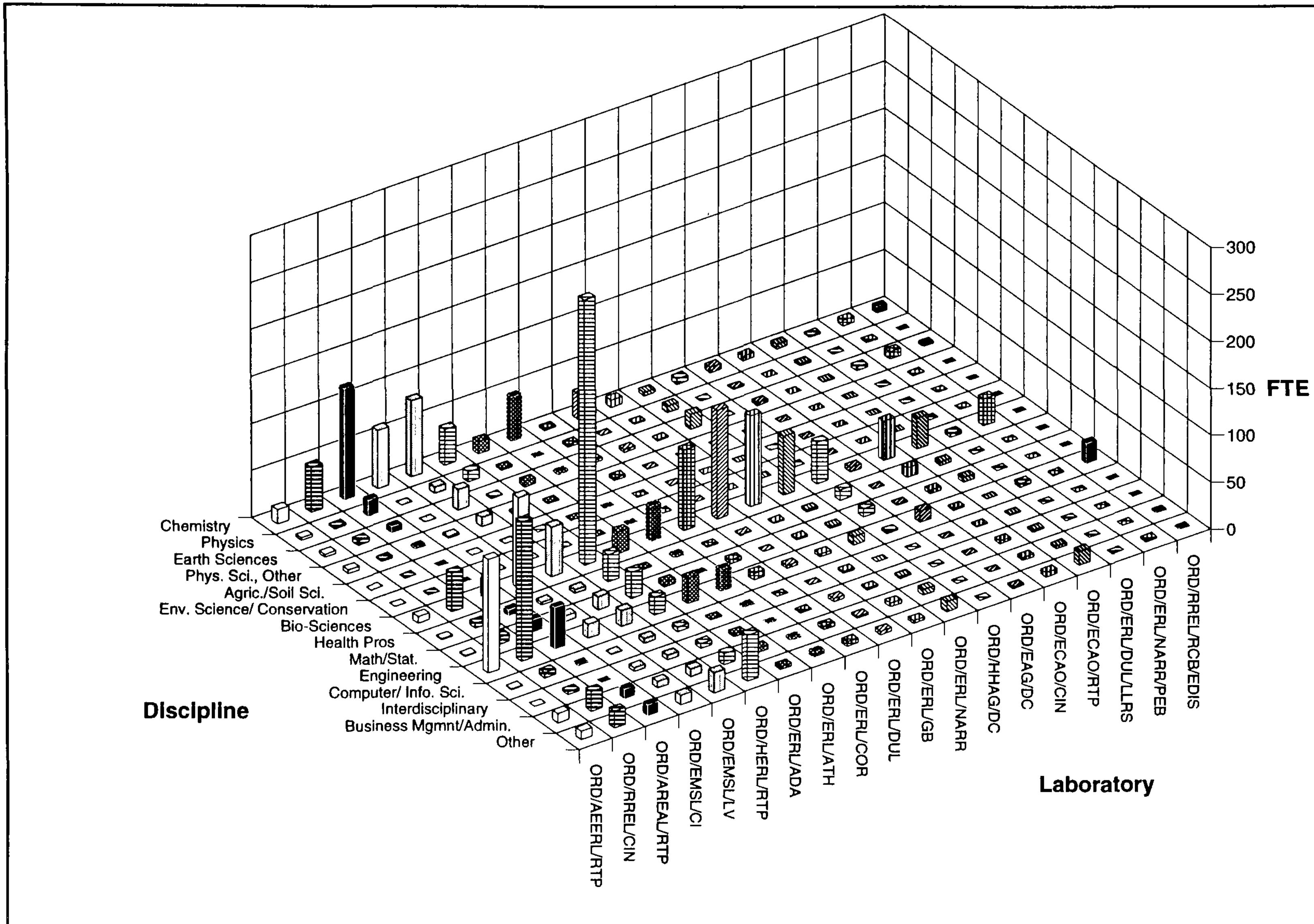
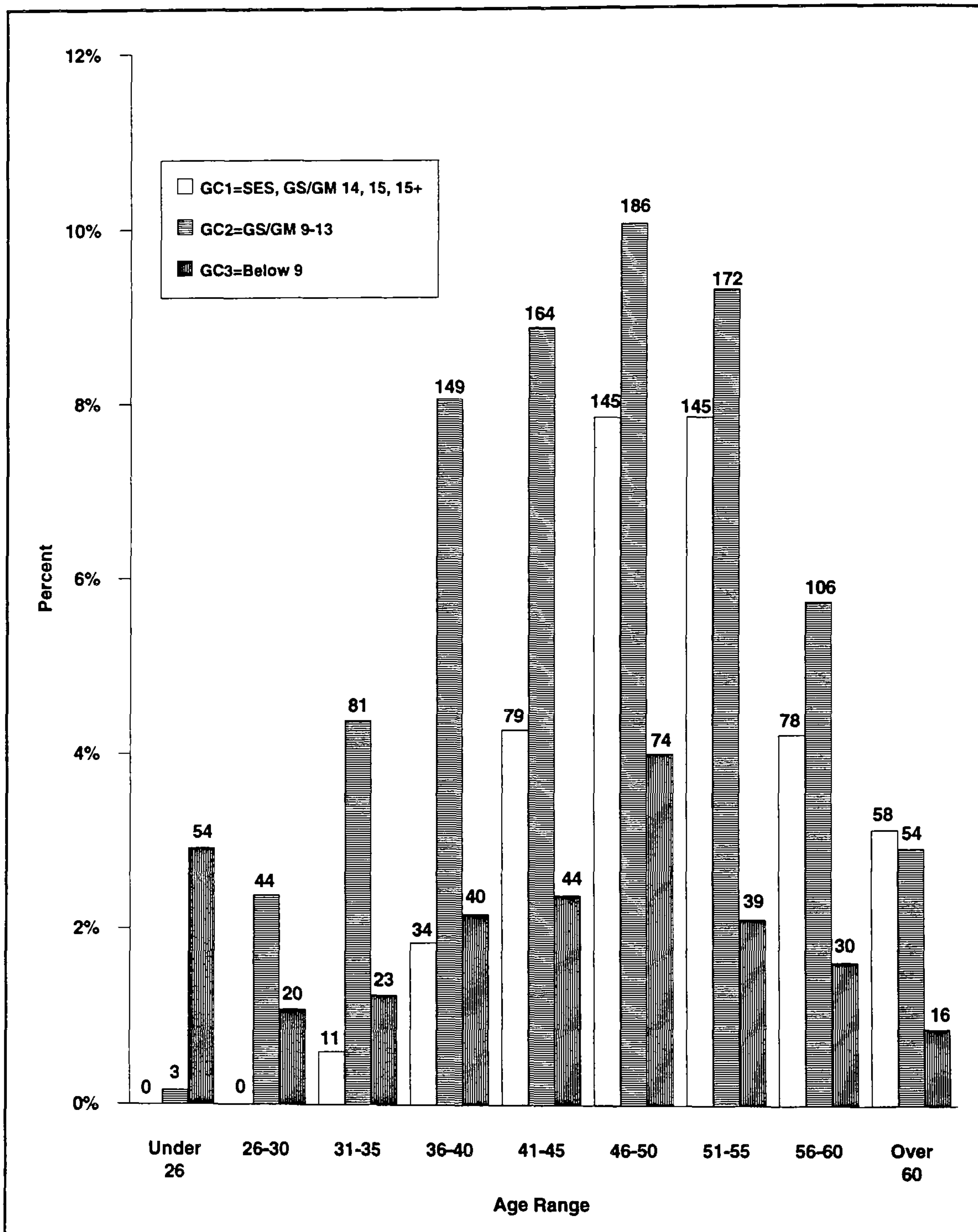
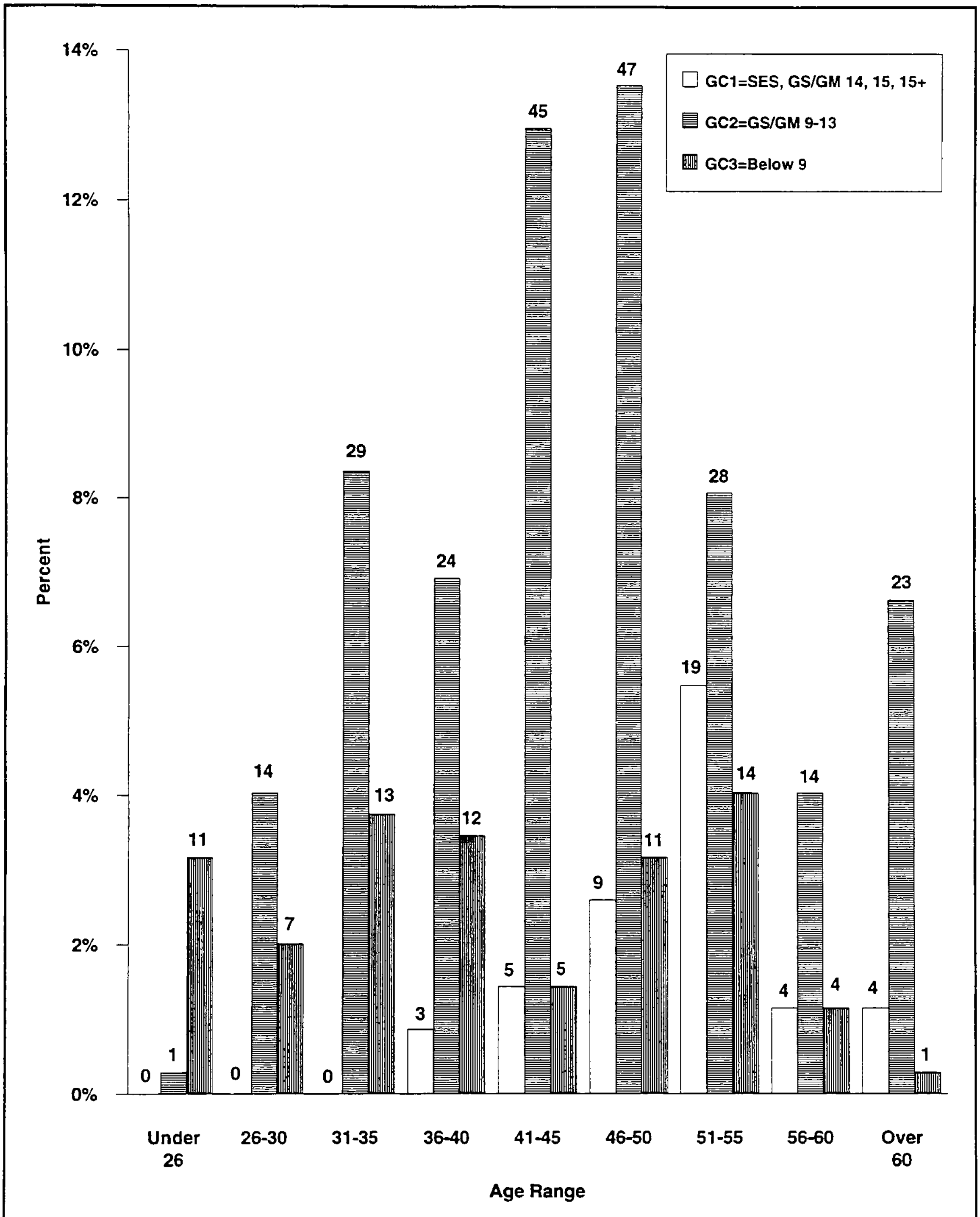


Figure 4-17. FTE by Discipline (Degrees) for ORD Laboratories for all Grades GS9 and Above



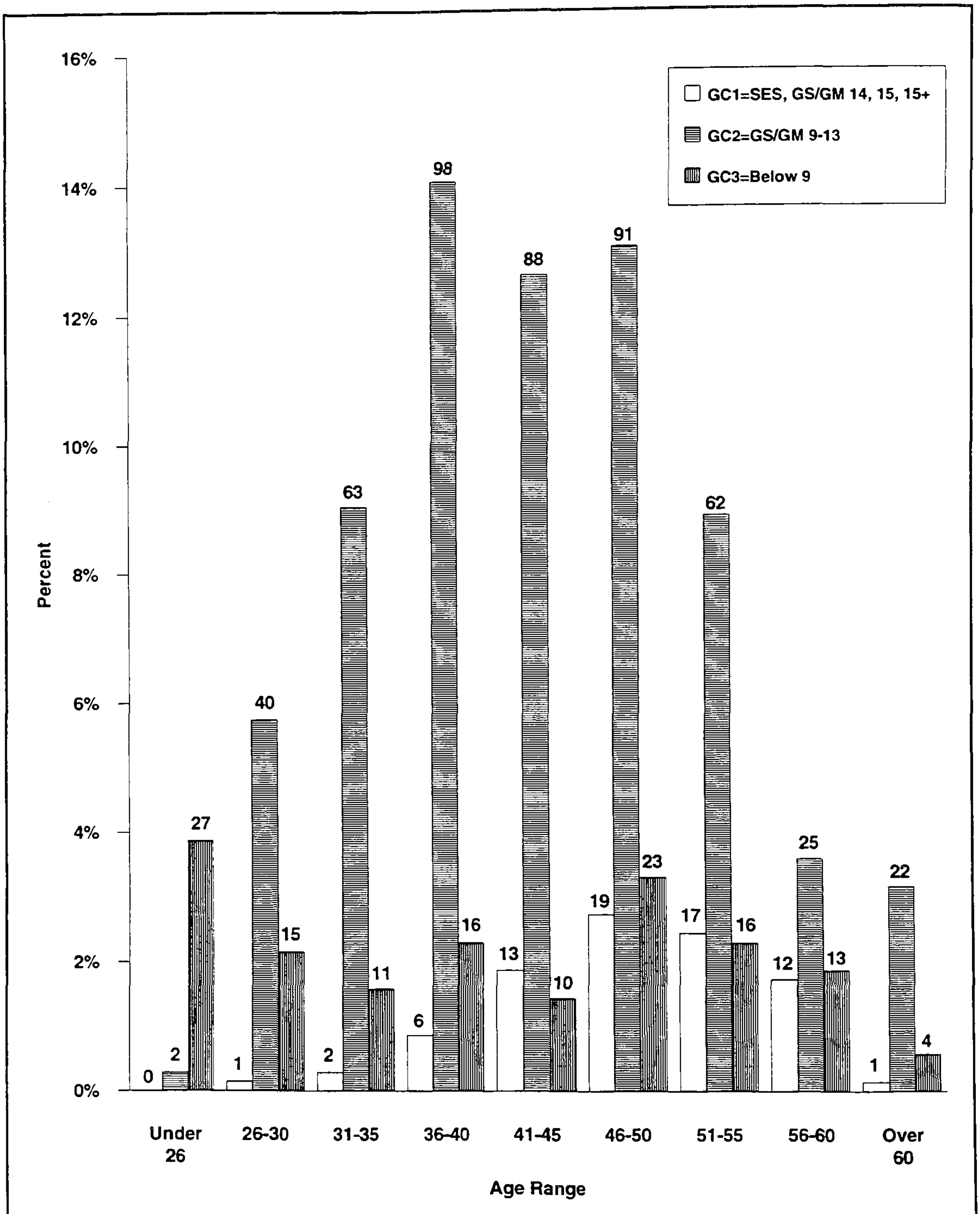
Source: Workforce 94

Figure 4-18. Intramural Workforce Age Distribution
ORD Laboratories



Source: Workforce 94

Figure 4-19. Intramural Workforce Age Distribution
Program Office Laboratories



Source: Workforce 94

Figure 4-20. Intramural Workforce Age Distribution
Environmental Services Organizations

laboratory to laboratory, some laboratories having large percentages of their staff in the categories above 45 years old.

Employee activities are summarized by percent of work year and presented in Tables 4-16, 4-17, and 4-18. These tables show the distribution of activities by four major functions and provide detailed comparison data on workforce activities across all laboratories.

Appendix A contains information on characteristics of employees eligible for retirement in the next seven years for each laboratory. No summary table has been prepared for this information.

Tables 4-19, 4-20, and 4-21 give summaries of the disciplines in which ORD laboratory staff and program office and ESO staff hold degrees. The total is the number of degrees reported; if a staff member holds bachelor, master, and doctorate degrees, three degrees would be counted. For this reason, the total number of degrees is greater than the total number of staff at the laboratories.

4.6.2 Extramural Resources

Laboratory staff were asked to provide information regarding their on-site extramural FTEs. These data are presented for the ORD laboratories in Table 4-22 and show that the total extramural force is about the same size as the intramural workforce. Data for the program offices and ESOs are shown in Table 4-23. The program office laboratories reported only 15 percent of their on-site workforce as extramural and the ESOs reported 34 percent as extramural. Figure 4-21 summarizes the intramural and extramural work year equivalents for each laboratory. The percent of intramural and extramural work years is displayed in Figure 4-22 for each laboratory reporting both intramural and extramural work years. The laboratories are arranged by type (ORD, program office, and ESO). Of the ORD laboratories, the two Environmental Criteria and Assessment Offices (ECAOs) and the RREL report greater than 60 percent of their total work years delivered by EPA staff. Of the program office laboratories and ESOs shown with data, the majority reported greater than 60 percent of their total work years delivered by EPA staff.

Table 4-16. Percentage Distribution of Reported Work Activities ORD Headquarters Offices and Laboratories

Work Activity	ORD/HQ/EMAP	ORD/HQ/OAA	ORD/HQ/OEETD	ORD/HQ/OEPER	ORD/HQ/OER	ORD/HQ/OHEA	ORD/HQ/OHR	ORD/HQ/OMMSQA	ORD/HQ/ORPM	ORD/HQ/OSPRE	ORD/AEERL/RTP	ORD/AREAL/RTP	ORD/EAG/DC	ORD/ECAO/CIN	ORD/ECAO/RTP
Management, Policy and Planning Functions	**46%**	**28%**	**47%**	**62%**	**21%**	**12%**	**27%**	**50%**	**45%**	**30%**	**14%**	**13%**	**13%**	**12%**	**10%**
Science and Engineering Functions	**31%**	**8%**	**11%**		**29%**	**29%**	**27%**	**19%**		**29%**	**54%**	**59%**	**81%**	**54%**	**65%**
Science and Engineering Management	8%						9%	4%		1%	4%	4%	6%	5%	3%
General Management Responsibilities										1%	1%	2%			
Bench Science,Engineering,Modeling											7%	12%	13%	5%	3%
Scientific Analysis and Interpretation	8%	3%				6%	9%			4%	7%	13%	25%	20%	32%
Extramural Management															
Technical Oversight and Project Direction	8%	3%	5%		14%			4%		3%	14%	8%	13%	7%	6%
Administrative Tasks	8%		5%		14%	6%		4%		1%	8%	5%	6%	2%	3%
Technology Transfer		3%				6%		4%		12%	6%	4%	6%	5%	6%
Technical Assistance						6%	9%	4%		5%	4%	6%	13%	7%	10%
Quality Assurance						6%					3%	5%		2%	
Other															
Technical Support to Science Functions		**8%**		**5%**	**7%**	**18%**		**8%**	**2%**	**22%**	**12%**	**11%**		**17%**	**3%**
Administrative Functions	**23%**	**56%**	**42%**	**33%**	**43%**	**41%**	**45%**	**23%**	**53%**	**19%**	**20%**	**17%**	**6%**	**17%**	**23%**
Total:	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Workforce '94

Table 4-16. Percentage Distribution of Reported Work Activities (Concluded)
ORD Headquarters Offices and Laboratories

Work Activity	ORD/EMSL/CIN	ORD/EMSL/LV	ORD/ERL/ADA	ORD/ERL/ATH	ORD/ERL/COR	ORD/ERL/DUL	ORD/ERL/DUL/LLRS	ORD/ERL/GB	ORD/ERL/NARR	ORD/ERL/NARR/PEB	ORD/HERL/RTP	ORD/HHAG/DC	ORD/RREL/CIN	ORD/RREL/RCB/EDIS
Management, Policy and Planning Functions	**15%**	**14%**	**15%**	**9%**	**12%**	**7%**		**10%**	**16%**		**8%**	**7%**	**15%**	**5%**
Science and Engineering Functions	**58%**	**42%**	**49%**	**51%**	**58%**	**59%**	**80%**	**49%**	**57%**	**72%**	**51%**	**80%**	**47%**	**81%**
Science and Engineering Management	3%	4%	3%	3%	6%	4%		3%	5%	6%	3%	3%	4%	5%
General Management Responsibilities	2%	1%	2%	3%	3%	2%		2%			2%	3%	1%	10%
Bench Science,Engineering,Modeling	16%	7%	11%	16%	15%	23%	20%	21%	20%	22%	21%	3%	8%	5%
Scientific Analysis and Interpretation	14%	7%	8%	11%	13%	14%	20%	11%	16%	17%	14%	37%	7%	5%
Extramural Management														
Technical Oversight and Project Direction	5%	7%	7%	4%	6%	4%	20%	5%	4%	6%	4%	7%	9%	14%
Administrative Tasks	4%	6%	5%	5%	6%	3%	20%	2%	4%	6%	2%	3%	6%	14%
Technology Transfer	3%	1%	3%	3%	1%	2%		2%	4%		1%	7%	4%	14%
Technical Assistance	4%	5%	8%	4%	3%	2%		2%	4%	6%	2%	13%	6%	14%
Quality Assurance	6%	4%	2%	3%	4%	3%		3%	2%	11%	2%	3%	2%	
Other														
Technical Support to Science Functions	**8%**	**22%**	**13%**	**15%**	**15%**	**22%**		**19%**	**11%**	**17%**	**23%**		**17%**	**10%**
Administrative Functions	**19%**	**23%**	**23%**	**25%**	**15%**	**12%**	**20%**	**22%**	**16%**	**11%**	**18%**	**13%**	**21%**	**5%**
Total:	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Workforce '94

Table 4-17. Percentage Distribution of Reported Work Activities
Program Office Laboratories

Work Activity	OAR/NAREL/MONT	OAR/NVFEL/AA	OAR/OAQPS/EMB/RTP	OAR/ORIA/LV	OE/NEIC/DEN	OGWDW/TSD/CIN	OPP/ACL/BELTS	OPP/ECL/BSL
Management, Policy and Planning Functions	**7%**	**29%**	**19%**		**10%**	**21%**		**9%**
Science and Engineering Functions	**54%**	**41%**	**81%**	**55%**	**50%**	**50%**	**50%**	**55%**
Science and Engineering Management	2%	6%	14%	9%	5%	4%		
General Management Responsibilities	2%	3%	5%		1%			
Bench Science,Engineering,Modeling	15%	6%	5%	18%	6%	8%	19%	27%
Scientific Analysis and Interpretation	12%	9%	5%	9%	16%	8%	19%	9%
Extramural Management								
Technical Oversight and Project Direction	5%	3%	10%		1%	4%	6%	
Administrative Tasks	2%	3%	5%		1%			
Technology Transfer		6%	10%		4%	8%		
Technical Assistance	7%	3%	14%	9%	9%	13%		9%
Quality Assurance	7%	3%	10%	9%	6%	4%	6%	9%
Other			5%					
Technical Support to Science Functions	**17%**	**6%**		**9%**	**18%**	**13%**	**31%**	**27%**
Administrative Functions	**22%**	**24%**		**36%**	**22%**	**17%**	**19%**	**9%**
Total:	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Workforce '94

Table 4-18. Percentage Distribution of Reported Work Activities
Environmental Services Organizations

Work Activity	R01/NERL/LEX	R02/ESD/EDIS	R03/CRL/ANN	R04/ESD/ATH	R05/ESD/CHI	R06/ESD/HOU	R07/ESD/KAN	R08/ESD/DEN	R09/ESB/RICH	R10/ESD/SEA
Management, Policy and Planning Functions	**18%**	**14%**	**19%**	**10%**	**14%**	**14%**	**7%**	**20%**	**5%**	**7%**
Science and Engineering Functions	**56%**	**74%**	**56%**	**40%**	**46%**	**49%**	**52%**	**48%**	**71%**	**63%**
Science and Engineering Management	4%		4%	2%	3%	4%	4%			3%
General Management Responsibilities		2%	2%	1%	1%	1%	3%		5%	1%
Bench Science,Engineering,Modeling	2%	2%	4%	5%	4%	3%	6%	12%	5%	4%
Scientific Analysis and Interpretation	18%	21%	14%	10%	14%	15%	20%	16%	5%	35%
Extramural Management										
Technical Oversight and Project Direction	7%	7%	5%	2%	3%	1%	3%	4%	10%	3%
Administrative Tasks	2%	5%	4%	1%	1%	1%	3%	4%	10%	1%
Technology Transfer	2%	2%	4%	3%	3%	3%	3%		5%	4%
Technical Assistance	11%	12%	9%	9%	7%	8%	4%	8%	14%	4%
Quality Assurance	9%	23%	12%	7%	9%	12%	6%	4%	19%	4%
Other										1%
Technical Support to Science Functions				**29%**	**14%**	**11%**	**7%**	**12%**		**15%**
Administrative Functions	**27%**	**12%**	**25%**	**21%**	**25%**	**26%**	**33%**	**20%**	**24%**	**15%**
Total:	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: Workforce '94

Table 4-19. Number of Degrees (GS9 and Above)
ORD Laboratories

Discipline	ORD/AEERL/RTP	ORD/AREAL/RTP	ORD/EAG/DC	ORD/ECAO/CIN	ORD/ECAO/RTP	ORD/EMSL/CIN	ORD/EMSL/LV	ORD/EMSL/LV/EPIC	ORD/ERL/ADA	ORD/ERL/ATH
Chemistry										
Chemistry, General	9	49	2	2	3	36	33		11	19
Analytical Chemistry	4	15				10	14		1	5
Inorganic Chemistry		5	2			4	2			1
Organic Chemistry	1	13	2	1		11	16			7
Chemistry, Other	1	37		2	2	1	16		1	16
Physics	3	18	1		2		7		2	1
Earth Sciences										
Geological Sciences	3	2	3		1		18		6	
Oceanography		1					1			3
Atmospheric Sciences		4					3			
Physical Sciences, Other	4	3				2	10		1	
Agricultural/Soil Sciences										
Environmental Science/ Resource Conservation										
Biological Sciences										
Biology	2	10		11	6	21	16		7	8
Plant Biology		3	2		5	2			1	1
Biochemistry/Cell Biology/Genetics		2	1	3	4	16	7		2	5
Microbiology/Bacteriology/Virology				4		22	5		9	12
Ecology		2	1	4	1	8	7		1	5
Marine/Aquatic Biology		1				2	4		2	3
Toxicology/Pharmacology	2			9	11	3	3			
Physiology/Anatomy/Pathology			1	2	2	2	2			
Biotechnology										
Zoology	2			3	3	10	4		1	
Entomology		2					1			
Biological Sciences,Other	1	2		6	1	11	4			4
Health Professions	1	7		10	4	3	4		1	3
Mathematics/Statistics	1	14	1	4	5	6	14		5	1
Engineering										
Chemical Engineering	60	16	5			4	2		4	5
Mechanical Engineering	24	3				3	1		1	
Civil/Environmental Engineering	18	12	2	1		6	3		18	8
Engineering, Other	19	14	5	1		2	11		4	11
Computer and Information Sciences	1	2		1	1	1	5		1	2
Interdisciplinary				3	2	4	5		3	1
Business Management and Administration	10	11		3	3	7	8		5	3
Other	9	12	2	5	15	10	22		3	6
No Response										
Total Number of Degrees:	175	260	30	75	71	207	248		90	130

Source: ORD/ORPM (Workforce '94)
Note: Each FTE may have more than one degree/discipline.

Table 4-19. Number of Degrees (GS9 and Above) (Concluded)
ORD Laboratories

Discipline	ORD/ERL/COR	ORD/ERL/DUL	ORD/ERL/DUL/LLRS	ORD/ERL/GB	ORD/ERL/NARR	ORD/ERL/NARR/PEB	ORD/HERL/RTP	ORD/HHAG/DC	ORD/RREL/CIN	ORD/RREL/RCB/EDIS	ORD Total
Chemistry											
Chemistry, General	1	11	1	5	1	4	20	4	21	2	234
Analytical Chemistry	1	5	1	2	1		2		9	3	73
Inorganic Chemistry		2							4	1	21
Organic Chemistry		1				1	8	1	7	2	71
Chemistry, Other		8		1	2	1	8	1	7		104
Physics	3			1	7	1	11		2		59
Earth Sciences											
Geological Sciences	1	3	2		5	2			5	2	53
Oceanography	2		2	1	11	5				2	28
Atmospheric Sciences						1	1				9
Physical Sciences, Other	3					1	2		2		28
Agricultural/Soil Sciences											
Environmental Science/ Resource Conservation											
Biological Sciences											
Biology	17	34	3	32	15	10	64	3	13		272
Plant Biology	20	4		2		3	4				47
Biochemistry/Cell Biology/Genetics	6	4		8	7		44	14	5		128
Microbiology/Bacteriology/Virology	7	1		13	2	1	20	3	14		113
Ecology	14	14		3	5	1					66
Marine/Aquatic Biology	7	17		14	16	13	2	1			82
Toxicology/Pharmacology	1	13		5	3		51	7	6		114
Physiology/Anatomy/Pathology		4		4	2		45	7	1		72
Biotechnology					1		1				2
Zoology	7	14		7	3	1	21	4		1	81
Entomology		2		2			2	1			10
Biological Sciences,Other	7	9	1	7	9		29	4	2		97
Health Professions	1	1		1	2		29	11	5		83
Mathematics/Statistics	4			2	2		28	9	8		104
Engineering											
Chemical Engineering									50	4	150
Mechanical Engineering	3						3		16	2	56
Civil/Environmental Engineering	2	2	4	1	5	1	5	2	69	12	171
Engineering, Other	2	1		2	4		11		14	4	105
Computer and Information Sciences				2			5		6		27
Interdisciplinary	1	3		2	2		5		3		34
Business Management and Administration	4	2		4	6		12		21	2	101
Other	5	4		3	11	2	49		18	2	178
No Response											
Total Number of Degrees:	119	159	14	124	122	48	482	72	308	39	2773

Source: ORD/ORPM (Workforce '94)

Note: Each FTE may have more than one degree/discipline.

Table 4-20. Number of Degrees (GS9 and Above)
Program Office Laboratories

Discipline	OAR/NAREL/MONT	OAR/OAQPS/EMB/RTP	OAR/NVFEL/AA	OAR/ORIA/LV	OE/NEIC/DEN	OGWDW/TSD/CIN	OPP/ACL/BELTS	OPP/ECL/BSL	Program Office Total
Chemistry									
Chemistry, General	5				26	5	10	5	51
Analytical Chemistry	1				5	3	2	3	14
Inorganic Chemistry					1				1
Organic Chemistry	1				2	5	1	1	10
Chemistry, Other	2				7	2	1	2	14
Physics	5		1	2	1		1		10
Earth Sciences									
Geological Sciences	2				4				6
Oceanography								2	2
Atmospheric Sciences					2				2
Physical Sciences, Other	1		2	2	1				6
Agricultural/Soil Sciences									
Environmental Science/ Resource Conservation									
Biological Sciences									
Biology	4		3		2	1	1	3	14
Plant Biology					2				2
Biochemistry/Cell Biology/Genetics					2				2
Microbiology/Bacteriology/Virology	1					1	1	1	4
Ecology					3				3
Marine/Aquatic Biology								2	2
Toxicology/Pharmacology									
Physiology/Anatomy/Pathology					2				2
Biotechnology									
Zoology					7				7
Entomology									
Biological Sciences,Other	1				5			1	7
Health Professions	1	1	2		3			2	9
Mathematics/Statistics	5		1		9			1	16
Engineering									
Chemical Engineering		3	3		11	1			18
Mechanical Engineering		8	12	1					21
Civil/Environmental Engineering		4	2		27	14			47
Engineering, Other	1	3	3	2	4				13
Computer and Information Sciences	1				5				6
Interdisciplinary	1			1	1				3
Business Management and Administration	3	1	15		15		1	1	36
Other	8	2	10	1	25		1	4	51
No Response									
Total Number of Degrees:	43	22	54	9	172	32	19	28	379

Source: ORD/ORPM (Workforce '94)

Note: Each FTE may have more than one degree/discipline.

Table 4-21. Number of Degrees (GS9 and Above) Environmental Services Organizations

Discipline	R01/NERL/LEX	R02/ESD/EDIS	R03/CRL/ANN	R04/ESD/ATH	R05/ESD/CHI	R06/ESD/HOU	R07/ESD/KAN	R08/ESD/DEN	R09/ESB/RICH	R10/ESD/SEA	ESO Total
Chemistry											
Chemistry, General	9	18	14	11	26	14	29	6	4	17	148
Analytical Chemistry	10	2	3	8	10	3	6	3	2	7	54
Inorganic Chemistry	1	3		1	6		2	1			14
Organic Chemistry	5	4	2	2	7	1		1	2	4	28
Chemistry, Other	1	3	3	2	13	3	8	2			35
Physics					2	3					5
Earth Sciences											
Geological Sciences		2		8	6	4		2	1	11	34
Oceanography										1	1
Atmospheric Sciences		1				1	1	1		3	7
Physical Sciences, Other	4		1		1	2			1	1	10
Agricultural/Soil Sciences											
Environmental Science/ Resource Conservation											
Biological Sciences											
Biology	7	4	12	14	4	8	7	2	2	4	64
Plant Biology	3	1			2				2	1	9
Biochemistry/Cell Biology/Genetics		3	2	2		4		1	1	2	15
Microbiology/Bacteriology/Virology	2	3		5	4		1	1			16
Ecology		4		4		2	3				13
Marine/Aquatic Biology	3	1		7		5	2	2	2	3	25
Toxicology/Pharmacology	1			1	2	2			2	1	9
Physiology/Anatomy/Pathology						2		1			3
Biotechnology											
Zoology	1	1		5	1	1	1	1	1		12
Entomology				1			1				2
Biological Sciences,Other	1	3	2	2	2	4			2	3	19
Health Professions	2			2	2	6	2			4	18
Mathematics/Statistics		1		3			3	1			8
Engineering											
Chemical Engineering	5	11	4		10	6	6	1			43
Mechanical Engineering	2		2	1		2	1				8
Civil/Environmental Engineering	18	4	9	18	13	14	19		2	9	106
Engineering, Other	1	1	5	9	3	8	3		2	6	38
Computer and Information Sciences			3	1	1	2	2		1	1	11
Interdisciplinary		2		2		1	1		2	1	9
Business Management and Administration	5	3	3	4	10	6	6			4	41
Other	4	3	7	9	9	5	13	3	4	7	64
No Response											
Total Number of Degrees:	85	78	72	122	134	109	117	29	33	90	869

Source: ORD/ORPM (Workforce '94)

Note: Each FTE may have more than one degree/discipline.

Table 4-22. On-Site Intramural and Extramural Workforce Summary ORD Laboratories

Laboratory	Extramural Mechanism (1)				Extramural		Intramural (2)		Total Work-Year Equivalents
	Contract Work-Years	Cooperative Agreement Work-Years	Reimbursable Work-Years	Other Work-Years	Total Work-Years	*Percent*	FTE	*Percent*	
ORD/AEERL/RTP	53	24			77	*43%*	102	*57%*	178
ORD/AREAL/RTP	110	26	45		180	*52%*	166	*48%*	346
ORD/EMSL/CIN	74	20	13	1	107	*47%*	119	*53%*	226
ORD/EMSL/LV	40	38		40	118	*44%*	151	*56%*	268
ORD/EMSL/LV/EPIC	12	2			14	*57%*	10	*43%*	24
ORD/HERL/RTP	181	75			257	*53%*	227	*47%*	483
ORD/ERL/ADA	52	10	11		73	*56%*	56	*44%*	129
ORD/ERL/ATH	19	26	13		58	*44%*	74	*56%*	132
ORD/ERL/COR	149	41	9	2	201	*76%*	64	*24%*	265
ORD/ERL/DUL	36	12	21		69	*46%*	80	*54%*	149
ORD/ERL/DUL/LLRS	15	3	6		24	*78%*	7	*22%*	30
ORD/ERL/GB	55	77			131	*69%*	58	*31%*	189
ORD/ERL/NARR	68	29	19		116	*68%*	54	*32%*	170
ORD/ERL/NARR/PEB	17	5			22	*51%*	21	*49%*	42
ORD/EAG/DC	1	1		1	3	*16%*	16	*84%*	19
ORD/ECAO/CIN	10	4			13	*25%*	39	*75%*	52
ORD/ECAO/RTP	12	2			14	*30%*	32	*70%*	45
ORD/HHAG/DC	1	3		1	5	*14%*	31	*86%*	36
ORD/RREL/CIN	55	35	11		101	*33%*	203	*67%*	304
ORD/RREL/RCB/EDIS	5	3			8	*22%*	28	*78%*	36
ORD Totals:	963	433	147	45	1588	*51%*	1535	*49%*	3123

Notes:
(1) Source: Workforce '94
(2) Source: ORD/ORPM (ORD); Laboratory/ESO Directors (Program Office Laboratories and Environmental Services Organizations)

Table 4-23. On-Site Intramural and Extramural Workforce Summary Program Office Laboratories and Environmental Services Organizations

Laboratory	Extramural Mechanism				Extramural		Intramural		Total Work-Year Equivalents
	Contract Work-Years	Cooperative Agreement Work-Years	Reimbursable Work-Years	Other Work-Years	Work-Years	*Percent*	FTE	*Percent*	
Program Office									
OAR/NAREL/MONT	10	9			19	*33%*	39	*67%*	59
OAR/OAQPS/EMB/RTP	0				0	*1%*	25	*99%*	25
OAR/OMS/NVFEL/AA	53	32	2	0	88	*24%*	277	*76%*	365
OAR/ORIA/LV	1	8.2	1		10	*40%*	16	*60%*	26
OE/NEIC/DEN	35	18			53	*30%*	120	*70%*	173
OGWDW/TSD/CIN	5	2	2		9	*27%*	23	*73%*	32
OPP/ACL/BELTS					0	*0%*	17	*100%*	17
OPP/ECL/BSL		2			2	*9%*	17	*91%*	19
Program Office Totals:	104	71	5	0	180	*25%*	534	*75%*	714
ESO									
R01/NERL/LEX	10				10	*16%*	51	*84%*	61
R02/ESD/EDIS	7		1		8	*8%*	86	*92%*	93
R03/CRL/ANN	45	4		19	68	*52%*	63	*48%*	131
R04/ESD/ATH	33				33	*23%*	113	*77%*	146
R05/ESD/CHI	41		21		62	*43%*	82	*57%*	144
R06/ESD/HOU	31				31	*46%*	36	*54%*	67
R07/ESD/KAN	31		7		38	*32%*	82	*68%*	120
R08/ESD/DEN	13	4			17	*40%*	25	*60%*	42
R09/ESB/RICH	22	5			27	*56%*	21	*44%*	48
R10/ESD/SEA	46	3		10	59	*42%*	81	*58%*	140
ESO Totals:	279	16	29	29	352	*36%*	639	*64%*	992

Notes:
(1) Source: Workforce '94
(2) Source: ORD/ORPM (ORD); Laboratory/ESO Directors (Program Office Laboratories and Environmental Services Organizations)

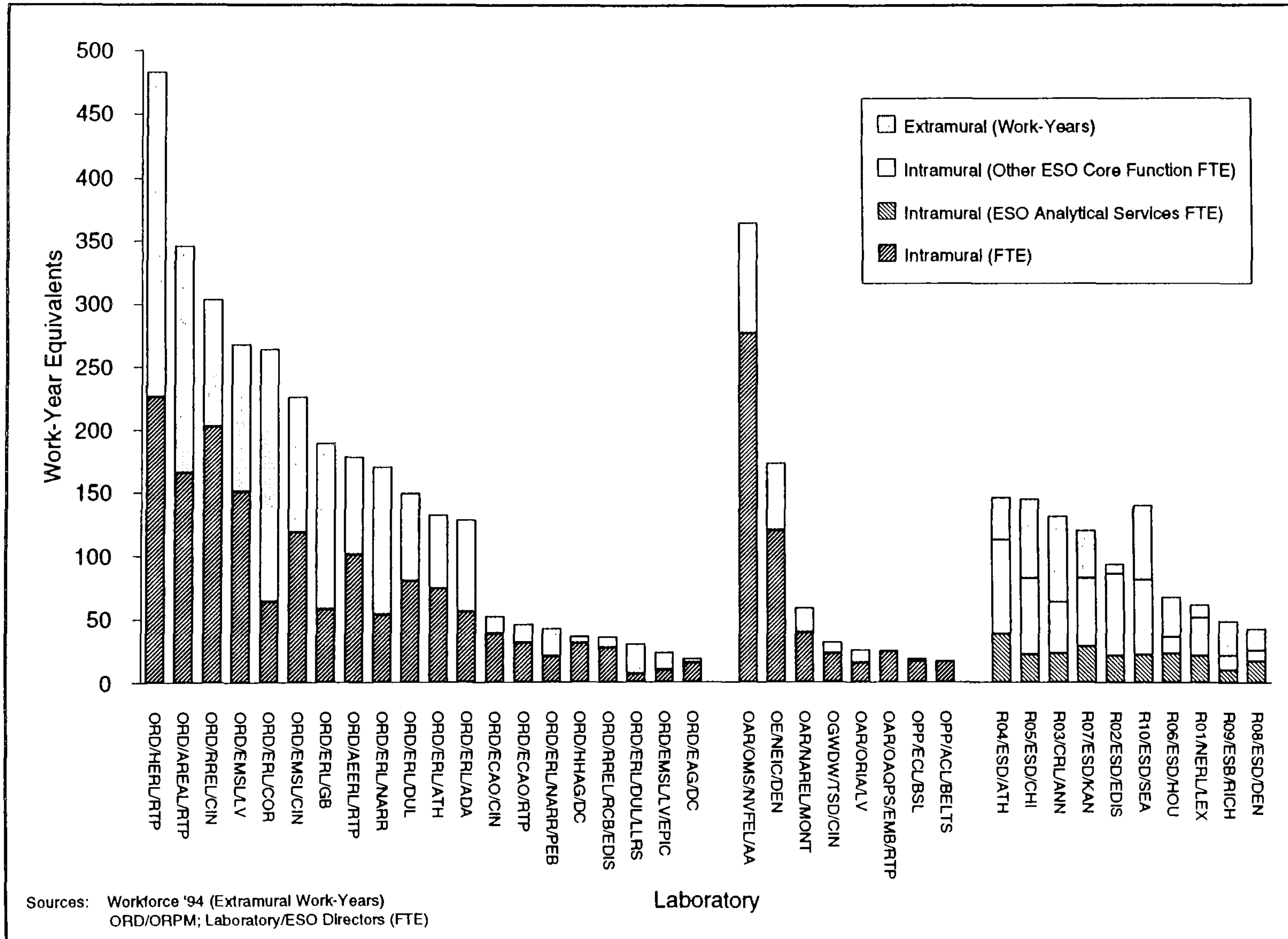


Figure 4-21. Laboratory Workforce Distribution
(Intramural and Extramural)

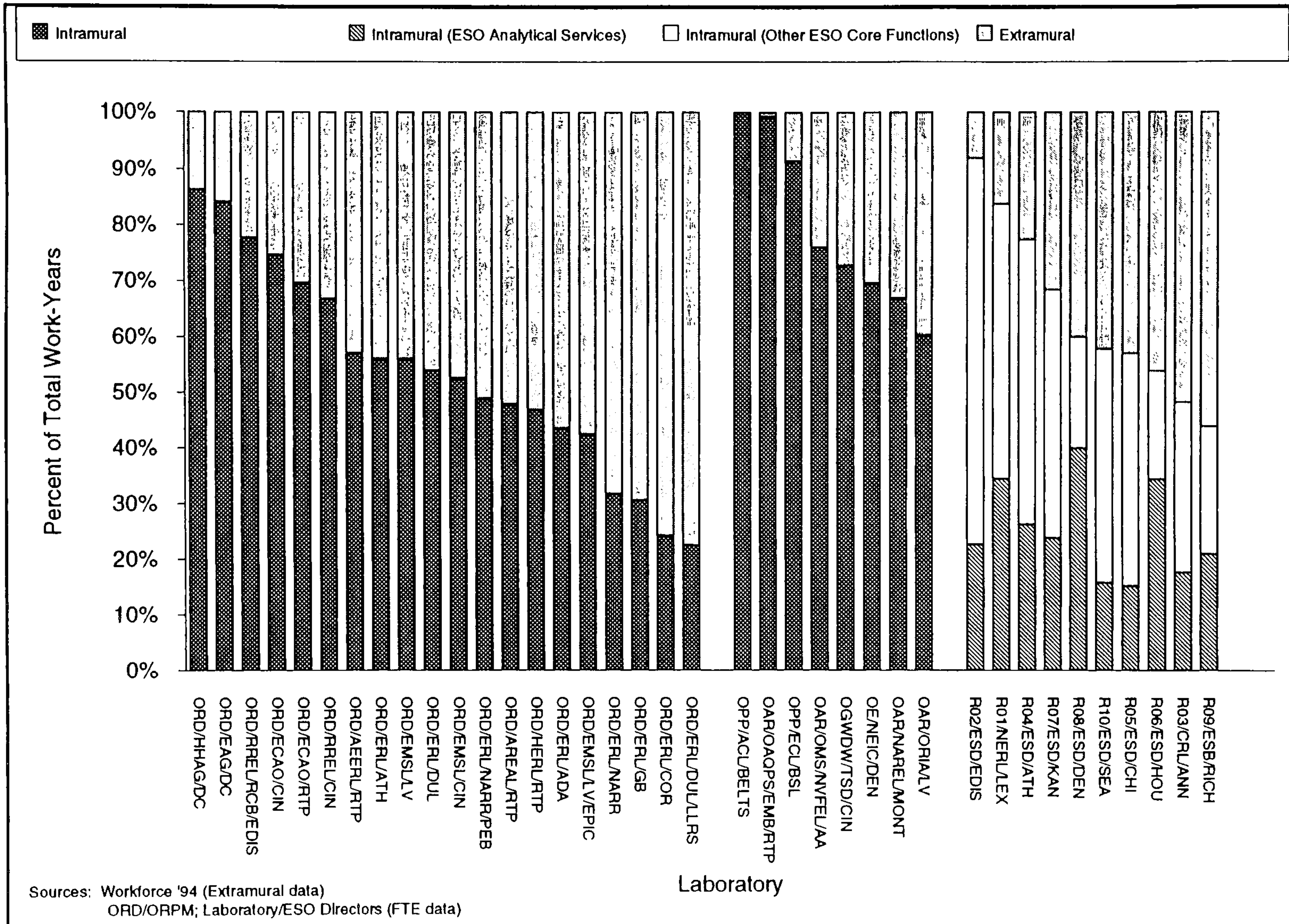


Figure 4-22. Relative Size of Intramural and Extramural Workforce By Laboratory

SECTION 5

ISSUES AND CUSTOMERS

Work conducted at the laboratories within the EPA system effects and is used by a wide variety of individuals and organizations. The word customer is used in a broad sense including laboratory personnel as well as individuals and organizations both internal and external to EPA. Internal EPA customers start with the other scientists and engineers within the laboratory system and other portions of the ESOs and extend to the staff of the headquarters and regional EPA program offices. External customers begin with the public, with whose protection EPA is charged, and its representatives, including elected officials, public interest and civic groups, tribal, state, local, and other federal agencies. The work of the laboratory system extends into the academic community, the regulated community, the media, and internationally to neighboring governments in Canada, Mexico, the Caribbean, and the rest of the international environmental community.

Participants in the study were asked for information on the relationship between users and providers of information and services coming from the laboratory system for a description of their needs as customers and how the existing laboratory system is or is not meeting those needs and for any issues relating to the administration, organization, and conduct of laboratory activities.

Information for this part of the study was gathered through laboratory visits and interviews with a wide variety of EPA customers as well as a review of existing documentation. These interviews included senior EPA executives, EPA staff members in the various program offices at both headquarters EPA and in the regional EPA offices, laboratory personnel, management and staff at state laboratories, and management and staff at private laboratories. The following sections will examine the issues raised by both internal and external customers of the laboratory system and will summarize these issues for use in evaluating the study options.

In addition, MITRE acted upon a recommendation of the NAPA Advisory Panel to visit several laboratories in the private sector to gain an impression on how these organizations organize and conduct their R&D activities and to tour laboratory facilities to discern if EPA's laboratories are comparable in terms of facilities and equipment. Due to schedule and cost limitations, only three organizations were visited, and the length of the visit was limited to a single day with two MITRE staff participating. While the information base is by no means comprehensive, the observations made with respect to organizational philosophies and operating practices are worth considering in the evaluation of EPA's laboratory options.

5.1 CUSTOMERS

The ORD laboratories provide research support for headquarters and regional program offices in the implementation of EPA's regulatory programs. Because many of these programs are delegated, state and tribal regulatory staff are also customers of the ORD system. The ORD laboratories network of customer extends beyond the regulators to encompass those affected by the regulations, including the public and their elected representatives, the regulated community, elected officials, civic and environmental organizations, other state and federal agencies, and the media. Through their more fundamental research on underlying science questions and emerging issues, the laboratories have additional customers in the academic community and internationally. A consolidated list of customers for the ORD laboratories is provided in Table 5-1. This list was drawn from the individual customer lists in the information on each laboratory in Appendix A.

The program office laboratories provide focused support to their sponsoring program offices. Directly connected with their primary customers in the program offices and frequently in direct with the regulated community governed by those programs, the program office laboratories serve not only this immediate customer base, but additional customers both internal and external to EPA who require scientific knowledge within the areas of expertise of the specific program office laboratory. Detailed lists of customers for the program office laboratories can be found as part of the laboratory descriptions in Appendix A.

Within the ten regional offices, the ESOs provide a wide variety of types of support to their customers. These activities vary depending upon the organizational structure of the regional offices, but the three core functions of laboratory services, QA/QC, and field monitoring are consistently provided through most of the ten EPA Regions. A consolidated list of customers for all ten Regions is provided in Table 5-2. This list was drawn from the individual customer lists found with the information on each individual laboratory found in Appendix A.

Table 5-1. Consolidated ORD Customer List

INTERNAL EPA*

Office of Administration and Resources Management
  Safety and Health Environmental Management Division
Office of Air and Radiation
Office of Enforcement
Office of Information Resources Management
Office of International Activities
Office of Policy, Planning and Evaluation
Office of Prevention, Pesticides and Toxic Substances
Office of Research and Development
  Office of the Assistant Administrator
  Office of Environmental Engineering and Technology Demonstration
  Office of Environmental Processes and Effects Research
  Office of Modeling, Monitoring Systems and Quality Assurance
  ORD Laboratories (laboratories are customers to each other)
Office of Science and Technology
  Engineering Analysis Division
  Health and Ecological Criteria Division
Office of Solid Waste and Emergency Response
  Office of Emergency and Remedial Response
  Office of Solid Waste
  Office of Underground Storage Tanks
  Hazard Site Evaluation Division
  Emergency Response Division
  Superfund Innovative Technologies Program
Office of Water
  Office of Groundwater and Drinking Water
    Drinking Water Standards Division
    Technical Support Division
    Enforcement and Program Implementation Division
Office of Science and Technology
  Health and Ecological Criteria Division

* Note: EPA as a whole is a customer for ORD. The portions of the Agency listed here specifically received or commissioned products or services produced by the laboratories.

Table 5-1. Consolidated ORD Customer List (Continued)

INTERNAL EPA (concluded)

Office of Wastewater Enforcement and Compliance
  Permits Division
Office of Wetlands, Oceans and Watersheds

National Estuary Program
Chesapeake Bay Program
Great Lakes Program

Risk Assessment Forum
Science Advisory Board

EPA Regional Offices (Regions 1 to 10)

EXTERNAL

Other federal agencies

- Department of Agriculture
  - Forest Service
  - Food and Drug Administration
- Department of Defense
  - Army, Ft. Detrick, MD
  - Army Corps of Engineers (New England Division, New York District, and WES)
  - Navy (NCCOSC and NOSC San Diego)
- Department of Energy
- Department of Interior
  - Bureau of Minerals Management
  - Bureau of Mines
  - Bureau of Reclamation
  - U.S. Fish and Wildlife Service
  - National Oceanic and Atmospheric Administration
    - Northeast Fisheries Center
    - Coast and Geodetic Survey
  - U.S. Geological Survey
- Department of Justice
- General Services Administration
- National Aeronautics and Space Administration

Table 5-1. Consolidated ORD Customer List (Concluded)

EXTERNAL (concluded)

Other Governmental Customers

- Native American governments
- State governments (i.e., Alaska Fish and Wildlife, California Fish and Game)
- Local governments (i.e., City of Los Angeles; Wayne County, Michigan)
- New South Wales Pollution Control Commission, Australia
- Canada

Other

- Congress
- Academic and scientific community
- Public
- Regulated community
- Technology and assessment application community

Table 5-2. ESO Customer List

INTERNAL	
Primary Customers	Regional Administrator Deputy Regional Administrator Management Division Director Line Program Division Directors Regional staff, including ESO personnel Office of the Inspector General Criminal investigators
Secondary Customers	Office of Regional Counsel Office of External Programs National ESO/Office of Regulatory Operations and State/Local Relations Associate Administrator Headquarters AAs/National Program Managers ORD Laboratories NEIC
EXTERNAL	
Primary Customers	Relevant state and Native American government programs (such as environmental, health, agriculture programs) Regulated community (recognizing ESO's portion of total EPA role) Local/regional governments
Secondary Customers	The public Volunteer monitoring groups Other federal agencies Academic community Commercial environmental laboratories Contractors General Services Administration Region-specific entities, e.g., Environment Canada, SEDSOL Public interest groups The media Congress/regional delegation

5.2 COMMENTS AND ISSUES

The issues raised during the laboratory visits and customer interviews can be broken into four issue categories: mission focus, expectations, locus of control, and administrative impediments. The following sections will discuss these consolidated issues.

5.2.1 Mission Focus

Laboratory personnel, EPA executives, and the customers of the ORD laboratory system all raised the issue of the focus of the mission of the ORD laboratories. Two primary elements of the mission, short-term support for EPA's regulatory mission and long-term support for EPA's overall environmental mission, were raised as competing interests by many of the study participants. There was no denial of the usefulness of either type of activity by any party, but depending upon their involvement in day-to-day implementation of the Agency's legal and regulatory mandates, the participants emphasized the value of one element of the mission over the other.

A second aspect of this competition raised during the study was the question of the primary customer of ORD's work. Again the respondents split into two groups with one advocating that the scientific needs of the general academic and public community come first, while the second group advocated the various implementing offices and their needs as the primary customer for ORD.

For the program office laboratories, the issue of mission focus is in many ways a mirror image of that of the ORD laboratories. Mission focus for the program office laboratories is controlled directly by the program office to which they report. The potential for ambiguity comes with the division of activities between the program office laboratories and the ORD laboratories. The work performed by the program office laboratories tends to be tightly focused on specific needs of the program. Broader research and research into issues that are not specifically covered by a legal or regulatory mandate tend to be left to the ORD labs. The issue remaining is the method of selecting which are specific program needs and which are fundamental research.

The program elements that make up ESOs in the ten regions serve an active role in the implementation of EPA's programs through the support of the implementing offices within the regional offices, the states, and the Native American governments. As the statement of the mission of ESOs developed by representatives of the ten regions shows (see Appendix A), the nature of this support is broad both in its scope and in the variety of tasks. By virtue of their intimate association with the implementing offices, ESOs incorporate at the most fundamental level the needs of their customers. Focused as they are on providing direct support, mission issues raised for ESOs are concentrated on the assignment of functions to be performed by ESOs as opposed to having these functions performed within the various regional program divisions. The question of assignment of functions and performance of those functions is slightly different for each of the core functions. Mission focus for the ESO core functions is discussed individually for each function.

Provision of laboratory services is not a unique function of the ESOs. Various programs have access to commercial laboratories, state laboratories, and other federal and EPA laboratories, including ORD, program office, and ESO laboratories in other regions. Given the variety of potential sources of laboratory services, the issue becomes one of determining a method for selection of the most efficient provider of laboratory services, while meeting the expectations of the users of ESOs.

The primary issue raised about QA/QC activities performed by ESOs was an organizational one. Residing for the most part in separate ESOs, QA/QC offices escape any loss of objectivity related to reporting to the same Division Directors as the program offices during the review of work originating in other divisions. This is not true, however, of QA/QC reviews of work performed within ESOs. Whether perceived or real, the potential for bias involving review of work produced by the same division within which the QA/QC offices reside remains. The current system does provide for some external check on quality through externally managed quality programs such as the use of blind performance evaluation samples.

The extent of field monitoring activities varies from region to region depending upon the needs of the regional offices and the resources available. The issue raised was one of the appropriate location for these activities. Two factors compete within this issue, the needs and expectations of the individual programs such as air, water, hazardous waste, pesticides, and toxics, and the wider need of EPA for multimedia information.

5.2.2 Expectations

Expectations for ORD's work ran high from all quarters. EPA program offices expect support in resolution of scientific and technological difficulties encountered in implementation of EPA's programs. This is particularly true of program offices that do not have their own laboratories. Even program offices that have laboratories within their organizations expect ORD support for research in areas not covered by their own laboratories. EPA executives expect ORD to provide the science to support the policy decisions and regulatory rule making that guide EPA's work. There is also a general expectation that ORD will help provide basic information on environmental issues important to the public and that ORD will also do advance research on emerging environmental issues.

The general public, public officials at all levels, and EPA administration also expect ORD to provide scientific and technological support for unanticipated or emergency situations. The health risks associated with exposure to river sediments during the midwest floods and the "killer carpet" investigations involving indoor air and exposure to chemical fumes serve as examples of these types of situations.

Study participants also expressed an expectation that ORD would provide multiyear research into specific scientific or technological problems facing the implementing program offices. ORD is also expected to use its technical knowledge to provide support to staff implementing EPA programs and to users of the methods and technologies developed or studied by ORD.

Because of the direct connection between the program offices and their laboratories, the expectations of these two parts of the organization are much more closely aligned than those of ESOs or ORD and their respective clients. The expectations of the program offices for their associated laboratories are also constrained by the resources that the program offices devote to the laboratories. The program offices know what resources are available to the program office laboratories and how they are expended. There are no feelings of desired work being of low priority or any fears of diverted resources that are expressed by customers in the other two study areas. This close marriage of expectation and performance is reflected in the generally high level of satisfaction found in the relationships between the program office laboratories and their parent programs.

The activities performed by ESOs depend directly on the expectations and demands of the implementing program offices and their related customers. Regional administrators, in response to the public and its elected representatives, expect the support of ESOs in responding to unplanned needs for environmental information on events affecting the public. Individual regional program offices expect support for implementation of their individual programs, response to requirements of headquarters program offices, and execution of unplanned activities.

Participants in the study also raised the issue of changing and increasing demands on ESOs. The development of new environmental programs and the expansion of existing programs leads to demands for new services, including the analysis of air toxics, additional Phase II and Phase V drinking water parameters, increased ecological sampling and analysis, and work in support emerging environmental programs. The regional program offices also expect support for special types of analyses and non-routine sample types often involving more difficult analyses for items like low-level metals, dioxins, and asbestos that require specialized skills and equipment. Combining these expectations with the pace of changing technologies for laboratory sample preparation and analysis raises the issue of how to meet these expectations across all ten regions when the demand for these services is not evenly distributed either geographically or temporally.

ESOs are also expected to provide technical support to state and tribal environmental agencies and to coordinate with the regulated community. This raises the issue of location and the ability to develop working relationships with customers outside of EPA. ESOs is also expected to provide even greater levels of support in areas where EPA programs have not been delegated or in which recipients of delegated programs lack experience or resources to implement the delegated programs. Again the issues of location and communication arise.

5.2.3 Locus of Control

All three type of laboratories have problems related to locus of control, but each type is different because of the different sources of funding. At the ORD laboratory level, many of the participants raised the issue of micro-management by ORD headquarters, which provides most of the funding for the laboratories. The distinctions between the relative responsibilities of the laboratory directors, the individual researchers, and the headquarters ORD staff have become blurred. Similarly the roles of issue planner, laboratory director, and administrator in headquarters ORD are now in conflict or, at a minimum, present areas of overlapping responsibility. Also raised as an issue was the performance of administrative management versus research management.

Locus of control issues for the program office laboratories were limited, because the programs exercise direct control of their laboratories. Study participants reported instances where the expectations of the program exceeded the resources provided. The suggested remedy to this problem was either increased administrative representation for the laboratories within the program office or organizational changes within the program office to place the laboratory function under the same administrative chain of command as the portion of the program office requiring the laboratory's support.

The major problem in this area for the ESOs is that the resources for supporting personnel come from the regional-level programs and not from a central office. The absence of a central office is central to the issue of ESOs representation at the headquarters level. Many of the participants in the study voiced concerns that ESOs, and in particular the ESO laboratories, do not have representation equal to that of other programs at the headquarters level. While the program offices at the regional level are represented by the AA for their program, and the ORD laboratories are represented by the AA for ORD, ESOs do not have a similar AA-level representative. Creation of an AA for ESOs would resolve this issue but this solution raises another issue. In response to specific questions on this issue, study participants raised the following concerns:

- The separation of ESOs into a separate AA-ship would result in the creation of an additional administrative layer.
- The ESOs would be separated from their customers in the regions.
- A separate AA would run counter to the concepts of streamlining and multimedia activities.

Another locus of control issue raised by the ESO participants in the study involves applied research directly related to implementation of EPA's programs. Methods and procedures developed through ORD and at headquarters EPA are used in the regions. As customers for these items, ESO staff members would like more applied research done at the regional level by individuals who are either the users of the products or are in direct contact with the users.

Universal among the participants was the issue of selection and prioritizing of research projects to be performed. This issue was also reflected in the degree of satisfaction felt by the implementing programs with the existing work planning process. The issue of who controls the selection of research projects raises the issues of prioritization of projects, the existing process for prioritization (issue-based planning in ORD), and division between fundamental research and research to support program implementation. The tension related to these issues is particularly intense when there is disagreement over an organization's primary customer. The prime example of this is difficulties with focusing ORD's work on either fundamental research to benefit science in general and the needs of the program offices for applied research to support program implementation.

In addition to these conflicts within EPA, external customers, and especially the Congress, also come into play. These conflicts manifest through congressional mandates and deadlines, direct appropriations for specific work, and requests for specific actions from politicians, organizations, and individual citizens. All these requests raise the issues of degree of control over the individuals and infrastructure available to conduct work.

5.2.4 Administrative Impediments

Facilities and equipment issues for the ORD laboratories vary with the location. A portion the activities of the ORD laboratories are tied to their locations by resources or constructed facilities that cannot be moved or would be difficult to move. Any discussion of movement of the portion of the ORD work tied to these resources raises the issue of loss of the capability or payment of large replacement costs.

Facilities and equipment problems are not evenly distributed among the program office laboratories. In general, the program office laboratories have a lower level of access to funding for new equipment, and limitations on funding prevent the accumulation of resources to purchase the larger, more expensive items over multiple funding periods.

Many of the participants raised issues related to impediments to their work. These issues start with the basics of facilities and equipment. Beginning with the ESOs laboratories, three regions have facilities constructed within the past three years that are sufficient for their current and anticipated future needs. Three additional regions have facilities that, while not new, are sufficient at least for current needs. The remaining four regions have either contracted for or are actively pursuing new laboratory facilities to replace existing facilities that are inadequate for current needs. In the area of equipment, the study has shown through laboratory visits and interviews that the ESOs have sufficient equipment to perform their tasks and that the current system of budget allocation for the purchase equipment is sufficient. However, obtaining routine supplies and maintenance was cited as an increasing problem.

Human resources was raised as an issue at every ESO. Human resources appear to be the limiting factor at the ESOs. The annual effort to obtain resources from the regional program offices differs in degree from region to region, but the lack of a stable core set of resources was mentioned during interviews in every ESO. Many of the ESOs also cited resource "underpayment" for services performed for regional program offices. At the same time, the regional customers who provide these resources support the existing system by which they "pay" with FTEs for work performed by ESOs. The greatest flaw in this system found during the study is the lack of accurate pricing factors that are truly representative of the cost in both FTE and dollars of work conducted by ESOs for the regional program offices. One of the ESO divisions does maintain a tracking and pricing system, indicating that implementation of such a system is possible. Such a system is a fundamental requirement for realistic determination of the most efficient way to provide ESOs. Such a system would also alleviate claims both by ESOs and regional customers about the expense and/or underpayment for services performed. It should be noted that the need for accurate pricing factors is not limited to the ESOs. All of the laboratories need to have accurate costing, accounting and accountability systems Agency-wide information that are a part of management systems. Such systems would enable EPA to improve its planning, programming, budgeting and accounting.

Additional resource issues include a lack of resources to support the activities of the criminal and civil investigators operating within the regional offices. Until now, the investigators efforts have been supported by taking resources from the various program offices. As the numbers of civil and criminal investigators continues to rapidly increase in response to the Pollution Prosecution Act, this method becomes less and less viable.

Another resource available within the regions for accomplishment of ESOs tasks is the use of contractors. The primary issues raised on the use of contractors were the resource intensive nature of the process for obtaining, communicating with, and performing oversight for Environmental Sampling and Analysis Team (ESAT) contractors within the ESOs. Multiple respondents stated that this work could be performed more efficiently by federal personnel. The constraints on communication and direction of these contractors, as well as the requirements for oversight, have the effect of making these contractors increasingly uncompetitive in terms of cost-per-sample analyzed or task performed. The impact of contract management duties, the convoluted communication chain, and the duplication of management hierarchies required under current contracting procedures in EPA were all named as items that divert work resources from the actual performance of laboratory work. Both ESO and ORD participants reiterated the potential efficiency of using EPA as opposed to contract employees to perform laboratory work.

In ORD, budgeting difficulties are complicated because the budgets for activities frequently are not known until midway through the fiscal year. Even when budgets are known they are not stable from year to year. This instability leads to difficulties in planning and execution of multiyear projects.

Even when outside resources are available, either from states, other federal agencies, other regional offices, or national EPA programs, respondents have stated that the existing budgeting structure is inflexible, making it difficult or impossible to incorporate these resources into regional ESOs. The existing system also prevents the joint funding of training and services with state and tribal agencies even when this would result in a cost savings to the federal government.

A potential solution to the problems of dealing with contractors and with the budget structure was suggested at several ORD laboratories—conversion of the laboratory to a Federally Funded Research and Development Center (FFRDC) or government-owned, contractor-operated (GOCO) organization. These alternative accountability models are discussed in Section 10, where the conclusion reached is that the problems that the conversion would solve are amenable to solution with less disruptive measures.

5.3 SUMMARY OF ISSUES

Laboratory visits and customer interviews identified issues that could be resolved using the options discussed in Section 7 and throughout the remainder of this report. The following summary issues is to be carried forward into the options analysis. Not all issues apply equally to all three portions of the EPA system analyzed in this document. Therefore, separate issue lists have been prepared for the ORD laboratories, the program office laboratories, and the ESOs.

5.3.1 ORD Laboratory Summary Issues

Mission Focus

- Short-term versus long-term research
- Selection of primary customer (EPA programs versus "science")

Expectations

- Research and technical support for regulatory program implementation
- Research to support policy and rule making
- Information on basic and emerging environmental issues
- Support for unanticipated demands

Locus of Control

- Selection of research projects to be performed
  -- Prioritization of projects
  -- Existing process for prioritization
  -- Division between fundamental and applied research
- External customer impact (Congress/politicians-public requests)
- Control of laboratory administration and budgets
- Conflict of interest in issue planning

Administrative Impediments

- Lack of resources/infrastructure to maintain world class science
- Construction of new facilities
- Burden attached to management and use of contractors
- Color of money issues
- Restrictions on non-ORD funding
- Negative impact of competitive cooperative agreements
- Information management systems not common to other parts of Agency

5.3.2 Program Office Laboratory Summary Issues

Mission Focus

- Division of research between program office laboratories and ORD laboratories

Expectations

- Priority will be given to tasks assigned by program office

Locus of Control

- Resources provided are less than needed to support expectations
- Appropriate chain of command within program office

Administrative Impediments

- Difficulties in procurement of equipment, supplies and maintenance
- Equipment budgets/funding for equipment (including restrictions on accumulating funds)
- Color of money issues
- Timing of budget availability
- Information management systems not common to other parts of Agency

5.3.3 ESO Summary Issues

Mission Focus

- Efficient provision of laboratory services (routine and special)
- QA/QC conflict-of-interest within regional structure
- Appropriate location for field monitoring within regional structure

Expectations

- Rapid gathering of environmental information on unplanned events impacting the public
- Close technical support for regional, state, and Native American programs and the regulated community
- Support in special and emerging areas of laboratory support combined with uneven demand

Locus of Control

- Representation of ESOs at the headquarters level
- Performance of applied research at level closest to users

Administrative Impediments

- Construction of new facilities
- True cost of ESOs
- Support for civil/criminal investigations
- Budget flexibility for external/joint funding
- Burden attached to management and use of contractors
- Limitations on human resources
- Information management systems not common to other parts of Agency

5.4 STATE LABORATORIES

This chapter is based on interviews conducted with state environmental personnel in California, Delaware, Florida, Georgia, New Jersey, Oklahoma, and Pennsylvania. The views held by the states depend to some extent on the EPA region to which they are attached. Furthermore, it appears that there may be considerable variations in the level of support provided by the regions; the conclusions in this chapter could be affected by the lack of input from states in other regions.

The states in each EPA region depend both directly and indirectly on the EPA. For example, the EPA is the originator of many of the laws, regulations, and rules that the states either must meet or themselves impose upon others. Because of the usually greater resources and expertise of the EPA, the states look to EPA for both legal and technical guidance.

Most states have an environmental enforcement unit, often organized analogously to the EPA. The state enforcement unit usually has a laboratory providing a range of analytic and technical services in support of the environmental regulatory activity. Due to this parallel organization, both regulatory and laboratory state staff have substantial contact with their EPA counterparts.

Because the states vary widely in the breadth and intensity of their environmental regulation activity, it is not possible to provide a complete list of the types or extent of service interactions between the states and the EPA. However, visits with a sampling of states showed that the laboratory services received by the states include the following:

- Consultation on analytic procedures and problems
- Source of analytic service for unusual types of measurement
- Training in administering new programs and regulations
- Joint work with EPA on toxicity and other research studies

- Audits of state labs by EPA
- Reviews of state regulatory programs by EPA
- EPA assistance in stimulating state-state cooperation
- Assistance with enforcement actions
- Staff training
- Source of performance evaluation samples for use in state certification of commercial labs

The small number of states interviewed in this study does not provide a complete picture of the satisfaction of the states with the EPA services. Nevertheless, several common themes emerged during the interviews:

- The states generally felt well supported by the ESOs, but had less contact with the ORD and program office laboratories. Some states perceived a lack of awareness within the ESOs of work being performed at ORD and program office laboratories. This has led to an inability to provide the desired support for state air and radiation analytical requirements.

- Several states suggested that the ESOs should make less use of contractors. They believe that regional personnel are burdened by contract management responsibilities and have lost technical capabilities as a result.

- The states wish to see more program and analytical training services. Region 3 administers a cooperative training program for the states that could serve as a model for other regions.

- Because states have little travel money (especially for out of state), the closer the geographic proximity, the stronger the relations with the EPA laboratory.

- The state staff value long-term, trusting personal contacts as a key to close working relationships.

- Several states suggested increased involvement of ESOs and state laboratories in long-term planning for analytical capabilities, especially for higher-cost, less-frequently used capabilities.

- The state laboratories are frustrated by regulations that specify different methods to do essentially the same analysis for different EPA programs and by the slowness of those regulations to incorporate improved technology, such as the use of inductively coupled plasma-mass spectrometry (ICP-MS) instruments.

- Several state officials expressed the opinion that there is not enough communication between EPA programs and analytical services technical staff, especially between those who obtain or analyze environmental samples. One result of this lack of communication is the profusion of and slowness to incorporate improved technology in analytical methods noted above. State officials felt that the technical role in formulating regulations concerning analytical methods should be equal to the roles played by regulatory and legal concerns. Several states suggested that a single administrative entity for analytical services could serve raise the level of technical input and improve communication.

In summary, the EPA laboratories can and do provide services to the states that are highly valued. However, the states strongly wish to retain the existing geographic proximity to the EPA laboratories. The states strongly desire that EPA provide adequate resources for support of the state programs.

5.5 PRIVATE SECTOR ORGANIZATIONS

Three organizations, E.I. du Pont de Nemours and Company, Ford Motor Company, and the Westhollow Research Center (WRC) of Shell Development Company, have been visited by MITRE. These are multinational corporations with a diversity of product lines within their given industrial sectors of chemicals, motor vehicles, and oil. All are subject to environmental regulations in their operations as well as in the characteristics and use of their products, and thus a significant portion of their R&D efforts are expended to comply with EPA requirements. Most of these observations are common to all the organizations that were visited; exceptions will be noted.

- At Dupont and Ford, R&D is a distributed function with laboratories located at or in close proximity to internal customers (strategic business units or equivalent). However, Shell has consolidated this function at WRC.

- Dupont and Ford perceive that their distributed structure and locations focus needed resources and priorities on near-term requirements of the business units.

  Provide technology to support and renew existing businesses
  Identify and define new businesses within the sector

  In contrast, in 1976 Shell determined to consolidate its research laboratories in order to improve efficiency and effectiveness.

Only three years would be required to pay off relocation expenses through efficiency gains.

The ability to recruit and support world-class experts by pooling costs would improve effectiveness.

- Central research is a corporate function for science and technology

  Provides basic knowledge for existing businesses
  Develops the technical base for new businesses

- Responsibility for all R&D functions is vested in a single corporate executive reporting to the chief executive officer.

- Common technical support elements, such as analytical services and information systems, report to a single manager.

- All research and technical development staff share a common understanding of the corporate mission and goals while retaining their professional integrity.

- Internal transfer of scientific knowledge and technology is promoted through a variety of means, including program planning, informal and formal networks, and internal publications.

- Strategic and annual planning establish needs, define resource requirements, and set priorities.

- Annual R&D budgets are approved by the Board of Directors.

- Researchers from central research seek the opportunity to and willingly participate in project teams formed to address near-term problems.

- Ample budgets are provided for professional development and related professional activities.

Most, if not all, of these principles and practices could be incorporated by EPA into its laboratory operations.

SECTION 6

MANAGEMENT IMPROVEMENTS

Improvements in quality, efficiency, and effectiveness can be gained through improved management policies and procedures regardless of the organizational structure that is adopted. In Section 5 of this report, a number of issues that were identified during the course of the study were presented. Some of these relate to current management practices that are perceived to reduce the quality, efficiency, or effectiveness of EPA's current laboratory operations. These issues have been examined by MITRE within the current structure, and suggestions for improvements are made below under broad categories that are applicable to current conditions as well as any of the proposed structural options.

6.1 QUALITY ASSURANCE

In partial response to one of the major recommendations in the report "Safeguarding the Future: Credible Science, Credible Decisions" (Expert Panel on the Role of Science at EPA, March 1992), that QA and peer review should be applied to the planning and results of all scientific and technological efforts to obtain data used for guidance and decisions at EPA, including such efforts in the program offices and ESOs, the Administrator issued a peer review policy to be implemented Agency-wide. Although all of EPA's laboratories have some form of a review process, it should be noted that the formal QA/QC responsibilities are not generally given high visibility in EPA, even in ORD where the Director of the Quality Assurance Management Staff reports to the Office of Modeling, Monitoring Systems and Quality Assurance, which reports to the AA for R&D.

To improve QA in the performance and use of science and technology throughout EPA, an in-depth review of the existing process should be made, particularly with the objective of achieving end-to-end QA throughout all of EPA's activities. The question of whether the QA functions should report to the Administrator/Deputy Administrator should also be addressed.

6.2 MISSION CLARIFICATION

To achieve improvements in the quality, efficiency, and effectiveness of EPA's laboratories, it is essential to develop an agreed-upon statement of the mission of the Agency and to implement a top-down strategy for the laboratory operations in support of it. Such a strategy must address such issues as:

Regulation versus science roles
Long-term research versus short-term technical support needs
Exploratory research versus monitoring and compliance
Media versus integrated approaches to scientific and technological issues

In a joint letter (February 1994), the laboratory directors have recommended dividing the research program into three components: (1) strategic research, (2) regulatory support to include technical assistance, and (3) national cross-cutting programs (such as EMAP). They emphasize that strategic research cannot and should not be separated arbitrarily from regulatory support research at the implementation level. And further, they recommend against percentage allocations to the various categories of research.

Although current activities and their quality have been documented, in this study the question of what should be done and how well the current laboratory structure fulfilling the strategy and its requirements has not been addressed. Examination and clarification of the Agency's mission would be helpful to management and staff.

6.3 PLANNING AND PRIORITY-SETTING

Section 5 of this report summarizes the observations from the laboratory interviews of the expectations that the customers have of the content, timeliness, and quality of the products and services of the laboratories. To a great extent, the lack of, or perceived lack of, responsiveness to customer needs depends directly upon the mission of the individual laboratories and the priorities that have been assigned to their work. If the mission clarification described above is accomplished, the base for planning and priority setting will be established that should lead to a common set of expectations. The issue-based planning, with improvements in its scope and participants, can serve as a point of departure for development of a framework to be employed for achieving the objective.

6.4 DELEGATION OF AUTHORITY

There appear to different practices (and perhaps policies) with regard to the delegation of authority to the laboratory directors. Where the authority at the laboratory level is limited, the efficiency of the operation may be impaired. More detailed examination of policies and procedures could lead to the elimination of perceived problems such as the inability to employ funding where it is most needed and the inability to respond in a timely manner due to a long approval chain.

6.5 IMPEDIMENTS TO LABORATORY PRODUCTIVITY

The bulk of comments MITRE recorded in its extensive interviews with laboratory managers and staff reflect serious frustration with administrative impediments to getting the research job done properly. It was apparent that most personnel feel a strong desire to fulfill their obligations to EPA, the public, and the scientific community, but feel just as strongly that unnecessary bureaucratic policies and procedures stand in their way. We found relatively little interest in global options such as reorganizing the laboratories, but intense concern that whatever option are pursued, these administrative impediments will be eliminated.

In this section, those impediments most commonly cited in the interviews are described. Then, approaches to eliminating these impediments, either directly, through ad hoc executive or legislative action, or systematically, by changing some "ground rules" of laboratory management, such that certain of the impediments are rendered moot are described.

With few exceptions, the interviewees described a frustrating "Catch 22" situation in which they are expected to accomplish at least as much research and program support as ever, but without the qualified personnel, either federal or extramural, necessary to succeed. They contend that federal staffing is inadequate to meet the needs, and that the level of competence can be expected to decline even faster than the numbers of federal scientists, as retirements remove senior personnel over the next several years and leave fewer, less experienced, and less-respected young colleagues. Further, recent restrictions on the use of contractors and cooperative agreements have rendered it very difficult and sometimes impractical to obtain needed scientific support through extramural channels. In summary, the work still has to be done, but all avenues to obtaining personnel resources are increasingly restricted.

This is a pervasive issue, affecting the answers to other important questions like the adequacy of facilities and equipment, ability to hire desirable staff, timeliness and quality of scientific support, opportunities for recognition, and even more fundamentally, the roles that EPA laboratories can hope to fulfill in the future. Clearly, some strategy must be found to bring the human resources available to do the job into line with workload and quality expectations.

Four basic strategies, or combinations of these, are available to EPA in seeking to remedy this problem: increase federal FTEs, increase the accessibility of high-quality extramural labor, increase the efficiency of both federal and extramural efforts, or reduce the expectations placed on the laboratories.

Increasing federal FTEs in the laboratories is the intent of "contractor conversion," and any new FTEs that are allocated down to the laboratories will be gratefully received. However, they are, by definition, replacements for the on-site contractors that formerly supported the programs and will not fully replace the losses from contract terminations. However, as a rule, interviewees stated that federal employees are worth much more to the laboratories than an equivalent number of contractor personnel, owing to the restrictive rules governing use and direction of contractors. Other than slight augmentations from contractor conversion, laboratory staff expect the numbers and grades of authorized personnel to decline continuously into the future.

It was noted in the ORD interviews that, in many cases, the net effect of hiring freezes and past efforts to attract senior scientists has left a wide gap beneath the senior scientists, such that there is an inadequate structure of junior scientists and technicians to support the work of the senior scientists. In some individual laboratories, lack of grade stratification is expected to result in complete loss of some research areas upon retirement of their practitioners and inhibits the development of cost-effective research teams by placing work with the lowest appropriate grade for each type.

Accessibility to high-quality extramural support has declined drastically within ORD laboratories as a result of Agency concerns about appropriate use of contractors and cooperators. The ESOs are less affected, because of the routine nature of contract services they require, but the program office laboratories may expect increasing difficulties. Until recently, the ORD laboratories have dealt with the deleterious effect of FTE limits and hiring freezes by shifting major scientific and engineering roles to highly qualified contractors, who were, for practical purposes, collocated with EPA and served as extended staff. In addition, long-term, stable working relationships were maintained with university and institutional researchers through cooperative agreements, and these cooperative agreements were used, in many cases, to obtain information needed to conduct the business of the Agency.

Both of these extramural arrangements were susceptible to abuse. Federal regulations and contract law enforce an arms-length relationship between federal technical personnel and contractor staff, in order to avoid (1) improper supervision of contractor personnel as staff extension; and (2) unauthorized redirection of contractor efforts, with attendant cost implications. Regulations governing the use of cooperative agreements are intended to foster joint scientific and technological efforts, but may not be used to procure services or goods in a *quid pro quo* arrangement, where contracts are appropriate.

Evidently, federal auditors found sufficient cause in their recent reviews of ORD laboratory extramural practices to stimulate a stringent reinforcement of proper rules and procedures. However, it appears that the interpretation of these intentions at the laboratory level may have been an overreaction. This subject was raised during the interviews as an impediment to the efficient conduct of laboratory operations, especially when the policies governing contractor management prohibited the intramural staff from working in the same laboratories as extramural staff and when it inhibited the giving of directions to the support staff during the conduct of experiments and sample analysis. Such an interpretation would seem to be far more strict and constraining than is seen elsewhere in the federal government. It is inconsistent with the use of contractors to support R&D, since it frequently is impracticable to specify methods and outcomes with any real precision where original R&D is desired—if the answer were known, there would be no need for the contract effort.

Similarly with the use of cooperative agreements—the interpretations now applied at the laboratories are uniquely strict and appear to be excessive. (This is not to suggest that EPA contracting officials have misunderstood the regulations, but rather that less qualified personnel elsewhere in the system have interpreted their directives freely.) ORD personnel have been led to understand that cooperative agreements cannot be used where *any benefit may accrue to EPA from the mutual work arrangement.* However, the exact purpose of cooperative agreements is to provide for shared work efforts where the government has an expectation to participate substantively and to accrue a share of the benefit from this effort. Instead, ORD staff contend they have been instructed to regard cooperative agreements exactly like grants—transfers of money with no expectation of shared benefit. Under this interpretation, the second vehicle to obtain extramural technical help is foreclosed.

A universally cited contributor to problems using contractors is the excessive time required to originate and implement an agreement. Six or more months was frequently mentioned as an optimistic average time to put a contract against a need. Since EPA has greatly reduced the availability of general-purpose on-site contractor support for quick-turnaround support, many short-term Agency needs cannot be addressed with extramural resources. This is further exacerbated by excessive delays in allocation of funding to laboratory programs—normally, five to six months of each fiscal year pass before funding levels settle down at the working level, at which time, there is hardly time to begin and complete the lengthy contracting process within the term of the fiscal year.

The third avenue available to EPA to bring laboratory workloads into line with personnel resources is to increase the efficiency of each labor hour expended. It is likely that every option discussed in this report bears in some ways on the efficiency of laboratory staff. However, the interviewees focused on several key administrative impediments that diminish their efficiency, as discussed below.

Most commonly, laboratory personnel complained that an excessive portion of their time is consumed in contract management. Some individuals in ORD and program office laboratories stated that most of their time is used this way, despite job descriptions as bench scientists, and that any research they perform is done after hours. Little or no support is provided to them in performing the more routine contract management tasks, and more time is consumed in those tasks than in providing professional review of contractor products.

Laboratory productivity is impaired by what were said to be three- to six-month delays in routine purchases of non-capital equipment, services, and supplies. Such delays are crippling and demoralizing in an R&D environment, where needs cannot always be anticipated.

Scientific productivity is impaired by a widely remarked lack of travel funds. Travel funds have been reduced in recent budgets, and official priorities for their use have favored managerial purposes rather than scientific purposes. Consequently, research staff at several laboratories report they are unable to work collaboratively with their peers and, further, are discouraged from submitting papers for publication by the knowledge they will not be funded to present them at conferences. This presents a frustrating contrast with the goal of the Agency to support first-rate science and to earn the respect of the scientific community for its scientific accomplishments.

The ORD laboratories face an unusual funding difficulty associated with the issue-based planning process. That process addresses research needs that are identifiable well in advance—the sort of R&D tasks that most outsiders associate with the ORD laboratories. However, it does not provide explicitly for unforeseen requirements that arise at Headquarters level from week to week, requiring scientific consultation and sometimes developmental effort. Depending on the laboratory, such short-fuse requirements can represent a major drain on senior management and scientist talents. This reduces laboratory productivity in respect to the explicit assignments they have received through issue-based planning and might be said to distort the intentions of budget planners.

To maintain and improve productivity it is essential to measure it in some way. Currently, the laboratories lack an accounting system that permits routine assignment of all costs to each activity. It is, for example, not routinely possible to say how much it cost, including the cost of federal staff effort, to complete a short-term assignment for Headquarters. Certain of the ESO laboratories are close on this, especially where the more routine services are concerned, but the rest cannot meet this need.

A final strategy available to EPA to match workload requirements to personnel resources is to alter or reduce the workload expected of laboratories. If personnel and other resources cannot be provided in adequate quantity to excel in performance of the entire current mission of each type laboratory, then it is better to reduce demands than to tolerate deterioration of performance across the board.

Consideration of this strategy goes quickly to the heart of cherished beliefs about the role of laboratories in the Agency. For example, a substantial proportion of senior scientists at ORD laboratories contended that the real "customer" for their research is the scientific community at large, rather than the program offices funding the work. It is possible, in contrast, to argue that all EPA laboratories should be limited to applied research and analysis, in clear and direct support of the regulatory functions of the Agency, and that basic research of the sort that responds to the scientific community as its customer belongs in the universities and research institutes of the nation. Another cherished belief regards the extent of "inherently governmental" laboratory functions—it is not at all certain that most analytical operations now performed by government FTEs in ESOs could not be contracted out—even those in support of litigation. In any case, serious consideration of reducing the workload expectation on EPA laboratories would necessarily include such categorical options.

6.6 MANAGEMENT IMPROVEMENTS IN RESPONSE TO IMPEDIMENTS

6.6.1 Ad Hoc Responses

Each of these administrative impediments to laboratory productivity can be addressed and significantly ameliorated by vigorous executive action, although some logical approaches would require White House and Congressional concurrence. Ad hoc response to each impediment is somewhat haphazard, of course, and would certainly produce uneven success, but a consistent effort would eventually address most problems. System-wide approaches are discussed in the next section.

The continuing erosion of FTE authorizations through the combined workings of Agency policies and retirements ought to be acknowledged, and specific strategies created laboratory by laboratory to evolve a work force of balanced grade distribution over the long run. This will promote cost-effectiveness by providing lower grade staff to perform less demanding parts of the work, and will foster a succession of new scientists who can be mentored by and continue the work of today's senior scientific staff. Contractor conversions should be allocated by Headquarters and the laboratory directors with this long-term purpose in mind.

Among the first new hires or reassignments within the ORD and Program Office laboratories ought to be a new cadre of contract support specialists, who would be assigned directly to those senior scientists who originate and manage contracts and cooperative agreements. These contract support specialists would relieve the non-scientific load on senior scientists of managing extramural agreements.

A review of EPA contracting is currently being conducted by NAPA; it is to be completed on 15 June 1994. Implementation of the results of this study may both alleviate many of the current problems in R&D contract acquisition and clarify the issue of inherently government functions as apply to the use of R&D contractors. The issue of personal services should be reviewed to determine if current policies either are too strict as they relate to laboratory operations or if they are being misinterpreted by laboratory management. The Agency should undertake to educate its contracting staffs at all levels and all technical staff responsible for contract and cooperative agreement management, so that the closest practicable working relationships with outside support can be maintained without confusion or fear.

A program should be devised and implemented to streamline the development of new contracts, with the goals of (1) reducing the burden of contract origination on staff scientists, and (2) reducing the time requirement 50 percent from current delays. A parallel program should be devised to improve the ease and speed of purchasing items of any cost below the $50,000 limit.

The bench-level allocation of budget should be settled and communicated to implementing staff not later than 31 December of each new fiscal year. That allocation of budget ought to be protected against reallocation from above except in the most extreme of emergency requirements.

Travel funds for the explicit purposes of scientific collaboration and the presentation of peer-reviewed papers at scientific gatherings should be increased radically, by reallocation of funds from administrative purposes and from Headquarters organizations, and by alteration of the current prioritization of travel funding. The amount of such increase and the sources will require a small study to develop alternative estimates, and an executive decision to implement.

ORD and the program offices must obtain reliable average estimate of the real costs to their laboratories of unplanned, unfunded requirements, and commit funds annually against that estimate. Only in this way can the true devotion of resources to planned functions be determined, and the response to unplanned needs appropriately staffed and provided for.

A corollary of this is that the Agency must develop as quickly as possible, in stages if necessary, an accounting system that references all forms of cost, including depreciation, to projects and other activities of the laboratories. With this accounting system, it will be possible in the future to assign the full costs of supporting activities to each customer of the laboratory, and to examine and minimize the costs of administration and reporting. It will be far easier to decide which laboratories are most cost-effective to retain, and which, perhaps, are relatively costly to maintain. Without such a system, such analysis will be locked in the realm of opinion.

6.6.2 Systematic Responses

As discussed above, various ad hoc responses to these administrative impediments are possible, but these are inevitably scattered and uncertain of success. Two more systematic approaches are deserving of consideration: empowerment of laboratory directors and, building on that, a market-based approach to implementation.

The empowerment of lower levels in organizational hierarchies is a leading tenet of reinvention and has been featured in the Streamlining Report as a critical element of its implementation. Empowerment of laboratory directors to control all feasible aspects of their organizations could permit them to address several of the impediments discussed above. In most cases, this empowerment implies major changes in the current policies and practices, within the Agency and even by Congress. However, if the Laboratory Directors could be granted new control of personnel resources, they could gradually cause their laboratories to evolve toward a balanced skill and grade structure appropriate to each work program and the needs of their customers. They could provide for contract support specialists in support of senior scientists, if they judged the need significant. Acting alone, or in cooperation with other laboratories, they could develop the accounting structures that would permit them to focus productivity improvements and cost reductions.

Over time, empowerment of the laboratory directors to mold their organizations will lead to a laboratory system much more finely tuned to the needs of "paying customers" Where laboratory capabilities overlap, there naturally would develop a competition among laboratories to provide services to the customers at least cost for best quality.

This observation suggests a very different approach to implementing management improvements in the laboratories and, ultimately, to dealing with perennial questions like responsiveness to customers and the relative roles of basic and applied research. This approach is founded on the Streamlining Study and the laboratory director's response to that study. It differs by proposing methods of implementation based on market forces rather than command-and-control, top-down decision making. It was suggested by MITRE's informal observation that the happiest laboratory and customer relations are seen where program managers maintain direct and constant contact with the laboratories they are funding to meet their needs, and the laboratories, in turn, interact with the program managers as their direct customers.

This approach begins with the current laboratories and encourages evolution, through market forces, toward the most efficient complement of laboratory service providers. To accomplish this, EPA would provide mechanisms to create a market in laboratory services of all types (except for a narrow category of reserved government functions). It would define customers for laboratory services and provide channels for those customers to publicize their needs to the laboratory community. EPA would empower the Laboratory Directors to assemble project teams and research plans to meet those needs, drawing resources from their laboratories, other laboratories in consortia, and extramural resources.

This approach is founded on the principles of market economics, modified where necessary to preserve crucial EPA functions. All other approaches considered here are fundamentally prescriptive; that is, they attempt to prescribe the most effective allocation of laboratory resources to Agency needs based on a central theme. This approach takes as its starting point that data and debate alone cannot resolve the differences of opinion that arise when such allocations are attempted and presupposes that any new approach based on the same prescriptive philosophy will fail to end the debate. Further, this approach argues that no group is sufficiently wise and knowledgeable to "pick the winners and losers" for today and the future. Instead, it seeks to harness familiar market forces in a long-term evolutionary process, through which the "winners" in providing laboratory services of all types to meet Agency needs will emerge naturally, by providing the most cost-effective suite of services to their direct customers.

To make this approach operational, it would be necessary to create a modified free market in laboratory services, in which customers are free to define and advertise their needs, and suppliers are empowered to propose meeting them by reasonable strategies.

Six major organizational functions must be recognized and implemented, as follows:

- Customers must be empowered to communicate their needs and to provide all needed resources to the selected source of services.

- Laboratories must be empowered, through changes in authorities, administration, and accounting methods, to respond to customers' requests for proposals, to assemble appropriate intramural and extramural teams, and to manage the execution of projects independently.

- A "marketplace" must be created in which buyers and sellers of laboratory services can get together—appropriate means of direct two-way communication must be provided.

- Adequate controls and planning structures must be instituted to guarantee that a minimal list of essential EPA laboratory services is preserved, whatever the possible workings of the free market.

- Exploratory research, which may not be sought by any one program, must be protected from short- and medium-term market pressures. Laboratories may perform exploratory research, but for a separate client, perhaps an expanded Office of Exploratory Research.

- A long-term R&D surveillance function must be created, to monitor and modify the elements of this approach as experience is gained with its impacts.

Impediments to this approach include the current large organizational investment in headquarters functions, staff, accounting structures, and annual planning structures that have arisen under the current command-and-control approach. Certain of these impediments can be changed by the Administrator; other critical impediments may require supporting Congressional action.

The market-based approach toward research management has worked for the General Electric Company (GE) (Center for Strategic and International Studies, September 1993). Until the late 1980s, GE's R&D Center received two-thirds of its funding from assessments of GE businesses, who complained that R&D efforts were not focused sufficiently on their needs. In 1988, GE shifted the balance of R&D Center funding to a 75/25 formula, under which 75 percent of funding comes from direct contracts with the GE businesses and 25 percent from assessments. The 25 percent number was selected on the strength of data indicating that about 18 percent of R&D Center activity in the past has been fundamental research that might not find a direct client in the market-based approach. GE has observed much greater interaction between the R&D Center scientists and the GE companies and much improved satisfaction among the GE companies with the performance of the R&D Center.

In conclusion, a number of serious administrative impediments to the cost-effective execution of laboratory programs have been identified that apply in most cases to the ORD and program office laboratories and the ESOs. Given sufficient management concern and commitment, both ad hoc and systematic approaches can be pursued to reduce these impediments.

SECTION 7

STRUCTURE FOR ANALYSIS OF OPTIONS

7.1 INTRODUCTION

EPA was charged by the Senate Committee on Appropriations to explore whether a consolidated laboratory structure would better enable the Agency to accommodate the need for integrated research and monitoring. In this chapter the structure for the analysis of the options is presented. Major options posed by the Steering Committee are defined in sufficient detail to permit an analysis to be made of the advantages and disadvantages of restructuring or realigning EPA's laboratory complex and instituting changes in operating practices and the options are related to the laboratory missions discussed in Section 4. The criteria that are used to evaluate these options are also defined.

7.2 OPTION DESCRIPTION

The options for realignment are defined based upon the previous Agency studies (as discussed in Section 3), recently published reports, and discussions with numerous individuals throughout EPA and other organizations. Options are defined at a division (or equivalent) level or above in the existing laboratories for the purpose of clarifying the description of the option rather than dealing with restructuring as an abstract concept. Other realignments within a given concept are also possible and no attempt has been made to select an optimum configuration for any concept. Confining the focus to the higher-level organizational units allows the analysis and comparison of options to be performed at a level that clearly discriminates the advantages and disadvantages of each in comparison to the existing structure. The final decision on realignment of the laboratories rests with EPA management.

For the purpose of clarifying and separating the issues, only the five structural options are discussed in this section:

- **Customer Orientation:** focus on program offices as the users of science and technology

- **Streamlining:** reduce administrative layers

- **Carnegie Commission:** emphasize multimedia issues in ORD

- **Distinct Environmental Services Organization (DESO):** centralize responsibility for all technical support functions of regional ESOs and program offices

- **Geographic Location:** address location-specific environmental issues

Management Improvements, which would apply to all structural options, were discussed in Section 6.

The option descriptions begin with a general description of the option, followed by any additional assumptions that were made for purposes of evaluating the options. Additional variations could be made in the assumptions. As discussed in Section 1.2, three types of consolidation—organizational, functional, and physical—are possible. While organizational and functional consolidation are integral to the options, actual physical consolidation is not. Therefore, for all the options, two versions were considered, one without and one with physical consolidation.

7.2.1 Baseline

The Baseline, the current laboratory structure frozen in time, is described in detail in Chapter 4 and Appendix A and shown in Figure 7-1. This is the standard against which the structural options are compared. It can be characterized as a distributed or decentralized structure with the 39 laboratories ultimately reporting to six AAs and ten Regional Administrators. The underlying organization principle is to separate the scientific and technological functions into research and development activities that report to the AA for Research and Development and to align development, technical services, and support activities by environmental medium or major function, such as enforcement. The intent is to distribute and control the scientific and technological resources at the most relevant point of application. Resource distribution (by FTEs and dollars) by policy level is presented in Table 7-1. No single individual (other than the Administrator/Deputy Administrator) is responsible for all of the scientific and technological functions of the Agency. The only explicitly identified quality assurance function in EPA is the Director of the Quality Assurance Management Staff, who reports to the Office of Modeling, Monitoring Systems and Quality Assurance under the AA for Research and Development. The Science Advisor has cognizance of all scientific and technological functions, including quality assurance, and acts as an advisor to the Administrator. The current structure has been in effect since 1979.

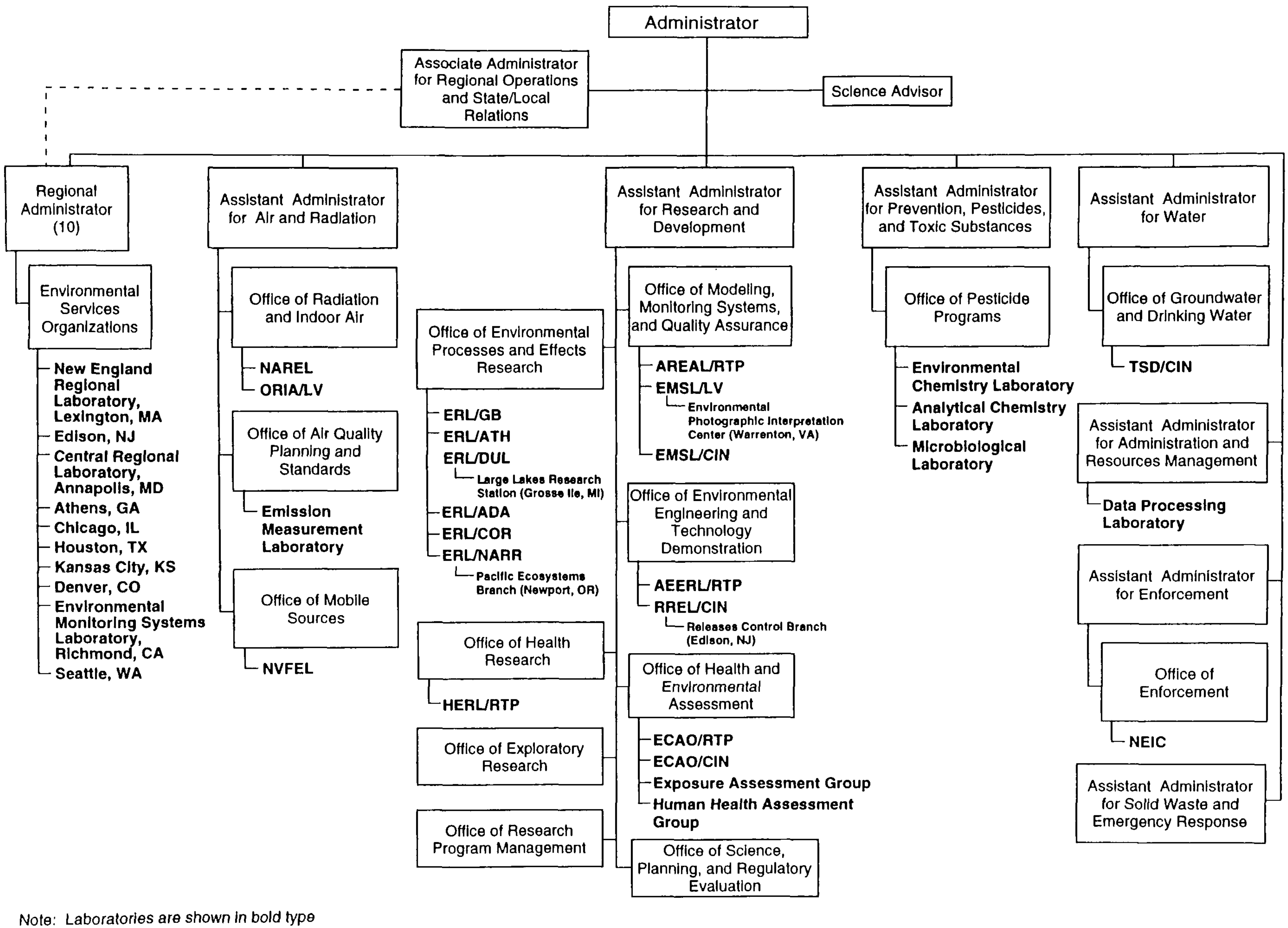


Figure 7-1. Current Laboratory Structure

Table 7-1. Distribution of FY93 Scientific and Technological Resources

Policy Level	Laboratory FTEs	Funding ($000)
ORD	1535	$392,516
Regional Administrator (10)	639	49,406
Air and Radiation	357	46,700
Enforcement	120	13,917
Prevention, Pesticides, and Toxic Substances	34	2,996
Water	23	2,096

Note: FTE totals are drawn from Figures 4-2 and 4-3; funding totals are drawn from Table 4-8 and Appendix A, Table 2 for individual laboratories.

7.2.2 Customer Orientation

Organizations, whether they be production, service, or scientific corporations, are now giving increased attention to customer needs. As a regulatory agency, EPA has to address two broad types of customer needs: the need for technical input to the development, implementation, and enforcement of environmental regulations addressed to identified or suspected problems and the need to anticipate and characterize as yet unidentified human health and ecological issues. Based upon interviews with customers for EPA's science and technology, both internal and external to EPA, there is neither a clear understanding on where to seek products or technical support within ORD nor an effective means to transfer scientific and technological knowledge in a timely manner to those who need it. The regional and program office laboratories are now more focused on customers than are the ORD laboratories, so this option would not affect them as much.

The Customer Orientation option postulates a greater alignment with the customers of the laboratories. It is intended to put ORD and program office laboratories more directly under the control of the program offices they serve and supports the mission of the conduct of research and the use of the information in strengthening environmental protection programs. As shown in Figure 7-2, it establishes a new structure for the program offices and ORD laboratories, with consolidation occurring within the dashed boxes. The proposed organization retains the current structure and reporting relationships of the ESOs (except where they are impacted by consolidation) and NEIC, since these organizations now have a customer orientation. Under this option, the ESO laboratories, not including the quality assurance/quality control and field monitoring functions, would

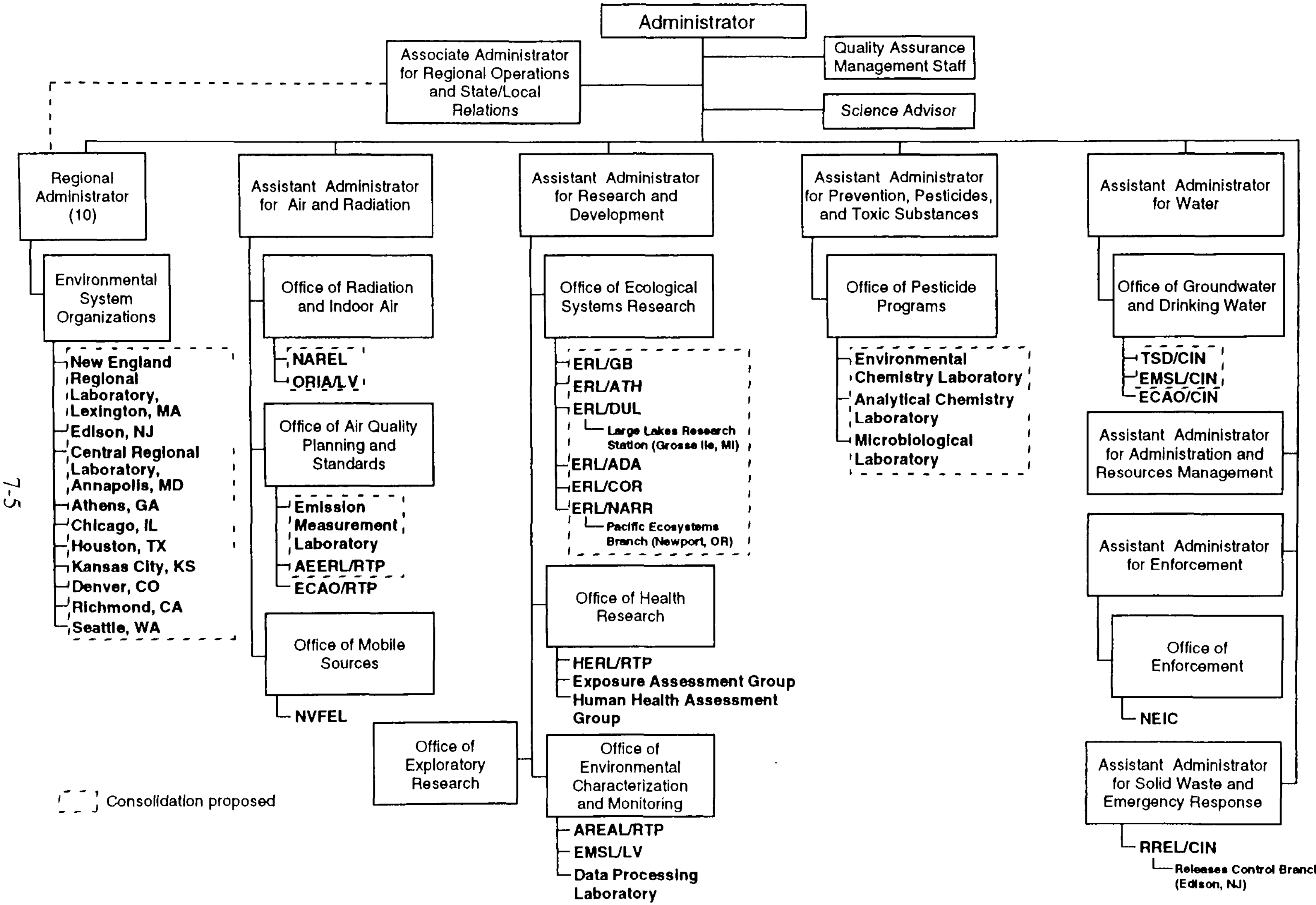


Figure 7-2. Structure for Customer Orientation Option

be consolidated from the present ten to a number to be determined through an analysis of such factors as sample analysis requirements, present state of laboratory facilities and equipment, cost of maintaining current facilities, and whether facilities are leased or owned.

Some of the functions that the ESOs perform, such as methods development, enforcement, and certification, may be inherently governmental. All of these functions require laboratory facilities. Because of this, there is a necessity to have some level of analytical capability. The staff in the ESO tend to be more mature and to remain at the ESOs longer than their counterparts in commercial laboratories. If laboratories are consolidated arbitrarily, EPA might lose its most experienced staff and lose the satisfaction of its customers that it now enjoys.

Figures 7-3 through 7-8 present the distribution of FTEs among science and technology functions for the new groupings that this option would create (laboratory groupings are indicated by the labeling of the Y-axis in each graph).

The Office of Radiation and Indoor Air (ORIA) would retain control of the two radiation laboratories located in Las Vegas and Montgomery. These two laboratories (Figure 7-3) are heavily weighted to the implementation of Agency monitoring and assessment mandates relating to environmental radiation and are well constituted to serve their program office. There is essentially no fundamental or other research that should be considered for relocation.

Three laboratories would answer to OAQPS in support of its efforts to develop regulations and technologies (Figure 7-4). This would concentrate most of the development and application-directed research capabilities for air in the Agency and would entail the "misplacement" in a line organization of very little current fundamental research activity. That small amount could be transferred into another suitable organization devoted to fundamental research.

Figure 7-5 shows the distribution of FTEs for the laboratories that would support an Office of Ecological Systems Research: the Environmental Research laboratories and field stations. This grouping plainly is focused on fundamental and applied research almost exclusively. This fits well into the placement of the office under ORD.

An Office of Health Research within ORD would inherit control of the HERL, HHAG, and EAG. Figure 7-6 shows that this would group substantial FTE resources in the functions of application-directed and fundamental research, development, quality oversight, technical assistance, and technology transfer.

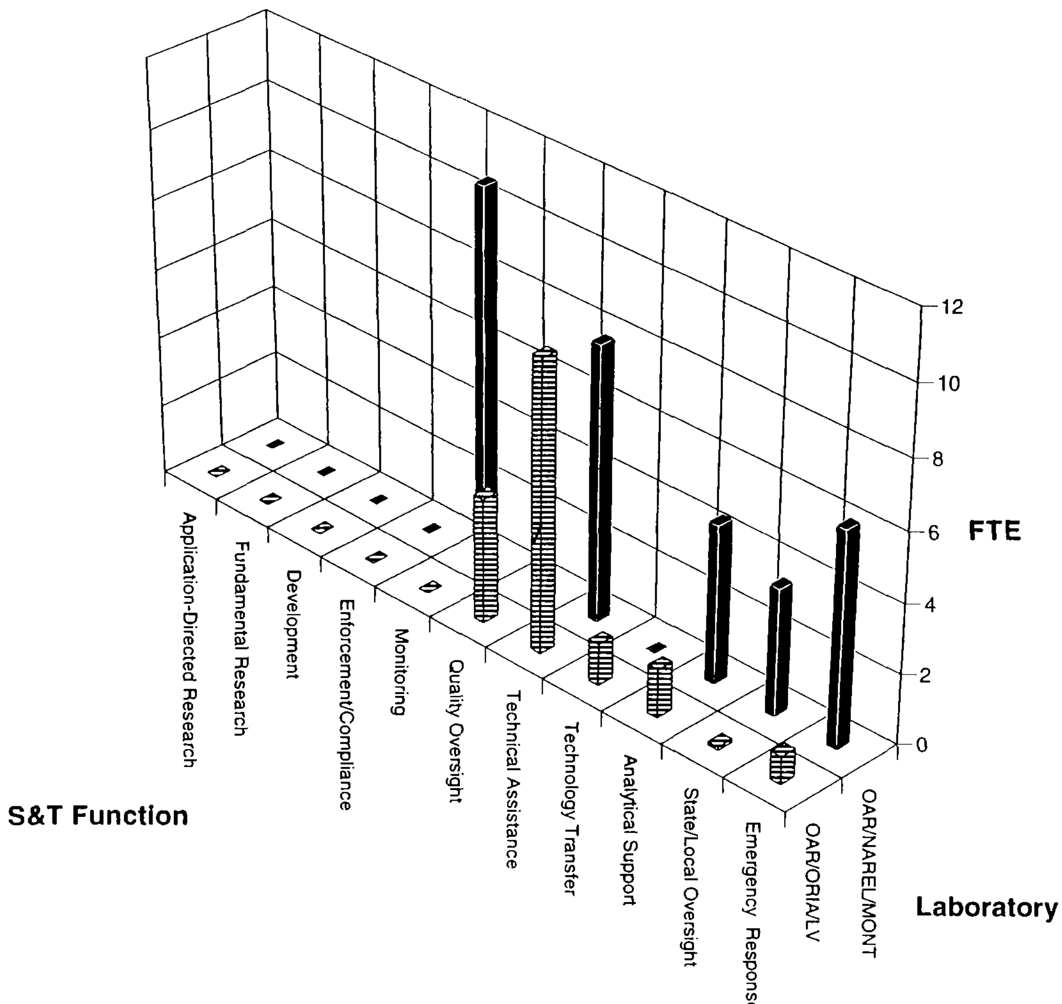


Figure 7-3. FTE by Scientific and Technological Function
Office of Radiation and Indoor Air
(Customer Orientation Option)

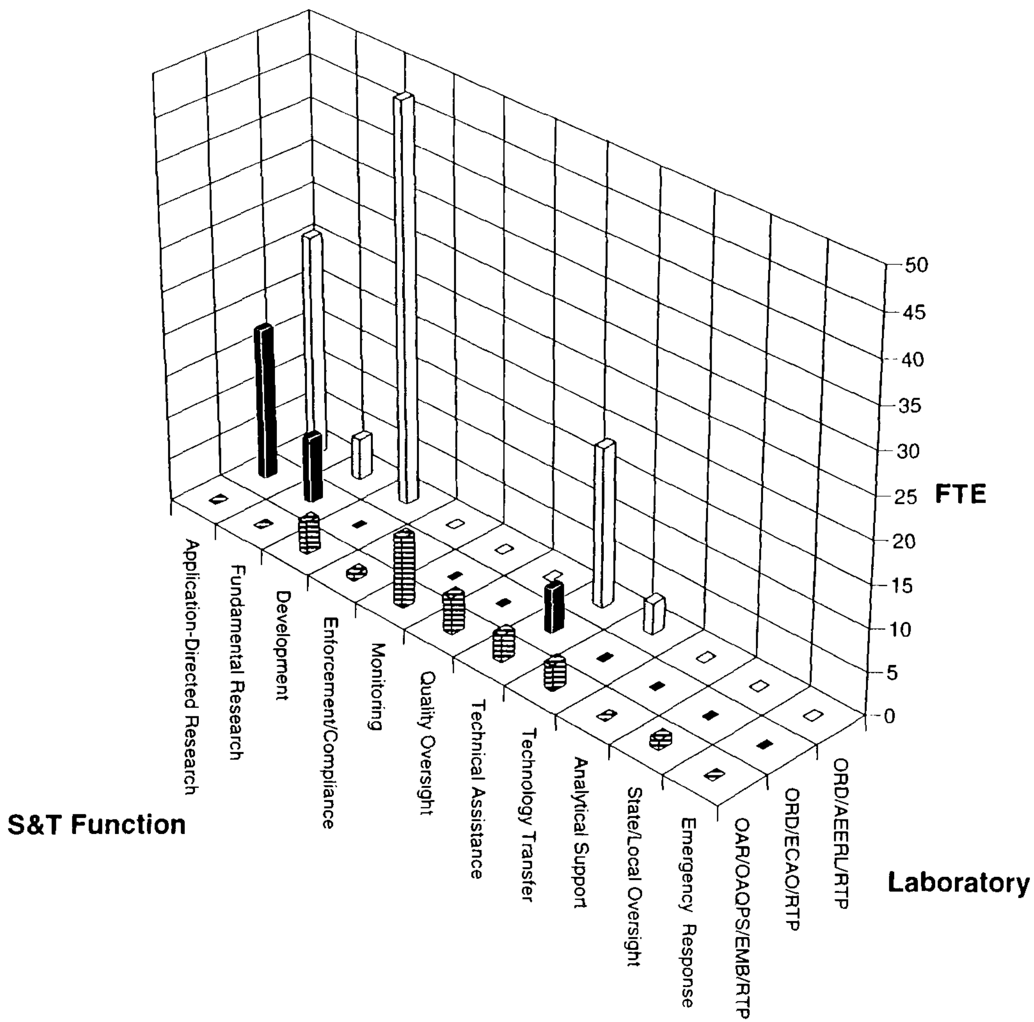


Figure 7-4. FTE by Scientific and Technological Function
Office of Air Quality Planning and Standards
(Customer Orientation Option)

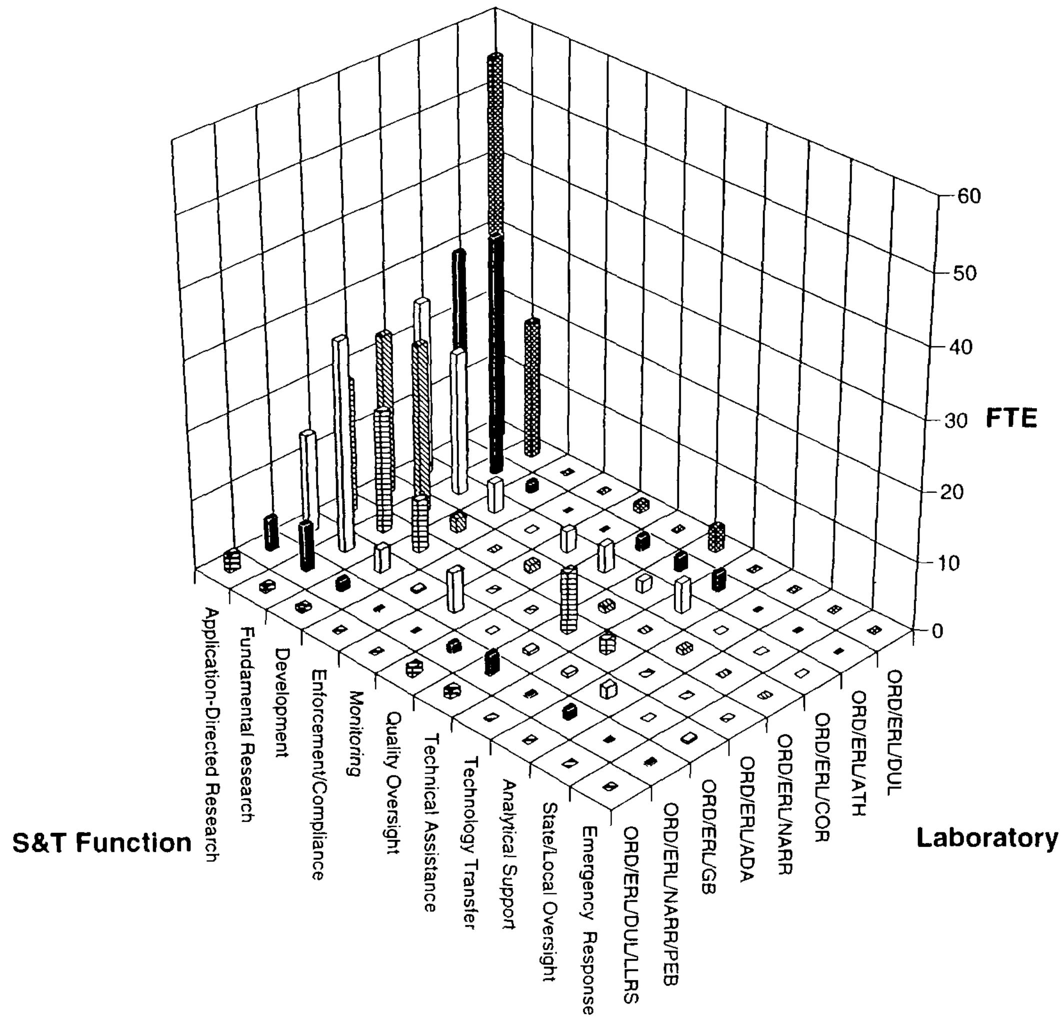


Figure 7-5. FTE by Scientific and Technological Function
Office of Ecological Systems Research
(Customer Orientation Option)

[COO-FUNC.XLW]FIG7-6.XLC

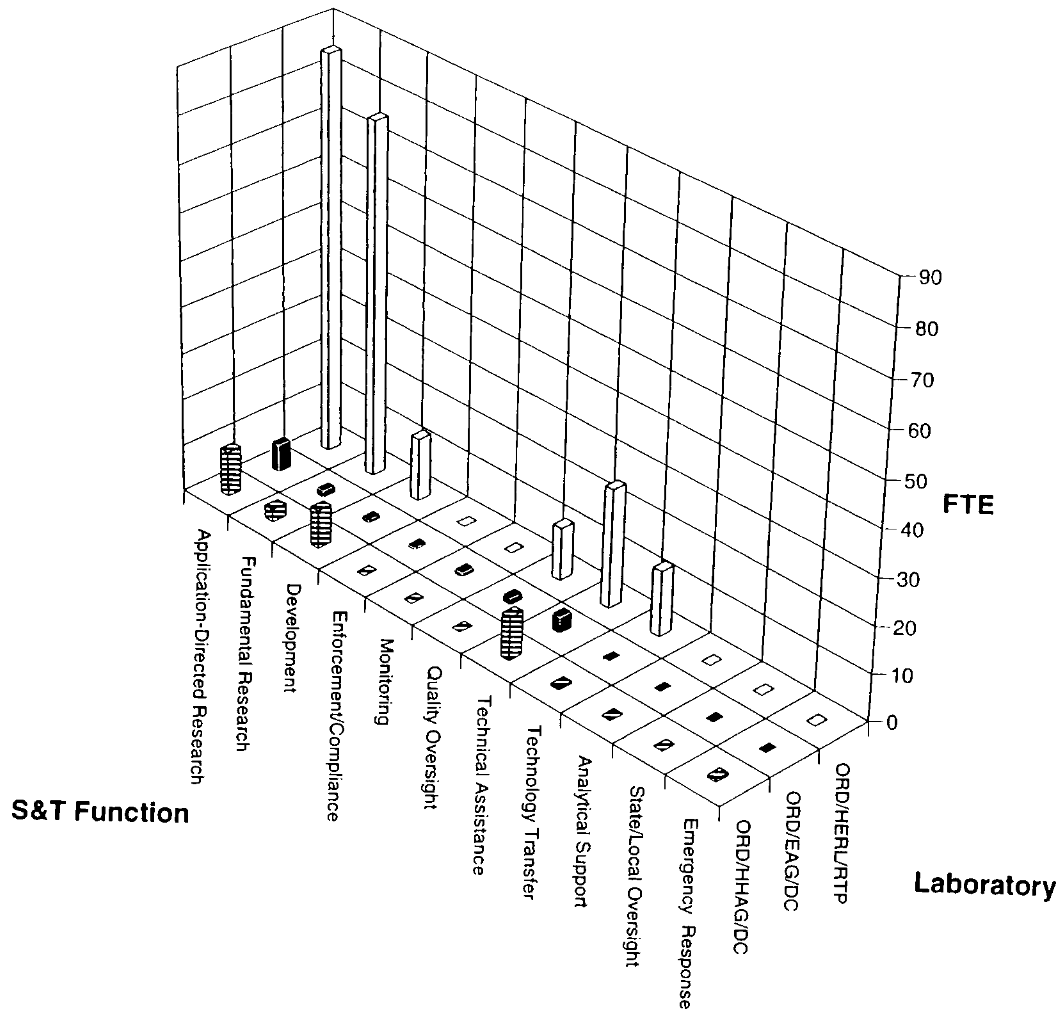


Figure 7-6. FTE by Scientific and Technological Function
Office of Health Research
(Customer Orientation Option)

[COO-FUNC.XLW]FIG7-7.XLC

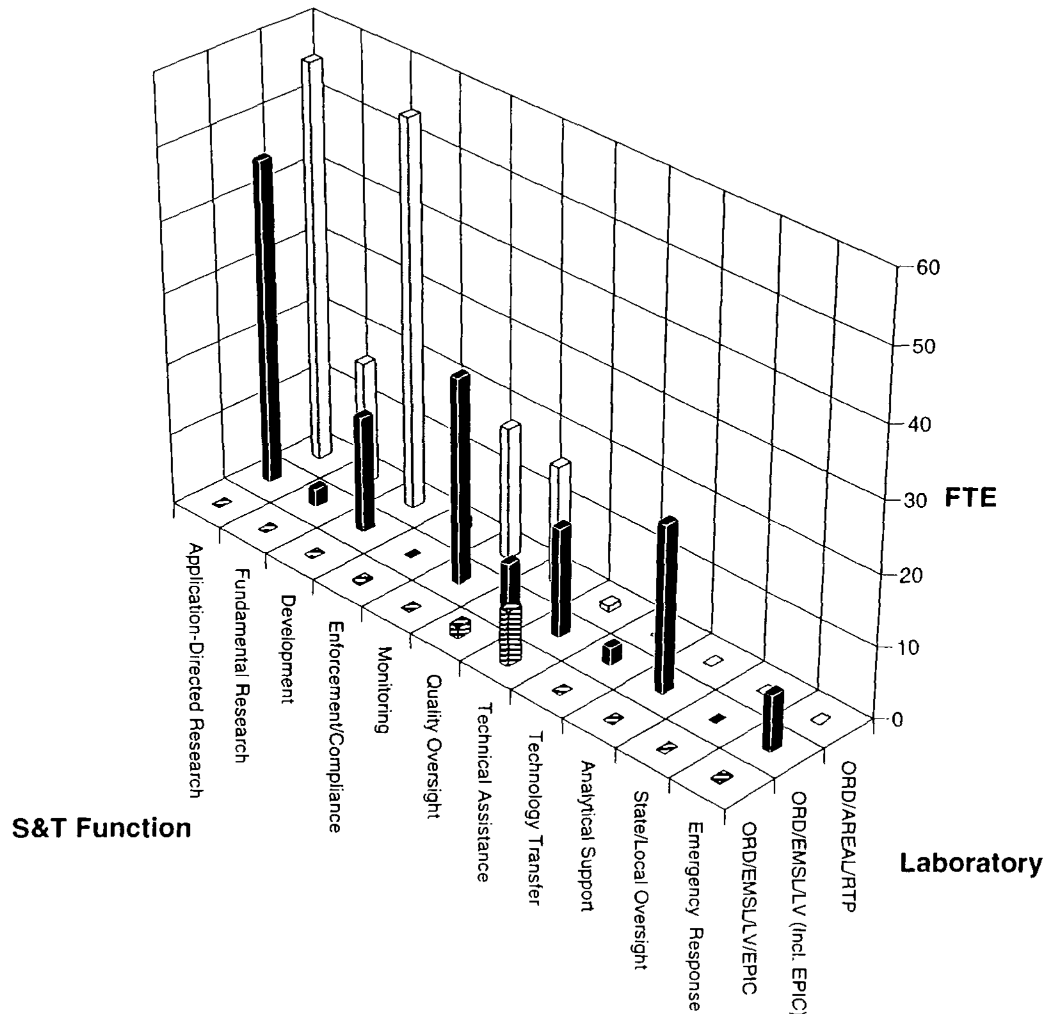


Figure 7-7. FTE by Scientific and Technological Function
Office of Environmental Characterization and Monitoring
(Customer Orientation Option)

[COO-FUNC.XLW]FIG7-8.XLC

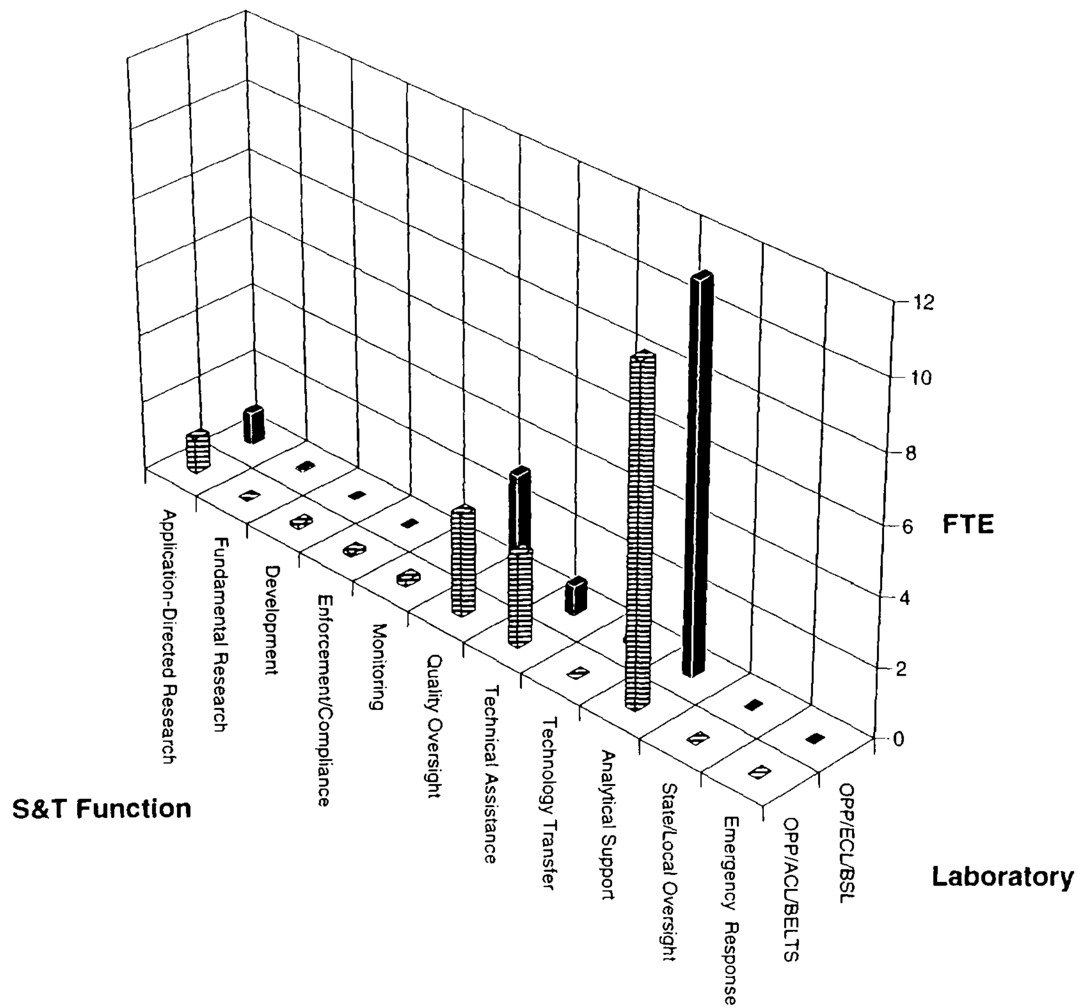


Figure 7-8. FTE by Scientific and Technological Function
Office of Pesticide Programs
(Customer Orientation Option)

Further, the HERL does not fit this picture very neatly, as it devotes more than a third of its effort to fundamental research, and much of the application-directed research may be closely tied to that fundamental research. Therefore, this option would place a mix of functions in an ORD organization; these now have problems of mixed directions, as discussed earlier. It would be useful to consider whether the functions of technology transfer, technical, and quality oversight of the three laboratories could and should be broken away and placed within appropriate program offices, leaving the research functions within ORD.

The laboratories organized under ORD's Office of Environmental Characterization and Monitoring (Figure 7-7) are heavily vested in implementation support activities, as well as development, and some research. Viewed strictly from the perspective of this mission analysis, these laboratories do not appear to fit as well under the ORD umbrella, and might perpetuate problems with customer responsiveness in some activities and, conversely, freedom to pursue fundamental research without the press of daily program office demands. These laboratories therefore would be candidates for splits of functions, with research functions perhaps remaining with ORD, but implementation support activities shifting, by medium, to the appropriate program offices.

The Environmental Chemistry Laboratories at Beltsville and Bay St. Louis would continue to serve the Office of Pesticide Programs with their high degree of focus on analytical support, technical assistance, and quality oversight (Figure 7-8). The two laboratories virtually duplicate their emphasis on scientific and technological functions, which raises the question of whether both are needed or whether some degree of consolidation might be appropriate. In comments on the draft of this report, the Deputy AA of the Office of Prevention, Pesticides, and Toxic Substances, stated that the Beltsville laboratory would be collocated with the new Region 3 laboratory proposed for construction at Ft. Meade, Maryland in FY96/FY97. He also supported the consolidation of the Bay St. Louis facility at Ft. Meade.

No change would occur in support by the NVFEL to the Office of Mobile Sources. The distribution of scientific and technological functions at that laboratory is a close fit to the daily needs of the sponsoring program office, as there is no interfering structure to inhibit direct responsiveness to the customer. In comments on the draft of this report, the Director of the Program Management Office, Office of Mobile Sources, stated that the NVFEL is the name of a facility to carry out Titles I and II of the Clean Air Act, fuel economy and other energy-related legislation, and other programs, a laboratory in name only. (Based on MITRE's observations during the visit to NVFEL, approximately 100 of the reported 277 staff there are performing laboratory activities for vehicle testing and certification.) In spite of this, the NVFEL is considered a laboratory for the purposes of this study. Mobile sources research activities now at the ORD AREAL in Research

Triangle Park, North Carolina (RTP) might be considered for consolidation into this group or for treatment by another mechanism to ensure close communications and support to the program office.

Without physical consolidation, this option would emphasize, through enhanced lines of communication with customers, closer customer contact and direction. With physical consolidation, the structural realignment would combine like functions to emphasize customer responsiveness and enhance the quality of science.

7.2.3 Streamlining

As part of the National Performance Review, EPA is addressing how it can best streamline its scientific and technological operations. This streamlining is directed toward improving the efficiency and effectiveness of carrying out all the Agency missions. The option, as addressed here, related only to ORD, although ESOs might be affected. ORD has recommended (Sussman, 1994) separating strategic research from program support research (at a minimum in planning and budgeting) to enhance decision making and increase the responsiveness of the research program. Two suboptions, one without and one with consolidation, are addressed under streamlining. Without consolidation, the Streamlining option assumes administrative changes to the ORD organization. EPA has stated (Sussman, 1994) that, based on a recent decision by the Office of Management and Budget and the National Performance Review, because of EPA's projected increase in FTE in FY95, it is unlikely that EPA will have to reduce Grade 14 and above non-supervisory scientific positions. The assumption is made that any reductions in FTE would take place primarily at EPA Headquarters. The proposed organization retains the current structure and reporting relationships; the major change is likely to be in the reduction of Headquarters staff. The evaluation of streamlining in ORD without consolidation in the memo from the ORD laboratory directors (Marchant, 1994) concentrates on organizational changes, with the reorganization of headquarters ORD, including the creation of the Director of Research and Director of Program Planning and the elimination of much of the headquarters ORD staff. Many of the current headquarters functions would then move to the laboratory level.

The streamlining changes within ORD incorporate the recommendations presented in the draft ORD report on Streamlining ORD (Foley, 6 February 1994) and the consensus recommendations by the ORD Laboratory Directors Group (Marchant, March 1994). The proposed ORD organization is shown in Figure 7-9. While the ORD laboratory directors endorse the concept of some kind of aggregation of laboratories, they recommended that the ORD laboratories be aggregated based on the following criteria:

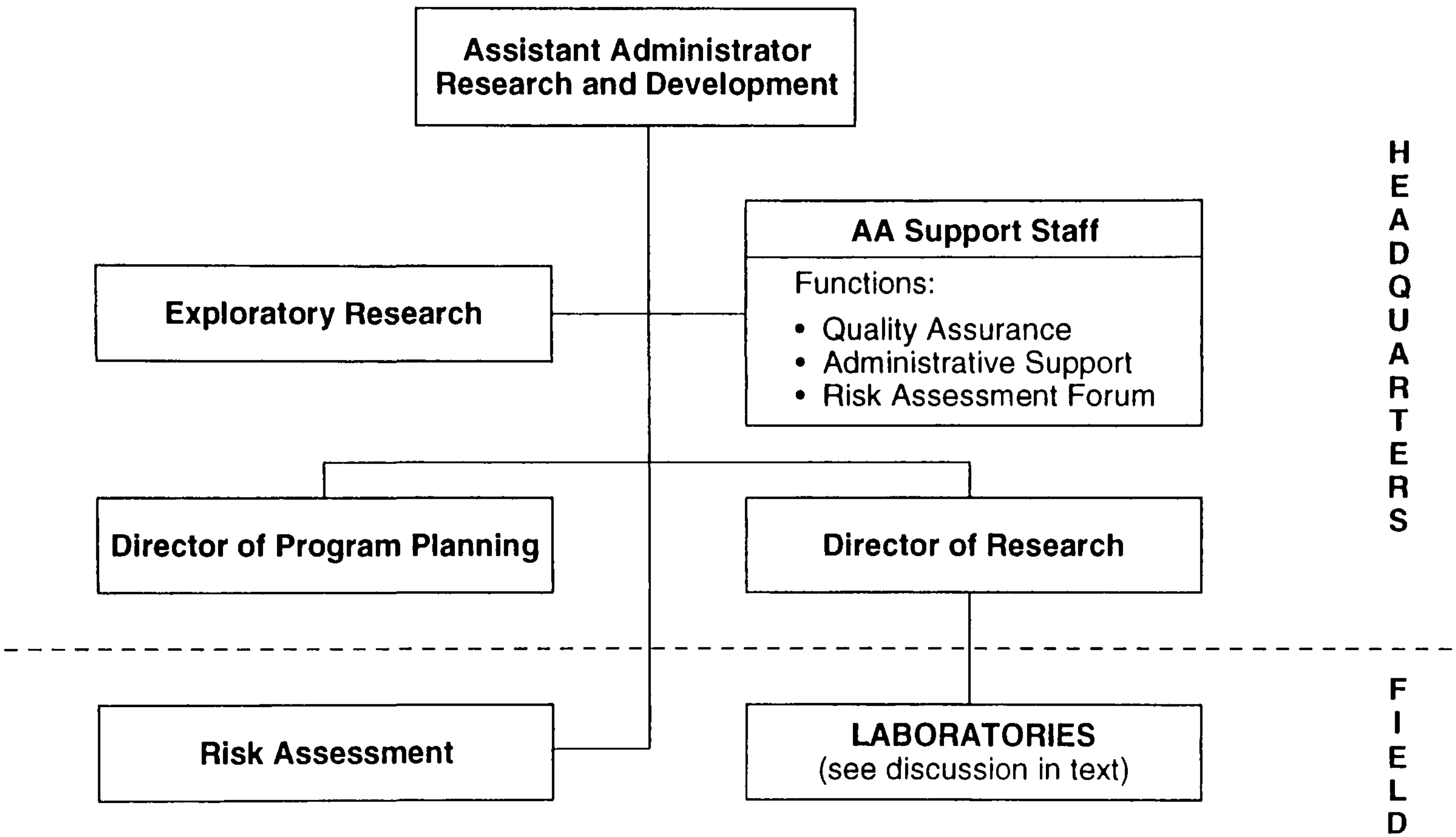


Figure 7-9. Laboratory Directors' Alternative

- "Flagship, mega-laboratories" as the Carnegie Commission recommended should not be created since all laboratories are carrying out important regulatory and statutory duties of EPA.

- Leadership—both scientific and managerial—should be concentrated in the field.

- Laboratory missions should be clarified to ensure that ORD research is responsive to existing and emerging EPA needs, and redundant missions should be avoided.

- Aggregation should result in and/or sustain "critical masses" in the disciplines essential to success in ORD's research program. Any such aggregation should be along disciplinary lines, with a multimedia emphasis.

- Wherever possible, as with geographically collocated laboratories, services should be consolidated.

- No extra layers of "bureaucracy" should result.

- There should be no wholesale personnel relocations.

To date, the ORD laboratory directors have not recommended organizational units within the Risk Assessment and Laboratories boxes on Figure 7-9, although several individuals commenting on the draft of this report have presented the merits of retaining a structure similar to the current one for risk assessment.

Consolidation is limited to convenient consolidation; that is, those laboratories that are convenient to one another, or physically collocated, would be consolidated, while the reporting relationships of the scientific and technological functions would be preserved. For example, the Region 4 laboratory and the ORD laboratory located in Athens, Georgia would be combined administratively to save on administrative expenses. They also would share laboratories. Administrative and support specialist positions could be consolidated.

Although it might stretch the definition of "convenient consolidation", funds have been approved by Congress for the construction of an EPA facility at Bay City, Michigan. This is a possible location for a new laboratory for Region 5, as well as a new site for the ORD Large Lakes Research Station (LLRS) now located at Grosse Ile, Michigan. The Bay City location would allow for the expansion and consolidation of two Region 5 laboratories. Construction of a replacement for the World War II-era converted warehouse at LLRS would also be possible.

7.2.4 Carnegie Commission

The Carnegie Commission (Carnegie Commission, 1992) recommended that the existing structure of the ORD laboratories be consolidated to create a National Ecological Systems Laboratory (NESL), a National Environmental Monitoring Systems Laboratory (NEML), a National Environmental Engineering Laboratory (NEEL), and a National Health Effects Laboratory (NHEL). This approach, which acknowledges the need for integrated long-range research and addresses the multimedia nature of environmental problems, forms the basis of the Carnegie Commission option. No changes would be made in the current structure or reporting relationships of the program office laboratories and ESOs. A nationally prominent scientist-administrator would serve as the director of each of the national laboratories and would report to the AA for Research and Development. As with all the other options, the management improvements proposed in Section 6 would be applied as appropriate under this option.

The proposed ORD organizational structure is shown in Figure 7-10. The NESL would 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. The existing laboratories are located at Corvallis, Oregon; Duluth, Minnesota; Gulf Breeze, Florida; Narragansett, Rhode Island; Ada, Oklahoma; and Athens, Georgia. Three laboratories in ORD devoted to environmental monitoring (the EMSLs in Cincinnati, Ohio, and Las Vegas, Nevada, and the AREAL in RTP) would be combined to form the NEMSL. A headquarters site would be established for the NEMSL, with the existing laboratories continuing to operate as field sites under its direction. The NEEL would be established by combining the existing EPA RREL in Cincinnati, Ohio, and the AEERL in RTP. 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 existing HERL in RTP would be raised to the same status as the other three proposed EPA national laboratories.

The effect of this consolidation on the distribution of scientific and technological functions is illustrated in Figures 7-11 through 7-14. Since the Carnegie Commission option focuses on grouping laboratories by gross discipline category, the distribution of scientific and technological functions would remain unchanged, and the only major shifts would occur because the laboratories within a particular group share certain functional characteristics. For example, the laboratories identified with the NESL are heavily vested in fundamental and application-directed research, while the laboratories comprising the NEML perform a wide range of other scientific and technological functions but little fundamental research.

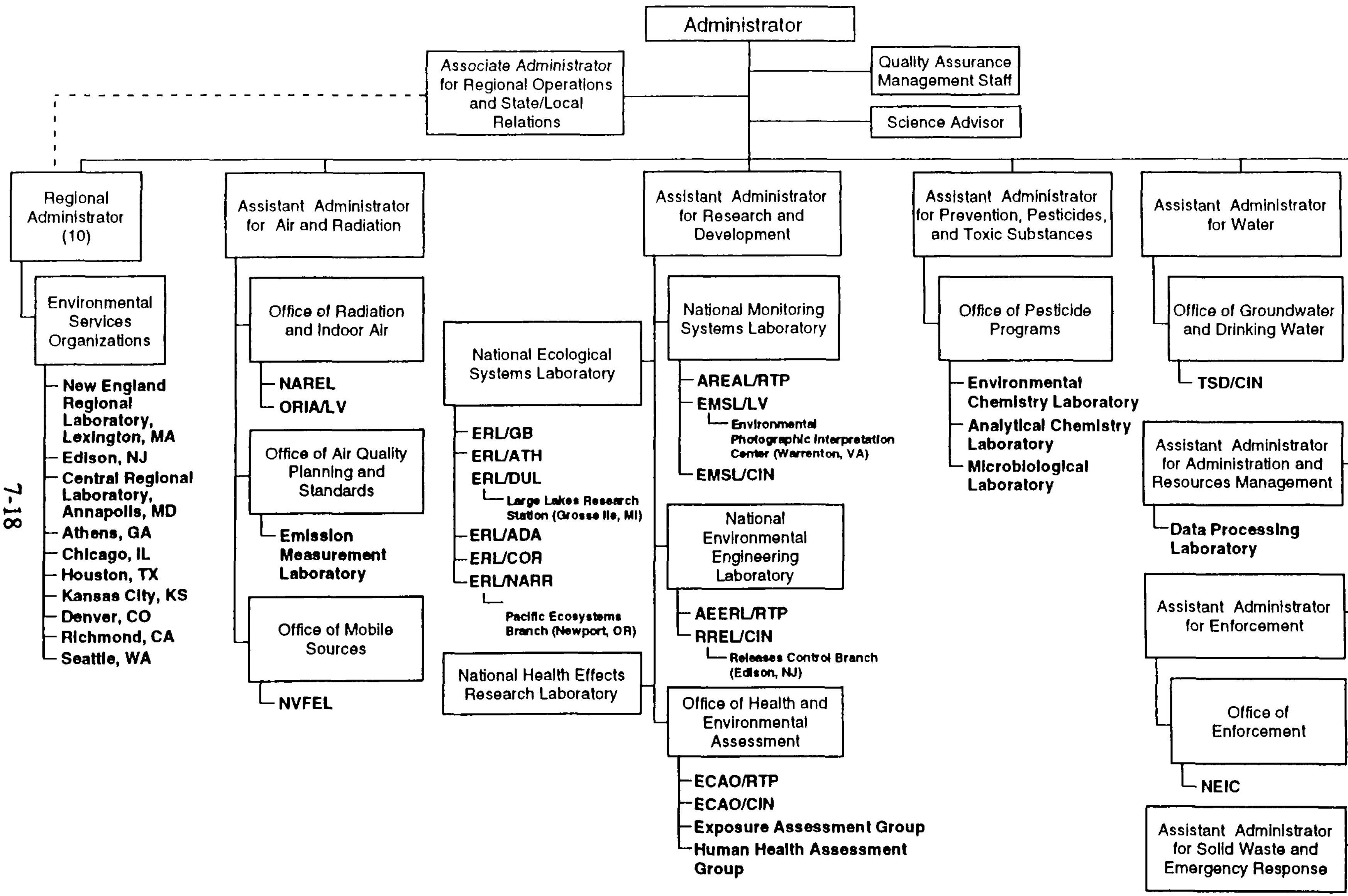


Figure 7-10. Structure for Carnegie Commission Option

[CCO-FUNC.XLW]FIG7-11.XLC

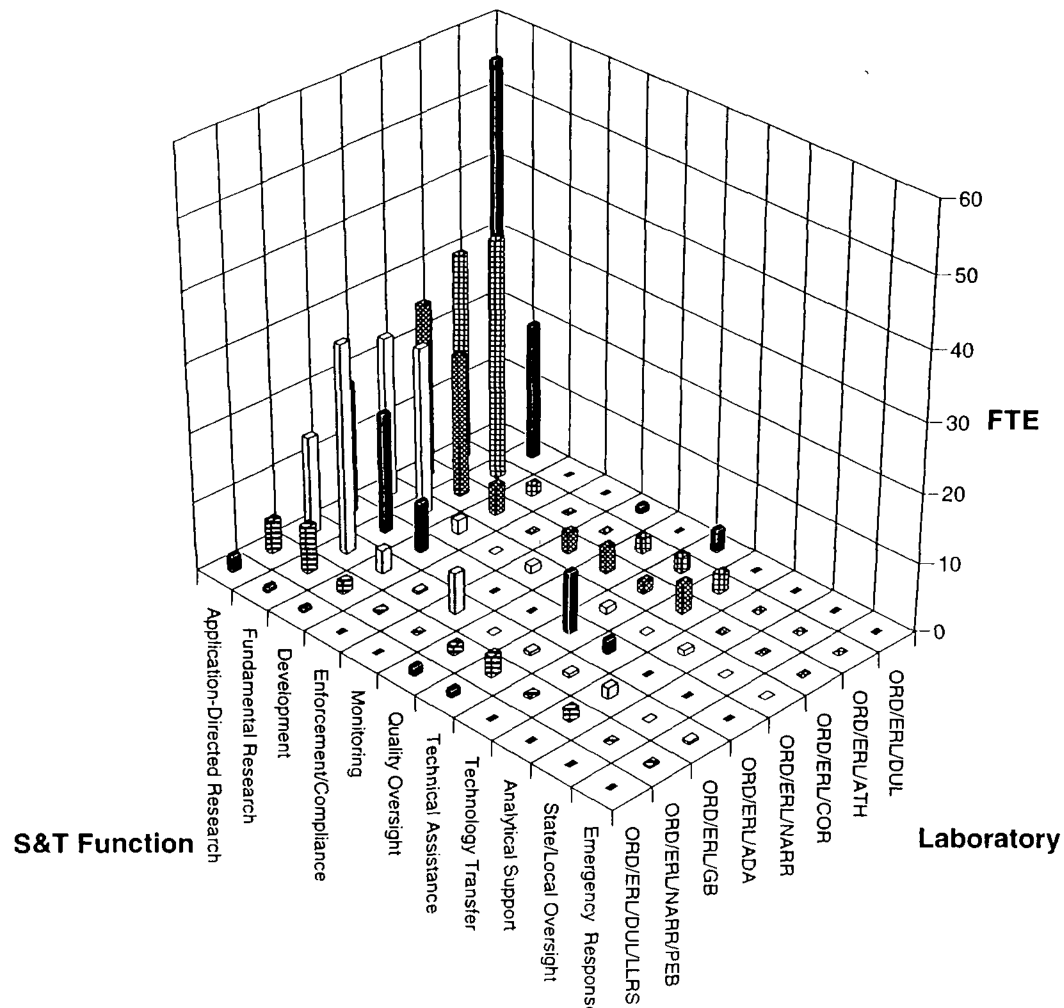


Figure 7-11. FTE by Scientific and Technological Function
National Ecological Systems Laboratory
(Carnegie Commission Option)

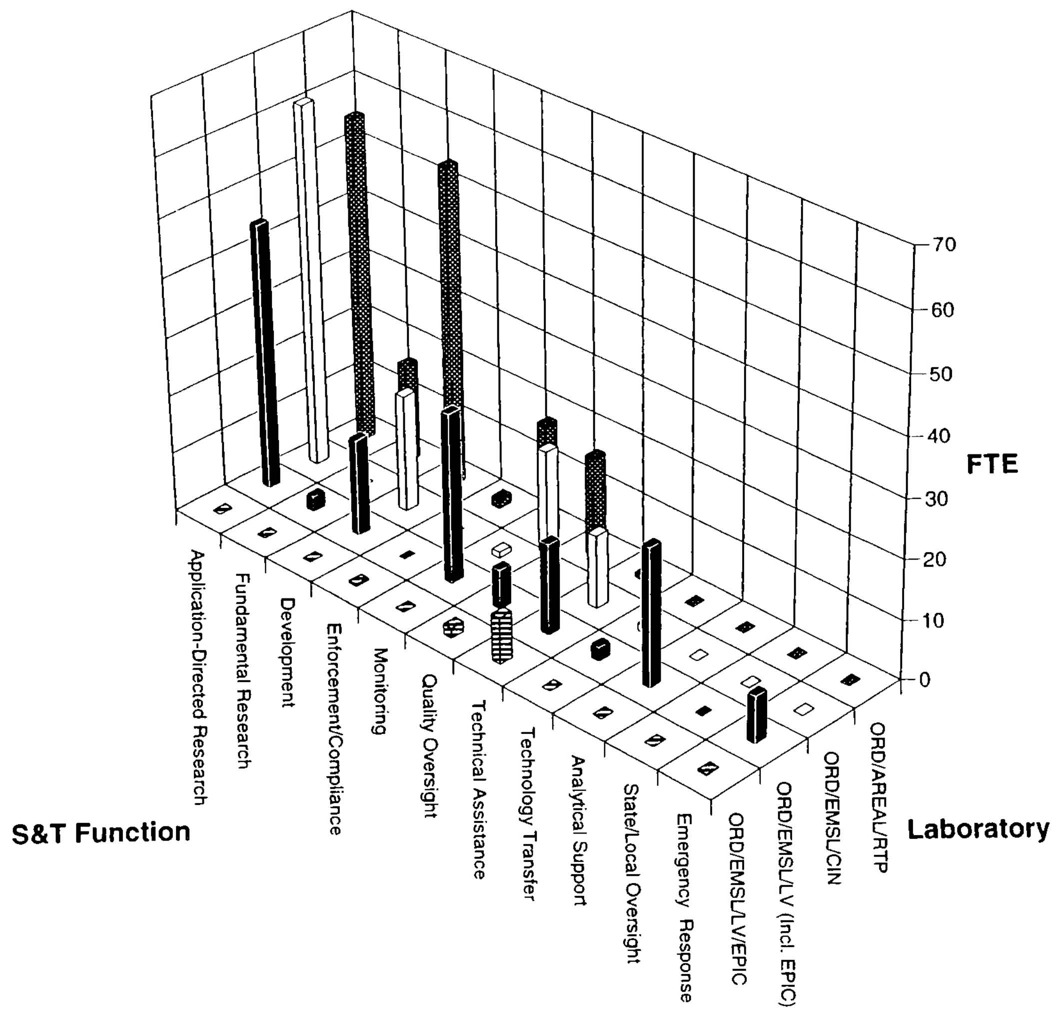


Figure 7-12. FTE by Scientific and Technological Function
National Monitoring Systems Laboratory
(Carnegie Commission Option)

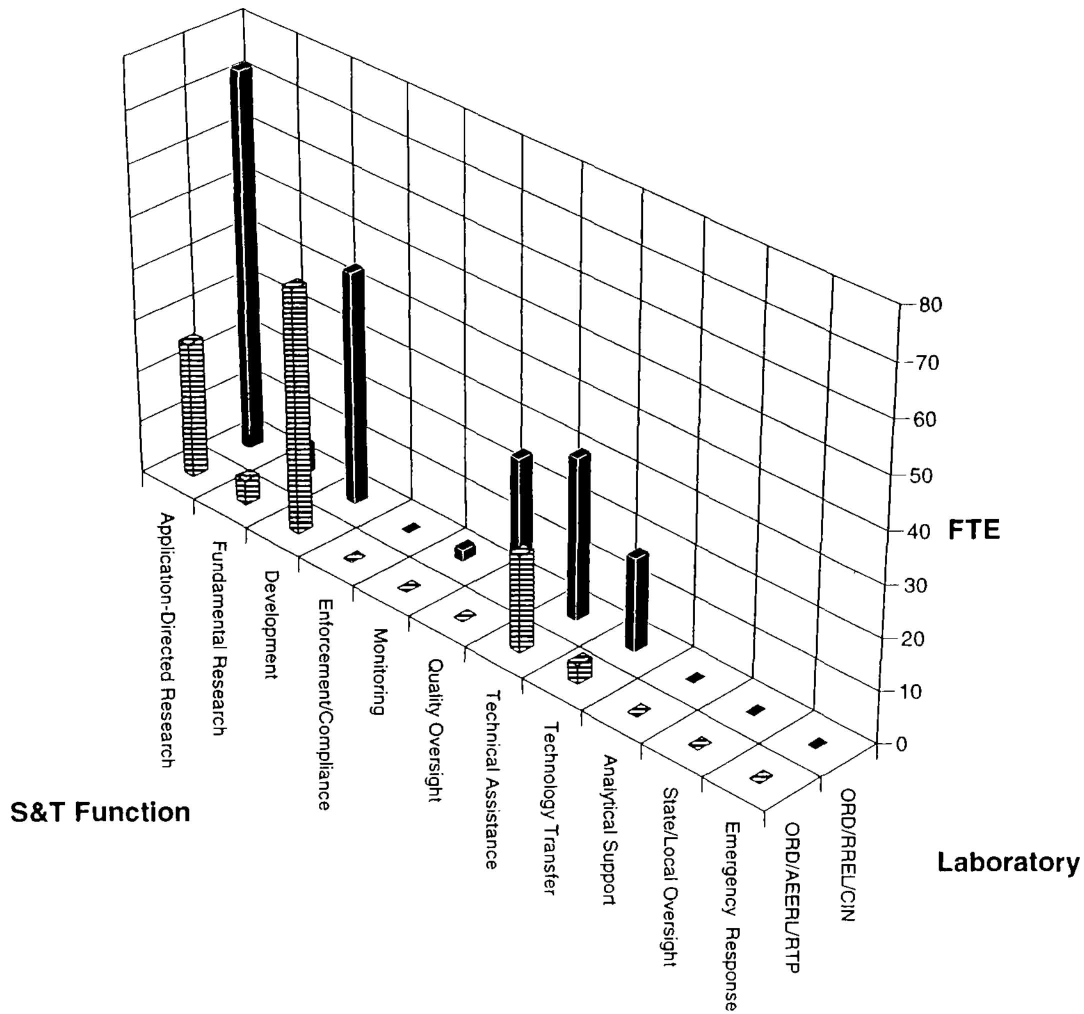


Figure 7-13. FTE by Scientific and Technological Function
National Environmental Engineering Laboratory
(Carnegie Commission Option)

[CCO-FUNC.XLW]FIG7-14.XLC

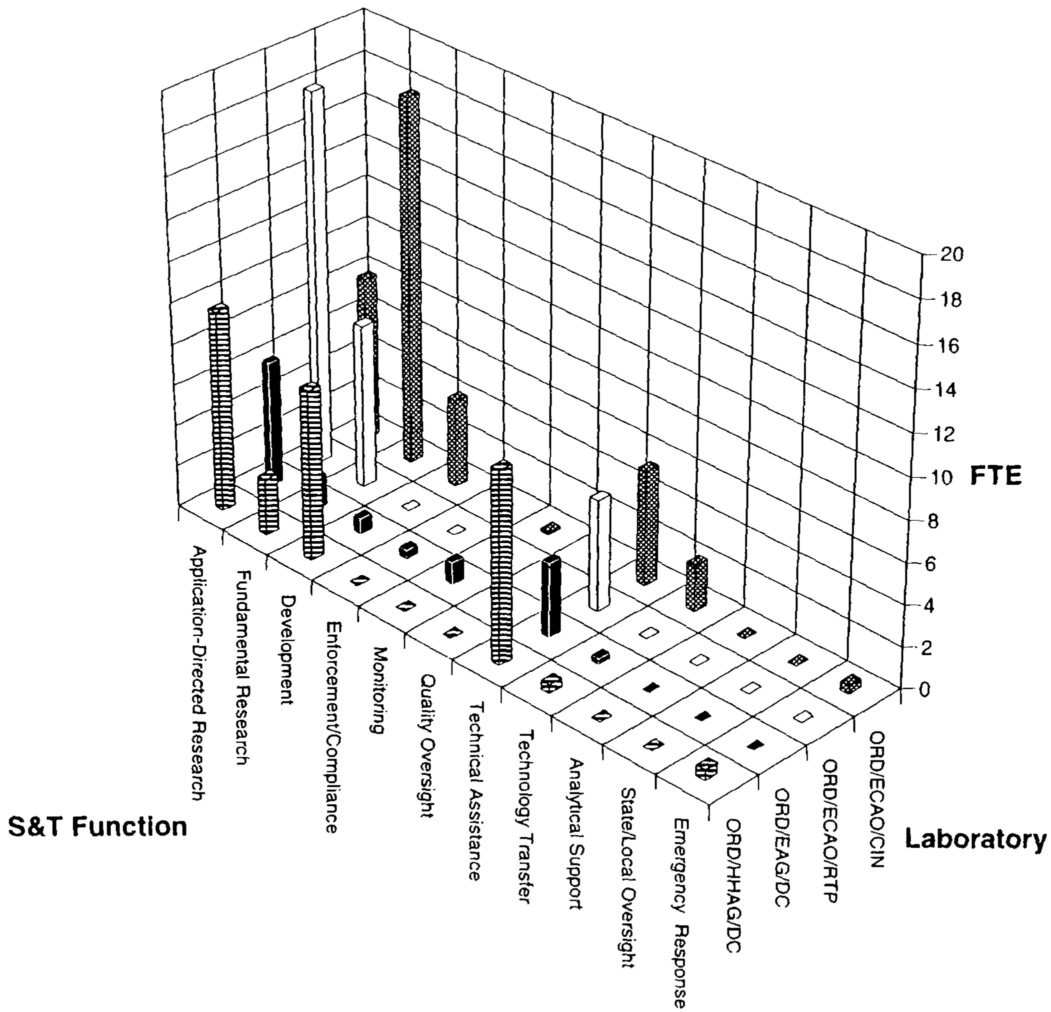


Figure 7-14. FTE by Scientific and Technological Function
Office of Health and Environmental Assessment
(Carnegie Commission Option)

Figures 7-15 through 7-18 show the effect of the Carnegie Commission consolidations on the distribution of professional degrees within the laboratories. This would produce the following groupings: the NESL would be staffed mostly by biologists, the NEMSL would be staffed by chemists and biologists, the NEEL would be staffed mainly by engineers, and the NHEL would be staffed by biologists (disciplines grouped as bio-sciences). These groupings appear workable, although it is possible that more physicists and engineers would be desirable within the NEMSL.

In its study, the Carnegie Commission did not consider several units that are a part of the current ORD organization but that have been included in the baseline. For purposes of this option, an office reporting to the AA for R&D, the Office of Health and Environmental Assessment, which includes the ECAOs in RTP and Cincinnati, and the EAG and the HHAG in Washington, have been retained. The functions of the Office of Exploratory Research would be incorporated into the responsibilities of each of the four national laboratories. The EPIC would be would be incorporated into the NEMSL, the Pacific Ecosystems Branch and the LLRS into the NESL, and the RCB into the NEEL.

Although not considered as a part of the structural changes addressed in this option, the Carnegie Commission further recommended the EPA should establish and support up to six major Environmental Research Institutes (ERI) in association with academic institutions and nongovernmental organizations across the country. The need for such extramural research capability was addressed as part of the management improvements.

The evaluation of the Carnegie Commission option is divided into two portions. The first considers implementation of the recommendations without physical consolidation of the laboratories. It was also assumed that in this case the directors of each of the national laboratories would reside at EPA headquarters and that each laboratory would have an administrator reporting to its director. The assumption was also made that the national laboratory directors would absorb research planning tasks currently performed by headquarters offices and that most administrative tasks would be pushed down to the laboratory administrator level. The second portion of the analysis includes these same assumptions combined with actual physical consolidation of the laboratories into single locations for each of the national laboratories. In this case, the directors of the national laboratories would reside at the laboratories. The bulk of the planning and administrative tasks would occur at the laboratories with only a small supporting staff at headquarters.

7.2.5 Distinct Environmental Services Organization

The DESO option considers only those organizations that primarily perform technical assistance and services within EPA, i.e., the ESOs and the program office laboratories. This option, shown in Figure 7-19, would place the program office laboratories and ESOs

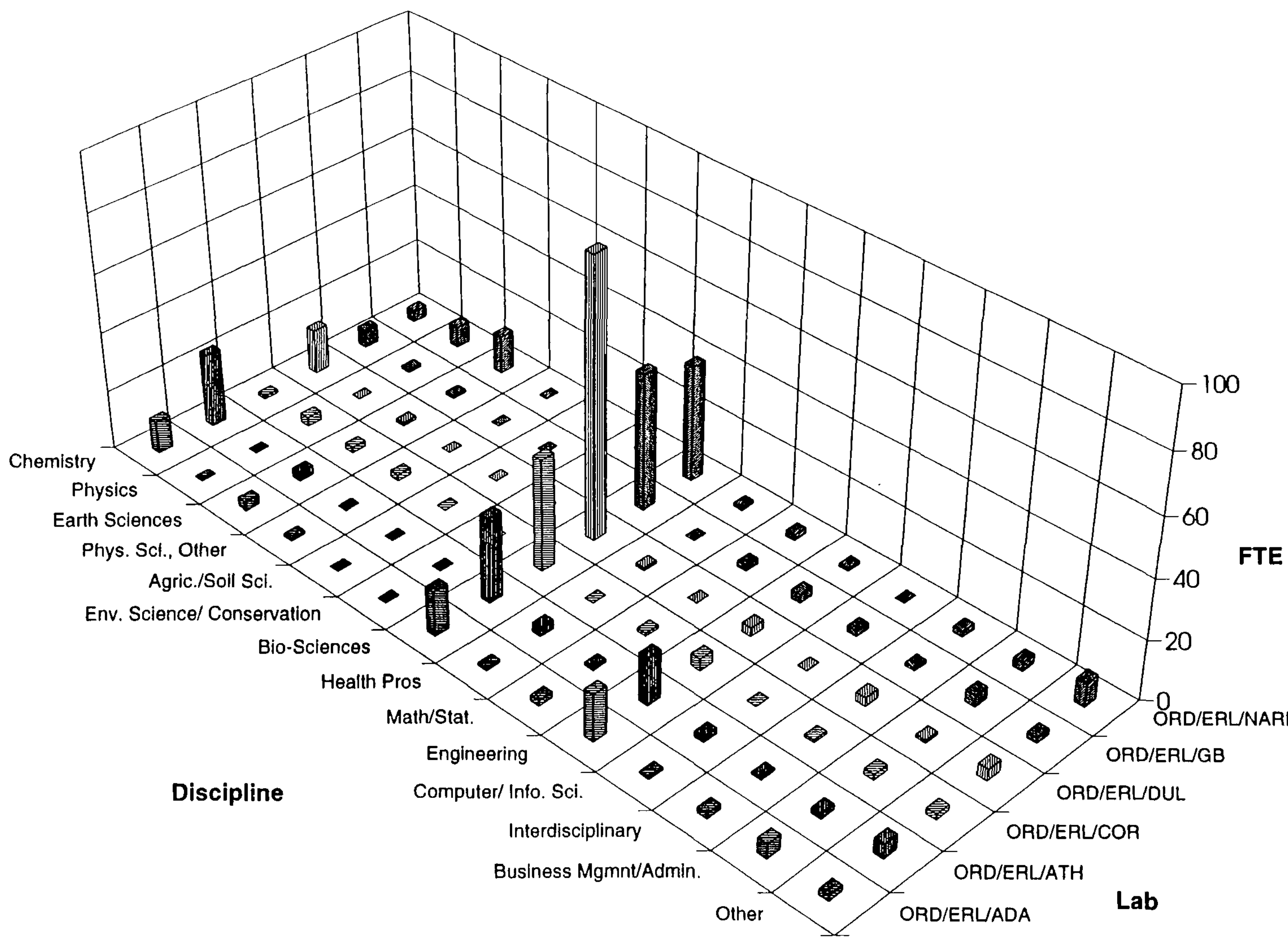


Figure 7-15. FTE by Discipline (Degrees)
National Ecological Systems Laboratory
(Carnegie Commission Option)

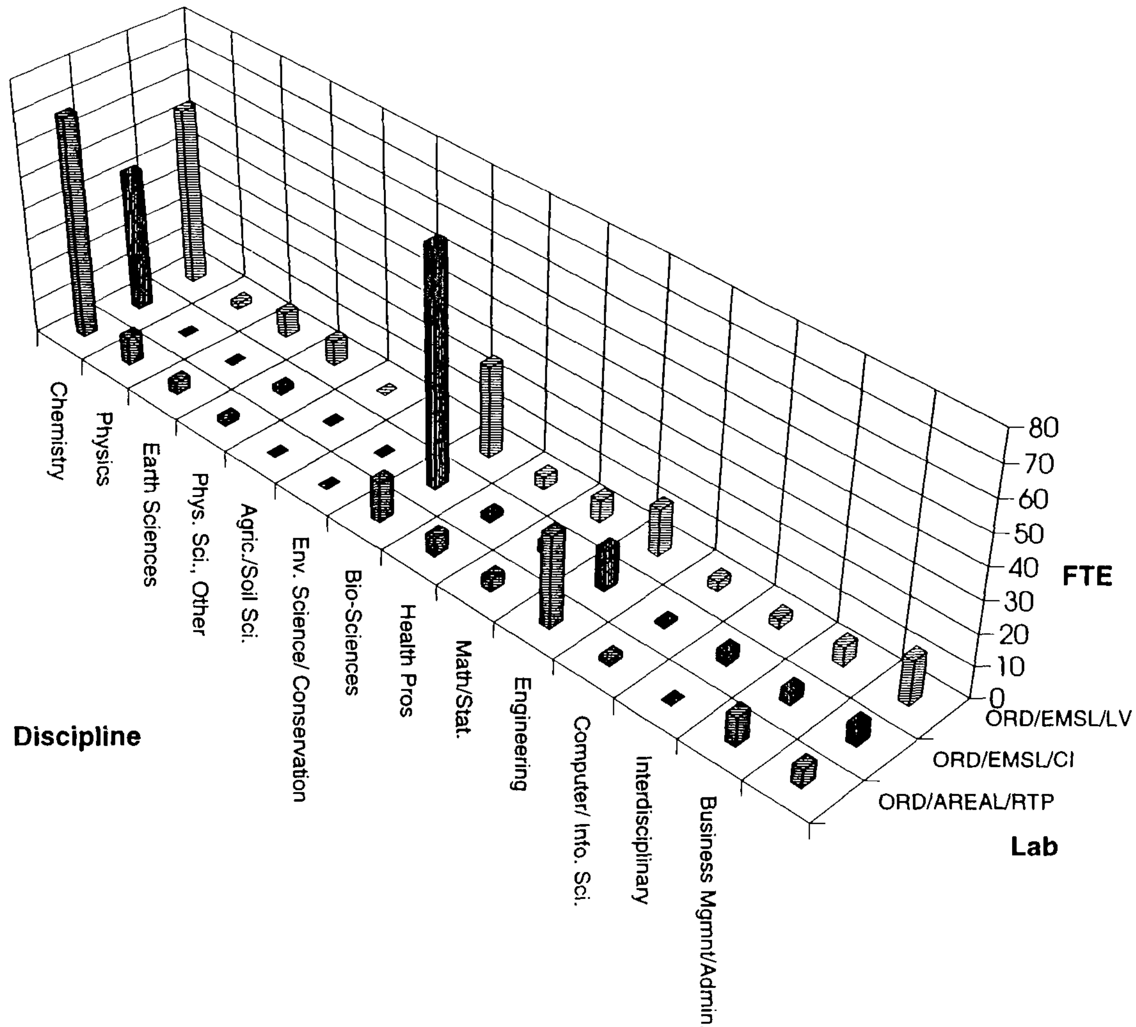


Figure 7-16. FTE by Discipline (Degrees)
National Monitoring Systems Laboratory
(Carnegie Commission Option)

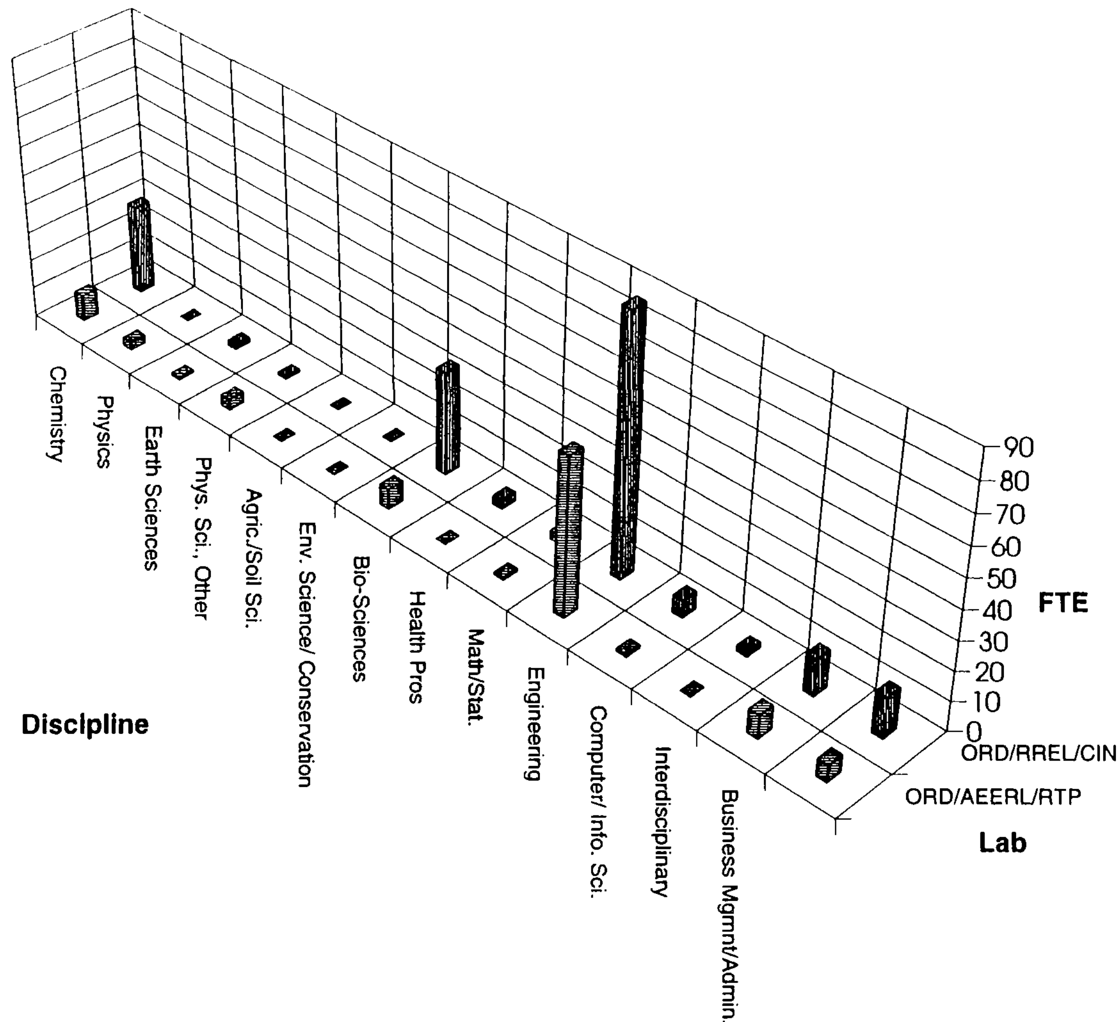


Figure 7-17. FTE by Discipline (Degrees)
National Environmental Engineering Laboratory
(Carnegie Commission Option)

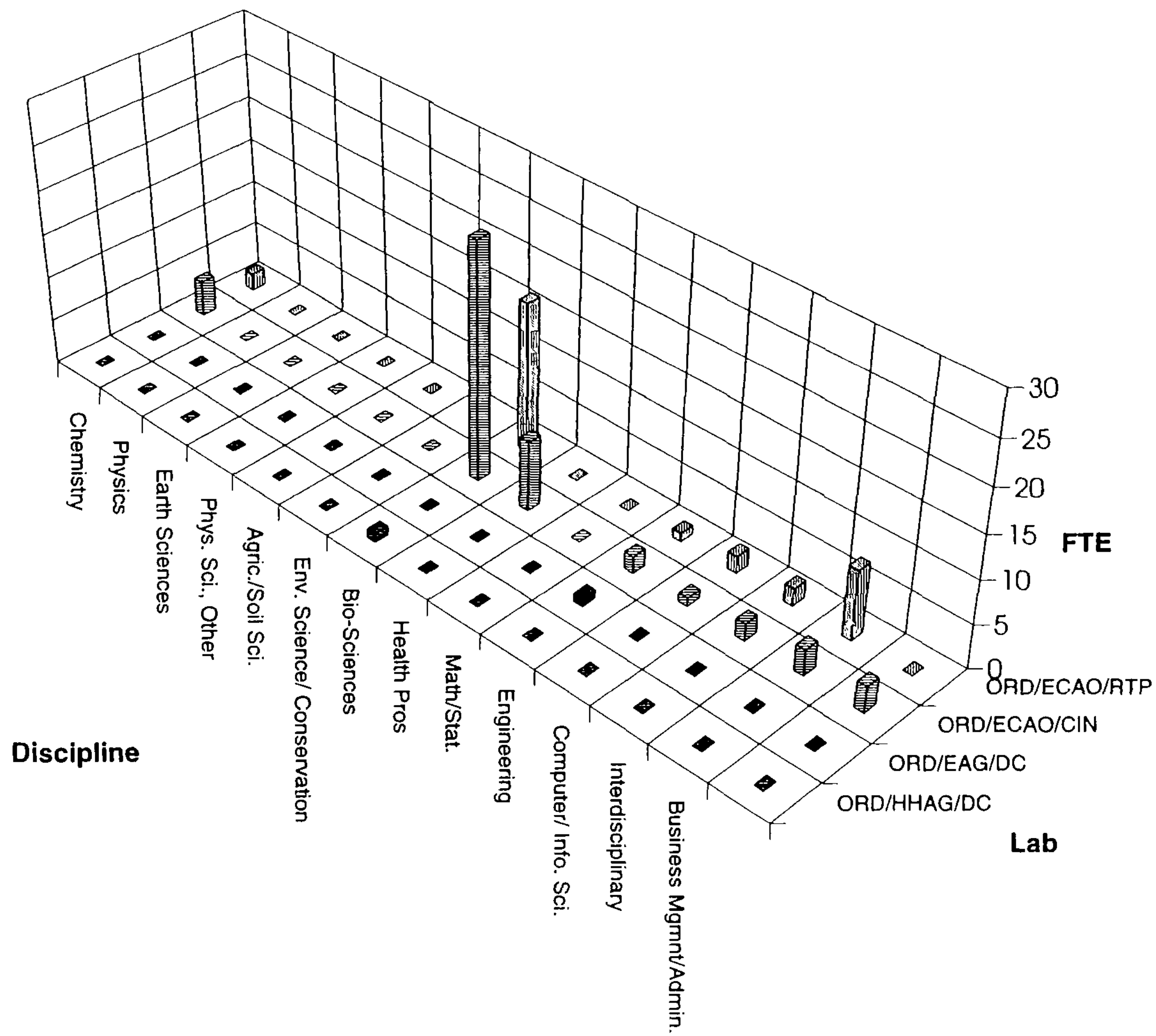


Figure 7-18. FTE by Discipline (Degrees)
Office of Health and Environmental Assessment
(Carnegie Commission Option)

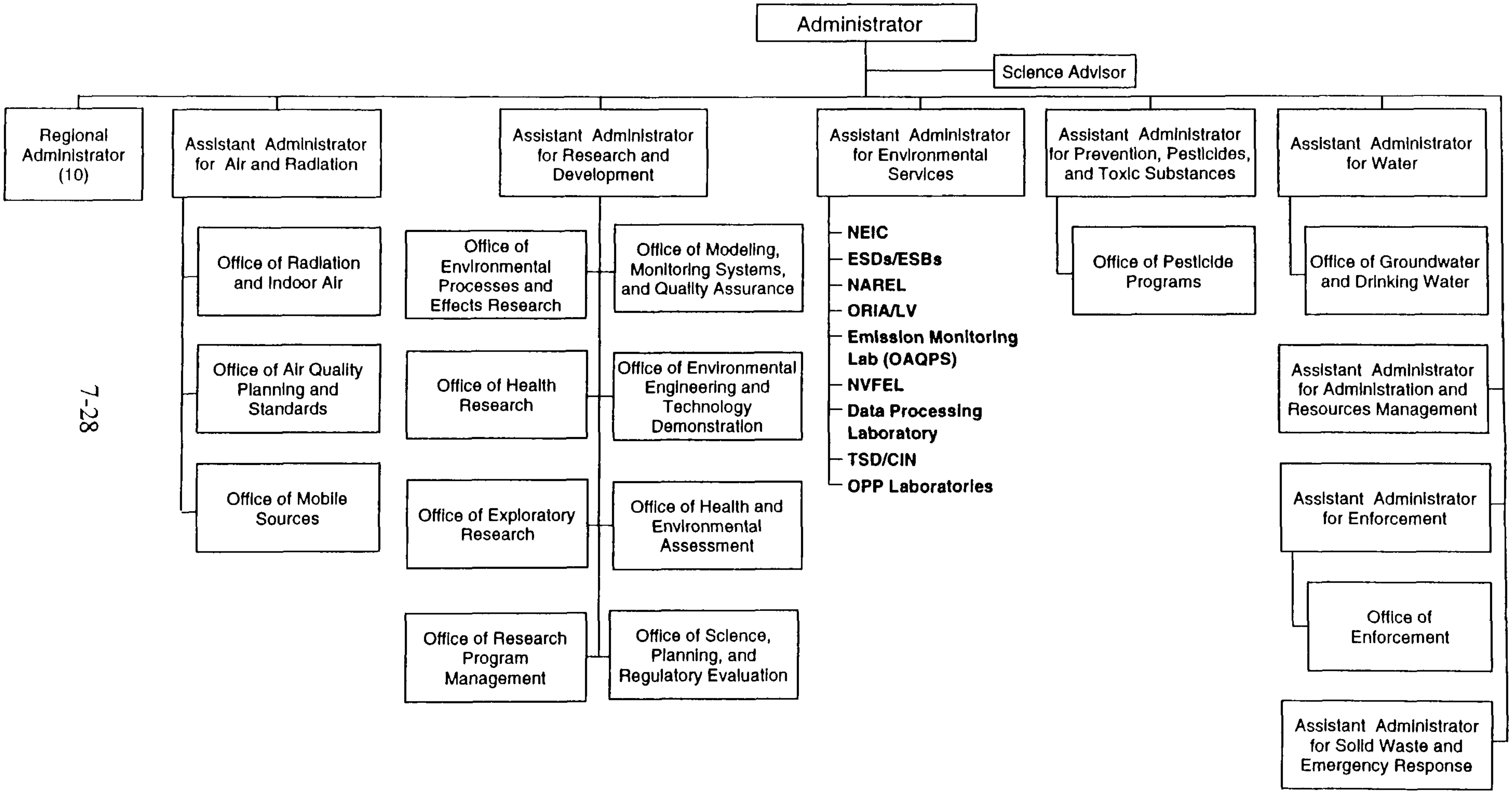


Figure 7-19. Structure for Distinct Environmental Services Organization Option

under a new AA who would make all national-level decisions and allocations of work and resources according to a consolidated view of the whole of such direct support requirements. Where applicable, the management improvements identified earlier would be implemented under this option, as well as laboratory consolidations noted in the streamlining option.

The DESO option recognizes the importance of technical assistance and services to the fulfillment of EPA's mission of establishing and enforcing environmental protection standards, as well as the mission of providing assistance to others to arrest pollution of the environment. Consolidation of similar functional activities within the ESOs is also proposed as part of this option, and the organizational units incorporated into the ESOs are as follows:

- National Enforcement Investigations Center
- Environmental Services Organizations
- National Air and Radiation Environmental Laboratory
- Office of Radiation and Indoor Air Laboratory
- OAQPS Emission Measurement Branch
- National Vehicle and Fuel Emissions Laboratory
- National Data Processing Division Data Processing Laboratory
- Office of Ground Water and Drinking Water Technical Support Division
- Office of Pesticide Programs
  - Environmental Chemistry Laboratory
  - Analytical Chemistry Laboratory
  - Microbiological Laboratory
- Regional Environmental Services Laboratories

This option creates a rich resource pool for executing the implementation activities of the Agency's mission, and provides many opportunities for constructive consolidation of services within geographic regions and particular service functions. An AA could begin operations with the current suite of laboratories and personnel, and, through experience with performance and cost-effectiveness in a series of assignments to each laboratory, assess where such consolidation would be most beneficial.

Changes to ORD, which are discussed above, are not included in this discussion. This permits the analysis of the impacts of changes on research functions (Carnegie Commission option) and technical assistance and services functions (DESO) separately. This structure also allows for the analysis of consolidation of both types of laboratories by combining the two options.

Figure 7-20 illustrates the groupings of scientific and technological functions (as measured by FTEs) that result from this organizational consolidation. Taken together, these organizations are focused almost perfectly on the implementation activities of Agency mission execution, with consistent representation in key activities, such as enforcement/compliance, monitoring, technical assistance, and analytical support.

Figure 7-21 shows the effect of the same groupings on available professional degrees. This picture resembles the overall average for all EPA laboratories combined—heavy concentrations in the biological sciences, chemistry, and engineering disciplines. In a more ambitious Environmental Services framework, it would be necessary to consider increasing the representation of other disciplines, such as the earth sciences for support of hazardous waste, more health professionals, and more computer scientists.

It might be argued that this consolidation deprives both the program offices and the Regional Administrators of the direct customer-supplier relationships they now enjoy, and that this option therefore moves in the exact opposite direction of more customer orientation. Counter to this is the possibility that the AA for Environmental Services would define his/her role as a broker and supplier of services to the customer organizations, and would refrain from interposing barriers to very direct service to those customers. The most effective means of ensuring this would be to make the budgets of the ESOs largely or completely dependent on "sales" of services to the customer organizations. Market forces could be expected to drive the ESOs rapidly toward the most cost-effective combinations of providers to meet the implementation scientific and technological needs of the Agency.

For purposes of evaluating this option, it was assumed that the AA for the ESOs would make all national level decisions including responsibility to oversee the evolution of types of services to be provided by particular laboratories and the laboratories moving into the ESO, and that the program offices would "buy" services from the associated allocations of resources for facilities and equipment. It was also assumed that core resources for basic regional environmental laboratory services would come from the ESO and that additional services would be paid for by regional programs requesting services not covered by the core resources. It was assumed that the two other core regional environmental services, QA/QC and field monitoring, would remain within the regional offices but that QA/QC would be moved out of existing ESOs and would report to either the Office of the Regional Administrator or to some other non-program regional office. A disadvantage of this configuration is that it would separate the QA/QC staff from the day-to-day contact in the laboratory that keeps their skills current.

This option has been considered both with and without physical consolidation. Without physical consolidation, the changes would be purely administrative, with all laboratories

FIG7-20.XLC

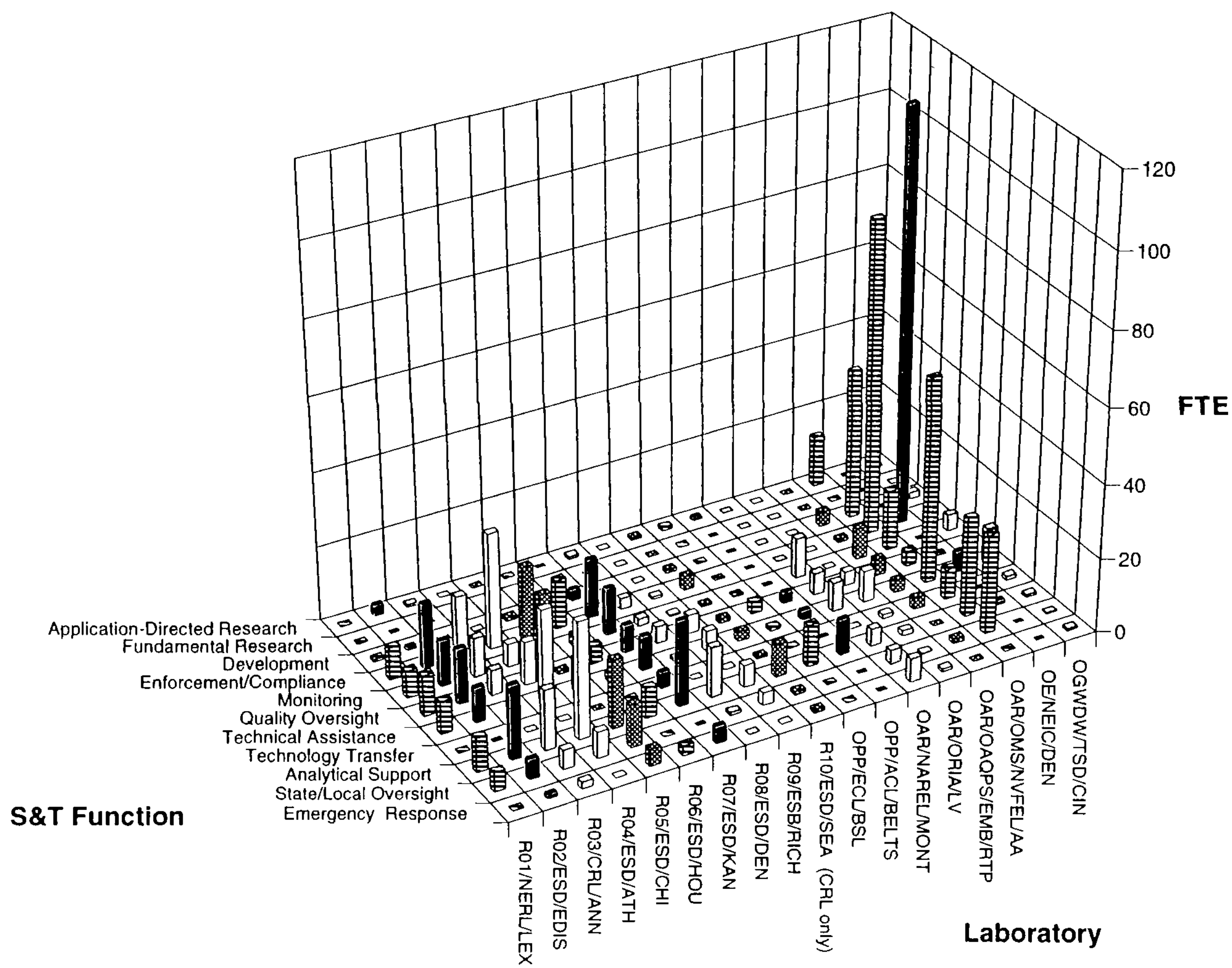


Figure 7-20. FTE by Scientific and Technological Function
Distinct Environmental Services Organization (DESO) Option

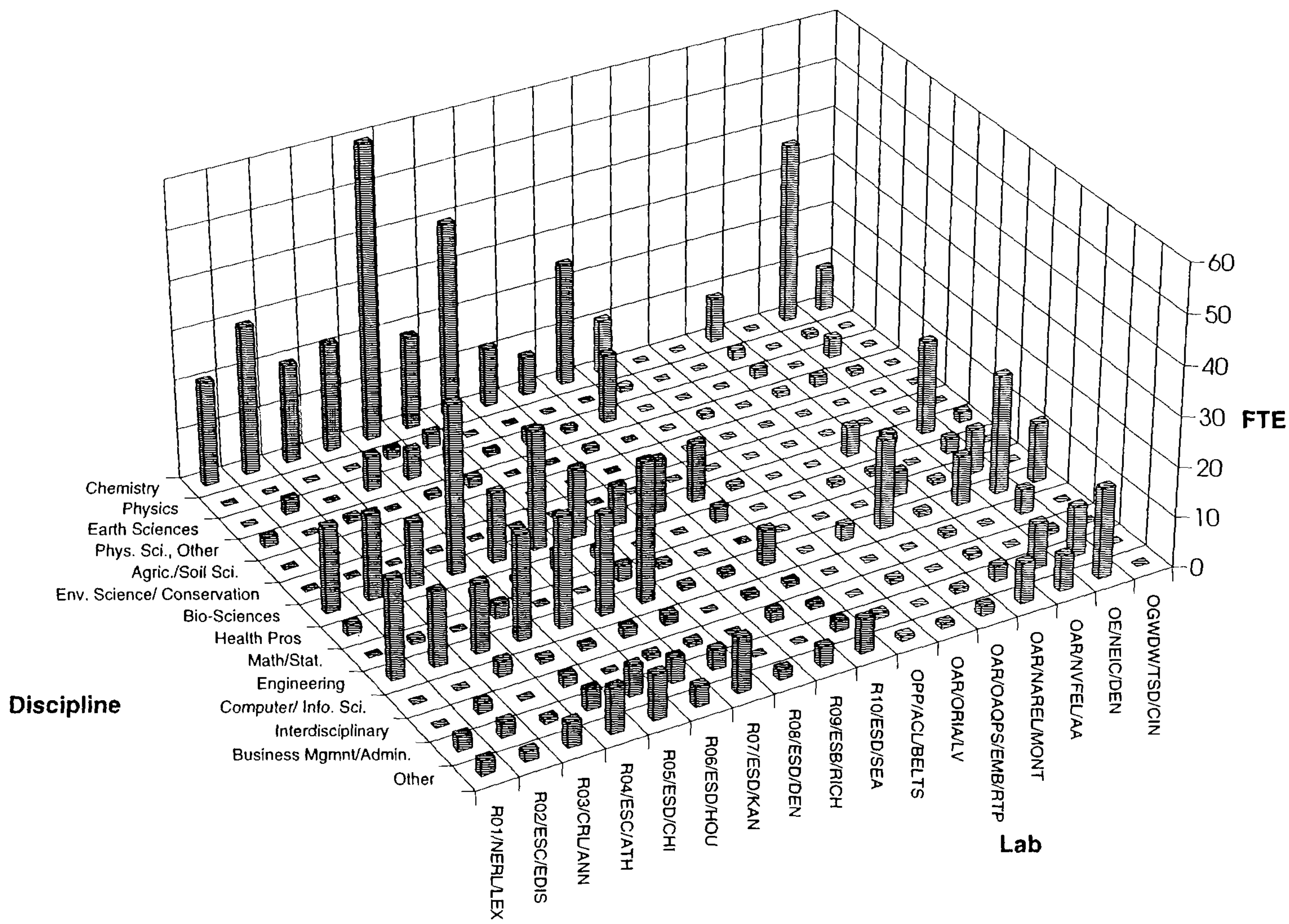


Figure 7-21. FTE by Discipline (Degrees)
Distinct Environmental Services Organization (DESO) Option

remaining located as they presently are. Under the consolidation scenario, there would be physical consolidation of the ESOs, with fewer than ten remaining.

7.2.6 Geographic Location

It is apparent that protection of the environment is a complex problem that demands an integrated approach that encompasses all media and focuses on human health and ecological factors. To a great extent, EPA's laboratories, especially the ORD and program office laboratories, currently are organized to address medium-specific issues and either human health or ecosystem impacts. The Geographic Location option is proposed to address integration across medium, human health, and ecological factors. Geographic locations are used as an organizing element to provide context for both research and customer needs. The option takes advantage of matrix management for integration of capabilities throughout the Agency. Initially, the current locations and reporting relationships of all of EPA's laboratories would be retained. Over time, there could be a realignment and replication of facilities, equipment, and staff within each of the defined geographic areas.

To analyze the merits of this option, it is not necessary to define the specific geographic regions, or provinces. In general, the major ecosystems found in the continental United States, such as the Ecoregions of the Continents defined by the Forest Service of the U.S. Department of Agriculture, or the river basin regions defined by the U.S. Army Corps of Engineers could serve as the basis for organizing the system program offices under this option. A third possibility is to expand the number of regions now included in ORD's ecological research initiative to encompass the entire country including Alaska and Hawaii. A fourth possibility is to embody the place-based reorientation concept proposed through the Edgewater Consensus (Perciasepe, Gardiner, and Cannon, 16 March 1994).

The organizational structure for the Geographic Location option assumes that each province would have an ecosystem program manager. The reporting chain for this option could take one of at least two alternative forms, depending on whether the emphasis is on *place-based research* or *place-based action* (implementation of environmental protection measures). If the emphasis is on research, then a logical arrangement would be to have the ecosystem program managers report to a central office directly under ORD management. On the other hand, with environmental protection action as the driver, then each ecosystem program manager would most appropriately report directly to the cognizant Regional Administrator. In this latter case, the Associate Administrator for Regional Operations would take responsibility for a coordination role to facilitate the cross-region communication and reporting needed to maximize the national benefit from a place-based environmental protection program.

For technical coordination and integration among the place-based ecosystem programs, a central, dedicated ecosystems protection team is proposed. This team would perform a variety of functions, as required by the ecosystem program managers and/or Headquarters, to support the ecosystem concept for environmental protection. Included in these functions could be the construction, maintenance, and dissemination of a lessons-learned database to maximize the Agency-wide experience base in place-based environmental protection and ecosystems management.

The Geographic Location option was evaluated both with and without physical consolidation which entails relocation. For the option without physical consolidation, the ecosystem program manager would be responsible for providing the necessary research to support the programs located within the province. This would include technical support to the media-based program offices and to the state and Native American governments. It was also assumed that the ecosystem program manager would control the resources to support these activities and that the laboratories would be providers of research services and would seek support from the ecosystem program managers.

In addition to the organizational changes proposed above, the physical consolidation suboption assumes that each province would have a laboratory, either through conversion of existing laboratories or establishment of a new laboratories for provinces that do not now have any laboratory facilities. This option would affect all three types of laboratories, since the existing laboratories of all types would be converted into centers for the specific geographic area. In contrast to the other options, where physical consolidation would lead to a smaller number of larger facilities, the physical relocation aspect of this option would lead to a larger number of smaller facilities. Thus, there would be more redundancy rather than less. This option also assumes that there would be duplication of basic laboratory services among the provinces and that there would be duplication of more specialized services required by provincial conditions (i.e., more than one province could have a need for marine sciences). Research into areas of interest for the province would be concentrated in the laboratory for that province.

7.3 EVALUATION CRITERIA

For this study, MITRE has performed an objective, but not quantitative, evaluation of the quality of the scientific and technological products and the effectiveness and efficiency of laboratory operations (human resources, equipment, and facilities) and determined the responsiveness of scientific and technological functions to EPA's needs. In order to evaluate the options discussed previously, criteria were developed from several sources. Criteria were proposed in the Final Study Plan (11 February 1994) prior to visits to the laboratories. Criteria also were suggested by several groups, among them the ESD Work

Group (Rhoades, 2 February 1994). Following the series of visits to the laboratories, it became apparent that the criteria suggested previously were too numerous and too specific to be useful in analyzing the options. The criteria defined in this section were developed to provide differentiation among the options and evaluation of the impacts of the options.

As the study progressed, it became apparent that the quality of the products of the laboratory operations are generally high and that this was not the major issue; the application of these scientific and technological products throughout the regulatory process is. Thus, in the quality criteria that are used to evaluate the options, the emphasis has shifted from the quality of the science to preserving the quality of the science in its use.

The evaluation criteria are divided into three categories: effective use of agency resources, efficient use of agency resources, and implementation. The evaluation using these criteria indicates the quality of any changes from the current conditions. This includes evaluation of the continuation of the existing baseline and whether conditions would improve, remain the same, or deteriorate if conditions remain unchanged. The administrative impediments issues discussed in Section 6 were not included in these criteria as the evaluation assumed that the management improvements discussed in Section 6 would be applied to all of the options. No attempt has been made to weigh the criteria for this analysis.

7.3.1 Criteria for Effective Use of Agency Resources

In the examination of the effective use of agency resources criteria, each option was examined for its impact in each of the following seven areas:

- **Science Quality/Utility:** Does the option facilitate the production and use of science of the highest quality throughout the Agency to support all facets of its environmental protection mission? Each option was evaluated for its potential to provide opportunities to increase the quality of science through enhanced interactions among scientific and technological personnel of similar disciplines. Interactions across disciplines among researchers focused on problems within the same or associated media, environments, or other cross-program or cross-disciplinary areas were also considered.

- **Stature/Credibility:** Does the option provide potential for enhancement and maintenance of the professional stature and credibility of the scientific and technological staff? Evaluation of the options under this criterion included the ability of the scientific and technological staff to produce research within their respective fields of sufficient merit to enhance and maintain their professional stature and credibility. Options were also evaluated for organizational changes that would enhance the stature and credibility of the scientific and technological staff through creation of physical or administrative units that themselves have enhanced credibility and stature as organizations.

- **Concentration of Resources:** Does the option permit sufficient concentration of specialized scientific and technological support resources (e.g., facilities, equipment, critical skills, critical mass) to conduct high quality research and support services activities within EPA? Options were evaluated on their potential to increase interaction and information transfer among intramural staff. Each option's potential for increasing access to shared equipment and facilities, ability to support specialists, and creation of an accessible pool of technical and administrative support personnel was also considered.

- **Geographic Location:** Does the option provide for access to resources necessary to carry out the assigned mission? Evaluation using this criterion included access to unique geographical and environmental factors necessary to conducting high-quality research and efficient delivery of technical support as well as well as access to customers and support resources such as academic institutions, related industries, and pools of scientific and engineering talent.

- **Mission Focus:** Does the option improve the mission focus? As identified in Section 5.2.1, the various portions of the laboratory and environmental services system can provide a wide range of services while being subject to conflicting demands and expectations. Under this criterion, options were evaluated for their potential to provide increased focus on specific areas of expertise by the subject portions of the laboratory and environmental services system.

- **Customer Satisfaction:** Does the option improve system ability to satisfy customer needs? The expectations and demands of the implementing program offices and their related customers impact directly on use of and satisfaction with products and services. The options were evaluated for their potential to increase the system's ability to determine customer needs and expectations and the subsequent ability to meet these needs and expectations. Issues related to communication with customers were included within this criterion.

- **Use of Intramural Workforce:** Does the option maximize the effectiveness of the use of EPA's intramural workforce? With this criterion, the options were evaluated for their ability to promote the effective use of the intramural workforce. This included items such as an option's ability to support administrative and support specialists to free researchers to do research instead of other activities (contract management or other administrative tasks) and increased use of scientific and technological skills of available intramural personnel.

7.3.2 Criteria for Efficient Use of Agency Resources

In the examination of the criteria for the efficient use of agency resources, each option was examined for its impact in each of eight areas:

- **Multimedia Approach:** Does the option enhance the Agency's ability to address multimedia interdisciplinary issues? The options were evaluated for their potential to enhance the Agency's multimedia capabilities. Linkages between medium-based programs and specialists, opportunity for multidisciplinary and multimedia team formation, and elimination of administrative and organizational barriers were all considered.

- **Priorities:** Does the option ensure that resources and organizations are focused on the highest-priority environmental problems and Agency support needs? Under this criterion, the options were evaluated for their ability to enhance the Agency's setting of goals and objectives for research, as well as the implementation and the administration of the implementation of these goals and objectives. Consideration was also given to the question of whether an option enhances the Agency's ability to discern the priorities of its customers or enhances its ability to perceive current or emerging environmental problems requiring research.

- **Functional Alignment:** Does the option ensure that resources and organizations are focused on Agency support needs by clarifying organizational responsibilities and reducing functional redundancy? Options were evaluated for their potential to use consolidation to reduce redundancy and increase structural alignment with customers.

- **Operating Costs:** Does the option provide potential cost savings? Options were evaluated for their potential to provide cost savings, including costs for travel, required space, bringing existing facilities and equipment up to standard, administrative services and equipment, and long-term operations and maintenance costs, including supplies.

- **Facilities and Equipment:** Does the option provide for more efficient use of the resources available for facilities and equipment? Under this criterion, the options were evaluated for their potential to use the existing infrastructure (including operations and maintenance costs) more efficiently, as well as maximizing the return from new investments in facilities and equipment. This evaluation included utilization rates, duplication of facilities and equipment across the laboratory system, and the existing condition of facilities and equipment.

- **Future Investments:** Does the option lead to optimal future investments in facilities or equipment? Required investments both to preserve and maintain existing equipment and facilities and to acquire facilities and equipment needed to maintain an appropriate level of technology were considered.

- **Locus of Control:** Does the option resolve locus of control issues raised during the study? Locus of control issues, as described in Section 5.2.3, relate to the distribution of administrative and decision-making authority. The options were evaluated on their potential to resolve these issues through changes in the decision-making hierarchy, the redistribution of control of resources, and the method of selection of projects, tasks, and research topics.

- **Use of Human Resources:** Does the option optimize the number of human resources required to achieve assigned tasks? The options were evaluated for changes in the level of human resources that would result from option implementation. This included decreases in human resources resulting from flattening the organizational structure, streamlining, and consolidation. However, increases in total human resources from contractor conversion were not considered a negative impact for an option.

7.3.3 Criteria for Implementation

The following are the general criteria developed to evaluate the results of the implementation of the option.

- **Implementation Time:** Can the option be implemented in reasonable time with minimal disruption of key research and support functions? Factors for this criterion included the required magnitude of construction of new facilities and numbers of individuals requiring relocation. Numbers of organizational units and individuals impacted by changes in organization and administration were also considered. It was assumed that the amount of disruption increased at least proportionally to the amount of relocation required.

- **Implementation Costs:** What is the magnitude of costs required to implement and maintain the option? Gross estimates were used to assign relative magnitudes of implementation costs. Costs associated with administrative or organizational changes without any associated physical relocation were assumed to be minimal.

SECTION 8

EVALUATION OF OPTIONS

8.1 INTRODUCTION

The purpose of this section is to analyze the options that have been presented in terms of their effect on improving the efficiency and effectiveness of the EPA laboratory operations and of the cost and time required for implementation. Decisions on the option or options to be pursued and the means through which they may be implemented rest with EPA's management. No options are recommended, although some have been evaluated as having more positive aspects, in terms of the evaluation criteria, than others.

In analyzing the options, the missions of the Agency, as discussed in Section 4, have been considered, as well as EPA's leadership role for the federal government in environmental protection. EPA's responsibilities for environmental protection require a balance between the need for technical assistance, including scientific information gathering and analysis, to support current issues relating to regulation, and the need for fundamental and applied research to strengthen the understanding of human and ecological environmental systems. Achieving this balance requires attention to priorities and to the deployment and use of all resources most effectively. It also requires attention to the needs of EPA's internal and external customers. The options are evaluated on the basis on their effects on the needs for both types of services.

8.2 METHODOLOGY FOR ANALYSIS

Each option was evaluated against the criteria given in Section 7 by a panel of MITRE staff who were familiar with the laboratories from personal experience in visiting the laboratories, interviewing EPA personnel, and analyzing data from the laboratories. Table 8-1 shows the effects of implementing each option. All the laboratories are considered as a whole for the analysis, except for those options, such as Carnegie Commission or DESO, that involve only a specific group of laboratories. Throughout the analysis, the management improvements discussed in Section 6 are assumed to have been implemented.

The symbols on Table 8-1 indicate the strength of the potential effects from the implementation of options. Their meanings are as follows:

Table 8-1. Evaluation of Options

Option	EFFECTIVE USE OF AGENCY RESOURCES							EFFICIENT USE OF AGENCY RESOURCES								IMPLEMENTATION	
	Science Quality/Utility	Stature/Credibility	Concentration of Resources	Geographic Location	Mission Focus	Customer Satisfaction	Use of Intramural Workforce	Multimedia Approach	Priorities	Functional Alignment	Operating Costs	Facilities and Equipment	Future Investments	Locus of Control	Human Resources	Implementation Time	Implementation Cost
Customer Orientation w/o consolidation	O	O	O	O	+	++	O	O	++	+	O	O	O	O	O	O	O
Customer Orientation w/ consolidation	O	O	+	O	+	+	+	O	++	+	+	+	+	O	+	-	-
Streamline w/o consolidation	O	O	O	O	O	O	+	O	O	O	+	O	O	+	O	O	-
Streamline w/ consolidation	O	O	+	O	O	-	+	O	O	O	++	+	+	+	+	-	--
Carnegie w/o consolidation	O	+	O	O	+	O	O	+	+	O	-	O	O	+	O	-	O
Carnegie w/ consolidation	+	+	++	O	++	O	+	+	+	++	+	+	+	++	++	--	--
Distinct ESO (DESO) w/o consolidation	O	+	O	O	+	--	O	O	O	O	O	O	O	O	-	O	O
Distinct ESO (DESO) w/ consolidation	+	+	+	-	+	--	+	O	O	+	+	+	+	+	+	-	-
Geographic w/o consolidation	+	O	O	O	+	+	+	++	+	O	O	O	O	O	O	-	O
Geographic w/ consolidation	+	O	+	++	+	+	+	++	+	--	--	-	--	O	-	--	--

Explanation of symbols: -- strongly negative - negative o no effect + positive ++ strongly positive

Note: The relative importance among the criteria was not considered in the analysis.

-- **Strongly negative effect:** This may mean greatly increased costs (as with some of the consolidation options) or a strong effect on an important aspect of operation of the laboratories (e.g., separation of laboratories from customers).

- **Negative effect:** This indicates some negative results are associated with the option. It also may indicate that there are both negative and positive effects but that the negative effects are greater.

o **Neutral, or no effect:** The major use of this symbol is to indicate that there are no effects and that there is no change from the current situation. There may be slight either positive or negative effects, but they are not considered strong enough to warrant a - or +. It also may be used to indicate that the slight positive and negative effects balance.

+ **Positive effect:** The overall effects of implementing this option are positive. If there are slight negative effects, they are outweighed by the positive.

++ **Strongly positive effect:** The positive effects greatly outweigh any negative ones. This indicates a great change for the better from the current situation at the laboratories.

8.3 ANALYSIS OF OPTIONS

The five options defined in Section 7 will be discussed in this section. Table 8-1 shows the results of the analysis. Only the major points are discussed under the Strengths and Weaknesses for each option.

8.3.1 Customer Orientation

Strengths

- *Emphasis on customer satisfaction*

  The increased customer satisfaction would be gained by greater administrative control on the part of the customers. Since the ORD laboratories would be placed under the customers for whom they do most of their business, they would be more responsive to these customers. The program office laboratories are now under their customers so there would be no change in their status. With consolidation, these gains would be partially offset by decreased access.

- *Increase in focus on mission and highest priorities of the Agency*

  The direct link to the program offices would enhance knowledge and execution of Agency priorities, especially in the present ORD facilities. The program offices and ESO facilities are more focused on their priorities now, so this would not be as much of a change.

Weaknesses

- *With consolidation, large costs*

  As with any of the options that include physical consolidation, costs in time and disruption to present programs as well as financial costs would be large.

- *With consolidation, negative effects on the ESOs*

  Consolidation would adversely affect the ESO because some of them would be taken away from their customers, who are now satisfied with the service they receive.

The analysis of the Customer Orientation option hinges on the major attribute of the option, transfer of control of the laboratories to appropriate program offices. The Customer Orientation with consolidation assumed convenient consolidation of laboratories that are already in close physical proximity. The strongly positive evaluation for this option of the criterion of customer satisfaction reflects the increased ability to determine customer needs and expectations with direct control by the customer program office. Although customer satisfaction is still improved with consolidation, it is less because than without consolidation because of the consolidation of the ESOs assumed under this option. Since their customers are now very satisfied, the change from the current situation would cause some discontent. The strongly positive evaluation on the priorities criterion reflected the expectation that the implementation of this option would increase the focus on those issues that were most important to the Agency.

8.3.2 Streamlining

Strengths

- *Reduction in operating costs and redundance*

  Numbers of non-supervisory scientific personnel probably would not be reduced, but other Grade 14 and above personnel might be.

- *More administrative control at local level*

  Because most of the reductions in personnel would occur at ORD Headquarters, day-to-day operations at the laboratories would be under the control of local administrators and scientists.

- *Savings from consolidation allow for creation of administrative and support specialists*

  One of the major concerns voiced by many of the scientists was that they spent more of their time administering contract that performing science. With consolidation, more specialists positions could be created to deal with contract administration, freeing scientists to pursue their own specialties.

- *Better use of staff and equipment*

  The use of the intramural workforce would improve, since removal of layers of middle management would increase efficiency. Because laboratories are, in many instances, pursuing similar types of research, they have similar types of equipment. With physical consolidation, the scientists and technicians would be more concentrated and expensive equipment with have greater usage.

Weaknesses

- *With consolidation, high implementation costs and disruption*

  As with all of the consolidation and relocation suboptions, the high implementation costs and the great disruption resulting from the changes would be a major disadvantage.

- *With consolidation, decline in customer satisfaction due to laboratory closings*

  The laboratories would no longer be serving some of their traditional customers (e.g., states) if they were closed or moved. If environmental services laboratories were consolidated, their customers, who tend to be very satisfied, might not receive the type of services they are accustomed to.

Both of the Streamlining suboptions—without and with physical consolidation—were judged to be the same on about half of the criteria. The with-consolidation suboption showed more improvement in the criteria related to costs. Under the physical-consolidation suboption, the scientific and technological work would be consolidated into fewer facilities, and the staff would be in closer contact with staff of the same disciplines. This suboption had large implementation costs.

8.3.3 Carnegie Commission

Strengths

- *Increase in mission focus, better grasp of priorities, and improvement in locus of control*

  The reorganizations proposed by the Carnegie Commission, whether functional or physical, would sharpen all of these. Under both suboptions, the effects on the priorities criterion are expected to be positive because of issue-based planning and because one person, the National Director, is assumed to be responsible for setting the research agenda. The on-site administrators are assumed not to be scientists, which the present directors are.

- *With consolidation, increase in functional alignment and elimination of redundancies*

  With physical consolidation, there is a potential for elimination of functional redundancies in the new national labs and clearer organizational responsibilities.

- *With consolidation, more laboratory-level administration*

  This would be true whether the director of the consolidated laboratories were at ORD Headquarters or in the field.

- *With consolidation, lower long-term facilities and equipment costs*

  Higher use of existing equipment and a reduction in the number of facilities would lead to long-term reductions in facilities and equipment costs.

Weaknesses

- *With physical consolidation, large costs and disruption*

  The disruption from functional consolidation would be less, but there would be some. Costs from functional consolidation would be negligible. Because of the large amount of relocation required, this would be an extremely disruptive and costly option.

- *Without consolidation, addition of an additional layer of bureaucracy*

  This would increase operating costs and decrease efficiency in ORD.

This option also has two suboptions, but they are judged to be more different than under the Streamlining option. The without-consolidation suboption has no strong positives or negatives, and this option is judged to be neutral on most of the criteria. With physical consolidation, mission focus, concentration of resources, and functional alignment would be greatly improved. Without consolidation, operating costs would increase because of the added layer of bureaucracy.

8.3.4 Distinct Environmental Services Organization

Strengths

- *Increased stature and focus on specific services*

  Recognition of the importance of technical assistance and services at the Headquarters level will add to the stature and credibility of the service laboratories and a national focus can be directed to specific areas of expertise within the laboratories.

- *With consolidation, increase in concentration of resources*

  Specialists in techniques would be brought together to share resources and functional redundancies would be reduced. This would result in higher use and of facilities and equipment and greater efficiency.

- *With consolidation, cost savings*

  Operating costs and future investments would be lower with consolidation. An Assistant Administrator with a national view could optimize investment decisions over fewer facilities

Weaknesses

- *With consolidation, large costs and disruption*

  Administrative costs and physical disruption would result from implementation.

- *Customer dissatisfaction from separation from the current administrative structure*

  Under either of the suboptions, great customer dissatisfaction would probably result from the new administrative separation from the customers. Customer satisfaction is one of the strong points of the current ESO structure, and implementation of this option would damage that.

- *Weakening of current close ties to customers in the regions.*

  With centralized direction, these ties would not be as strong.

- *With consolidation, fewer laboratories, with loss of access to familiar locations*

  Environmental services staff have worked within a geographical area and have become familiar with its particular problems, e.g., Region 4's work on mercury in the Everglades. Although this work could continue, it is likely that the team that is most familiar with problem would not remain intact.

This option, which would provide for representation of the environmental services organizations in EPA Headquarters, was judged to have no strong positive attributes and one strong negative attribute. Although there would be the ability to make national-level decisions and allocations of work, many of these same decisions are now being made within program offices and regions. As a result, only a limited number of positive effects would result from the implementation of this option without consolidation. The stature of the scientific and technological functions would be raised by attention at Headquarters as well as the national mission focus. The option was seen as positive for eleven of the with-consolidation criteria, but was judged to be strongly negative for customer satisfaction, one of the major issues discerned in the interviews at the laboratories. As with the other consolidation suboptions, its implementation would entail costs and disruption.

8.3.5 Geographic Location

Strengths

- *With implementation of place-based approach to environmental management, increased emphasis on multimedia activities*

  Under the place-based approach for ecosystem protection EPA would integrate ecosystems management with strategic planning, budget reform, streamlining, and reinvention.

- *Focus of research on a particular geographic area*

  Specialists on a particular geographic area would be concentrated in the area. Because of the proximity, more work would be done on environmental problems in that area.

- *With relocation, enhanced geographical access*

  Researchers would be closer to their geographic area of specialization

- *Closer access to customers, yielding increased satisfaction*

  Customers would be in closer contact with the scientists who were working with them and be able to provide close direction.

Weaknesses

- *With relocation, large costs and disruption*

  This option has the potential for great administrative and physical disruption over a long time. The disruption would be greater than for consolidation under some other options, since new areas of specialization would be established.

- *With relocation, duplication of investment from an increased number of facilities*

  Operating costs and future investment costs would increase because of the costs of starting and maintaining a greater number of laboratories.

- *With relocation, more people needed to provide critical skills*

  The creation of the new provincial laboratories would require more people.

The Geographic Location option was evaluated both without and with physical relocation. Assuming a place-based approach, both suboptions are strongly positive for having a multimedia approach. Under this assumption, the focus on the mission and the priorities of the Agency would increase, a major change resulting from the emphasis on work pertaining to a specific geographic location. The without-relocation subotion is neutral for the cost criteria, since the there would be only administrative changes at the laboratories. In contrast to the consolidation suboptions, this suboption calls for more, not fewer, new facilities. With these new facilities, costs would increase, resulting in a strongly negative evaluation for the cost criteria.

8.4 ANALYSIS OF CRITERIA

As shown in Table 8-1, the effects of the options are more clearly discrimination by only some of the criteria. In this section, all the criteria are discussed in relation to the options.

8.4.1 Criteria for Effective Use of Agency Resources

- **Science Quality/Utility:** None of the options inherently produce science of a higher quality or utility than others, although some may favor it. This criterion had very little discriminating power among the options. Options that brought together scientists of like interests, such as Carnegie Commission and DESO with consolidation and Geographic Location without and with relocation, were evaluated more highly than other options on this criterion.

- **Stature/Credibility:** All the options, except the Carnegie Commission and DESO, were evaluated as neutral on this criterion. Because of the raising of the laboratories to national status, the effects of implementing the Carnegie Commission DESO options, both without and with physical consolidation, were evaluated as positive.

- **Concentration of Resources:** All the options that contained consolidation or relocation were evaluated positively on this criterion. This suboptions would concentrate scientific and technological resources, both staff and equipment, with the expected result of increasing interactions, information transfer, and use of equipment among staff. Since the Carnegie Commission with consolidation option would provide the most concentration, this was given a strongly positive evaluation.

- **Geographic Location:** All the options were evaluated to be neutral on this criterion, with the exception of DESO with consolidation (negative) and Geographic Location with relocation (strongly positive). Part of the neutrality was the result of the assumption that the ORD and program office facilities would remain open as field stations even with consolidation. If these facilities were eliminated, then there would be more negative evaluations for this criterion. The DESO with consolidation suboption was negative because, in this case, some laboratories would be eliminated, thus losing one of the major positive aspects of the environmental services organizations, their closeness to their customers. The Geographic Location with consolidation suboption was evaluated to be strongly positive because more laboratories would be opened to be more closely tied to specific geographic areas, as well as because of assumed implementation of the place-based approach to ecosystem protection.

- **Mission Focus:** Sharpening the focus on the mission of the ORD laboratories would be one of the major advantages of the Carnegie Commission and DESO options, especially the with-consolidation suboption. This criterion is also positive for both suboptions of the Customer Orientation option, because the mission focus is one of the major aspects of this option. Streamlining is not directed toward this criterion, and the ESOs are already focused on their missions.

- **Customer Satisfaction:** Major emphasis has been placed on customer satisfaction during the executive interviews and at the laboratories, and this criterion provides for discrimination among the options, with the full range of possible evaluations. While the evaluation for the Customer Orientation option, both without and with consolidation, was positive, the greater benefits were seen to be derived without consolidation. Although the overall effect would be positive, consolidation would negate some of the benefits gained through its negative effects on the ESOs. The strongest negative effects would be seen in the DESO option, because it would adversely affect relationships with the ESO customers because of the separation brought about by this option. Under the Geographic Location option, customer relationships would be realigned, but an overall improvement would be expected as facilities become attuned to the needs of their new customers.

- **Use of Intramural Workforce:** Options were generally evaluated as neutral without consolidation and positive with consolidation for this criterion. An exception was Streamlining, which was positive for both suboptions. The effects of consolidating the workforce were considered to be positive.

8.4.2 Criteria for Efficient Use of Agency Resources

- **Multimedia Approach:** This criterion had effects on only the Carnegie Commission and Geographic Location options; it was neutral for all the other options. For the Carnegie Commission option, a greater ease of coordination among multimedia teams would result from fewer administrative leaders. Both susboptions of the Geographic Location option were evaluated as strongly positive for this criterion, resulting from the multimedia aspects of the assumed implementation of the place-based approach to ecosystem protection.

- **Priorities:** None of the options were seen as being negative for this criterion; all were neutral or positive. This is closely related to mission focus, since better focus on the mission would enable the priorities to be directed to the mission. The Customer Orientation option was strongly positive for this criterion, since the direct link to the program office customers on the part of ORD would ensure that program priorities were met.

- **Functional Alignment:** Both strong negatives and strong positives were seen on this criterion. The strong positive was for the Carnegie Commission with consolidation. One of the goals of this suboption is to provide function alignment for the ORD laboratories, and, to the degree that that goal is successful, the suboption is successful. The Geographic Location with relocation suboption is evaluated as strongly negative because of the redundancy of the new provincial facilities and duplication of basic services.

- **Operating Costs:** With the exception of the Geographic Location with relocation suboption, operating costs improve with consolidation, especially so under Streamlining with consolidation. Consolidation provides for more efficient use of both staff and equipment resources. Operating costs would increase under the Carnegie Commission without consolidation, because this would add a layer of administration in ORD.

- **Facilities and equipment:** This criterion provides very little discrimination among the options. All options without consolidation or relocation are evaluated as being neutral, and all options with consolidation are evaluated as being positive. The Geographic Location suboption, with relocation, is negative because it requires construction of new laboratories.

- **Future Investments:** As with facilities and equipment, this criterion provides little discrimination among the options. For all the options except Geographic Location, the suboption without consolidation is neutral and the suboption with consolidation is positive. This reflects higher use of existing equipment and the reduction in the number of facilities with consolidation and the lack of change from the current without consolidation. The strong negative evaluation for Geographic Location reflects the investment required for new laboratories.

- **Locus of Control:** This was one of the few criteria where the presence or absence of consolidation generally did not make a difference in the evaluation of the option; except for DESO, both suboptions were in the same direction. The positive evaluations were based on the probability that implementing the option would result in increased administrative authority at the local level, especially in the Carnegie Commission with consolidation suboption. The difference in the evaluation of the DESO suboptions reflected the lack of increase in local control in the present unconsolidated ESOs (they already have local control) and the increase in local control with consolidation.

- **Human Resources:** This criterion provides little discrimination most of the suboptions without physical consolidation are evaluated as neutral and most of the suboptions with consolidation are positive. The DESO is negative because of the additional resources required for the Assistant Administrator position at EPA Headquarters. Geographic Location with relocation is negative because of the additional personnel required at the new provincial laboratories.

8.4.3 Criteria for Implementation

- **Implementation Time and Cost:** These two criteria are considered together because their evaluations are similar. There were no positive evaluations for any option because of the changes required; the best evaluation any option received was neutral. (EPA is preparing a cost analysis of consolidation and relocation options.) The Carnegie Commission with consolidation and the Geographic Location with relocation suboptions were evaluated as strongly negative on both these criteria because of their high costs in both time and money. Such aspects of consolidation as buying out leases, moving personnel, and loss of personnel who choose not to move would be high. Disruption of moving would also be costly in terms of morale and changes to programs.

8.5 SUMMARY

Since the Carnegie Commission option affects only the ORD laboratories, and the DESO option affects only the ESOs, these options should not be be compared but could be combined.

Among the positive aspects of the options, the Carnegie Commission option with physical consolidation was evaluated more favorably than any of the other options that involve ORD. In the areas in which the Carnegie Commission with consolidation suboption was strongly positive—human resources, mission focus, locus of control, functional alignment, and concentration of resources—none of the other options that would affect the ORD laboratories was as positive.

The strongly positive aspects of the Geographic Location option, i.e., its multimedia approach resulting from place-based ecosystem protection, could be implemented under other structural options as well. This is true also of the strongly positive aspects of the Customer Orientation option, customer satisfaction and focusing on the highest priorities of the Agency.

The Streamlining option was essentially neutral for the criteria, although it was the only option that provided large cost savings. If the provisions of this option were implemented under either the Carnegie Commission or DESO option, these savings could be effected.

The evaluation of the DESO option showed it could have positive effects on the stature of the laboratories and the mission focus, although it is strongly negative with a large loss in customer satisfaction, an area in which the ESOs are now highly rated. With consolidation, some savings would be seen in operating, facilities, and equipment costs, and other benefits are offset by the decline in customer satisfaction. Geographic Location would provide improvements in the area of customer satisfaction, where the DESO option was very weak.

The option judged most to be most negative, Geographic Location with relocation, would affect all three types of laboratories. This option was evaluated as strongly negative for functional alignment—a criterion for which the Carnegie Commission option with consolidation was judged strongly positive. The difference in the evaluation was based on the nature of the consolidation, which was functional in the case of the Carnegie Commission and geographical for the Geographic Location option. The alignment resulting from the Geographic Location option was seen as expensive and not productive; it was seen as having the negative aspects of relocation—disruption and high costs—and few of the advantages of the Carnegie Commission option.

The implementation costs, in both time and money, were high for all consolidation and relocation options. For two suboptions—Carnegie Commission without consolidation and Geographic Location with relocation—the potential administrative disruptions were considered to be very high. The large costs involved would be a strong impediment to the full implementation of these options.

SECTION 9

OTHER FEDERAL MODELS

A brief examination has been made of three federal agencies—the U.S. Food and Drug Administration (FDA), the NIH, and the U.S. Nuclear Regulatory Commission (USNRC)—to gain a sense of how these agencies deal with the performance of quality scientific and technological functions that directly or indirectly support regulations, planning and priority setting, acquisition and management of extramural support, and inherently government functions. Like EPA, these three agencies must maintain a long-range research competence while fulfilling the near-term needs of their internal regulatory customers, external regulated organizations, and other stakeholders such as the public and the scientific and technological community at large. The three agencies were chosen because they represent different approaches to science and technology relevant to regulation. While EPA may want to consider reviewing additional agencies, these three provide a range of useful information to the EPA laboratory study regarding different management approaches to the practice of regulatory science. For instance, the USNRC has no intramural research laboratories, while the FDA maintains an extensive intramural laboratory system and devotes only a small percentage of its funding to extramural research. In contrast, the NIH maintains a substantial intramural program yet invests the majority of its funding in an extramural grant program. A summary of these agencies is presented in the following sections.

9.1 U.S. FOOD AND DRUG ADMINISTRATION

9.1.1 Mission

FDA is a science-based regulatory agency. The scope of FDA regulatory responsibility is extremely broad and highly diverse, and it principally serves the general public in its health and safety mission. More specifically, FDA's regulatory responsibilities focus on safeguarding the following public interests:

- Foods (excluding most meat and poultry products) are safe, wholesome, and sanitary; human and veterinary drugs, human biological products, diagnostic products, and medical devices are safe and effective; cosmetics are safe; and radiation-emitting electronic products are safe.

- Regulated products are honestly, accurately, and informatively advertised and labeled.

- Regulated products are in compliance with FDA regulations and guidelines, noncompliance is identified and corrected, and any unsafe or unlawful products are removed from the marketplace.

9.1.2 Science Base

Science underpins FDA's regulatory activities. The knowledge and capabilities of its scientific staff are integral to product review, surveillance and compliance, problem analysis, consumer education, and other responsibilities. FDA scientists directly support regulatory decisions by assessing risks associated with FDA-regulated products, setting standards that contain risk, testing products against those standards, improving the usefulness and precision of risk assessment methods, and developing methods to increase the accuracy of sample analysis and detection of chemicals and biological substances. FDA depends on science to support four of its primary functions:

- **Provide a sound basis for regulatory decisions:** FDA scientists develop answers to scientific and technological questions that are vital to the safety and effectiveness of regulated products and manufacturing processes. These questions encompass such diverse research and regulatory activities as methods development, product testing, hazard determination, enforcement tolerances, standard setting, risk assessment, and support for new technologies. In addition, FDA scientists participate in research to extrapolate animal health data into relevant human terms and serve on committees designed to forge a consensus concerning the scientific principles that may be used as a basis for risk assessment.

- **Stay current with advancing science and technology:** FDA's scientific expertise enables it to assess new products and technology, to advise sponsors on the design of clinical trials, and to detect weaknesses in safety and effectiveness data. For example, FDA research in pharmacokinetics has greatly enhanced the program knowledge of drug delivery, optimal dosage levels, bioavailability, and bioequivalence. The success of such research activities and their applications depends on the ability of FDA scientists to interact effectively, decisively, and knowledgeably with their peers in industry.

- **Expedite product development:** When FDA researchers participate in research involving design, development, testing, and evaluation of new technologies, they can offer valuable advice to product sponsors to expedite product testing. Scientists conducting reviews can also evaluate novel product submissions more promptly if they already understand the product's mechanisms.

- **Transfer technology:** FDA develops and improves methods that become the industry (as well as the FDA) standards for the testing and measurement of regulated products. Examples include development of field instruments in use for measurements on microwave ovens and diagnostic ultrasound machines.

FDA is being severely challenged to maintain and update its science base. Each year, hundreds of new drugs and biologicals and 5,000 to 6,000 new and enhanced medical devices are cleared for marketing. In addition, 10,000 new products appear on American supermarket shelves, and thousands of new chemicals are introduced yearly. This continuing introduction of new products requires a broad array of scientific capabilities to analyze and characterize their composition, detect and assess their risks, and understand and evaluate their effects within the human body.

9.1.3 Scientific Organization

The various scientific research activities at FDA are carried out by the following organizations that are part of the Office of Operations, which is headed by the Deputy Commissioner for Operations (see Figure 9-1):

- Center for Biologics Evaluation and Research (CBER)
- Center for Drug Evaluation and Research (CDER)
- Center for Devices and Radiological Health (CDRH)
- Center for Food Safety and Applied Nutrition (CFSAN)
- Center for Veterinary Medicine (CVM)
- National Center for Toxicological Research (NCTR)

The Senior Advisor for Science advises the Commissioner on ways to strengthen and improve the quality of science and scientific research at FDA. To assist the Senior Advisor in this capacity, three groups have been established:

- **Science Board to the FDA:** A standing advisory committee of experts from academia and industry who specialize in the scientific disciplines relevant to FDA

- **Senior Science Council:** One senior scientist from each FDA center and the Office of Regulatory Affairs; established to advise the Senior Advisor for Science on science issues throughout FDA

- **Consultants to the Senior Advisor for Science:** Two scientists from each FDA center and the Office of Regulatory Affairs who have worked at FDA between three and ten years

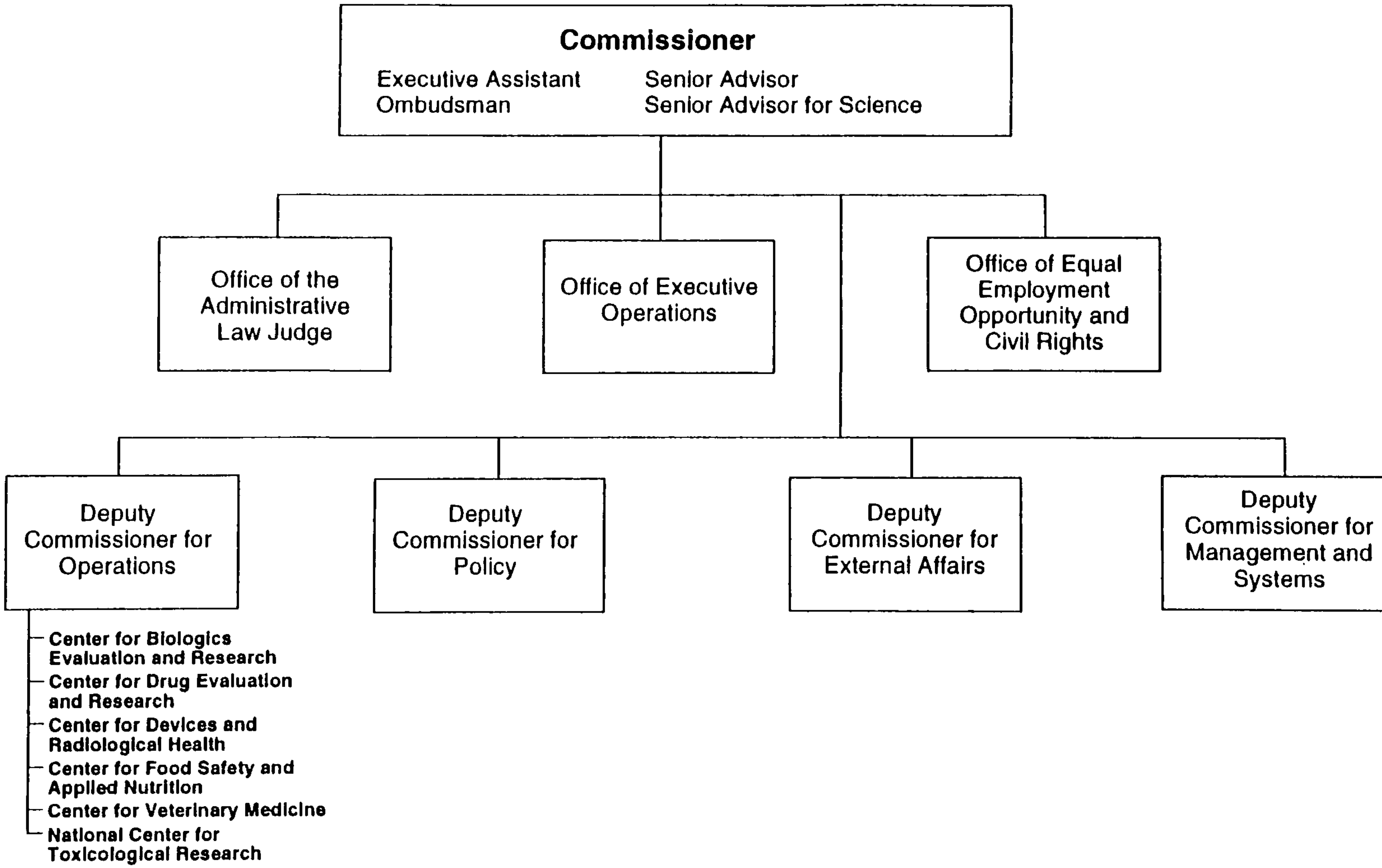


Figure 9-1. Organization Chart for the U.S. Food and Drug Administration

The Council and Consultants have made recommendations regarding staff development, recruitment and retention, and enhancement of FDA's scientific infrastructure.

9.1.4 Program Management

FDA relies heavily on the Program Management System (PMS) for conducting its scientific research activities. It has been used for planning, budgeting, reporting, and evaluation by the Agency since 1971. Programs and projects are the basic pieces that form the PMS. A framework of six programs form the foundation of the PMS. The majority of programs—Animal Drugs and Feeds, Biologics, Food and Cosmetics, Human Drugs, and Medical Devices and Radiological Health—follow the major product categories for which the Agency is responsible. The one exception is the NCTR program, which represents a specialized capability to address regulatory concerns that affect all product areas. These six programs are subdivided into 30 projects that form the basic building blocks of the structure. The projects in each program represent important areas of emphasis.

The PMS structure is extensively used for strategic planning, operational planning, budget allocation, and budget execution. Each phase of the process relies on the PMS structure so that from year to year, the details of program and project areas are closely linked to the fundamental activities of the Agency. During the yearly planning process, the structure serves as a basis for program planning. Proposals for changes in programs can be assessed based on their possible impact on project activities and objectives. Program managers throughout FDA also use the structure each year for the operational planning of field resources, including the activities of the field offices and laboratories. Finally, the PMS structure serves as the basis for preparation and submission of plans and budget requests through the Executive Branch and Congress, as part of the annual budget cycle. The structure provides the basis for the allocation of portions of the total funding request to the Agency's programs and projects. The President's Budget contains a table that depicts the allocation of FDA resources by PMS programs and projects.

9.1.5 Resources and Constraints

In spite of its critical regulatory responsibilities and impacts, FDA has some resource constraints that are discussed below:

- **Funding:** In the last ten years, significant new responsibilities have been added throughout FDA as the result of the enactment of 31 new laws. In almost all cases, the new legislation added new responsibilities, but the funds required to implement them were either not provided or inadequate. Thus, FDA has been coping with rising responsibilities by reprogramming resources to new, high priorities. Over the same period, there has been a decline on the order of

10 percent in FDA's staffing level for areas such as foods, animal drugs, and critical infrastructure. In contrast to EPA, FDA devotes a very small percentage of its budget to fund extramural contractors. In five of the six PMS program areas, contractor employees constituted only 1 to 6 percent of the total in FY93. The only exception is the NCTR program, which allocated 58 percent (332 out of 571) of its FTEs to various contractors. Tables 9-1a through 9-1c summarize the Agency's current resources in terms of workforce numbers and dollars.

- **Staffing:** FDA, along with other science-based federal organizations, faces severe competition for qualified scientists, engineers, and physicians. FDA may have difficulty competing in this labor market for certain critical shortage categories because its salary level average is well below that of industry. Low pay and poor working conditions have already led to periodic high turnover in some occupations. A 1989 General Accounting Office (GAO) study found that the turnover rate for FDA biologists was four times higher than the federal government average, and turnover in pharmacologist positions was twice as high. In addition, FDA faces staffing challenges because its work force is aging. The average age of FDA staff in 1992 was 46.5 years, and about half of FDA managers will be eligible to retire by 1995.

- **Facilities:** FDA's facilities in the Washington, D.C. area are widely scattered in 40 buildings in 15 separate locations. Many headquarters and field facilities, especially laboratories, are old, outdated, and inadequate for FDA's needs. FDA is currently the only Public Health Service (PHS) agency lacking complete accreditation from the American Association for the Accreditation of Laboratory Animal Care of all its laboratories. A General Services Administration (GSA)-directed study of FDA's facility needs in FY90 confirmed the inadequacy and inefficiency of FDA's headquarter facilities. FDA's field facilities are as seriously inadequate as its headquarter facilities. The need to update obsolete facilities has sharply increased FDA's facility costs, which are the fastest growing item in FDA's budget. FDA's facility costs increased over 100 percent from FY87 to FY93 (a time period when FDA's staffing increased 29 percent). Facility costs now account for over 10 percent of FDA's budget.

- **Equipment:** FDA depends on its laboratory equipment to give rapid and reliable results in laboratory analyses ranging from detecting pesticide residues or microbiological contamination to investigating tampering incidents with forensic drug analysis. FDA annually identifies and allocates funds in the planning and budgeting cycle to maintain existing equipment and replace worn-out and obsolete equipment. However, due to past budget constraints, funding for proper maintenance and replacement has often been reduced. As a result, equipment has

Table 9-1a. FDA's FY93 Agency FTEs by Program and Strategic Area

Program	Strategic Area										
	Pre-Market Review	Post-Market Assurance	Food Safety	International Harmonization	Information Systems	Science Base	Organization/ Management	People/ Facil/Equip	Appropriated FTE Total 1/	Contract FTEs 2/	TOTALS
Biologics	359	289	-	11	26	164	50	36	935	61	996
Human Drugs	1,335	847	-	11	70	61	60	32	2,416	90	2,506
Devices	418	753	-	24	76	170	51	79	1,571	10	1,581
Foods	155	1,925	112	5	49	473	34	20	2,773	50	2,823
Animal Drugs/Feeds	148	221	19	2	10	38	54	4	496	13	509
NCTR	34	-	16	1	10	85	13	80	239	332	571
Program Management	22	100	2	25	41	4	45	123	362		362
TOTALS	2,471	4,135	149	79	282	995	307	374	8,792	651	9,348
PCC	-	-	-	-	120	-	-	-	120	-	-

1/ FY 1994 Volume XII Justification of Estimates for Appropriations Committees, pg. 2. FY 1993 total was 9,053 FTE including salaries and expenses, and other accounts.

2/ Contract FTEs based on FY 91 data.

Table 9-1b. FDA's FY93 Agency Dollars by Strategic Area

Funding Type	Strategic Area								
	Pre-Market Review	Post-Market Assurance	Food Safety	International Harmonization	Information Systems	Science Base	Organization/ Management	People/ Facil/Equip	TOTALS
Staff Expenses	158,144,000	264,640,000	9,536,000	5,056,000	18,048,000	63,680,000	19,648,000	23,936,000	562,688,000
Variable Operating Costs 1/	44,768,000	74,915,000	946,000	501,000	6,185,000	21,824,000	1,947,000	8,203,000	159,289,000
Capital Infrastructure 2/	16,307,000	27,288,000	344,000	182,000	2,253,000	7,949,000	709,000	2,988,000	58,020,000
TOTALS	219,219,000	366,843,000	10,826,000	5,739,000	26,486,000	93,453,000	22,304,000	35,127,000	779,997,000

Table 9-1c. FDA's FY93 Agency Dollars by Program

Funding Type	Program							
	Biologics	Human Drugs	Devices	Foods	Animal Drugs/Feeds	NCTR	Program Management	TOTALS
Staff Expenses	59,840,000	154,624,000	100,544,000	177,472,000	31,744,000	15,296,000	23,168,000	562,688,000
Variable Operating Costs 1/	27,885,000	44,103,000	18,976,000	30,964,000	7,480,000	13,256,000	16,625,000	159,289,000
Capital Infrastructure 2/	10,157,000	16,064,000	6,912,000	11,279,000	2,724,000	4,829,000	6,055,000	58,020,000
TOTALS	97,882,000	214,791,000	126,432,000	219,715,000	41,948,000	33,381,000	45,848,000	779,997,000

1/ Includes: relocation, travel, transportation, service contracts, materials/supplies, equipment replacement costs, and extramurals (including $5.8 million in ORA contracts for state inspections).

2/ Includes: rental payments, buildings and facilities, communications, utilities, printing, selected central accounts, and PC&B in service contracts.

not been operated efficiently or been replaced on a systematic schedule. Much FDA equipment is approaching obsolescence. In the CFSAN alone, more than 50 percent of scientific equipment is obsolete. In FDA overall, about 70 percent of the $167.2 million laboratory equipment inventory is scheduled for replacement by the year 2000, but tight budgets are likely to constrain needed funding.

9.1.6 Strategies for the Future

FDA managers realize that it will be difficult at best to acquire additional resources through appropriated funding. In light of this situation, the following strategies have been designed to maximize the use of existing Agency resources in the area of scientific research.

- **Improve research planning and coordination:** The Agency plans to conduct regular research program peer reviews to address both the quality of the science and its relevance to the Agency's regulatory needs. These review programs are being expanded to identify opportunities for improved efficiency or joint research with other components of the Agency or with outside organizations. FDA is working to fully coordinate access to scientific expertise in support of research and decision making.

- **Enhance recruitment and staff development:** The Office of the Senior Advisor for Science has established two internal groups to address science issues across the Center, including recruitment and retention of scientists and staff development. The recommendations they have made include: establishing a post-doctoral fellowship program, holding annual awards for excellence in science, and coordinating recruitment by job types, rather than by Center. Programs for professional development of scientists are being expanded. One approach is the use of a Staff College that is comprised of in-house, academic training programs.

- **Promote interactions with outside organizations:** Through the Interagency Personnel Act, FDA scientists can benefit from sabbaticals outside the Agency and from the expertise of researchers from academia or industry who are working in FDA laboratories. These exchanges may last from six months to two years. The Office of the Senior Science Advisor will establish an Agency-wide Science Scholar Program through the opportunities presented by this Act. FDA plans to further pursue targeted, cooperative efforts with other agencies, industry, and academia to facilitate the development and introduction of safe and effective new product technologies. Such collaboration can generate the critical mass needed in areas of emerging technologies and can be a cost-effective way to leverage FDA's limited science resources.

- **Consolidate research programs and facilities:** FDA is assessing ways for consolidation of some programs and combination of some technical resources so that it may build a critical mass of research in areas of growing importance. In addition, the Science Board to the FDA, an Office of the Commissioner advisory committee, will examine the proper role of research in the Agency, the relevance of current research programs, and methods for improving these programs. FDA plans to consolidate and co-locate headquarters facilities in two locations in suburban Maryland at a projected expense of $825 million.

9.2 THE NATIONAL INSTITUTES OF HEALTH

The NIH is the steward of biomedical and behavioral research for the nation. As such, it is broadly responsible for research into the pathogeneses or processes that might impair health and the implementation of approaches to modify untoward outcomes. The NIH carries out biomedical research through its intramural program located in Bethesda, Maryland and a few additional sites around the country. It also is a major granting agency for research at institutions of higher learning throughout the country. A great deal of university biomedical research is funded through such NIH research grants. The NIH, as its name implies, consists of several individual institutes, each with its own organizational structure. Institutes have their own intramural programs and also administer their own grants, contracts, and training programs. The NIH Director serves primarily as an overall supervisor of NIH activities and as a liaison with the Department of Health and Human Services (HHS) and the community. Until recently, essentially all research was funded through the individual institutes, administered by their individual institute directors. Recently, the NIH Director has been allocated a substantial amount of money for directed research efforts.

9.2.1 Mission

The mission of the NIH, according to NIH Manual 1125 of September 1993, is science in pursuit of fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to extend healthy life and reduce the burdens of illness and disability. The following have been identified as goals of the NIH:

- Foster fundamental creative discoveries, innovative research strategies, and their applications as a basis to advance significantly the nation's capacity to protect and improve health

- Develop, maintain, and renew scientific human and physical resources that will ensure the nation's capability to prevent disease, improve health, and enhance the quality of life

- Expand the knowledge base in biochemical and associated sciences in order to enhance the nation's economic well-being and ensure a continued high return on the public investment in research

- Exemplify and promote the highest level of scientific integrity, public accountability, and social responsibility in the conduct of science

In realizing these goals, the NIH provides leadership and direction to programs designed to improve the health of the nation by conducting and supporting research in the following areas:

- The causes, diagnosis, prevention, and cure of human diseases

- The processes of human growth and development

- The biological effects of environmental contaminants

- The understanding of mental, addictive, and physical disorders

- The collection, dissemination, and exchange of information in medicine and health, including the development and support of medical libraries and the training of medical librarians and other health information specialists.

Thus, the broad mission of the NIH relates to the health of the nation. Nevertheless, its mission is largely distinct from that of other arms of its HHS parent agency (e.g., Medicaid) or of other agencies dealing with aspects of health. With regard to the latter, it is largely excluded from the responsibilities delegated to related regulatory agencies such as the FDA, EPA, the Centers for Disease Control and Prevention (CDC), and the Occupational Safety and Health Review Commission (OSHRC). There is, however, some overlap between EPA and NIH, between CDC and NIH, between FDA and NIH, and between OSHRC and NIH. There is also health-related research funded by CDC, FDA, EPA, the Department of Defense, the Department of Energy (DOE), and other arms of the federal government.

The NIH mission is, perhaps, most evident in the realm of clinical and basic research directed at the understanding of disease pathogenesis. This includes detailing basic molecular mechanisms underlying normal physiology and cell biology as well as abnormalities of those mechanisms which may lead to disease. Such understanding leads to new approaches to diagnosis and therapy, and ultimately, prevention.

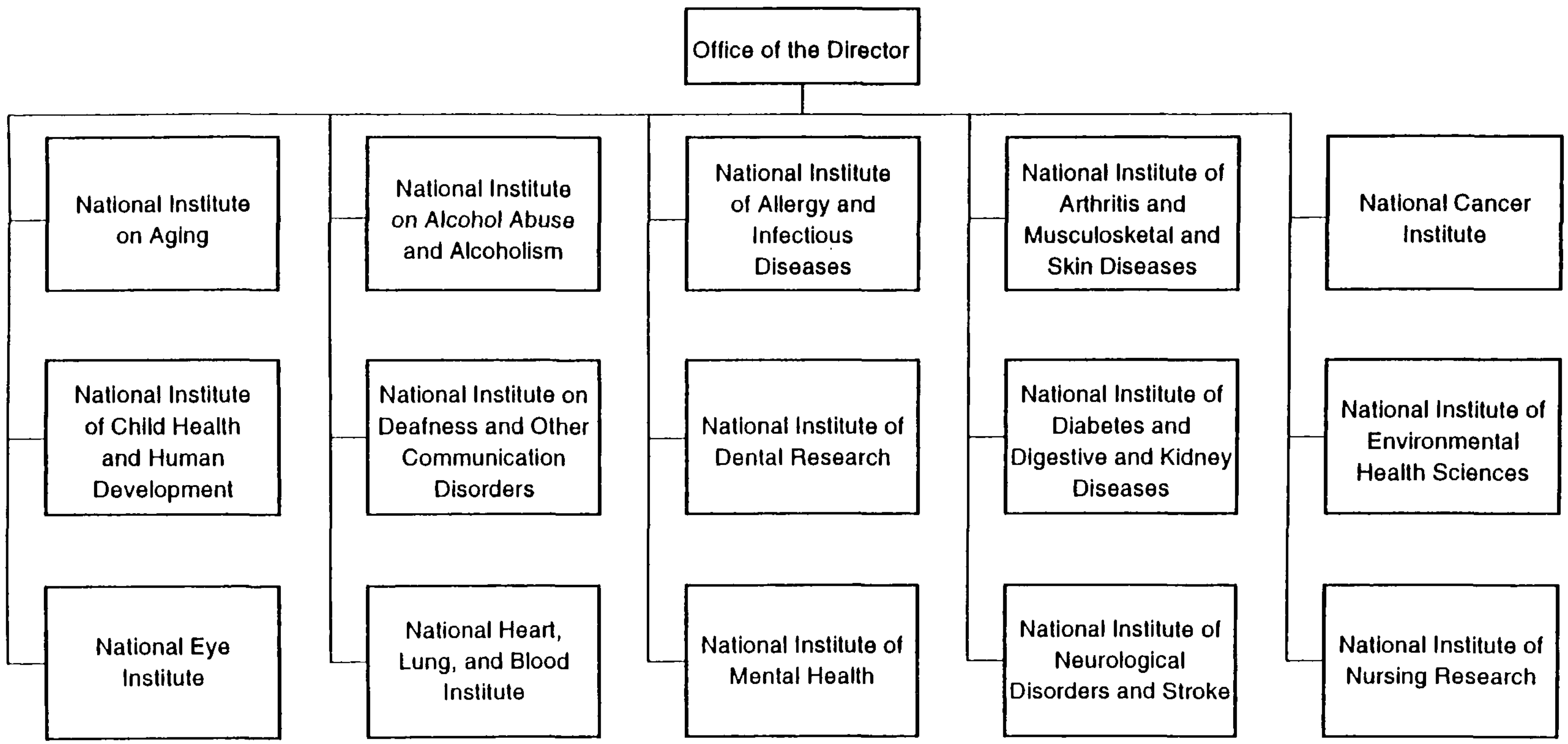
9.2.2 Organization and Funding

The NIH is organized primarily into individual institutes with broad responsibilities for funding and carrying out research in specific areas (Figure 9-2). The NIH primarily supports research through (1) direct intramural funding, (2) a granting mechanism to support extramural scientists (usually at universities), and (3) contracts to support directed research efforts. This support is divided among various program areas administered by individual institutes. Each program area decides if proposed research falls within its institute's individual mission or missions.

The overall funding for NIH and the recipients of this funding are shown in Table 9-2. Based on the 1992 estimate, NIH received about two and a half times as much money for health research and development as all other federal agencies combined; the projections for 1993 (not shown) indicate that NIH's share of funding was more than four times that received by all other federal agencies. The government provides funds for research in institutions other than those of the federal government. Thus, as Table 9-2 illustrates, much research is performed outside of government. Table 9-3 shows the allocation of NIH funds by performers of the health-related research. Much more money is allocated to support university research than to support intramural research. Non-industry research is primarily funded by the NIH and primarily performed at institutes of higher learning.

Table 9-4 represents the NIH obligations for 1992. The majority of funds were obligated in the area of research grants. The two next greatest were intramural research and development contracts. Approximately 5 percent of funds was used in research management and support.

The locus of control of support for specific activities at the NIH resides in the individual institutes. The institute director provides overall supervision of all activities within the institute. Intramural research is usually administered by the Director for Intramural Research of each institute. Institutes and programs within institutes often differmarkedly in the degree of high level control of individual research efforts. In practice, much research planning is done by individual investigators with only general programmatic control by their superiors. However, the superiors usually exercise strict budgetary control. The superior can reduce personnel, laboratory space, and budget for an investigator thought to be doing sub-par work. There is some, but usually much less, ability to increase space, personnel and budget for investigators doing an outstanding job. Thus, in the intramural program, the budget and control are closely linked.



Note: As a rule, the laboratory functions for the Institutes depicted above are overseen by each Institute's Intramural Research Division.
The National Institute of General Medical Science is not shown above since it has only extramural programs.

Figure 9-2. Organization Chart for Department of Health and Human Services, Public Health Service, National Institutes of Health, Division of Intramural Research

Table 9-2. National Support for Health Research and Development
(1992 estimate, in $ millions)

	Sources of Funds	Research Performers
Federal Government	$11,727 (41%)	$2,837 (10%)
National Institutes of Health	$8,407 (29%)	
Other Federal Government	3,320 (12%)	
State and Local Governments	1,900 (7%)	544 (2%)
Industry	13,870 (48%)	11,370 (39%)
Institutes of Higher Education		9,279 (32%)
Other Private Nonprofits	1,221 (4%)	2,481 (9%)
Foreign		2,205 (8%)
TOTAL	$28,718	$28,716

Source: NIH Data Book 1993. Basic Data Relating to the National Institutes of Health. U.S. Department of Health and Human Services, National Institutes of Health.

Table 9-3. 1992 Distribution of NIH Health Research and Development Funds by Performer
(in $ millions)

Federal Government	$1,604 (19%)
State and Local Government	61 (1%)
Industry	378 (4%)
Higher Education	4,982 (59%)
Other Nonprofit	1,335 (16%)
Foreign	46 (1%)
TOTAL	$8,407

Source: NIH Data Book 1993. Basic Data Relating to the National Institutes of Health. U.S. Department of Health and Human Services, National Institutes of Health.

Table 9-4. Distribution of 1992 NIH Obligations
(in $ millions)

Research Grants	$6,102 (69%)
Research and Development Contracts	638 (7%)
Research Training	310 (3%)
Cancer Control	108 (1%)
Construction	12
Intramural Research	996 (11%)
Research Management and Support	409 (5%)
National Library of Medicine	99 (1%)
Office of the Director	144 (2%)
Buildings and Facilities	61 (1%)
TOTAL	$8,879

Source: NIH Data Book 1993. Basic Data Relating to the National Institutes of Health. U.S. Department of Health and Human Services, National Institutes of Health.

In the extramural program, the institute decides on general levels of funding for specific programs. The greatest direct control comes through contracts. These are let by the administrators of the extramural programs of the various institutes. The granting mechanism provides peer review by outside 'consultants' and so approval of specific grants is, essentially, outside the strict control of the institute administrators.

The three general mechanisms for funding mentioned above—grants, contracts, and intramural research—are evaluated somewhat differently. Grants are funded based upon the results of a peer-review process in which working scientists with intimate domain knowledge meet to evaluate and grade (by secret ballot) proposals. Only a relatively small portion (approximately 10 to 20 percent) are funded. Contracts vary in scope and detail. A contract may be let to a university or a company. The criteria for obtaining a contract are stringent, and an NIH project officer has overall monitoring responsibility. Each intramural program uses its own evaluation criteria for program selection. In general, they hire excellent young scientists and bring their careers along by providing increasing resources. If the work is excellent, funding continues. Each institute's Director for Intramural Research is responsible for both clinical and basic research within the institute.

For evaluation of the effectiveness of a scientist, the director tends to rely on (1) direct knowledge of the work done, (2) list of publications generated (which can be appraised by the director who is a working scientist with domain knowledge), and (3) recommendation of direct supervisors of an evaluated scientist who stand between director and the individual scientist in the organizational structure.

The expectation of the staff in NIH's intramural research laboratories is that they are to perform research or provide support to others who are carrying out research. The same is true of grant recipients in universities. Occasionally, such people are asked to deal with issues involving regulations of one kind or another; however, the NIH is not preoccupied with regulations the way FDA is; therefore, this is less of an issue. In the overwhelming majority of cases, the laboratories produce what is expected of them: good research. In the intramural program, the laboratories generally receive the support they expect from headquarters. This is not always the case for individual scientists at universities: many of them apply for research grants and are not funded. This regularly happens even to good scientists.

In recent years, there has been increasing pressure from the extramural community for tighter review of intramural research. This has lead to a greater use of, and attention to, outside scientific review committees. These committees include high-powered scientists with domain knowledge of individual aspects of the program. They can recommend increasing the funding, space, and support staff for outstanding work and contracting or eliminating less productive scientists or whole laboratories. Although these committees are only advisory, and often were ignored in the past by the directors, in recent years they are carrying more and more weight. The Director for Intramural Research of an institute is now more inclined to follow the recommendations.

9.2.3 Science Base

The NIH has excellent science for the following reasons:

- There is an atmosphere of excellent science which draws outstanding scientists that is a positive feedback.

- There is a scientific tradition that is built upon. Excellent scientists from elsewhere feel it is an honor to visit, give lectures, and work at NIH.

- The mission is science. In other words, doing cutting edge work is not something one does in spare moments or when the boss isn't looking.

- There is funding for good science.

- There are local professional rewards for good science. In other places, the rewards may be for program efforts unrelated to cutting edge science.

- There are external (peer) rewards for good science (scientists are invited to give lectures throughout the country or the world, attend desirable meetings, sit on important committees, etc.)

- Good science is its own reward for inquisitive people who desire new information. This is a special breed. They do not gravitate towards regulatory agencies. They want the freedom to push new frontiers their own way.

9.2.4 Administrative Issues

The NIH is able to recruit very talented young scientists into its intramural research program. Because they must compete for funds with other very talented investigators who already have carved out their small domains, it is possible for younger scientists to be under-supported for many years. There are major space limitations in certain units and also limitations on FTEs. The NIH experiences intermittent job freezes; as a result, it is sometimes difficult to maintain sufficient high-quality support personnel. The purchase of large-ticket items by an individual investigator is sometimes hampered by the small size of a programmatic unit—that small size prevents the flexibility to purchase such large items from current funds.

There are additional problems with purchasing. Purchasing must be done according to government purchasing regulations which are designed to assure lowest price and competitive bids for common off-the-shelf items; these regulations are less suitable for the purchase of needed biological reagents of high quality.

There also are many administrative successes. Program project grants bring together several scientists at a single institution so as to (1) pool resources, (2) collaborate meaningfully, and (3) undertake projects of a breadth or depth not possible by an individual scientist. The purchase of large items for the intramural program may be anticipated by high-level administrators who may set aside funds for such a purpose. Mechanisms are sought for working within government regulations but with the recognition of the unique needs of the NIH employees. This holds for purchases of certain biological materials from specific suppliers. Many younger intramural scientists do not have as much travel money available to them as they would like. Because of the enormous Bethesda, MD scientific community and the many scientific visitors, this is less of a problem for most intramural NIH scientists than would be the case if they were disbursed.

9.3 U.S. NUCLEAR REGULATORY COMMISSION

9.3.1 Introduction

Prior to 1974, nuclear activities in the United States were regulated by the U.S. Atomic Energy Commission (AEC), which also had federal responsibilities for the development of nuclear power and radioisotope applications and for radioactive waste management. With the Energy Reorganization Act of 1974, which abolished the AEC, the responsibilities for regulation of commercial nuclear activities were vested in a new organization, the USNRC. One of the provisions of the enabling legislation prohibited the USNRC from establishing its own research and development laboratories and from engaging in other than confirmatory research. The legislation encouraged the USNRC to use DOE's laboratories and private sector organizations to perform the confirmatory research necessary for the discharge of its regulatory responsibilities. A waiver was granted in 1989 to the USNRC for the establishment of a federally funded research and development center to provide an independent, long-term scientific and technological capability to support the Agency's regulation and licensing of storage facilities for high-level nuclear wastes from commercial nuclear power reactors.

Three characteristics taken in combination distinguish the research programs within the USNRC from the other two federal agencies described in Section 9.1 and 9.2. First, all of USNRC's research, except research conducted by the Center for Nuclear Waste Regulatory Analysis, is performed under contracts, interagency agreements with other federal agencies, and grants. Second, scope of the USNRC's research programs is confined to confirmatory research, while the development of nuclear power reactors, nuclear waste management options, and the application of nuclear materials, and design of safety systems to protect the health and safety of the public, are reserved to others. Third, the research projects sponsored by the Office of Nuclear Regulatory Research (RES) are scoped and defined through negotiation of formal user needs raised by RES's customers internal to the Agency, the Office of Nuclear Reactor Regulation (NRR), the Office of Nuclear Materials Safety and Safeguards (NMSS), and the Office for Analysis and Evaluation of Operational Data (AEOD). In addition, funding for the USNRC's research program is derived from fees paid to the USNRC by its licensees. Because the research program is user-needs–driven and fee-funded, it is responsive to its customers, and transfer of the technology and use of the results occurs readily.

9.3.2 Mission

The USNRC nuclear regulatory research program has three main purposes. The first is to provide independent expertise and information for making timely regulatory decisions. The information should be independent in the sense that it is not derived solely from information provided by licensees and that it has received peer review by experts who did not perform the research. Research required for this purpose is mostly oriented to problems that are foreseeable in the near term. The second purpose is to anticipate problems of potential safety significance for which new or expanded knowledge can assist the USNRC in pursuing its missions. To this end, exploratory research is frequently required to provide new knowledge. The expansion of knowledge can help to recognize unforeseen situations and to prepare for dealing with them. Research for this purpose is generally long term, requiring effort over a period of five to ten years. The third purpose is to develop the regulations and regulatory guidance necessary to implement Commission policy or technical requirements.

9.3.3 Organization and Operations

Currently the RES is divided into four divisions: Engineering, Safety Issue Resolution, Systems Research, and Regulatory Applications. The director of this office reports to the Executive Director for Operations who, in turn, reports to the USNRC.

The USNRC's research program is overseen by a federal staff of 125 scientists and engineers who are professional project managers, that is, by individuals who possess both technical and project management skills but are not currently hands-on researchers themselves. Extensive peer review of project plans and research reports is performed within contractor organizations, by the USNRC staff, and by external experts and advisory committees (e.g., the Nuclear Safety Research Review Committee, the Advisory Committee for Reactor Safeguards, and the Advisory Committee for Nuclear Waste). This peer review complements the efforts by the project manager to ensure the quality of RES products. The level of quality has generally been judged high by the advisory committees and users of the information in the United States and abroad.

Several types of contracting vehicles are used by RES to obtain the capabilities it requires from the categories of organizations shown in Table 9-6. Given its mandate to use the DOE laboratories, it is not surprising to note that the majority of the research funding is placed in those laboratories. Funding of universities is also important to the USNRC to meet programmatic research needs while at the same time maintaining a technical capability in universities to provide a source of USNRC employees in the future.

Contracts for work at DOE's national laboratories are consummated through a streamlined version of commercial contracting procedures. Justification for the use of a national laboratory must be prepared by the project manager prior to the release of a statement of work (SOW) to the DOE operations office whose laboratory is deemed to have the requisite facilities, staff, and experience. Proposals received from the laboratories

Table 9-5. U.S. Nuclear Regulatory Commission Research Funding by Category
($ thousands, FY 1993)

DOE National Laboratories	$67,489
University (includes educational contracts, and grants)	4,797
Private Contractor (includes commercial contracts, SBIR, and not-for-profit contracts)	21,850
Foreign Agreements	1,923
Other (Government interagency agreements, and not-for-profit grants)	3,814
Total USNRC Research Funding	$99,873

Source: Office of Nuclear Regulatory Research, Financial Management, Procurement, and Administrative Staff

are evaluated by the USNRC, and the approach, schedule, staffing, and costs are clarified through discussions with the laboratory determined to be best suited for the project. A standard contract including all terms and conditions is issued to the laboratory through the DOE operations office.

Contracts and grants with universities and contracts with private contractors follow the usual path of program announcements, sources sought announcements, and requests for competitive proposals, followed by technical and cost evaluations by the USNRC. The time required to complete these procedures is generally longer than the time needed to let a contract with a DOE laboratory.

Quality assurance and quality control procedures under university and private contractor agreements are similar to those followed in DOE contracts. Foreign government contracts are negotiated on a case-by-case basis when the USNRC wishes to access special research facilities that are not available in the United States.

9.4 SUMMARY

Two of the agencies discussed in this section, FDA and USNRC, share EPA's current mission of environmental protection and the need to maintain long-range scientific and technological competence while fulfilling the near-term needs of their regulatory customers and of external regulated organizations. NIH shares with EPA a current and continuing common interest in the biological effects of environmental contaminants, and, as EPA moves toward a scientific leadership role in the environment, NIH may provide EPA insight into organizational and management practices that engender and foster a strong science base. Obviously, EPA cannot and should not directly adopt or replicate the practices of other federal agencies, but some insights can be obtained from these agencies that should be considered when making changes in the EPA's laboratory structure and management practices.

The FDA and USNRC address the need for credible science to support regulation through two different mechanisms. FDA conducts a comprehensive intramural program with limited extramural research, while the USNRC relies solely on extramural contractors, particularly DOE's national laboratories. Both approaches can be made to work, and EPA's management can determine what combination of the two is best suited to its mission. The quality of the science and its use in the regulatory process is assured in both organizations through extensive peer review process within and outside the Agency. In addition, FDA has established a Senior Science Council composed of scientists from each FDA center and the Office of Regulatory Affairs to advise the Senior Advisor for Science on science issues throughout FDA. This approach supports the assurance of end-to-end quality in the use of science.

Responsiveness of the research activities of the USNRC to its regulatory needs is ensured through a formal user needs process. The adoption of a similar formal process is something EPA may wish to consider as a part of the management improvements described in Section 6.

All three agencies, but especially NIH, maintain and sustain a commitment to the expansion of the scientific and technological information. USNRC fulfills this commitment through its university programs and in part through its contracts with DOE laboratories, and FDA and NIH use both their intramural and extramural programs to expand the information base. The allocation of resources and the means to fulfill the commitment rest with the agency management. A similar situation will exist within EPA.

In contrast to FDA and NIH, USNRC has not generally chosen to retain nationally and internationally recognized scientists within its staff, but operates through professional project managers. While such an approach seems to work well for USNRC and its regulatory role, it may or may not be suitable for EPA.

SECTION 10

ALTERNATIVE ACCOUNTABILITY MODELS

No study of laboratory options for EPA would be complete without an examination of the prospects of fulfilling almost all of EPA's needs through the use of contractors. This section discusses alternative accountability models that would free federal staff for inherently governmental functions, while minimizing additional contractor oversight responsibilities.

10.1 FEDERAL CONTRACT RESEARCH CENTERS

The term Federal Contract Research Center (FCRC) was first used in the early 1960s by the Department of Defense (DOD) to single out a particular sub-class of organizations with which it was doing business. This designation was given to certain private, usually non-profit, concerns that contributed directly to key planning, strategy, and management policy functions of federal agencies. A typical list of areas of assistance provided by the organizations includes the following:

- R&D program planning
- Research, experiment, and demonstration programs
- Systems design and engineering
- Implementation planning
- Preparation of specifications
- Integration of contractor design, testing, and implementation efforts
- Evaluation of contractor proposals
- Monitoring and evaluation of existing programs
- General technical support
- Consulting services

Each FCRC had a special relationship with one principal DOD sponsor. Later, other agencies also developed special relationships with appropriate non-profit organizations and, in the late 1960s, the term Federally Funded Research and Development Center (FFRDC) was coined as a generic label for all such organizations regardless of the major sponsor.

In 1972, the Commission on Government Procurement made the recommendation that federal agencies shall "continue (to have) the option to organize and use FFRDCs to satisfy needs that cannot be satisfied effectively by other organization resources." This recommendation led to Office of Federal Procurement Policy (OFPP) Policy Letter 84-1, "Federally Funded Research and Development Centers" (Office of Management and Budget, 4 April 1984). Among the criteria given for establishing an FFRDC relationship was that it "is brought into existence...to meet some special research or development need which, at the time, cannot be met as effectively by existing in-house or contractor resources." The policy letter emphasized the long-term and special relationship that was intended to exist between an FFRDC and its sponsor(s). Among the other characteristics of this special relationship are the following (OFPP Policy Letter 84-1):

- Work from other than a sponsoring agency is undertaken only to the extent permitted by the sponsoring agency and accordance with the procedures of the sponsoring agency.

- The activity, whether the operator of its own or a government-owned facility, has access, beyond that which is common to the normal contractual relationship, to government and/or supplier data, employees, and facilities needed to discharge its responsibilities efficiently and effectively, whether the data is sensitive/ proprietary.

- The primary sponsor undertakes the responsibility to ensure a reasonable continuity in the level of support to the activity consistent with the agency's need for the activity and the terms of the sponsoring agreement.

- The activity is required to conduct its business in a responsible manner befitting its special relationship with the government, to operate in the public interest free from organizational conflict of interest, and to disclose its affairs (as an FFRDC) to the primary sponsor.

Policy Letter 84-1 sets forth an elaborate set of criteria for defining an FFRDC. Basically, they are *ad hoc* R&D or study and analysis centers that are set up and/or managed by industrial, academic, or other non-profit organizations, at the request of the government, to help one or more federal agencies on a long-term basis to do that portion of their job in some mission area that the government cannot get done as effectively in any other way. The three main contributions an FFRDC brings to such an assignment are:

- A relatively unique knowledge and/or technical skill base in the mission area

- A willingness and breadth of capability for playing certain overview, "corporate memory", and "honest broker" roles among and between the other organizational participants in the various government programs in the mission area

- As the major requirement, a willingness to tailor itself to operate on the government's "side of the table" in the buyer/seller relationship that characterizes government procurement, in such a way as to minimize any possible organizational conflicts of interest that could arise from the special relationship that the FFRDC has with both its sponsoring agencies and their suppliers.

In general, all of the following criteria must be met before an activity is identified as an FFRDC (OFPP Policy Letter 84-1):

- The organization performs, analyzes, integrates, supports (non-financial), and/or manages basic research, applied research, and/or development.

- Performance of the above functions is either at the direct request of the government or under a broad charter from the government, but in either case the results are directly monitored by the government. However, the monitoring shall not be such as to create a personal services relationship, or to cause disruptions that are detrimental to the productivity and/or quality of the FFRDC's work.

- The majority of the activity's financial support (70 percent of more) is received from the government with a single agency usually predominating in that financial support.

- Most or all of the facilities are owned by the government or funded, under contract, by the government.

- The activity is operated, managed, and/or administered by either a university or consortium of universities, other non-profit organization, or industrial firm as an autonomous organization or as an identifiable separate operating unit of a parent organization.

- A long-term relationship evidenced by specific agreement exists or is expected to exist between the operator, manager, or administrator of the activity and its primary sponsor.

Additional rules regarding the establishment, use, and termination of FFRDCs are set forth in the Federal Acquisition Regulation (FAR) Part 35, Section 17.

10.2 CONTRACTING AT GOVERNMENT-OWNED, CONTRACTOR-OPERATED ORGANIZATIONS

In some cases, particularly when large properties are involved, the facilities are actually owned by the federal government and only operated for it by an outside party. In such cases, the facilities and its operation are also known as GOCOs. The use of private contractors to manage and operate government facilities has enabled agencies such as the Atomic Energy Commission and its successor agencies to attract the highly specialized scientific and engineering talent from academia and the private sector that was not otherwise available to the government. Not all GOCOs are FFRDCs, since not all of them perform the activities given in the basic research, applied research, and/or development discussed above.

This alliance between government and the private sector gave rise to the development of the management and operating (M&O) contract, which can be the contracting vehicle for either for-profit or not-for-profit contractor operations at government-owned facilities. The FAR (Subpart 17.6) defines an M&O contract as:

> an agreement under which the government contracts for the operation, maintenance, or support, on its behalf, of a government-owned or controlled research, development, special production, or testing establishment wholly or principally devoted to one or more major programs of the contracting federal agency.

This type of contract contemplates long-term relationships under which the contractor handles most aspects of day-to-day management, while the government pays virtually all costs and exercises only broad, general oversight. Under M&O contracts, programs have been carried out with a relatively small number of federal employees, who have served mostly to provide general oversight, review, and programmatic direction. The M&O contract is a cost-reimbursement contract under which the government reimburses all reasonable ordinary business expenses of the contractor, subject to certain specified exceptions and limitations. The contractor is also paid a fee (fixed or award) or management allowance for performance of the work. In these respects, the M&O contract is similar to the standard cost-type contract outlined in the FAR and used by other government agencies. M&O contracts include very broad scopes of work, which are intended to accommodate changes in such areas as available funds, national defense needs, and the course of ongoing research. This approach permits work to continue without the administrative burden of developing continual detailed revisions of the scope of work.

With regard to funding and finance, the M&O contractors traditionally have functioned in closer relationship to the government than most other cost-reimbursement government contractors. Most M&O contractor organizations are separate business entities from their parent corporations, and the only work they perform is that work authorized under their government contracts.

10.3 IMPLICATIONS FOR EPA LABORATORIES

In considering the use of alternative structures for the EPA laboratories, several aspects of the structures, including formation and impacts on issues, are identified. Since the criteria for an FFRDC require basic research, applied research, and/or development, for the purposes of this discussion, the belief is asserted that neither the EPA program office nor regional laboratories would have sufficient extensive activities in research and development to justify the effort and disruption that would accompany a change from the present status to FFRDC status. Further, since many of the activities undertaken by the regional laboratories could be, and often are, performed by existing commercial laboratories, who already have made the requisite capital investment, there would be no incentive for the government to establish either a for-profit or not-for-profit GOCO arrangement. Therefore, only the ORD laboratories will be discussed as possibilities for FFRDC or GOCO status.

10.3.1 Establishment of an FFRDC

With few exceptions, the 40 current FFRDCs were all organized out of already-existing non-governmental groups to satisfy a government need that could not be addressed, or could not be addressed as well, in some other way. To establish a new FFRDC, an agency is required to meet a heavy burden of demonstrating that existing private and federal facilities cannot meet its research needs. This burden was created to discourage the creation of unneeded FFRDCs that take work away from the competitive private sector or duplicate existing federal capabilities. An agency must also design a mission statement that will allow it to differentiate between work to be performed by the new FFRDC versus other research facilities, including those in the private sector. Under FAR 35.017-2(c), the agency must also establish controls "to ensure that the costs of the services being provided to the government are reasonable."

Once it demonstrates compelling need for a new FFRDC, an agency is required to issue a contract, called a sponsoring agreement, to establish the FFRDC's research mission, how the FFRDC will interact with the agency, and how the contractor will operate the FFRDC to accomplish its mission. The contract term may not exceed five years and usually extends for that period of time. It can be renewed after an agency review for additional periods not to exceed five years.

Most FFRDCs were established prior to the 1984 Competition in Contracting Act and so were established without competitive procedures. In recent years, agencies have on occasion used competition to determine who will operate a new FFRDC for the initial five-year period. The Internal Revenue Service recently competed its FFRDC to support tax system modernization. Universities, university consortiums, and corporations have all been awarded contracts to operate FFRDCs.

10.3.2 Impacts on Issues

As discussed previously, the major issues identified at the laboratories have been separated into four classes for this study—mission focus, expectations, locus of control, and administrative impediments. The impacts of the alternative accountability models on these issue areas is discussed here. The assumption is made that EPA would be the sponsoring agency for an alternative structure. That structure will be referred to here as an FFRDC, assuming a non-profit status.

10.3.2.1 Mission Focus

The concern with defining the mission of the laboratories would not be alleviated by the imposition of either an FFRDC or GOCO structure. In fact, it might be worsened since another layer of management—that of a university or corporation—would be introduced. EPA would still have to provide direction on long-term versus short-term research.

10.3.2.2 Expectations

The introduction of an alternative structure would not solve the problems associated with the difference in expectations, although it might alleviate at least one of them.

- **Role of staff:** Because new staff would be hired by the FFRDC, they would better understand their role as scientist or contract manager, so that the expectations of the present employees at the laboratories would be brought into alignment with the needs of the organization.

- **Excellence in science:** The expectation for excellence in science would not necessarily change, since the FFRDC would need to employ top scientists to maintain its contract. The expectation of an ability to respond to emergency needs would not change.

- **Emergency needs:** The clients of the present laboratories expect that the laboratories will be available to respond to emergency needs with directed research. At the present time, these emergencies displace the ongoing research at a laboratory, since time, not money, is the currency for meeting the need. An FFRDC could set aside a portion of its funds to meet emergency needs of its sponsor and could hire additional personnel, either permanent or temporary, to accommodate the need.

10.3.2.3 Locus of Control

Although EPA would still have to provide direction on focus of research and prioritization of issues, control over resources, both personnel and money, would devolve to the level of the alternative structure.

- **Personnel:** An FFRDC could make decisions on number and type of personnel hired without the strictures, or protections, of the federal personnel system. If an FFRDC were introduced at a laboratory, the probability is that most, but not all, of the present staff would be hired as employees of that FFRDC. Flexibility would be added to the system but without the guarantees of the present federal system. If a laboratory had what the managing organization considered an overabundance of a particular type of scientist, not all of these persons would be retained.

- **Budget:** An FFRDC would give the local organization more control over the spending of resources. One of the issues raised at the laboratories was the lack of travel money as opposed to the abundance of equipment money. An FFRDC could contract on how to spend the money it receives from its sponsor. The timeliness of acquisitions would be improved since the FFRDC would know its budget farther in advance.

10.3.2.4 Administrative Impediments

Many administrative issues were discussed at the laboratories. The impacts of an FFRDC on some of these are discussed below.

- **Interactions with contractors:** With the reduction of contractors at the EPA laboratories, the past interactions that took place collegially among researchers and support staff no longer occur. If the researchers and support staff were both employees of the alternative organization, these collaborations would be possible once again.

- **Perceived micromanagement:** Although the use of an FFRDC would add a layer of management, at the same time it would reduce interactions with ORD headquarters personnel. Decisions would be made at the local, rather than headquarters, level.

- **Streamlining:** One of the points of discussion in the streamlining effort has been the reduction in the number of ORD federal employees in the higher grades (14 and above). The use of an FFRDC would aid in this effort by converting some of these positions at one or more laboratories from federal employees to FFRDC employees.

10.4 CONCLUSIONS

One of the major concerns with the initiation of the type of alternative accountability model discussed above is that EPA has no experience in dealing with such a structure. The time required to set up the structure, and the decisions that would go into the implementation would be very consumptive of resources, including personnel time for planning. The costs and benefits, whether the solicitation would be competed, and negotiating an M&O contract are only a few of the many issues that would require investigation.

Many of the issues that have been identified can be solved with less disruptive measures, as discussed in Section 6.

SECTION 11

FINDINGS

In the course of meeting the study objectives to develop a baseline description of all of EPA's laboratories and to assess options for physical, functional, and organizational consolidation, a number of findings were made. The purpose of this section is to summarize the major findings presented throughout this report. These findings are intended for consideration by those who will be developing EPA's recommendations for potential consolidation of EPA laboratories and for potential Agency changes intended to improve the efficiency, effectiveness, and quality of EPA's laboratory operations.

In the FY92 annual report of the SAB, it was concluded that "insufficient funds and FTEs pose a serious threat to the continued viability of the EPA research program." The SAB went on to raise its major concerns, including (1) excessive reliance of on-site contracts for research, (2) attrition of federal career scientists, and (3) increasing obsolescence of equipment and facilities. The current EPA laboratory study found all of these observations still relevant. Additional findings are summarized in the following pages.

MISSION

To achieve improvements in the quality, efficiency, and effectiveness of the laboratory system, it is essential to develop an agreed-upon statement of the mission of the Agency and to implement a top-down strategy for laboratory operations in support of it. The Agency's mission with regard to scientific and technological activities also needs updating and refining in light of the increased involvement over the past 20 years in environmental issues by other federal agencies. The Agency's laboratories could, in turn, revise their missions, sharpening the focus and eliminating the potential for redundancies. During the past 10 to 15 years, as research budgets have decreased, it appears that some laboratories interpreted their missions more broadly in an effort to maintain or expand the size of their operation. The Agency's mission rather than funding opportunities should be used to set the agenda for the scientific and technological activities.

FINANCE

In FY93, EPA's laboratory system (including the regional QA and field monitoring functions) spent a little over $500 million. (Superfund CLP extramural funds have not been included in this figure). This was 12 percent of the Agency's operating budget (appropriations less revolving funds), which seems low for an agency that depends upon credible science to support development and enforcement of environmental regulations. For the 20 ORD laboratories, a total of $392.5 million was expended in FY93 with only 35 percent being intramural funds. This suggests that much of EPA's science base lies outside the Agency. The contractor conversion steps that are planned will increase the portion of funds being spent intramurally. For the program office laboratories and ESOs, 74 percent of the total expenditures is for intramural activities.

Agency-wide financial analyses are constrained by the categories of funds reported in the Agency's financial systems and the level of organizational units reporting data. For this study, core functions were used to define the ESOs, but data are not reported to the financial system by these functions, so separate calculations had to be performed. Financial analysis of consolidation options could not be performed without supplementing the information currently in the Agency's financial system. In addition, ORD's research plans are being developed around issues, but the financial performance cannot be tracked within the laboratory.

FACILITIES

Of the 20 ORD laboratories, only two, LLRS and RCB, have been rated by EPA's FMSD as in poor condition, and both are EPA-owned. Three of the program office laboratories are classified as in poor condition: NEIC and both pesticide laboratories (ACL and ECL). The facilities in Region 2, 3, 5, and 8 are classified as poor, and the Agency is far along in its plans to build a new laboratory for Region 3. Many of the laboratory facilities are in need of significant repairs requiring substantial financial resources. Information compiled in this report on the facilities includes and supplements the headquarters information and should be useful input to the Agency deliberations regarding consolidation.

The FMSD staff need to be kept informed of laboratory consolidation being considered by the Agency so that they do not make commitments for new leases or budget funds for plans or new construction projects not consistent with Agency recommendations being developed out of this study. Long lead times are required to construct new facilities, renovate existing facilities, or lease different facilities. The EPA staff working on such projects have the best access to the necessary data and understanding of that data to prepare estimates of implementation costs and times associated with laboratory reconfigurations.

EQUIPMENT

For ORD laboratories, total equipment investments of at least $2 million to $3 million per year are needed in the $50,000 and above budget category to maintain their current capabilities; enhancements to their capabilities would require additional funding. For the limited number of program office laboratories that reported data, the total is in the $500,000 to $700,000 range. For the ESOs, total investments of $800,000 to $1,000,000 are required. Any option involving physical consolidation should result in a reduction in these costs. Data on equipment expenditures and inventory came from several sources and did not always agree with what individual laboratories possessed. Consideration should be given to improving the current reporting systems and equipment databases, to allow Agency-wide review of equipment requirements, expenditures, and current inventory.

HUMAN RESOURCES

The Workforce '94 study has made a large quantity of data available to this study. The data on disciplines, age, and activity have been reviewed. These data have been used to help characterize the current laboratory operation and support the option evaluation.

In the interviews at several laboratories, concern was expressed about the large number of staff nearing retirement. Age information obtained from the EPA Payroll System (EPAYS) shows that the percentage of staff in each grade category is greatest in the 46- to 50-year-old age category. Retirement profiles for individual laboratories were obtained from the Workforce '94 database and document the concerns expressed. These data are included as part of the baseline description and, while not used directly in the option evaluation, can be used to project hiring needs.

No single EPA database exists that could provide information on the human resource characteristics discussed above. Workforce '94 was conducted to provide the required information, but it only covered part of the Agency. If policy makers feel this type of data would be valuable for other agency studies, consideration should be given to conducting a similar work force study Agency-wide. A database containing human resource data for the entire Agency could be updated annually and used for all Agency studies of management, facilities, career development, and training needs.

QUALITY ASSURANCE

To improve QA in the performance and use of science and technology throughout EPA, an in-depth review of the existing process should be made, particularly with the objective of achieving end-to-end QA throughout all of EPA's activities. The formal QA/QC responsibilities are not given the highest organizational visibility in EPA. The question of whether the QA functions should report to the Administrator/Deputy Administrator should be addressed. Consideration should also be given to having the group performing the laboratory QA function report to the directors of ESOs rather than to the laboratory management. Regions 1, 6, 8, 9, and 10 are presently organized this way.

ISSUE-BASED PLANNING

During interviews with ORD customers, ORD office directors, ORD laboratory directors, and other personnel, concern was expressed that there were too many issues for them to cover in the planning process. Several issues have been combined reducing to 36 the total number currently being used for planning. However, of these 36, RREL, for example, has funding and/or FTEs from 15 of them. While it may be necessary to partition the issues among the ORD laboratories to encompass the full range of expertise needed, it places management burdens on the ORD laboratory director to control the resources appropriately and upon the issue planner to integrate the results. Further examination of the situation could indicate how ORD laboratories might be consolidated or how the issues could be better defined.

INFORMATION SYSTEMS

As mentioned in some of the other findings above, Agency-wide information systems in the areas of finance, human resource, facilities, and equipment could enhance the Agency's ability to perform studies such as this. Systems that could be easily accessed that use common data formats and are updated at least monthly would help the Agency work more efficiently and effectively when searching for these types of information.

MANAGEMENT IMPROVEMENTS

Improvements in quality, efficiency, and effectiveness can be gained through improved management policies and procedures regardless of the organizational structure that is adopted. In addition to QA and mission clarification discussed above, five areas are identified for potential management improvement at all three types of laboratories:

- Establish QA as a visible high-level function
- Perfect the issue-based planning process
- Create a customer orientation throughout the Agency with a clearly focused and articulated mission statement
- Improve the information management system to increase the accessibility of managers to complete, consistent, and accurate data
- Delegate authority to the lowest level of management consistent with federal policies

LABORATORY SYSTEM RECONFIGURATION

In this report, five options were defined and evaluated. All of the options were evaluated twice, once with the physical consolidation or relocation of the resources and once without.

If the options are implemented without physical consolidation, the implementation time is short, since the changes from the current operations are mainly those of reporting relationships. Implementation costs would be expected to be substantial for physical consolidation of the laboratories, but no quantitative estimates of these costs have been made as yet by EPA or MITRE. Since the Carnegie Commission option affects only the ORD laboratories, and the DESO option affects only the ESOs, these options should not be compared.

Among the positive aspects of the options, the Carnegie Commission option with physical consolidation was evaluated more favorably than any of the other options that involve ORD. In the areas in which the Carnegie Commission with consolidation was strongly positive—human resources, mission focus, locus of control, functional alignment, and concentration of resources—none of the other options that would affect the ORD laboratories was as positive.

The strongly positive aspects of the Geographical Location option, i.e., its multimedia approach resulting from place-based ecosystem orientation, could be implemented under other options as well. This is true also of the strongly positive aspects of the Customer Orientation option—customer satisfaction and focusing on the highest priorities of the Agency.

The Streamlining option was neutral for most of the criteria, although it could reduce operating costs. If the provisions of this option were implemented under either the Carnegie Commission or DESO option, similar savings could be achieved.

The evaluation of the DESO option illustrated that it could have positive effects on the stature of the laboratories and the mission focus, although it is strongly negative with a large loss in customer satisfaction, an area in which the ESOs are now highly regarded. With consolidation, some savings would be seen in operating, facilities, and equipment costs, but other benefits are offset by the decline in customer satisfaction. The Geographic Location option would provide improvements in the area of customer satisfaction, where the DESO option was very weak.

The option judged to be most negative, Geographic Location with consolidation, would affect all three types of laboratories. This option was evaluated as strongly negative for functional alignment—a criterion for which the Carnegie Commission option with consolidation was judged strongly positive. In the Carnegie Commission option, consolidation reinforced the functional alignment, while the Geographic Location option did not. The alignment resulting from the Geographic Location option was perceived as expensive and not productive; it was seen as having the negative aspects of relocation—disruption and high costs—and few of the advantages of the Carnegie Commission option.

The assessments made by MITRE of the restructuring options have been useful in identifying the major controlling factors that must be addressed by EPA in making its report to Congress. However, there are also opportunities for EPA to improve the efficiency and effectiveness of its operations through management changes. The following changes appear reasonable to MITRE for eliminating the apparent duplications of facilities and equipment and for increasing the disciplinary strengths of the human resource base:

- Consolidate laboratories in the Office of Prevention, Pesticides, and Toxic Substances and the two laboratories under the Office of Radiation and Indoor Air

- Realign and consolidate the ORD laboratories in the manner of the Carnegie Commission option

- Reduce the number of laboratories within the Regional Offices through consolidation to a few laboratories with national service focus.

SECTION 12

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GLOSSARY OF ACRONYMS

AA	Assistant administrator
AC&C	Abatement, control, and compliance
ACL	Analytical Chemistry Laboratory
AEC	Atomic Energy Commission
AEERL	Air and Energy Engineering Research Laboratory
AEOD	Office of Analysis and Evaluation of Operational Data
AREAL	Atmospheric Research and Exposure Assessment Laboratory
B&F	Buildings and facilities
CBER	Center for Biologics Evaluation and Research
CDC	Center for Disease Control and Prevention
CDER	Center for Drug Evaluation and Research
CDRH	Center for Devices and Radiological Health
CERCLA	Comprehensive Environmental Response, Compensation and Liabilities Act
CFSAN	Center for Food Safety and Applied Nutrition
CVM	Center for Veterinary Medicine
DESO	Distinct Environmental Services Organizations
DOD	Department of Defense
DOE	Department of Energy
EAC	Environmental Assessment Center
EAG	Exposure Assessment Group
ECAO	Environmental Criteria and Assessment Office
ECAP	Environmental Criteria Assessment Program
ECL	Environmental Chemistry Laboratory
EMA	Environmental Monitoring Agency
EMAP	Environmental Monitoring and Assessment Program
EMB	Emission Measurement Branch
EMSL	Environmental Monitoring Systems Laboratory
EPA	U.S. Environmental Protection Agency
EPAYS	Environmental Protection Agency Payroll System
EPIC	Environmental Photographic Interpretation Center
ERI	Environmental Research Institutes
ERL	Environmental Research Laboratory
ESAT	Environmental Sampling and Analysis Team
ESO	Environmental services organization
F&E	Facilities and equipment
FAR	Federal Accounting Regulation
FCRC	Federal Contract Research Center
FDA	U.S. Food and Drug Administration
FFRDC	Federally Funded Research and Development Center

FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FMSD	Facilities Management and Services Division
FTE	Full-time equivalent
FY	Fiscal Year
GAO	General Accounting Office
GE	General Electric Company
GOCO	Government-owned, contractor-operated
GSA	General Services Administration
HERL	Health Effects Research Laboratory
HHAG	Human Health Assessment Group
HHS	Department of Health and Human Services
ICP-MS	Inductively Coupled Plasma-Mass Spectrometer
IEA	Institute for Environmental Assessment
LLRS	Large Lakes Research Station
LUST	Leaking underground storage tank trust fund
M&O	Management and operating
NAPA	National Academy of Public Administration
NAREL	National Air and Radiation Environmental Laboratory
NASA	National Aeronautics and Space Administration
NCTR	National Center for Toxicological Research
NEC	National Environmental Council
NEEL	National Environmental Engineering Laboratory
NEIC	National Enforcement and Investigation Center
NEML	National Environmental Monitoring Systems Laboratory
NEP	National Environmental Plan
NESL	National Ecological Systems Laboratory
NHEL	National Health Effects Laboratory
NIE	National Institute of Environment
NIER	National Institute of Environmental Research
NIH	National Institutes of Health
NMSS	Office of Nuclear Materials Safety and Safeguards
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NRR	Office of Nuclear Reactor Regulation
NSF	National Science Foundation
NVFEL	National Vehicle and Fuel Emissions Laboratory
OAQPS	Office of Air Quality Planning and Standards
OARM	Office of Administration and Resource Management
OEETD	Office of Environmental Engineering and Technical Demonstration

OEPER	Office of Environmental Processes and Effects Research
OER	Office of Exploratory Research
OFPP	Office of Federal Procurement Policy
OGWDW	Office of Ground Water and Drinking Water
OHEA	Office of Health and Environmental Assessment
OHR	Office of Health Research
OMMSQA	Office of Modeling, Monitoring Systems, and Quality Assurance
ORD	Office of Research and Development
ORIA	Office of Radiation and Indoor Air
ORPM	Office of Research Program Management
OSHRC	Occupational Safety and Health Review Committee
OSPRE	Office of Science, Planning and Regulatory Evaluation
PAMS	Photochemical Assessment Monitoring Systems
PEB	Pacific Ecosystems Branch
PHS	Public Health Service
PMS	Program Management System
PPAYS	Personal Property Accountability System
PRO	Program and resource operations
QA/QC	Quality assurance/quality control
R&D	Research and development
R&I	Repair and improvement
RCB	Releases Control Branch
RCRA	Resource Conservation and Recovery Act
RES	Office of Nuclear Regulatory Research
RREL	Risk Reduction Engineering Laboratory
RSKERL	Robert S. Kerr Environmental Research Laboratory
RTP	Research Triangle Park, North Carolina
SAB	Science Advisory Board
SERDP	Strategic Environmental Research and Development Plan
SES	Senior Executive Series
SF	Superfund
SOW	Statement of work
TRI	Toxic Release Inventory
TSCA	Toxic Substances Control Act
USGS	U.S. Geological Survey
USNRC	U.S. Nuclear Regulatory Commission
WRC	Westhollow Research Center

APPENDIX A

LABORATORY DESCRIPTIONS

The large quantity of laboratory descriptions made it necesary to compile these descriptions in a separate volume of this document, MTR-94W-0000082V2.

APPENDIX B

SCHEDULE HIGHLIGHTS

17 November 1993	MITRE Effort Initiated
13 December 1993	Senior Executive Interviews Initiated
30 December 1993	Delivery of Draft Study Plan
11 January 1994	First Meeting with National Academy of Public Administration (NAPA)
5-21 January 1994	Participated in Briefings to EPA Laboratory Personnel
3 February 1994	Initiated Laboratory Visits and Interviews
11 February 1994	Delivery of Final Study Plan
4 April 1994	Second Meeting with NAPA
18 April 1994	Draft Report Submitted for Agency Review
4 May 1994	Addenda to Draft Report Submitted to Agency
12 May 1994	Study Review by Research Strategies Advisory Committee, Science Advisory Board
31 May 1994	Delivery of Final Report
23 June 1994	MITRE testifies before the House Committee on Science, Space and Technology, Subcommittee on Technology, Environment and Aviation
Jan-May 1994	Attended twice-monthly EPA Steering Committee Meetings

APPENDIX C

EXECUTIVE INTERVIEW SUMMARIES

This appendix includes the following executive interview summaries:

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 22 December 1993

Person Interviewed: Herb Barrack, Regional Administrator, Region 2

Response submitted in writing as follows:

Scientific and Technical Issues

Science and Technology data, information—quality, response time, reliability. The regional laboratories support the following:

- Collection of samples and generation of analytical data for project specific media programs (air, water, and hazardous waste) to support compliance, monitoring, and enforcement activities in the region

- Development of quality assurance project plans to support enforcement actions, remediation goals, and decision making

- Evaluation of whether ambient standards are in compliance with Agency regulations

- Geographic-specific initiatives

To support these activities, it is essential that the region have the highest quality data. Assessment of data quality objectives is an essential first step in the process to ensure that proper procedures are used in the collection of data, that the methods meet the data quality objectives, and that the information can be used in decision making. For example, among the different programs, there are different methods for sampling lead in water. Under RCRA, sampling procedures are at the 5 ppm range, while under the Safe Drinking Water Act requirements are for 15 ppb. These sampling procedures have significantly different costs, and it is essential that in selecting sampling methodologies that program-specific needs are met.

The laboratories also play a significant role in the region's ability to quickly respond to environmental episodes and catastrophes. For example, in Region 2, the laboratory was essential to identifying chemical contaminants when the Chemical Control Company of Union County in Elizabeth, New Jersey exploded in 1980. Considering current public concerns about potential chemical exposures, it *is* essential that the Regional Administrator have access to the expertise to analyze and address environmental crises in a timely manner.

The laboratory staff also provide a technical base of knowledge in analytical techniques that is invaluable in supporting Agency enforcement cases. This technical knowledge provides a firm foundation for the regional scientists to serve as expert witnesses in winning enforcement cases. Without the continuation of the laboratory there is a potential that this knowledge base might be lost.

In the regions, the response time varies depending upon regulatory requirements. Similarly, to support regulatory decisions and response from industry, it is essential that the region establish credibility and reliability in the development of the data. Response time is also dependent on the urgency of the situation; if danger to the public is imminent, response time must be immediate; this is one of the unique capabilities of the regional labs (quick turnaround time for data generation so that a decision can be made).

Technical Assistance and Support. All programs within the regions are required to submit project specific quality assurance project plans before any sampling or data analysis is started. The technical analysis of the project plan ensures that the data objectives are clearly identified, that sampling procedures are appropriate to meet these objectives and that the results meet these objectives.

The Environmental Service Division provides training in the development of quality assurance procedures, formal review of Quality Assurance Project Plans developed by our states and local agencies where appropriate, and telephone discussions where appropriate. Our regional laboratory expertise is currently being transferred to laboratories in Eastern Europe.

The regional laboratories also coordinate with the research and development laboratories in Las Vegas and Cincinnati to identify appropriate methods to meet regional needs and to share field experience in the application of these methods.

It is important to keep in mind that the regional laboratories and the research and development laboratories have different missions. For example, the regional laboratories must respond to emergency situations or site-specific problems within strict deadlines. The research and development laboratories have greater flexibility in the method development and validation process. It is important in developing new structures for ORD that the team keep in mind the distinctions in the missions of these different parts of ORD.

Risk Assessment. The region uses risk assessment as a tool for evaluating potential exposure to chemical mixtures at Superfund sites, RCRA facilities, and ambient air toxicants. Comparative risk analysis is used as a tool to comparatively rank various environmental problem areas and support strategic planning.

Scientific or technical assessment or evaluation. As indicated previously, in many site-specific analyses as a final step we rarely evaluate the data from the project in relation to the original data quality objectives. In many cases, depending on the length of the project, the number of scientists involved, and the changes in personnel there is a potential to lose sight of the original objectives. It is important that we develop better plans to carry out the final step of reviewing the collected information versus the original data objectives to ensure that we have met the objectives. If the objectives are not met, it is important that we identify ways to improve the process for the future.

To support regional and geographic specific decisions, it is important to develop appropriate models for fate and transport analysis of contaminants in a temporal manner, develop computerized systems to store data that can be easily used by non-computer specialists, and develop procedures for validating models and indicating appropriate conditions for the use of the model. As indicated in the recent meetings on the workplan for the Waste Technology Industries (WTI) incinerator in Ohio, the Agency selected model was not appropriate for the complex terrain conditions in the area of the incinerator. It is essential that better scientific and technical analyses be developed to support the selection of the appropriate model and that a formal Method for approving models be developed.

In the area of risk assessment we have utilized ORD offices, expertise in developing modeling, exposure assessment, and toxicology to review media-specific workplans and risk assessments. It is essential that these resources be made available to help support regional and site-specific actions.

Quality Assurance. Coordination between the research laboratories that develop the methods, the Headquarters Quality Assurance office, and the regions to use validated methods must continue to support regional decision making. It is essential that a centralized data repository of regulated methods and their validation be developed so that quality assurance is integrated across all program offices and consistency is developed. In the future, we need to use current computer technologies to ensure that this information is available for use across all program offices to ensure against duplication of effort.

Peer reviews of programs or activities. We have utilized ORD's expertise to peer-review media-specific workplans and risk assessments; currently Region 2 is developing its own peer-review policy.

Science and technology review of proposed regulations. One area where this overlap in responsibilities presents special problems is the area of standard development. For example, many regulations are developed based on health, ecological or economic considerations. In some cases, such as dioxin, the regulatory limits set for specific criteria cannot be measured using current sampling methodologies and therefore it is difficult to determine whether the facility is in compliance with the permit levels. It is essential that questions of sampling methodology be addressed earlier in the regulatory process so that the regulators can make appropriate decisions before the method is promulgated.

Success in Addressing Identified Needs

Coordination within the Agency's program specific laboratories, research laboratories, and regional laboratories is essential to ensuring that the methods are available to support geographic and site-specific regional needs.

In the regional laboratories we use the management tool of workplan development to ensure that we do not over-commit our resources and continue to provide quality scientific data. It is essential that special consideration be given to providing additional resources to the regional laboratories to provide the flexibility to address regional specific problems. Of special concern are those geographic specific problems that cannot be anticipated. Additional resources can help to provide a cushion of expertise to address these geographic needs on an as-needed basis. For the region, it is essential that we develop better facilities to carry out laboratory research. The laboratory should provide state-of-the-art design to reflect the various types of analyses that are carried out.

In the area of risk assessment, the regions are faced with a lack of Agency consensus information on specific chemicals. Alternatively, we need to identify other potential sources of risk specific toxicological information (i.e., other program offices, states and other sources). It is essential that the regions have the opportunity to identify specific needs for fast-track review by existing workgroups (i.e., CRAVE, RfD/RfC) so that these needs are addressed in a timely manner. In addition, if consensus numbers are removed, it is essential that the regions have access to the original numbers since our experience has shown that revised numbers are not readily forthcoming.

Changes in Function and Structure

It is important for the Agency to reaffirm its commitment to use the best science available and support the Agency scientists in this endeavor. It is important that the Agency become more active in addressing science issues in a timely manner. Strategic planning is essential in the process.

For the regional laboratory, it is essential that we develop better facilities to carry out laboratory functions. Our current laboratory facilities are old and require significant updating to meet the changing scientific developments.

It is also essential that we fully consider the importance of the QA/QCed data provided by the laboratories and ensure that adequate staff are available to meet existing and future needs.

Coordination among the various program offices, laboratories, and regions is essential in identifying critical areas where additional research is required, assuring against duplication of efforts and assuring the best science is used in decisions. It is also important that we coordinate with other federal agencies on specific issues to avoid duplication of effort.

Where possible, it is essential to provide travel funds to support regional participation on national workgroups to discuss specific methods and applications to ensure that field experience and expertise is appropriately incorporated into development of new methods.

Future Scientific and Technical Needs

Fundamental research (Environmental Monitoring and Assessment Program [EMAP] and National Human Exposure Assessment Survey [NHEXAS]). Under the NHEXAS program it is essential that the data from the project be made available in a timely manner so that it can be used to develop better risk methodologies for evaluating sensitive subpopulations and addressing environmental justice issues. The NHEXAS data could also be potentially used to evaluate progress in reducing the levels of various toxic pollutants in the environment (i.e., DDT, dioxin, lead, and PCBs).

As part of fundamental research, it is important that we develop mechanisms (funds, resources, etc.) for the regions to address smaller, geographic-specific problems that are not amenable to the larger E-MAP and NHEXAS projects. In many cases, the time that it will take to complete the larger projects does not meet the regions more immediate needs, and flexibility is required to address these issues.

Risk Assessment Methods. Risk assessment methods are needed for both human health and the ecological analyses. For human health in the following methods are needed:

- Assessing potential health effects from non-carcinogens
- Evaluating both cancer and non-cancer health effects
- Addressing physical habitat alteration
- Addressing fate and transport of chemicals, biomagnification especially related to the current combustion strategy under RCRA
- Sampling methods able to detect contaminants at the carcinogenic and non-carcinogenic risk levels
- Statistical methodologies to quantitatively evaluate risks (Monte Carlo, Meta analysis, etc.)
- Environmental indicators that can be used by managers to assess success of current efforts

- Better ranking methodologies to evaluate cancer and non-cancer health effects and combine the ranking results with population data and display the results using Geographic Information System technologies

- Toxicological, bioavailability and bioconcentration information concerning the speciation of chromium and the associated health effects. Other issues concern bioavailability and bioconcentration of these chemicals.

- Better methodologies for assessing risks from complex chemical mixtures.

- Evaluation of indirect exposure assessment methodologies.

- Methods for analyzing indoor air exposure and contributions to indoor air from outdoor contaminants.

- Consistent Agency policy on assessment and management of exposure source contribution. Some offices, like the Office of Water, look at allocation of RfDs across exposure pathways (e.g., drinking water and fish consumption), while other offices, like OPPTS, are not yet looking at multiple exposure (e.g., dietary and household). As a result, EPA cannot evaluate total exposure and the most significant exposure pathways and sources.

- International activities leading to standardization of hazard testing and classification and assessment. EPA needs to harmonize activities across program, agencies and internationally.

- Areas not addressed by existing risk assessment guidelines, a process is needed to make interim Agency-consensus decisions. Examples, include risk assessment of PAHs, PCBs, less-than-lifetime exposures, complex or multiple media exposures, use of Monte Carlo simulations for exposure assessments.

For ecological assessments, methods are required in the following areas:

- Specific guidelines and criteria for developing ecological risk assessments,
- Biological indicators and criteria for wetlands.

Support of the external environmental research community needs (i.e., academic grants). In the area of GIS we have used grants to state agencies and local universities to develop necessary data for the program. It is important for the Agency to develop closer ties with the environmental research community to ensure a sharing of ideas, scientific information and expertise. To accomplish this, additional funds need to be made available to award to these research groups.

Future needs. For the next 10 to 15 years, we see the need for better coordination among the various portions of ORD and the development of appropriate computer applications to support regional decisions. We also see the need for the laboratories to continue to evolve to include the latest scientific knowledge and quality science.

Over the coming 10 to 15 years as the scientific disciplines supporting risk assessment continue to expand, it is important for the Agency to be able to incorporate the latest scientific information in a more timely manner. Using the Science Policy Council, the Science Advisory Board, and the Agency's scientific expertise, it is essential that we develop a pro-active approach to incorporate the latest scientific information in a timely manner. It is also essential that we provide the opportunity for

Agency scientists to share information and the flexibility to keep abreast of the latest scientific data and information through attending scientific meetings, sabbaticals, and publication in scientific journals.

In considering peer-review we need to keep the following issues in mind:

- We need to continue to support the scientific development of our staff so that their credentials reflect the current scientific expertise and they serve as peer reviewers,

- We need to develop our own expertise to peer review documents within the regions and better coordinate with Headquarters program offices, and with the states.

- We need to consider resources to support external peer reviews. For example, the external peer review of the WTI risk assessment workplan cost $130,000. If we intend to use this mechanism, it is essential that adequate funds be made available to access these diverse groups.

- We also need to develop better relations with other federal agencies, states and academia to identify scientists that can aid peer review of specific documents and serve as external peer reviewers. The Science Advisory Board currently addresses this need for major projects however resources of the SAB preclude using this organization for all projects. It is important to identify other scientists outside of the SAB that can provide review of specific topics on an as needed basis. This will help to alleviate the burdens on the SAB members and identify potential future candidates for the SAB.

- It is essential that we build peer review into the process early to prevent completion of projects that do not meet the original needs of the project. Building relationships with the peer-reviewers early in the project, providing updates and other opportunities for evaluation during the project will help to ensure that the best science is included in the project.

What the Agency Should Be Doing

Unfortunately, many of these projects are long-term and results will not be available in the foreseeable future. One problem is that while the research is carried out the regions need to make site-specific decisions. To address this need it is important that mechanisms be developed for short-term research projects possibly using university cooperative agreements. In addition, it is important to develop mechanisms, such as the Science Policy Council, that can address interim policy decisions while the research continues.

It is important to provide the regions with the flexibility to use existing contract and cooperative agreements to identify specific research needs and develop workplans and programs to meet these needs.

ORD's current mission leads it first to pursue research. Other functions such as quality assurance, methods development, multilaboratory validation, etc., are slighted in staffing and funding. From a regional perspective, technical assistance functions—which ORD views as secondary—are equally or even more important to accomplishing Agency objectives.

One way to address this problem is to split the non-research support from the research funding base. Cross-program efforts such as quality assurance, methods development, monitoring, and other technical and policy support should have separate funding.

EPA's Role in the Fundamental Environmental Research

I see EPA's role as a leader in the development of regulatory methodologies for assessing human health and ecological effects from exposure to chemicals in the environment. EPA must develop the technologies needed to assess the fate and transport of chemicals in the environment and to develop models to accurately predict the fate of chemicals, the results of which can be used by managers to make policy decisions.

In addition, it is also important for EPA continue to coordinate with other federal agencies (National Institutes of Environmental Health Sciences, National Toxicology Program, Agency for Toxic Substances and Disease Registry, National Centers for Health Statistics, National Institutes of Health, etc.) to share information, coordinate research programs, and ensure against duplication of efforts.

Quality Control Authority

The region should set, implement, and audit standards for assessing the quality of EPA scientific and technical decisions. This can be accomplished using the mechanisms of the peer-review process within the region. In cases where additional expertise coordinated reviews through Headquarters program offices and other regions are extremely important. Access to resources to involve appropriate HQ and other regional staff in the review is important to ensure that documents and workplans are evaluated in a timely manner.

For analyses on the cutting edge of the science, it is also important for the regions to have better access to the Science Advisory Board and external peer-review mechanisms where appropriate. It is essential, that the regions have access to these peer-review mechanisms (internal and external) during all phases of the project (i.e., workplan stage, performance, and post-review) to ensure that the project reflects the best available scientific expertise.

Federal Employee Functions

It is essential that EPA scientists carry out their review and development activities with integrity and the ability to access the best available scientific information. It is important that Agency scientists have the ability to share information with other scientists (inside and outside the Agency) on issues that are on the cutting edge.

It is also important to keep in mind that Agency staff have inherent government functions that cannot be delegated to non-EPA staff—e.g., criminal enforcement, decision making, etc.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 23 December 1993

Person Interviewed: Michael Cook, Director, Office of Wastewater Enforcement and Compliance (OWEC), Office of Water (OW)

EPA Personnel Conducting the Interview: Roger Cortesi

Scientific and Technical Issues

This office is responsible for NPDES permit issuance where authority has not been delegated to a state, enforcement of NPDES regulations, and administration of the state's revolving fund for municipal wastewater facility construction. The enforcement role will be shifting to Office of Enforcement next year.

NPDES enforcement is based on self-reporting by permit holders. This function relies on accurate analysis and reporting by permit holders. To help ensure accurate results, OWEC relies on ORD to conduct annual performance evaluations of laboratories performing water analyses for permit holders.

OWEC has high-priority needs in the area of wet-weather runoff and wastewaster control problems, such as with large animal feedlots, mine drainage, and combined stormwater overflows. These areas will require $50 billion dollars worth of capital construction to address. Some research is needed in order to make the best use of limited resources by the affected communities.

How Well Are These Needs Being Met?

ORD is thinking of phasing-out laboratory performance evaluations. If this occurs, it is not known how data from permit holders can be QA'd, even after OE takes over the role.

ORD does not conduct much research for OW. A need exists to conduct research both in "hard" and "soft" technologies for addressing wastewater and runoff problems, especially in light of the large sums of money spent by federal and municipal governments on construction of control and treatment facilities. Currently, the municipalities and such associations as the Water Environment Federation have conducted their own research. However, there is little coordination between the various research efforts. EPA should be coordinating these efforts and conducting some research of its own to increase the effectiveness and efficiency of the available construction funds. ORD could be doing more in this area. However, it has been difficult to get ORD to pay attention to OW's needs.

OW needs for peer-review are met mainly through one-to-one contacts with people in the laboratories that OW people know. There is no institutional mechanism in place for peer-review.

Changes in Function and Structure

OW once operated a water laboratory in Cincinnati. This laboratory was very useful and supported OW's needs.

The number of laboratories that EPA operates is surprising and there appears to be a great deal of overlap. Some of this could be consolidated and focused to provide better use of resources.

The regional laboratories are an asset and should be maintained, although they might be consolidated and focused as well. They could be focused into Centers of Excellence, as has been discussed. For example, Regions 3 and 8 have a great deal of expertise in biosolids management and could become Centers for this knowledge.

The recent controversy over the roles of contractors versus Federal employees may have gone overboard. And the actions EPA is taking in this regard may be the wrong move. They run counter to what one sees in the private sector now, with closer partnerships between suppliers and customers. Close working relationships are also part of the TQM philosophy.

What the Agency Should Be Doing

EPA must have a strong leadership role in environmental research, including some basic research. However, EPA doesn't really have enough funds to conduct an extensive basic research program. Even if EPA doesn't do some types of research, it should act to coordinate that research that is going on outside of the Agency or the government.

The research community within EPA should listen to the needs of the regulators and try to meet them. However, ORD does need some independence from the program offices to conduct leading-edge research which may not have an immediate payoff. ORD should also be in touch with leading-edge research outside of the Agency.

Future Scientific and Technical Needs

The OWEC would like to see more work done on bio-monitoring techniques and techniques for assessing changes to habitats.

The OW needs a comprehensive and systematic way of characterizing the effects of single and multiple effluent discharges and non-point discharges on aquatic systems. They need new types of environmental indicators to tell whether programs are really making a difference or not. They would like to build such environmental monitoring techniques into future permits.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 16 December 1993

Person Interviewed: Peter Cook, Deputy Director, Office of Ground Water and Drinking Water

EPA Personnel Conducting the Interview: Carl Gerber, Tom Pheiffer

Long-Term Data Needs

Data are needed for standard setting, for regulation, and on treatment processes. Two examples of the use of data for standard setting are (1) to establish maximum contaminant levels and (2) to determine if frequencies of occurrence of a particular contaminant are high enough to set a national standard. For regulation, data are needed to determine the toxic end points (for example, cell culture studies to do risk assessment). Some examples of treatment process data are Best Available Treatment Technology, costs of treatment, and unit cost information. This office also needs a national data set for ground water, including latitude/longitude, to identify sampling points.

Work with Other Laboratories

This office has worked with the treatment technology and engineering branches of the Cincinnati laboratories on basic methods.

What the Agency Should Be Doing

Historically, this office has not gathered parametric data, but this could be done with electronic data transfer. Systems could be set up to catch some data inconsistencies, e.g., lack of turbidity spikes during a rainy season. Currently, data systems have minimal content, and current needs cannot be met with the existing system. As a result, the Office of Ground Water and Drinking Water is developing new analytical methods. The expectation is that industry would test the methods, an EPA audit could certify that these methods meet standards, and data collection could be expanded.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 15 December 1993

Person Interviewed: Tudor Davies, Deputy Assistant Administrator for Water (Acting)

Others in Attendance: Margaret Stasikowski, Director, Health and Ecological Criteria Division

Arnold Kuzmack, Senior Advisor, Office of Science and Technology

EPA Personnel Conducting the Interview: Roger Cortesi, Carl Gerber, Tom Pheiffer

Scientific and Technical Issues

There is a need for all areas of scientific and technical data, technical assistance and support, risk assessment, scientific and technical assessment, quality assurance, peer reviews, and scientific and technical review of proposed regulations.

Industry now provides data because there is no in-house capacity for technical work.

Work with Other Laboratories

Work with the Health Effects Environmental Research Laboratory at Research Triangle Park (RTP) on mechanisms of carcinogenicity and mechanisms of toxicity; risk assessment work is done at Cincinnati.

OW works with the laboratories to drive technologies; health effects research is limited by the money that ORD has.

OW has worked closely with laboratories at Ada, Duluth, Corvallis, Athens, Narragansett and others; more scientist-to-scientist communication is needed.

The formal ORD research planning process is not helping the OW mission, but working directly with the people at the laboratories who are interested in the issues has made a difference.

Resource constraints limit interactions with ORD laboratories, since the laboratories have not had enough ORD funds to provide the technical assistance needed by OW. Perception is that ORD has a hidden agenda to move resources into more general areas.

Access to Data

OW needs to develop methods to measure and identify microbiological problems (needs are identified, funding is not) and to develop indicator methods.

Long-Term Data Needs

Perhaps funding for short-term research and basic and applied research could be separately identified; EPA may cut back on some areas, but it should not eliminate anything (e.g., microbiologists).

With many needs, how should priorities be set?

OW has felt excluded from the decision process.

Changes in Function and Structure

Each region should have a laboratory capability, but the question is, do they need to have the same capability?

Regional laboratories should be looked upon by the states as supplements to what the states can do.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 15 December 1993

Person Interviewed: Scott Fulton, Deputy Assistant Administrator for Enforcement

Others in Attendance: Earl Devaney

EPA Personnel Conducting the Interview: Roger Cortesi, Tom Pheiffer

Scientific and Technical Needs

The National Enforcement Investigations Center (NEIC) is used to support the development of criminal cases. EPA has a memorandum of understanding with the FBI to provide them with technical assistance. Evidence development must be performed in government laboratories, even if agencies have to share laboratories. NEIC needs multimedia inspectors trained in how to design and implement sampling plans.

How Well Are These Needs Being Met?

The number of criminal cases has doubled in the past two years and continues to increase rapidly. The capacity at NEIC has been reached, and the regional laboratories have to handle some of the workload. This introduces the potential problem of having eleven protocols which may lead to the lose of cases. Because of the capacity problem, the FBI is turning to state and contract laboratories. The FBI have considered setting up their own laboratory because they are very concerned about using a variety of laboratories.

Changes in Function and Structure

To meet the need for capacity, bring the regional laboratories up to NEIC standards and put greater reliance on the regional laboratories. Give NEIC the authority to have more formal relationships with the regional laboratories and improve communications. NEIC needs to be under enforcement. Through the recent Office of Enforcement reorganization, they are trying to do better strategic planning.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 25 February 1994

Person Interviewed: Lynn Goldman, Assistant Administrator, Office of Prevention, Pesticides, and Toxic Substances (OPPTS)

EPA Personnel Conducting the Interview: Roger Cortesi, Bettina Fletcher, Carl Gerber

Scientific and Technical Issues

Scientific and technical data are extremely important to OPPTS. There must be good data generated with approved/certified methods., as well as a place to test these methods. Moreover, there is a need for methods capable of rapid testing of multiple pesticides. The health effects of multiple pesticides are not thoroughly understood as there may be both additive and contradictory effects.

There is also a need to address the assessment of household exposures to pesticides. Although risk assessment techniques are improving there should be more efforts placed on understanding noncarcinogenic effects and non-health risks such as risks to endangered species and the ecosystem. This would translate to providing registrants of new pesticides with better guidance on assessing ecological risks.

How Well Are These Needs Being Met?

OPPTS has had good experience with the ORD laboratories, in particular the laboratory in Las Vegas, NV It does not the environmental services laboratories as much. OPPTS relies on ORD to develop test techniques.

Changes in Function and Structure

There are problems with mixing research activities with support services. Usually, there is preference for research work and clients needing services are made to feel unwanted. On the other hand, when it comes to budget cuts, R&D is the first affected because it is undervalued and not readily understood. To protect research, it must be in an organization separate from the services group.

Collocating state and EPA facilities may have some merit as it will increase collaboration. The concept can also be expanded to include other federal agencies such as the FDA. However, it must be understood that collocation does not necessarily mean sharing use of equipment. People don't want to have others use their equipment. Hence, sharing of equipment should not be considered as the driving force for laboratory consolidation.

Program offices do not have time to do independent research, but it is difficult to get into ORD's priorities. Thus, a joint process is needed. Scientists need to have a long-range view of the programs and an awareness of where the programs are going. Currently there is a disconnect between science and policy. This affects the planning for research.

Program and research relationships work when you have good people. Rotational assignments are needed to give the staff opportunity to be competent in both technical and policy matters.

Excellent science in the Agency is not very visible. The Agency should showcase its scientific expertise. More successful researchers should be given higher profile and visibility (the peer review process helps in this regard). The Agency should move away from measuring performance in terms of activities (e.g., no of permits granted). In addition, better ways should be explored for linking EPA research activities with those being performed at other federal agencies.

Future Scientific and Technical Needs

There is a strong push towards developing lower risk agents (pesticides). However, work on this area is not thoroughly planned. Regulating multiple pesticides can become a logistics nightmare. More basic scientific studies on the effects of multiple pesticides are needed.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 24 February 1994

Person Interviewed: Ann Goode, Acting Assistant Administrator for Air and Radiation

EPA Personnel Conducting the Interview: Roger Cortesi, Carl Gerber

What EPA Should Be Doing?

Because of equipment needs and the resources being spread over so much, EPA can't monitor industries. EPA needs to coordinate the laboratories and set goals for them. It should provide some sort of balance between what is critical and what is more long term and do strategic planning.

A collaborative process for setting agendas is critical. The Office of Air and Radiation does both top-down and bottom-up reviews. We look at developing goals based on the planning process, hoping for more futuristic thinking. The Agency needs to collectively think ahead. The regions should include states in the planning process.

Research Needs

I am not sure that research needs have been articulated. Before 1990, this office was focused on just getting the regulations for the Clean Air Act. We are just now recognizing the problems. EPA not been effective in developing a research agenda that will enable us to make tradeoffs between economics and other goals.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 7 February 1994

Person Interviewed: William Hunt, Branch Chief, Monitoring and Reports, Technical Support Division, Office of Air Quality Planning and Standards

EPA Personnel Conducting the Interview: Roger Cortesi, Bettina Fletcher, Carl Gerber

Scientific and Technical Issues

The EPA laboratory system is essential is an essential component of the national air monitoring program. Past work by the EPA laboratories has helped achieve the "best data set in the world" of ambient air quality. This data base is essential in developing air strategies as well as in taking enforcement actions.

One of the vital, day-to-day activities involves the Federal Records and Equivalance Program. This lab-based activity acts as the "court of last resort" in resolving technical issues and challenges from the states and other public monitoring as well as from private parties, and in helping maintain a high quality of monitoring activity. This activity is related to how quality assurance of the monitoring network is to be maintained. This is not a formal function of ORD, yet it is in ORD that much of the monitoring expertise resides.

How Well Are Current Needs Being Met?

One area requiring additional effort is the need for improved capability in measuring VOCs in relation to attaining the ozone and meeting the ozone standards. However, the current ORD support for this effort is too little, evidently as a result of competing priorities.

In another area, Title III requires that a research air quality network be developed. However, while this is an ORD responsibility, only one station has been developed to date.

Changes in Function and Structure

The current method of setting ORD priorities using the Research Committee system requires a heavy investment of time, but has not so far been successful in setting more appropriate research priorities.

There appears to be a fragmentation of responsibilities in AREAL for monitoring. A reorganization that would concentrate such activities into fewer entities would assist.

Other Concerns

Many of the ORD research staff are in the 50-year old age range. There is widespread concern that in a few years there will be a relatively sudden loss of experience across ORD. It is essential that steps be taken to develop a younger generation of researchers.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 6 April 1994

Person Interviewed: Floyd Kefford, Director, Bureau of Laboratories, Pennsylvania Department of Environmental Resources

MITRE Personnel Conducting the Interview: George Bizzigotti

George Bizzigotti met on 6 April 1994 with Mr. Kefford, Samuel Harvey, and Paul Baker of the Pennsylvania Department of Environmental Resources (PADER).

The PADER officials noted that there was a meeting of state laboratory staff every six months in Region 3. They indicated that they saw the Regional laboratory location in Annapolis, MD as very convenient for all the states in the region except West Virginia. Annapolis is within 300 miles of Harrisburg, and travel costs generally do not exceed $200.00; these are thresholds that require approval at higher levels in the Pennsylvania State government. If travel funds are limited, the trip to Annapolis and back can be made in a single day. Annapolis is a medium sized city, so a variety of accommodations are available at a reasonable price. The PADER officials stated that prices would be too high in a large city, whereas choice would be limited in a small town; Annapolis is an attractive compromise between the virtues of urban and rural areas. Finally, they stated that there were no perceived disadvantages to the current location.

When asked whether obtaining services from other regional ESD laboratories would affect their programs or projects, PADER officials indicated that they currently have a mobile laboratory program that is supported by the Region 2 laboratory (where mobiles laboratories are a specialty area) because Region 3 lacks this capability. They pointed out that given state restrictions on travel funds, it would be impractical for them to travel to any EPA regional laboratories other than those in Regions 2 and 3. They believed that they would lose a long-term close working relationship if forced to obtain services from another laboratory. They would favor the development of ESD laboratory areas of specialization in areas which they perceive are currently under-supported, such as air and radiation analyses.

PADER requests support from the EPA regional laboratory on a peer-to-peer basis. Depending on the scope of a problem, PADER staff may contact laboratory staff directly (e.g., for discrete problems of limited scope), or the Mr. Kefford will contact the laboratory director (e.g., for broad problems of less well-defined scope).

PADER does not provide any funding for regional laboratory operations (except for the training cooperative described below).

EPA regional laboratory does not solicit feedback from states concerning the services they provide.

Scientific and Technical Issues

PADER officials were dissatisfied with EPA policy concerning the following technical issues:

- Regulations that specify "home-built" laboratory apparatus that is not widely available
- Regulations that do not allow the use of improved technology (e.g., ICP-MS instruments).

- Regulations that specify different methods to do essentially the same analysis for different EPA programs

- The required use of CFC-113 in the method for oil and grease analysis. Production of this solvent is being phased out under environmental treaties, but the program cannot agree on a replacement.

- EPA-required methods that conflict with EPA pollution prevention initiatives.

PADER officials expressed the opinion that there is not enough communication between EPA programs and analytical services providers, especially between those charged with obtaining environmental samples and those charged with analyzing the samples. They noted that regulatory methods are often not consistent between programs and that the state of the analytical art may be incapable of meeting certain regulatory requirements. They also pointed out a perceived lack of awareness within the region of work being performed at the EPA program and Office of Research and Development laboratories which has led to an inability of the regional laboratory to provide the desired support to state air and radiation analytical requirements.

PADER officials said EPA regional laboratories could provide the states better services by better keeping up with technology. They noted that state and commercial laboratories often have more recent technology than the EPA laboratory does, which impairs EPA's ability to provide up-to-date expertise.

How Well Are These Needs Being Met?

PADER officials indicated that the EPA region 3 laboratory was not responsive to the state's needs. They believe that this is a direct result of heavy reliance on contractors; EPA personnel "just don't run as many samples as they should to have the expertise" to provide expert technical assistance.

Changes in Function and Structure

PADER officials suggested that the regional laboratories should make less use of contractors. They believe that regional personnel are burdened by contract management responsibilities, and have lost technical capabilities as a result. EPA personnel should perform more of the routine laboratory work so that when states encounter a problem they can contact an EPA worker with expertise and experience in performing the analysis.

PADER officials expressed a preference for EPA laboratories split into a service component and an R&D component under a single administrative entity. They believe that this will improve their access to work now being conducted in program laboratories (e.g., air). PADER officials also believe that EPA should unite analytical and sampling groups under the same administrative entity. They suggested that all EPA laboratories should report to a single entity which should be able to raise the level of visibility of analytical functions relative to sampling or programmatic functions, so that analytical requirements are considered when regulations are promulgated. They stated that there is a need for a single entity, because there should be a single analytical "voice" from scientists who are actually using methods on a day-to-day basis; that voice should be heard when developing regulations to improve the consistency between regulations. They repeated on several occasions their belief that EPA staff who develop analytical methods are not responsible to the eventual users of those methods.

PADER officials pointed out that there is a coalition of practicing state laboratory scientists that meets on the regional level. This group has succeeded in raising analytical concerns and have influenced regional programs. They pointed out that there is currently no national level EPA group that meets to discuss analytical methodology and laboratory operations. PADER believes that there should be a national forum of state environmental laboratory scientists to communicate such concerns at the national program level. This would represent a change in the current top-down regulation of analytical methodology.

What the Agency Should Be Doing

PADER officials stated that the following functions should be available at the EPA regional laboratory:

- Support state quality assurance programs

- Provide analytical capabilities for high cost/low volume analyses, such as transmission electron microscopy (for asbestos) and high-resolution gas chromatography/mass spectrometry (for polychlorinated dibenzodioxins and furans). PADER officials maintain that it is not cost-effective for individual states to maintain such capabilities.

- Share expertise in and the capability to perform all EPA-promulgated analytical methods

- Provide training in state-of-the-art analytical technology. PADER officials pointed out that Region 3 has a training cooperative, under which each state provides funding and input concerning topics of interest, and EPA administers the training program based on the priorities expressed by all the states. This enables the states to obtain training more cost-effectively than they could do individually. The state funding entitles each state to provide input on the training priorities and to send their staff to training sessions.

- Provide technical assistance for analysis of samples which prove difficult to analyze using standard methods, such as analysis of kepone and mirex in fish.

- Provide technical support in analysis of air samples. PADER officials stated that the EPA Office of Air laboratory in North Carolina has this capability, but there appears to be little interaction between program and regional laboratories.

PADER officials stated that they did not want to have EPA contractors provide analytical services because contractors could go to work for the regulated community. PADER believes that government employees should perform analyses, because the governmental employees provide institutional memory independent of contract awards, as well as specific areas of expertise.

PADER officials believe that training could be contracted out, but should still be coordinated by the EPA. They pointed out that contractors are often more expensive for analytical work because of the added overhead and rigidity inherent in the contracting process. They believe that a significant amount of experience is usually lost when contracts change.

Future Scientific and Technical Needs

PADER officials reiterated the need for analytical capabilities for asbestos and dioxins in drinking water. They also stated that the region will need to develop a program to certify state drinking water laboratories so that they in turn can certify other laboratories, as required by regulation. PADER is currently operating under a waiver of the state certification requirement.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 20 December 1993

Person Interviewed: Walter Kovalick, Acting Deputy Assistant Administrator, Office of Solid Waste and Emergency Response

EPA Personnel Conducting the Interview: Roger Cortesi

Others in Attendance: Thomas Pheiffer, Bettina Fletcher

Scientific and Technical Issues:

Budget for meeting EPA science needs will not grow and will never be enough to meet needs.

Insufficient coordination and connecting of the work done at each laboratory

In the area of establishing method equivalency, there is no one uniform process that is being followed at EPA. For example, the Office of Air has a more formal method for establishing equivalency while this is done more informally for Superfund sites.

Lead responsibilities in the development of new technologies must be assigned to the regional offices. For example, action on requirements for pollution monitoring happens in the enforcement side (permitting or cleanup action) of the process. The region's involvement (through meeting user's needs) comes too late. They have no input in defining the requirements.

Long-Term Data Needs:

ORD data requirements are mostly driven by regulations.

OSWER relationships with the regional laboratories are primarily in support of Superfund sites. One important contributor to technical support success is that OSWER pays for the laboratory's services to them (presumably this leads to better issues/needs definition and accountability).

Access to Data

Need an agency-wide system for getting information, e.g., determining equivalency of new treatment methods with known and already accepted methods. [The Superfund program appears to be the only one with a system for new methods development that works, but results don't get spread around the agency.]

Changes in Function and Structure

A structure is needed to allow the agency to co-plan and co-execute scientific endeavors with other federal agencies, such as NOAA, USGS, etc.

It may be useful to consider removing the engineering research functions from ORD and creating research centers as part of the program offices or use the "Centers for Excellence" concept for regional laboratories with clear accountability for meeting the agency's science research needs.

What the Agency Should Be Doing

Agency should consider establishing environmental research as a separate discipline, but simila to the NIH model, to focus mainly on research without worrying about specific outcomes or outputs. [ORD does not cultivate a wide body of research efforts.]

Other Comments:

The technical support system is working very well, especially with Superfund activities.

"Selective networking" seems to be the norm of doing buisness. [this can lead to underutilization of the laboratories' capabilities.]

The program offices are "disenfranchised" by ORD's issue planning process. The task of coordinating issues is a nightmare. ORD deals with too many issues, many of which are disconnected from OSWER's needs.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 17 December 1993

Person Interviewed: Jerry Kurtzweg, Director, Office of Program Management Operations, Office of Air and Radiation (OAR)

EPA Personnel Conducting the Interview: Roger Cortesi, Tom Pheiffer

Scientific and Technical Issues

This office develops strategic plans and budgets for the Office of Air and Radiation (OAR) and reviews various inputs from other program offices within the context of the OAR policies. This office also participates in standards setting, guidance development, and regulatory rulemaking.

OAR has its own laboratories for mobile source research, development, testing, and evaluation. OAR also does research in radiation, both nuclear and electromagnetic.

Lack of resources is a problem. It forces OAR to focus on the most pressing needs while other needs are deferred. The Clean Air Act imposed several new research or standards development requirements. For example, the Ann Arbor laboratory is only working on Phase I standards. They currently don't have the funding or staffing to work Phase II and non-vehicle emission standards.

OAR has difficulty keeping testing equipment up to date in laboratories. This is especially a problem with newer standards that are exceeding current technology capabilities. It is also important to keep abreast and maintain credibility with the regulated industries.

Work with Other Laboratories

OAR receives some support from ORD, mainly in the areas of stationary sources and in development of criteria documents for ambient air standards. They also look to ORD for some new methods and instrumentation, particularly for ambient and stationary source monitoring.

Changes in Function and Structure

Currently, there is a tension between research needs and program support needs. These areas should be separated with research guided by legislative requirements. The development of monitoring instrumentation should be somewhat insulated from program demands. However, standards development needs closer ties to programs.

EPA must decide if it wants to have a world-class laboratory system for a few things or a less-than-world-class system for a lot of things. EPA must have capability to do research, development, testing, and evaluation in some areas, but maybe not all.

Future Scientific and Technical Needs

OAR requires resources to upgrade facilities and equipment in order to maintain parity with capabilities of manufacturer's laboratories and to ensure continued compliance with increasingly stringent emission standards.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 15 February 1994

Person Interviewed: Stan Laskowski, Acting Regional Administrator, Region 3

Others in Attendance: Greene A. Jones, Environmental Services Director, Region 3

EPA Personnel Conducting the Interview: Roger Cortesi, Bettina Fletcher, Tom Pheiffer

Scientific and Technical Needs

In general, the regional laboratories do a fine job.

Programs need support information from the labs. The D.C. water supply problem is a good example. The current test for detecting cryptosporidium takes about 48 hours. A more immediate analytic technique for detecting cryptosporidium would permit more real time decision making.

In the area of air toxics, there is a need to project and assess the combined impact of a suite of air pollutants over time on a population group. This is especially relevant in terms of environmental justice issues. What is the impact on children, sensitive groups, or minority subpopulations of different contaminants?

Non-cancer health impacts continue to be an area of research need.

Standard methods for substances that are being regulated need to be developed Include a mechanism to establish equivalency between methods used by the Federal labs and those used by state labs. Need a sound and scientifically supportable data base for decision making.

Establish a centrally located expertise that could be available continuously to respond to health emergencies at any location in the country.

Changes in Function and Structure

It is not obvious that a great restructuring of the lab system is needed.

The existing distinction between the ORD labs and the ESD labs should be maintained. These organizations fulfill fundamentally different functions.

ORD research should be more oriented to the real world, it should be motivated by the requirement to respond to regional needs–Q/A, sampling, compliance monitoring. The feeling in the region is that ORD is a hard system to crack to get the methods needed.

Taking action on customer feedback may be more useful than any organizational restructuring effort. ORD should improve its customer orientation and view the region as a customer. An ongoing customer survey would provide ORD management with continual feedback on status, relevance, and quality of ORD products.

Nonetheless, ORD has been very helpful on a variety of issues including biodiversity and wetlands.

Geographical orientation is not the issue. We can keep in touch through electronic communications. On the whole, if the need and service can be matched with a nearby laboratory, it would be preferable to use the nearby facility, but there is not enough distinction to justify a reorganization along geographical lines.

ORD should be pursuing innovative technological solutions that could provide big leverage if a breakthrough is achieved.

There is a tradeoff between establishing large central labs, which can offer efficiency in mass production, and maintaining smaller more localized ones, which are closer to their customers. Currently, lab directors have a good relationship with their customers.

Some regional labs have developed specialties to reflect particular needs in their region. These specialties are a resource for the entire agency. There should be a way to budget for and access these resources without being penalized.

The regions should have a core base of positions that they can dedicate to the ESD labs over time. Say, a fixed core of positions with a five-year guarantee of stability would avoid the annual bloodletting.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 13 December 1993

Person Interviewed: Susan Lepow, Associate General Counsel for Water

EPA Personnel Conducting Interview: Roger Cortesi, Bettina Fletcher, Carl Gerber, Tom Pheiffer

Scientific and Technical Issues

Scientific and technical data in support of rulemaking must be prepared well enough to hold up in court, and timeliness of the availability of data is critical to meet court schedules. EPA is obliged to move ahead on cases based on the data that are available. Quality assurance records are often requested, and if requested, they must be presented and stand up to challenges.

How Well Are These Needs Being Met?

Needs for high-quality data on time are being met better today than in the early 1970s when poor data and sloppy records resulted in loss of many cases.

Changes in Function and Structure

More emphasis on planning and establishing priorities would be helpful. The Office of General Counsel (OGC), Assistant Administrator for Water (OW) and ORD need to become involved early in the process. ORD labs need to understand that once the court schedules are set, they must be met. Going back for time extension is more difficult than initially setting a realistic schedule and can result in a hostile court environment. Missing court deadlines has also led Congress to issue an increasing number of statutory deadlines.

Future Scientific and Technical Needs

Data needs in the future will be similar to those of the past, but industry is becoming more sophisticated in its challenges. Therefore, the sufficiency and quality of the data will have to improve if EPA is to meet more stringent challenges. In addition, it is becoming increasingly important to articulate the benefits of the rule to decision makers and to have technical support for these benefits. EPA needs to develop pollution prevention technologies since industry has not been very innovative in this area. Environmental justice and equity are gaining attention and will lead to a need for new and additional types of data.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 16 December 1993

Person Interviewed: Henry Longest, Director, Office of Emergency and Remedial Response (Superfund), Office of Solid Waste and Emergency Response (OSWER)

Others in Attendance: Larry Reed, Director, Hazardous Site Evaluation Division; Hans Crump-Wiesner, Chief, Analytical Operations Branch

EPA Personnel Conducting Interview: Roger Cortesi, Bettina Fletcher, Carl Gerber, Tom Pheiffer

Specific Scientific and Technical Needs

- Support is being obtained from the Ada laboratory on hazardous waste in ground water.
- The Duluth laboratory is needed for its expertise in cold water fisheries.
- Guidelines for risk assessment are needed.
- The top issue is risk—not health risk, but more ecological risk, fate and transport. Help is needed in basic long-range science, especially ground water research

Work with Other Laboratories

- The Analytical Services Advisory Committee can help determine roles of laboratories.
- Method development is performed by the Environmental Monitoring Systems Laboratory (EMSL/Cincinnati).

Changes in Function and Structure

- PA needs its regional laboratories, and they should report to an Assistant Administrator.
- Superfund does not need its own laboratories; preference for EPA staff, but no funds available.
- Smaller regions need to be able to link to other laboratories.
- A combination of the regulatory laboratories with other laboratories, into a centers-of-excellence structure should be considered; there should be a unification of functions, such as methods and QA/QC development to serve all programs.

Data Quality

- Environmental Services Division laboratories review data on sites and direct support to CLP.
- If laboratory contracts out work, the number of federal full-time employees (FTEs) is reduced.
- The expansion of laboratory certification will increase data quality. The contract laboratory program (CLP) is an indirect QA/QC program, and makes a bad contractor easier to spot.

What the Agency Should Be Doing

- Develop a new priority pollutant list.
- Develop and apply new technologies to Superfund sites (cluster concepts, lead and toxics, groups of related chemicals).

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 21 December 1993

Person Interviewed: Jack McGraw, Regional Administrator (Acting), Region 8

Others in Attendance: Kerry Clough, Deputy Regional Administrator (Acting), Region 8

EPA Personnel Conducting Interview: Roger Cortesi, Bettina Fletcher, Carl Gerber, Tom Pheiffer

Specific Scientific and Technical Needs

- Region can't contract for laboratory support.
- Major concerns: water activity, protocols, equipment, capacity under drinking water standards

Access to Data

- Needs are being met well now.
- Good production-oriented data from all laboratories, inside and out.
- Are we getting good quality at a good cost?
- Are we running too many parameters for the level of decision?
- ORD laboratories are research institutions; they address tomorrow's problems.
- ESD and National Enforcement Investigation Center (NEIC) address today's needs.

Data Quality

- There is no question on data quality, but there may be vulnerability.
- Samples are taken by contractors under direction of a government employee.
- A government employee decides where samples are to be taken.

Changes in Function and Structure

- ESD has QA and monitoring responsibilities around the country.
- NEIC would like to do all their analyses themselves.
- Regional laboratories should have expertise in some particular area.
- ESDs would have more stature under an assistant administrator.
- The regional scientist program could be the focus of the centers of excellence to show the regional chemists new techniques.

Work with Other Laboratories

There is almost no relationship with other laboratories.

Long-Term Data Needs

- Bioassay
- Risk assessment
- Research in real-time for air monitoring
- Definition of data needs for Superfund's new, long-term contracting strategy

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 15 December 1993

Person Interviewed: Richard Morgenstern, Assistant Administrator for Policy, Planning and Evaluation (OPPE)

EPA Personnel Conducting Interview: Roger Cortesi, Bettina Fletcher, Carl Gerber, Thomas Pheiffer

Scientific and Technical Issues

OPPE has cross-cutting responsibility, dealing with air, water, waste, and global climate. The work of this office rarely relies on original data nor does it design experiments; rather, it is usually involved with extracting some existing scientific data to derive policy information. Most of the office's current information needs involve a quick response

OPPE has a climate program that needs scientific support. The program has attempted to coordinate with ORD in the past, but the results have been uneven and the support ineffective. Specification of information needs by this office to the laboratories is limited. However, OPPE does have considerable contact with the mobile source laboratory in Ann Arbor, in particular.

Long-Term Data Needs

OPPE tries to identify decisions that may be required in the future and to project what data will be required to inform these future decisions. An example may be the long-term damages of global warming, particularly the scope of the consequences and the need for better information on the possible damages. ORD seems to be slow in responding to this need. In areas where ORD is not the leading research entity, ORD may more effectively apply its resources in results analysis rather than toward developing the research itself. OPPE would benefit from research results on problems we define now, even though the research may not yield results for more than two years. There is not a high payoff for OPPE to influence short-term focused decisions.

The primary client for specific media research will always be the respective media office. However, in the climate area, OPPE is becoming a major client of the Air office.

Access to Data

OPPE is fairly adept at using contractors, and cooperative and interagency agreements to acquire timely information, although the contracting problems often interfere. The office relies on the same mechanisms to ensure the reliability of data acquired in this way as it does for internally derived data, i.e., largely formal and informal peer review processes. Occasionally, OPPE will rely on a laboratory employee to contribute to a peer review if that individual is in possession of a particular expertise.

Changes in Function and Structure

Because EPA has 38 laboratories, there must be some mechanism to inform all offices throughout the Agency about what is going on at these facilities. Perhaps new information technologies might facilitate that communication; using the internet is one technology that might help.

OPPE is not especially aware of what is going on in the regional support laboratories. This is symptomatic of a broader problem that relates to the sheer amount of activity undertaken in the laboratory system. OPPE personnel could spend a disproportionate amount of their time coordinating with all of the laboratories just to stay abreast, rather than making progress toward accomplishing the specific objectives of the office, that is, developing policy guidance.

The laboratory system needs to provide an accountable mechanism for expression of the needs of the office both in the 6-month and the 2-year timeframe. This is now accomplished through an informal process.

What the Agency Should Be Doing

- EPA needs to define its expertise and specialize in it.

- ORD should be technically knowledgeable and policy-relevant. ORD work should have a policy link without sacrificing technical quality.

- Several long-term programs (e.g., EMAP and NHEXAS) are apparently resource-intensive, but may be developing data that is in need of a client. Some of this information may or may not be of use in the future since a great deal is already known about health impacts.

- The federal work force is accountable and responsible to the public and the taxpayer; their motives are not compromised by private gain incentives.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 10 March 1994

Person Interviewed: Jean Nelson, General Counsel

EPA Personnel Conducting the Interview: Roger Cortesi, Tom Pheiffer

Needs of Office of General Counsel

As the lawyers for the agency, with the regulatory issues and lawsuits that arise from that, we are dependent on a good, sound science base for what we do. We focus on information being solid and timely. The timeliness is important for the creditability of the agency. The lawyers are responsible for faithfully executing the laws and meeting the deadlines. We are dependent on you all doing as much as possible up front in a timely manner. Our credibility with the court system and the lawyers that go up against us, and the public, is lessened by being late. Timeliness is one of the most important factors.

There are two separate parts of the science question. One is, do you have the data you need to make the decision? The second point is, when studying a case, it seems that you would like to know two things--that all the relevant data have been looked at and is it sound science? I am more focused on the second point and whether that is a high enough standard. One of the things that we have identified in terms of meeting the perceived needs of our clients in the agency is that maybe we need more exchange with ORD as a client.

We are so dependent on the record that is built, and our work is dependent on timely science on the record. The work must be defensible. The courts still give a fair amount of deference to the agency if we can show that there is a good basis for the information.

We worry that we spend a lot of time being rule writers, and we could spend more time on the up front work if we didn't have to spend time correcting the English. If the goal of the agency is to have quality rules, then we should do back end as well as front end work.

RC - Explaining why you did what you did is very helpful.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 14 February 1994

Person Interviewed: Margo Oge, Director, Office of Radiation and Indoor Air (ORIA), Office of Air and Radiation (OAR)

EPA Personnel Conducting the Interview: Roger Cortesi

Mr. Cortesi provided some background on why this interview was conducted, and agreed to allow the interview to proceed outside the planned agenda.

Scientific and Technical Issues

ORIA would like to have the benefit of ORD experience in the areas of modeling, risk assessment, guidelines for QA and QC, and methods standardization. Guidelines for QA and QC should be provided by ORD for other labs to follow.

How Well Are These Needs Being Met?

ORIA would like ORD to play more of a role in the radiation program. They feel that ORD currently provides no support to ORIA so that the program office has had to do their own work. ORIA finds it troubling that ORD has no capacity for peer review of program office science, stating that ORD has disinvested in this area during the last 10 years.

ORIA is developing radionuclide cleanup standards under the Atomic Energy Act, and also needs QA/QC support for this activity. ORIA believes that ORD has the necessary depth and breadth of scientific knowledge for this task.

ORIA is also responsible for the indoor air program and would like ORD research in certain areas of this program, especially the area of multiple chemical sensitivity. ORIA's needs in the indoor air area run more towards research than to program support. The regions are not doing much work in this area. Generally, ORD support for indoor air has been good.

ORIA has 2 field facilities in Montgomery, AL and Las Vegas, NV supporting their program. Both facilities evaluate the proficiency of independent radon measurement contractors and radon measurement kits. This evaluation has become a de facto certification program, as it is often required by state governments. Both facilities provide support for rulemaking and for Superfund. The Montgomery facility has emergency response monitors of background levels in air, water, and milk. Montgomery does not have enough capacity to analyses for the regions and states under Superfund; both staff and funding are limiting factors. Private sector capability is difficult to judge because of the lack of standard methods and QA/QC procedures.

ORD once supported radon remediation, but that is being defunded. ORD provides no support for non-ionizing radiation.

Changes in Function and Structure

ORIA does not understand how ORD makes decisions concerning their priorities. ORIA believes that program offices should be given more information about ORD's priority-setting process; they don't know whether they could do it better because it's such a mystery to them.

ORIA suggested asking how we get a faster response (much less than 2-3 years) center of excellence in ORD.

What the Agency Should Be Doing

ORIA believes that spending on research for the indoor air program should be higher than $8 million.

ORD has provided good support in the area of radon risk assessment, serving as a referee between the program office and other agencies. ORIA hopes that ORD will play such a role more often.

ORD should set aside some FTEs for radiation.

Future Scientific and Technical Needs

- Framework for QA/QC (similar to that for the drinking water program)
- Increased capacity for analytical work (mostly Superfund; this is necessary because there is no certification for radiation labs and the quality of results from commercial labs has been poor)
- Technical support for cleanup standards review under the Atomic Energy Act for oversight of DOE work
- Research on multiple chemical sensitivity and mixtures for indoor air (joint action with ATSDR and DOE)
- Indoor radon study (similar to the work on second-hand smoke)

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 11 March 1994

Person Interviewed: Robert Perciasepe, Assistant Administrator for Water

EPA Personnel Conducting the Interview: Roger Cortesi, Bettina Fletcher, Carl Gerber

Scientific and Technical Issues

The Agency is focused on chemistry, but the water program is focused on biology. They should have predicted the cryptosporidium crisis and have had the scientific knowledge to respond quickly.

If EPA gets the states to take responsibility for more activities, the Agency must provide them guidance to assure consistent, high quality activities.

The quality and quantity of scientific data available for rulemaking decisions varies from rule to rule implying room for improvement.

Changes in Function and Structure

It is appropriate for the Agency to contract out science to the experts, but the Agency should not be in the position of having to rely on consultants. The Agency should guard against losing the in-house ability to judge the science conducts for it.

Future Scientific and Technical Needs

- An emerging need is for ecosystem indicators.
- The agency needs more expertise in microbiology.
- Science should be driving the regulations, but currently regulations are ahead of the science.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 17 December 1993

Person Interviewed: William Rice, Regional Administrator (Acting), Region 7

Others in Attendance: Charles Hinsley

EPA Personnel Conducting Interview: Roger Cortesi, Bettina Fletcher, Carl Gerber, Tom Pheiffer

Scientific and Technical Issues

The regional ESD supports a variety of activities within the region, including sample collection and analyses, field investigations, program support, and state laboratory capacity development. Region 7's ESD also conducts removal actions under the Superfund program.

The Laboratory Study needs to distinguish between the roles of the regional ESDs and the ORD laboratories. ORD has charter to do research in certain areas regardless of program needs. This sets up a tug-of-war between programs needs and research needs. The regional ESDs, on the other hand, *must* support program functions in the regions.

The regional administrators need to have regional ESDs, particularly for quick response to environmental emergencies, for example, such as the recent Midwest flooding. Having people in the laboratory with field experience allows them to respond quickly and confidently to incidents. It also allows better communication and control.

Also, having experienced laboratory personnel in the regional office allows them to do better QA of data and to aid states in developing their QA plans. Also, it helps them to develop analytical capacity and expertise in the states.

The regional ESDs also have a role in enforcement. ESD personnel perform inspections, train inspectors, conduct sample analyses, and testify in court. Region 7 believes it gives EPA added credibility in court to have experienced and knowledgeable laboratory and field personnel. The attorneys are less confident when non-EPA employees are involved in developing a case. Region 7 believes that ESDs could be more useful in enforcement if standardized sampling and analysis protocols were developed and certification, QA/QC, and audit procedures were implemented Agency-wide. The NEIC is not the only qualified laboratory to conduct enforcement analysis. However, for ESDs to increase their enforcement support additional resources would be needed, particularly for criminal investigations.

Work with Other Laboratories

Methods development is important for regional ESDs, especially in areas where technology is changing rapidly. ORD is source for methods development for the region. Methods currently take about 4 to 5 years to develop, which is too long. ORD needs to work with ESD directors to determine needs. Response of ORD to ESD needs is very slow. ESDs appear to be given lower priority and don't have the funds to get ORD's attention.

Changes in Function and Structure

ORD is so technically diverse and geographically dispersed that scientists in the region do not know who is doing what or who they should contact for help on a specific problem. It is becoming increasingly difficult to keep up with all of the activities in ORD. Currently, Region 7 does not have anyone in the ORD regional scientist position and the ORD Technical Assistance Book is not a good means of communicating the capabilities and activities of ORD to regional scientists. A better method for communicating ORD's activities and capabilities to the regions would be to return to analytical work groups to force ORD and regions to sit down and talk about specific issues and needs. There needs to be more face-to-face contact. However, the Agency would have to provide the budget for it, especially travel money.

In response to the suggestion that the regional laboratories might be organized as centers of excellence, they thought that it made a lot of sense. However, currently the regional ESDs have no mechanism for charging clients in other regions or programs for work that they perform. They simply absorb the cost. Under a center-of-excellence concept, a resource-trading mechanism would need to be found.

Future Scientific and Technical Needs

- Better explanation of basis for regulations. Need to put science in understandable context for states and public.

- Better ways of treating ground water where it is not necessary or possible to clean up contamination to a pristine state

- Lower cost of pollution control for small communities

- Guidance to allow communities to make risk decisions on their own

- Better comparative risk analysis techniques—more information needed before regions can talk to states about this

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 21 December 1993

Person Interviewed: John Seitz, Director, Office of Air Quality Planning and Standards (OAQPS), Office of Air and Radiation (OAR)

EPA Personnel Conducting the Interview: Roger Cortesi, Bettina Fletcher, Tom Pheiffer

Scientific and Technical Issues:

There is an immediate need for further examination of the health effects of PM10, and ozone, and an assessment of the "189" trading scheme.

Testing is accomplished by non-EPA sources, although EPA sources are responsible for inhalation testing.

Ozone modeling capabilities of OAR need to be improved and collaboration with other labs pursued.

An objective, quantitative system is needed to define science and technology data gaps, rank these needs, and facilitate efforts to meet them through prioritized allocation of resources.

Monitoring and long-term work in the area of particulates receive a lower priority.

Long-Term Data Needs

- Multimedia research is essential.
- Ecosystem-wide problems must be examined in a holistic approach.
- ORD should referee the multimedia assessment.
- Criteria and methods for plant and ambient monitoring should be developed.
- Encourage universities and private sector to fulfill long-term needs with EPA providing QA and oversight.

Access to Data

There is no mechanism to permit ready identification and retrieval of useful work and expertise in the lab system nor instruction on how to use it.

OAR coordinates with the NAIHS for information on health-related issues and with DOE for global impact questions.

A strong technical relationship exists with the states through the monitoring networks.

Changes in Function and Structure

- Areas of research must be chosen selectively and outside research leveraged carefully.

- Committee recommendations are overwhelmed by the politics of the process.

- No changes in the ORD structure is recommended; research and program activities have a useful cross-fertilization impact on one another.

- Program labs should be doing testing, certification, and implementation, while research and QA should be centralized.

What the Agency Should Be Doing

- Labs must focus their expertise and do what they do best.
- ORD should ensure that all labs are producing quality data.
- Some ESD labs are good, while others are not so good; on average they perform at about a "C" level.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 28 December 1993

Person Interviewed: Michael Shapiro, Office of Solid Waste

EPA Personnel Conducting the Interview: Roger Cortesi, Bettina Fletcher

Scientific and Technical Issues

- Need to develop partnerships with outside organizations.
- Establish balance between research (ORD) and program needs.
- Need to continue efforts to improve multi-pathway risk assessment methods.
- Massive shift of resources to projects like EMAP is diverting activities in support of program needs.

Long-Term Data Needs

- Fundamental research is needed in support of ozone and PM10 standards.
- Need analytical methods that are species-specific and inexpensive.
- Large amount of work needs to be done in the air toxics program (in support of amendments to Clean Air Act)—monitoring requirements and standards toxic air pollutants that are species-specific; continuous monitoring systems, either remote or in-situ; noncarcinogenic effects of toxic pollutants.

Access to Data

- ORD is not responsive to program needs—can't provide models needed by program office in timely manner.

- Joint technical support centers program is working—provides opportunity for partnering program and research people to address specific problems; center staff act as bridge between program and research staff.

Changes in Function and Structure

- No strong need for major reshuffling of responsibilities.

- Moving the OAR laboratory (in Alabama) to ORD will be burdensome and will achieve no gain in overall research.

- Engineering laboratory at RTP could be shifted to program office laboratory at Ann Arbor—they have same functions.

- Improvements are needed in communicating needs—program office pressured to come up with decisions; hard to get ORD, which is set on quality of science issues, to support program office needs.

- Too many organizational hurdles in translating program priorities to laboratory-level work.

What the Agency Should Be Doing

Strengthen relationships with other federal agencies—DOE is putting lots of money on environmental research; EPA should get leverage for such relationships.

Other Comments:

Risk-based planning is not a tool for restructuring the Agency's work across programs, but it has been useful in day-to-day priority decisions.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 28 December 1993

Persons Interviewed: Robert Wayland, Director, Office of Wetlands, Oceans and Watersheds
David Davis, Deputy Director, Office of Wetlands, Oceans and Watersheds

EPA Personnel Conducting the Interview: Roger Cortesi, Bettina Fletcher

Scientific and Technical Issues

Need to put emphasis on ecosystems

Long-Term Data Needs

- Ecosystem characterization
- Status and trends—to help formulate policies and programs
- Indicators—basic science needed to formulate indicators, such as environmental, management, and monetary indicators, for use in goal-setting
- Routine operations monitoring, e.g., a water quality data system needed to collect and analyze water samples; provide oversight of the state's monitoring process
- Water quality standards and assessments, e.g., meteorological modeling and sampling needed to calculate total maximum daily loads of pollutants
- Management and remediation techniques

Access to Data

Generally good support from other laboratories and research community (e.g., knowledge on restoration technologies provided by ORD's Corvallis and Duluth laboratories)

Changes in Function and Structure

- Broaden ORD environmental research functions—more emphasis on gaining knowledge from basic and applied research instead of purely technical support.
- Enhance creative approaches for networking—currently Corvallis staff networks with other laboratories to address regional needs and advance state of knowledge in certain areas. Also, in the wetlands area, there is a person who serves as liaison so that programs and research efforts are communicated to others.
- Changes needed to eliminate overlap of functions.
- Structural changes needed—issue-based planning process is too elaborate; issues need to be consolidated; there is lack of ownership; process is unwieldy.

- Consider making EMAP a separate entity or integrate it with other ecological programs.

- Research programs should manage the external grants, not a central office (like OER?).

What the Agency Should Be Doing

Risk communication must focus on ecological risks, not just on health risks. Consider market approaches to induce behavioral changes.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 22 December 1993

Person Interviewed: Richard Wilson, Director, Office of Mobile Sources (OMS), Office of Air and Radiation

EPA Personnel Conducting Interview: Roger Cortesi, Bettina Fletcher, Carl Gerber, Tom Pheiffer

Scientific and Technical Issues

This office directs laboratories located in Ann Arbor, Michigan that conduct research, development, testing, and evaluation related to controlling emissions from mobile sources. Laboratories conduct fuels analysis, and automobile and truck testing for compliance with various clean air regulations and standards. They work with the states to improve the states' vehicle inspection capability. They contract out for in-use testing of automobiles. Because they rely heavily on manufacturer self-testing data, they also conduct laboratory correlation studies to ensure that manufacturers are accurately testing their own engines and vehicles. This capability gives EPA leverage with the regulated manufacturers to ensure compliance with regulations. Lack of resources in this area is a problem, particularly for new equipment to support compliance testing.

The OMS laboratories also conduct some development work. The purpose of this work is to test and demonstrate the feasibility of innovative emissions-control technologies. They believe it is much easier to convince industry to add new control technology if they can demonstrate its feasibility first. It is important for EPA to maintain such a capability.

It is also important for EPA to have expertise in certain areas, such as advanced control technologies or health effects of fuel additives, to be able to credibly and effectively explain and defend its positions in developing and enforcing regulations.

Work with Other Laboratories

OMS has working relationship with the laboratory at Research Triangle Park, North Carolina. OMS develops the standards for testing the vehicle. It relies on ORD to develop the instrumentation it needs for compliance testing. A key element in such a relationship is to keep the laboratory focused on the research issues needed to develop a basis for rulemaking. This office does not have much contact with regional laboratories.

Changes in Function and Structure: No changes specifically identified.

Future Scientific and Technical Needs

Funding to purchase new equipment that will keep abreast of the regulated industry is critical. As standards become more stringent and technology advances, access to the latest testing equipment will become increasingly important for ensuring manufacturer compliance with Clean Air Act regulations and standards. The focus in OMS is shifting to research in the area of health effects of fuel additives, such as MTBE and manganese. Data and research are needed in this area. Also, it is important to be able to explain to the public the scientific basis of any future regulations in this area.

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 16 December 1993

Person Interviewed: John Wise, Deputy Regional Administrator, Region 9

EPA Personnel Conducting the Interview: Roger Cortesi, Carl Gerber, Tom Pheiffer

Scientific and Technical Needs

The focus of this region is on operational aspects such as the following:

- Ambient monitoring
- Compliance assessment
- Enforcement case development
- Remedial investigations
- Laboratory certification
- Technical assistance to state laboratories
- Quality assurance

The need for technical assistance to state laboratories is expected to increase over time. The regional laboratory will continue to support regulatory functions and enforcement activities. The state laboratories need the regional laboratory support for audits, methods developing, and capacity building.

How Well Are These Needs Met?

The region's basic needs are being met by the use the regional laboratories and contractors (CLP, ESAT). However, there is increasing concern about CLP contractors' quality not keeping pace, in addition to claims of fraud, and mismanagement. EPA could do the job better, faster, and cheaper. EPA should invest in its own laboratory base for economic improvement and more benefit to the public.

Functional Changes

The Agency needs to improve its planning activities (e.g., sampling plan development, design monitoring, and data quality objectives). People in the field need protocols as guidance to optimize the data-gathering and analysis efforts. A policy directive could increase the use of field screening methods.

Changes in Structure

The suggestion was made to increase state capacity and invest in improving their performance (provide training in new methods, help with quality assurance plans, develop protocols). Then let the states handle wet chemistry and EPA handle the newer methods. An alternative offered was to network EPA regional laboratories with each being the expert or center of excellence in a particular work area.

Access to Data

EPA needs to improve its information transfer capability if its products are to reach EPA's customers. This is a current weakness.

What the Agency Should Be Doing

- EPA should continue to develop methods for competent sampling and analysis in air and water (for ecological risk assessment).
- Better field monitoring techniques should be provided.
- Work should continue on exposure assessments, particularly for children.
- Goals need to be prioritized. Long-term and short-term goals are always competing with each other. The resolution has been compromise at both ends.
- Huge investments are needed in basic research. For years, ORD has been systematically plundered. The whole range of research in the federal sector should be accessed to determine where EPA can make significant contributions and then focus on only those areas. EPA should be preeminent in the environmental research agenda.
- Continued investment is needed in the academic community, which has the responsibility for exploratory research.
- Since regional laboratories don't have their own budgets, they should have a champion in headquarters.

Research Functions Versus Technical Support Activities

A balance is needed between research functions and technical support activities. About 70 percent of funding should go to ORD for fundamental research, while 30 percent should go to technical support. The degree of integration between technical support and laboratory functions varies from region to region, but Region 9 is well-connected to the program office laboratories (e.g., Ann Arbor has helped them develop vehicle emission strategies).

Scientific and Technical Laboratories and Facilities
Interview Summary

Date of Interview: 22 December 1993

Person Interviewed: Gerald Yamada, Principal Deputy General Counsel

EPA Personnel Conducting the Interview: Roger Cortesi, Bettina Fletcher, Carl Gerber

Scientific and Technical Issues

- Transfer and communication of technology—better communication links are necessary.
- A strong, objective research program is needed.
- Need strong science in-house to maintain credibility; current trend seems to cultivate "contract managers" instead of scientists.

Long-Term Data Needs

- Data is needed to support rulemaking and negotiate regulatory schedules.
- Data to support rulemaking is generally adequate; challenge of data very rare.

Access to Data

This office does not get heavily involved in data collection; it relies on program offices to ensure that data is of good quality and reliable.

Changes in Function and Structure

Should EPA reorganize, there should be an Office of Research and an Office of Environmental Economics reporting directly to the Administrator.

What the Agency Should Be Doing

- Need to take a look at the economic impacts of regulations.
- Science must drive the regulatory agenda of the Agency.

Other Comments

- Misrepresentation of academic credentials by EPA employees happens periodically; this raises credibility question for the Agency even though there is nothing wrong with the quality of data.

- Although industry-generated data can be used to support rulemaking, the Agency must review the data and ensure that they are reliable.

- Interagency agreements may be effective means of enhancing EPA's research capabilities, but conflict of interest issue must be addressed.