United States
Environmental Protection
Agency

EPA/600/9-89/070
September 1989

Research and Development

EPA

FY-1990 EPA Research Program Guide

EPA/600/9-89/070
September 1989

FY-1990 EPA Research Program Guide

October 1, 1989 — September 30, 1990

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

Printed on Recycled Paper

Notice

The program descriptions and resource estimates included in this document reflect the latest detailed information available at time of publication. Time will change some of this information. In addition, the resource figures have been rounded off and some smaller programs omitted. For the latest information, you may want to contact the individual listed.

Contents

Introduction 1

How to Use the Program Guide 2

Air 3
- Hazardous Air Pollutant Regulatory Activities 3
- Mobile Source Pollutant Regulatory Activities 7
- National Ambient Air Quality Standards (NAAQS) 10
- New Source Performance Standards and State Implementation Plans 13
- Indoor Air Pollution Activities 16
- Stratospheric Ozone 19
- National Health and Nutrition Examination Survey (NHANES) 21
- Global Change Research 22
- Global Climate Change 24
- Health Effects Institute 25

Drinking Water 26
- Health Effects of Drinking Water Contaminants 26
- Groundwater Research 27
- Ground Water 27
- Drinking Water Technology 28

Water Quality 30
- Water Quality Based Approach/Permitting 30
- Industrial Wastewater Treatment Technology 31
- Wastewater Treatment Technology 32
- Marine, Estuaries, and Lakes 34

Hazardous Waste 37
- Alternate Technologies 37
- Incineration 37
- Land Disposal 39
- Quality Assurance 40
- Releases 40
- Modeling and Monitoring Releases 42
- Waste Characterization 43
- Waste Identification 45

Toxic Chemical Testing/Assessment 46
- Biotechnology 46
- Biotechnology/Microbial and Biochemical Pest Control Agents 47
- Ecology: Ecotoxicity and Risk Assessment 49
- Ecology: Transport/Fate/Field Validation 50
- Exposure Monitoring 51
- Health: Markers, Dosimetry, and Extrapolation 51
- Special Human Data Needs 52

Contents (continued)

Structure Activity Relationships 52
Support for Toxic Substances Control Act (TSCA) 54
Engineering 54
Test Method Development 56
Emergency Planning and Community Right to Know 57
Asbestos 57
SARA Title III 58

Pesticides 59
Biotechnology/Microbial and Biochemical Pest Control Agents 59
Ecology: Ecotoxicity and Risk Assessment 60
Ecology: Transport/Fate/Field Validation 60
Engineering 61
Exposure 62
Health: Markers, Dosimetry and Extrapolation 62
Support 63
Test Method Development 64
Support for Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) Activities 65

Multi-Media Energy 66
Develop and Evaluate LIMB Technology 66
Establish Deposition Monitoring Data Base 66
Estimate Emissions from Man-Made Sources 67
Understand and Quantify Effects on Material and Cultural Resources 67
Understand and Quantify Aquatic Effects 67
Understand and Quantify Terrestrial Effects 68
Understanding Atmospheric Processes 69

Intermedia 70
Manage ORD's Technology Transfer, Regulatory Support and Regional Operations Activities 70
Manage the Mandatory Quality Assurance Program 70
Visiting Scientists Program 72
Exploratory Research Centers 73
Exploratory Research Grants 74
Small Business Innovation Research (SBIR) Program 75
Research to Improve Health Risk Assessment (RIHRA) (Health) 76

Radiation 77
Off-Site Monitoring Program 77
Scientific Support for Radon Program 77

Superfund 78
Provide Techniques and Procedures for Site and Situation Assessment 78

Contents (continued)

Clean-up of Uncontrolled Hazardous Waste Sites Requires Technologies for Response and Remedial Action, for Protecting the Personnel Involved and for Supporting Enforcement Actions 79
Provide Quality Assurance—Superfund Program Requirements 80
Provide Technical Support to Enforcement, Program, and Regions 80
Provide Technical Support to Enforcement, Program, and Regional Offices 82
Hazardous Substance Health, Risk and Detection 82
Hazardous Substances Health Effects/Risk Assessment and Detection Research 83
Superfund Reportable Quantity Regulatory Efforts 84
Innovative/Alternative Technology Research, Development, and Demonstration 85
Evaluate Technologies to Manage Uncontrolled Waste Sites 86
Manage Hazardous Substance Research Centers Program 86
Small Business Innovation Research (SBIR) Program—Superfund 88
Superfund Research Grants 88

Interdisciplinary 89
Consistent Risk Assessment 89
Total Human Exposure 90
Ecological Trends 91

Overview 92

Organization Chart 94

ORD Organization 95

ORD Organizational Descriptions 101

ORD Office/Laboratory Abbreviations 112

ORD Key Contacts 115

ORD Regional Contacts 119

EPA Regional Offices 120

Introduction

The free and open exchange of knowledge both stimulates and provides quality control for the progress of science. This report provides information on the research which EPA is planning for this fiscal year, on how much we intend to spend on each program area, and on whom to contact for further details. More than 60 percent of our research budget will be spent through extramural contracts, grants, and cooperative agreements with organizations outside of EPA's laboratories.

It is our intent to increase the efficiency and effectiveness of this research by placing great emphasis upon open competition for extramural support. We hope that the information in this report will stimulate qualified parties and make their capabilities known to our research managers so that we all might gain from sharing experience and expertise. Please feel free to contact any of the parties listed in this report.

How to Use the Program Guide

The following descriptions of ORD's research program are organized first by media such as air, water, hazardous wastes, etc. These categories are further broken down into research foci such as scientific assessment, monitoring and quality assurance, health effects, environmental processes, and engineering technology. Each description is a very broad summary of the research being done, where that research is being done, who to contact for more information about the program, and both the approximate total funding for that area and the percentage of total funding which is reserved by EPA for in-house research. Funding which is not reserved for in-house research is spent through extramural contracts, grants and cooperative agreements.

For each program description, one or more contacts are listed along with the major research areas to be pursued. For further information, you may call the contacts. Their commercial and Federal (FTS) telephone numbers are listed in a separate section near the end of this report. Where two or more research laboratories are listed, please turn to the "EPA R&D Organization" section of this report for descriptions of the major mission and functions of each.

Some of the research funded for this fiscal year will be done in-house by EPA's laboratories. The rest will be accomplished extramurally. Proposals for funds for research in areas of interest to the agency are welcomed and are considered on a competitive basis. To receive information regarding application procedures for extramural funds, please contact the person indicated in the area of specific interest to you. In addition, approximately fifteen percent of EPA's research budget is used to support long-term exploratory research. Information regarding funds for exploratory research grants can be obtained from the:

Research Grants Program
Office of Exploratory Research (RD-675)
USEPA
Washington, DC 20460
(202) 382-5750

Finally, for further information regarding Office of Research and Development research publications (600/series) or for additional copies of this report, please contact:

Center for Environmental Research Information
USEPA
26 W. Martin Luther King Drive
Cincinnati, OH 45268
CML (513) 569-7562
FTS 8-684-7562

Environmental Engineering and Technology Demonstration

Hazardous Air Pollutant Regulatory Activities

The engineering program for hazardous air pollutants addresses problems in the industrial, commercial, governmental (e.g., military), and public sectors. The program is comprised of three parts: (1) prevention of Hazardous Air Pollutant/Volatile Organic Compound emissions; (2) overcoming technical barriers to effective application of control devices; and (3) direct engineering technical support.

Prevention of HAP/VOC emissions is accomplished through development of engineering control strategies involving the use of such options as:

—Substitutes
—Alternative feedstocks and processes
—Recovery, reclamation, reuse
—Decision making systems for product manufacturers and formulators
—Special prevention techniques

Overcoming technical barriers to control VOC/HAPs and Particulate Matter less than 10 microns HAPs involves development and evaluation of high-tech control technologies. Such new, advanced technologies make control possible where it was not feasible before. A good example is the problems associated with controls for small point and area sources. Overcoming barriers also involves work with source-oriented controls for problem sources such as woodstoves, flares, municipal waste incinerators, chrome electroplating, and asbestos manufacture.

In addition, resolving technical barriers includes work to enhance cost/effectiveness of existing types of generic air toxic controls such as carbon adsorption, catalytic oxidation, and particle controls.

Other barriers that are being addressed are the increasing complexity of application of multi-pollutant air toxic controls. This work includes the development of rapid-response computerized assessment of source specific controls for permitting and standards development. This

includes development and operation of a "Situation Room" for quick, effective, consistent, and quality assured engineering assessments.

Technical support includes direct support to state and local agencies and EPA Regional Offices through operation of the Control Technology Center. It also includes source assessment (source-related measurements to help define the magnitude and character of air toxic emissions, especially as related to application of controls. The Integrated Air Cancer Program falls into this area. Technical support includes also accidental and short-term release hazard identification/prevention.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Wade Ponder W. Gene Tucker	2,996.3	53
OEETD/HQ	Marshall Dick	150	75

Hazardous Air Pollutant Regulatory Activities

Health Effects

The health research program in hazardous air pollutants (HAPs) has three goals: (1) to develop and validate techniques to evaluate the toxic effects of HAPs, (2) to produce dose-response data on the toxic effects of HAPs, and (3) to develop methods which improve our ability to use toxicological data in performing risk assessments.

Research is conducted on effects associated with specific chemicals, chemical classes and complex mixtures.

More broadly, there is a need to evaluate whether prolonged exposures to ambient levels of potential HAPs poses a significant health risk. Primary research approaches are animal toxicology and dosimetry studies. EPA researchers will develop methods to provide data on the genetic, developmental, and neurotoxic effects of HAPs. Emphasis of this research will be on the toxic components of gaseous-aerosol complex mixtures and source emissions.

Dose-response data on the mutagenic and carcinogenic activity and noncancer end points including neurotoxicity, physiological, and pulmonary health effects of potential HAPs will be determined. These HAPs will be selected based upon assessments prepared by the Office of Health and Environmental Assessment (OHEA) and research needs identified by the Office of Air Quality, Planning, and Standards (OAQPS). The effects of selected chemicals suspected of being hazardous to the nervous system will be studied. The *dose-exposure* research will provide quantitative information on the relationship between dose (body burden) and human exposures to toxic pollutants.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Ila Cote	3,591.4	66
OHR/HQ	Susan Perlin		

Modeling, Monitoring Systems and Quality Assurance

Hazardous Air Pollutant Regulatory Activities

The need for technology to monitor non-criteria contaminants at the regional, state, and local levels continues. EPA has established monitoring stations to detect and measure hazardous air pollutants in selected urban areas. These stations will function as a focal point for development and evaluation of monitoring methods in ambient air. Stationary source methods will be evaluated and validated. Methods for asbestos, cadmium, nickel, dioxins, and gaseous organics are needed. In addition, certain advanced methods will be evaluated, including cryogenic preconcentrations, gas chromatography and Fourier transform infrared (FTIR) spectrometry.

To support quality assurance needs within the program, reference samples will be developed and maintained, guidelines for procedures will be developed, and laboratory audits will be performed.

A major ORD field program, the Integrated Air Cancer Project, will continue to study the origins and chemical composition of individual species of toxics, mutagenic or carcinogenic pollutants which are present in ambient air.

In the Characterization, Transport, and Fate (CTF) research program, laboratory and field studies will be conducted to determine the atmospheric lifetimes and transformation products of hazardous air pollutants; to determine deposition and removal rates of hazardous chemicals; and to identify the factors responsible for concentration levels and spatial and temporal (i.e., seasonal) variability of selected volatile organic compounds. Also, research studies will examine the atmospheric chemical and physical processes that are important in producing mutagenic compounds in the atmosphere. The information obtained from this program is used for preparing health assessment documents to determine if chemicals in the atmosphere present a hazard.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	John Clements Steve Bromberg	5,134.1	51
AREAL/RTP (CTF)	Larry Cupitt	1,102.8	27
OMMSQA/HQ	Deran Pashayan	0	0

Hazardous Air Pollutant (HAP) Regulatory Activities

Scientific Assessment

Scientific assessments of HAPs by the Office of Health and Environmental Assessment (OHEA) evaluate research findings concerning the health effects of airborne substances emitted from restricted stationary sources or their transformation products, as well as background information on physical and chemical properties, sources, emissions, transport and transformation, and ambient concentrations. Such assessments also evaluate chemical compositions of fuels and fuel additives, engine exhaust emissions, human exposure to motor vehicle pollutants, and evidence of resulting health effects.

The Agency strategy for assessing the toxicity of various chemical substances nominated by the Office of Air Quality Planning and Standards (OAQPS) includes the following steps: (1) preparation of a summary health issue assessment, i.e., an initial review of the scientific literature concerning the key health effects associated with a given chemical or class of chemicals; (2) if the evidence suggests significant health effects associated with exposure to the substance(s) reviewed, a draft health assessment document (HAD) is developed for review at a public workshop; and (3) if the scientific peer review supports conclusions on significant health effects, a comprehensive health assessment is developed for public comment and Science Advisory Board review prior to final publication and use in HAP listing and regulatory decisions.

There is a trend in FY-90 to assess the health effects of complex mixtures of pollutants (i.e., all emissions) associated with a particular facility or site. This is a shift from EPA's past practice of evaluating the health effects of a single chemical in various exposure scenarios.

In addition, as part of the Agency's Air Toxic Strategy, the scientific assessment program will also provide direct assessment support to Regions and States. This includes: (1) joint operation with OAQPS of an Air Risk Information Support Center (AirRISC) providing rapid response to requests for technical assistance from State and local agencies, and providing technical guidance on issues related to health risk assessment of air toxics; and (2) development of inhalation reference dose (IRfD) values for non-cancer health effects associated with toxic air pollutants.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/RTP	Lester Grant	2,774.1	60

Mobile Source Pollutant Regulatory Activities

Health Effects

The health effects research program for mobile sources provides health effects data for selected

emissions and transformation products associated with motor vehicles. One goal of the research conducted by the Health Effects Research Laboratory is to develop methods and data that can be used to characterize the risk of mobile source emissions as a component of the total human exposure to carcinogens and mutagens. Methods will be developed to apportion the potential cancer risk from alternative engine and fuel types. The work will include the assessment of DNA adducts as biomarkers of exposure, dosimetry, or cancer risk from mobile source emissions in comparative mutagenesis and tumorigenesis bioassay systems *in vitro* and *in vivo*.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Ila Cote	222.9	48.7
OHR/HQ	Susan Perlin		

Modeling, Monitoring Systems and Quality Assurance

Mobile Source Pollutant Regulatory Activities

The major effort in the Characterization, Transport, and Fate (CTF) portion of this program is to characterize the emissions from motor vehicles using both traditional fuels as well as alternative fuels, such as methanol. Laboratory studies of the impact of ambient temperature on the emission rates of regulated and unregulated pollutants from light duty motor vehicles will continue. Emphasis will be directed to the composition of organic emissions. Studies of the relationship between fuel composition, including gasoline and gasoline-alcohol blends, and the composition and rate of tailpipe, evaporative, and refueling emissions will continue. Other programs will emphasize the development of analytical procedures suitable for real-time measurement of motor vehicle emissions. Procedures for determination of the operating condition of motor vehicle emission control devices will be evaluated. Programs for examination, development, and improvement of procedures for apportionment of

observed ambient pollution to motor vehicles will be conducted.

Studies will also be conducted to characterize organic emissions from motor vehicles under widely variant operating conditions, i.e., temperature, speed, and fuels. Emission rates of formaldehyde, benzene, paraffins, and other organic compounds of interest will be determined.

Research in the Monitoring Systems and Quality Assurance portion of the program focuses on developing methodology for determining exposures of the population to mobile source pollutants. A general methodology has been developed for measuring and modeling the exposures of the population to carbon monoxide, and this methodology has been successfully field tested. Future research will extend this methodology to other locations and, where possible, to other mobile source air pollutants. Detailed analyses of human exposure field data collected in selected highway microenvironments will be undertaken to develop improved commuter exposure models incorporating traffic variables (roadway type,traffic count, trip time, and seasonal characteristics). Data on human activity patterns and time budgets will be further evaluated for use in exposure models. Improved models of human activity patterns and microenvironmental concentrations will be developed and field tested.The Simulation of Human Activities and Pollutant Exposure (SHAPE) model will be modified and validated using field data from another urban area. Additional testing of basic assumptions incorporated in the NAAQS Exposure Model (NEM)will be undertaken. The purpose of the research will be to improve the accuracy and reliability of the Agency's exposure assessment methodology for mobile source pollutants.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	Gerald Akland	455.0	55
OMMSQA/HQ	Wayne Ott	0	0
AREAL/RTP (CTF)	Frank Black	1,567.9	47
OMMSQA/HQ (CTF)	Deran Pashayan	0	0

Modeling, Monitoring Systems and Quality Assurance

National Ambient Air Quality Standards (NAAQS)

The purpose of this program is to provide scientific information on atmospheric processes and monitoring methodologies to support the Agency's regulatory program on National Ambient Air Quality Standards (NAAQS). The current program will focus on inhalable particulate matter, fine particles and acid aerosols research. Research will also be conducted on the effects of particles on materials; it will concentrate on the influence of particle size and composition on the soiling of paint.

Under the Monitoring Systems and Quality Assurance portion of this program improved air pollution monitoring methods are being developed to help determine air quality trends, support compliance with standards, and meet enforcement needs. The data from these methods are often used as the basis for regulatory action. The areas investigated include ambient methods development, quality assurance guidelines and audit materials preparation.

Ambient methods development will focus on measuring particulate matter in support of anticipated changes to the National Ambient Air Quality Standards (NAAQS). EPA researchers will continue to analyze the mass and chemical composition of the particles collected through the Inhalable Particulate Network. Also, fiber filters from the national, state, and local air monitoring stations will be analyzed for trace metals and *benzo-a-pyrene*. Also, a monitoring network will continue to characterize visibility trends at several eastern locations.

Quality Assurance support will be provided through a standard laboratory and repository of quality assurance materials. Routine and special audits will be conducted at laboratories making ambient measurements and at compressed gas vendors. QA guidelines, handbooks, data handling systems and a precision and accuracy reporting system will be maintained and updated. QA procedures, materials, and audit techniques will be developed for compliance monitoring.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	John Clements	1,542.4	24
EMSL/LV	James McElroy	262.3	35
AREAL/RTP (CTF)	William Wilson	776.9	12
OMMSQA/HQ	Deran Pashayan	0	0

National Ambient Air Quality Standards (NAAQS)

Health Effects

This research program has three major goals: (1) to provide data on health effects of exposures of O_3, NO_2, CO, sulfur oxides, particles, and lead using both human and animal studies; (2) to provide better models to extrapolate animal data to human effects; and (3) to develop improved test methods for research into the physiological responses of humans to the primary air pollutants.

Health effects research is conducted to refine and improve the toxicological and epidemiological data base relevant to criteria pollutants. Both human and animal-dose response studies, as well as mathematical modeling, will be given special attention to determine the deposition, clearance, and pulmonary function effects of particles, alone and in combination with ozone, NO_2 and SO_2.

Research will be done to improve the models used to extrapolate animal biochemical and metabolic responses to human effects. Both human and animal experiments will provide data on the functional, morphological, and biochemical changes which occur following exposures to the primary air pollutants, and provide extrapolation techniques to predict human pulmonary responses, including functional and morphological, to gases and particles.

Animal, human clinical, and epidemiology studies will provide data to determine the extent to which the primary air pollutants cause or exacerbate the development of noncarcinogenic chronic disease. Biological endpoints to be examined include development of cardiovascular or pulmonary disease, aggravation of existing conditions, changes in biochemistry and host defense mechanisms, and changes in pulmonary

structure or function. Emphasis is currently placed on determining the acute and chronic effects of O_3 and NO_2 inhalation.

The health effects data from this research program are incorporated into EPA criteria documents which are used to set and revise National Ambient Air Quality Standards (NAAQS).

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Ila Cote	15,362.5	26
OHR/HQ	Susan Perlin		

National Ambient Air Quality Standards (NAAQS)

Environmental Processes and Effects

This research provides scientific support of NAAQS by determining the effects of ozone on forests, with emphasis on species of economic importance. Selected forest species will undergo a range of ozone exposure scenarios possibly experienced in the forested regions of the United States. The ecophysiological impacts of ozone will be studied in sensitive tree species, and studies of the economic impact of ozone damage will continue on economically and ecologically significant forest species. The research on exposure scenarios and tree responses will be used to assess the risk from ozone on major commercially valuable forest tree species.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	Bill Hogsett	1,985.5	35
OEPER/HQ	Anthony C. Janetos	13.2	0

National Ambient Air Quality Standards (NAAQS)

Scientific Assessment

The main objective of the NAAQS scientific assessment program is to review and revise criteria documents for sulfur oxides, particulate matter, nitrogen oxides, ozone and other

photochemical oxidants, carbon monoxide, and lead. Air Quality Criteria Documents (AQCD) are mandated by the Clean Air Act and, as directed by the Act, are revised at 5-year intervals. These documents are evaluations of the available scientific information on the health and welfare effects of criteria pollutants. As such, criteria documents are the primary source of information used by EPA regulatory decision makers in setting or revising the NAAQS.

Criteria document draft materials are developed by EPA scientists and outside expert consultants and are peer- reviewed by scientific experts in public workshops. Subsequently, the document drafts are revised and through announcements in the *Federal Register*, the public is invited to comment on the resulting external review drafts, which are also reviewed in public meetings by the Clean Air Scientific Advisory Committee of EPA's Science Advisory Board. The final documents are submitted to the Clean Air Docket and are published concurrently with the proposed regulatory decisions.

In FY90, work will continue on revision of the Carbon Monoxide and Oxides of Nitrogen AQCDs and on the assembling and updating of data bases concerning ozone, acid aerosols, lead, and fine particle-visibility relationships.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/RTP	Lester Grant	1,963.4	58

Modeling, Monitoring Systems and Quality Assurance

New Source Performance Standards and State Implementation Plans

Air quality models predicting the air quality impacts associated with pollution abatement strategies are used in the evaluation and development of State Implementation Plans for the control of photochemical oxidants and gases and particles.

The Characterization, Transport, and Fate (CTF) portion of this program is responsible for conducting air quality modeling and laboratory

studies to develop a single, defensible chemical mechanism module for use in ozone air quality simulation models. A regional ozone air quality model recently developed is being used to support ozone air quality standard development and implementation. Models will be used to assess the air quality impacts associated with various ozone control strategy scenarios. In a cooperative program involving ORD, the Program and Regional offices, the Regional Oxidant Model (ROM) will be used to assess the impact of long range ozone transport in the Northeast. Also in response to questions that have been raised concerning the role of biogenic emissions in ozone formation in the southeastern U.S., a research program has been initiated to determine the role of biogenic emissions and other factors that may affect the attainment of ozone standards.

Field and laboratory studies to further develop and test different source apportionment methods (SAMs) are underway and will evaluate hybrid SAM models with chemical composition and meteorology for apportionment of regional aerosols. In anticipation of a revised particulate air quality standard based on inhalable particulates field, smog chamber, wind tunnel, water channel, and laboratory studies are being used to develop and evaluate chemistry and dispersion components of urban scale particulate air quality models. Research is continuing to develop a first generation regional particulate air quality model (RPM). Cooperative transport and fate studies with the Peoples Republic of China will continue.

The User's Network for Applied Modeling of Air Pollution (UNAMAP) program is continuing to evaluate models to prepare computer programs for new versions of UNAMAP, prepare user's guides and supplements, and provide modeling consultation to users. Fluid modeling studies are being conducted on the flow in the wake of buildings.

Additional research activities in the Monitoring Systems and Quality Assurance area emphasize the development of monitoring methods and provision of quality assurance samples and support. EPA's monitoring

methodologies for source air pollutants will include evaluation, methods improvement, preparation of operating guidance and manuals for developed and commercial monitoring instruments. A major effort will be conducted to evaluate methods for PM10 monitors. Quality assurance for the source monitoring program is essential to ensuring that only data of known accuracy and precision are used for regulatory and enforcement decisions. Reference samples will be provided and audits of laboratories making source measurements will be continued.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	John Clements	2,714.0	68
EMSL/LV	James McElroy	587.7	53
AREAL/RTP (CFT)	Gary Foley	7,924.3	30
OMMSQA/HQ	Deran Pashayan	0	0

Environmental Engineering and Technology Demonstration

New Source Performance Standards and State Implementation Plans

Research in this program supports the development of New Source Performance Standards (NSPS) and State Implementation Plans by aiding in the development of pollutant control technology which is cost-effective and energy-efficient. The focus of the research is on the reduction of Volatile Organic Compounds, NO_x, SO_x emissions.

Volatile Organic Compounds (VOCs) are a major cause of non-attainment of photochemical oxidant National Ambient Air Quality Standards. Extramural research will evaluate VOC abatement technology such as adsorption, thermal oxidation, and catalytic oxidation. Of particular interest will be effective and affordable control methods for small VOC-emitting industries.

Combustion modification methods of controlling NO_x and other emissions will be evaluated to determine combustion modification (CM) methods for reducing NO_x emissions and improving the performance of utility and industrial boilers. Prior research has proven the

CM methods can be effective for control of NOx as well as other emissions, if each method is tailored to the characteristics of the specific combustion equipment (e.g., stoker or package boilers, coal or oil burners, and internal combustion engines or gas turbines). Research will evaluate an in-furnace NO_x reduction technique called reburning which involves injection of fuel downstream of the primary combustion zone. In-house reburning experiments on pilot-scale combustors will be continued and field test projects in a full-scale coal-fired utility boiler will be started. In-house tests of selective catalytic reduction (SCR) systems for internal combustion engines will be completed.

Existing technology to control gaseous pollutants is expensive. For new utility sources, approximately 30% of boiler costs are attributable to air pollution control. Design and performance data for low cost, high-reliability emission reduction technology are needed to support the Agency's regulatory functions. Technical support to regulated entities will be provided by conducting assessments and fundamental research on technologies for reduction of stack emissions of sulfur dioxide (SO_2).

SO_x emissions reduction technology research includes: In-house pilot efforts will emphasize evaluation of low cost, more active sorbents and additives for spray drying and other dry scrubbing systems. A joint EPA/Electric Power Research Institute symposium on SO_x emissions reduction via flue gas cleanup will be planned.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Jim Abbott Everett Plyer	1,760.5	54
OEETD/HQ	Marshall Dick	100	90

Indoor Air Pollution Activities

Scientific Assessment

EPA's indoor air program is geared toward identification, characterization, and ranking of indoor air problems and assessment and implementation of appropriate mitigation strategies. EPA's research and analytical

activities will pursue both source-specific and generic approaches to indoor air pollution. From a source-specific standpoint, the Agency will identify high-risk pollutant sources and characterize the exposures and health risks of various populations to those sources. At the same time the Agency will also pursue broad, cross-cutting strategies aimed at assessing the total exposure of people to indoor air pollutants and developing the mitigation strategies that can address multiple pollutants simultaneously through improved building design and management techniques.

Activities in FY90 in the area of scientific assessment will include development of an exposure assessment risk characterization framework, updating and revising the Indoor Air Pollution Information Assessment and the Indoor Air Reference Data Base, determining the extent of population exposure to indoor air pollutants, and developing biological contaminant measurement methods.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/RTP	Michael Berry	424.6	42

Indoor Air Pollution Activities

Health Effects

The goal of the indoor air health effects research program is to determine whether exposure to indoor air pollution contributes or leads to adverse health effects. Indoor air often contains higher levels of pollutants than outdoor air. Most individuals spend over 80% of their time indoors. Sensitive populations, e.g., children and the elderly, may be at higher risk from exposure to indoor air pollution. Therefore, the exposure, dose, and effects from indoor air pollution need to be factored into the total risk assessment of air pollution.

A balanced program involving humans, laboratory animals, and bioassay approaches will be maintained to better understand the "sick building syndrome." The approach to study the

effects of indoor air is broad. Genetic bioassay studies of the combustion products from indoor air sources, including environmental tobacco smoke and kerosene heaters, will be conducted in chambers, test homes, and targeted field studies to provide a comparative estimate of the potential cancer risk from various sources. Human clinical studies of volatile organic compounds will continue to be conducted in chambers to determine effects related to the "sick building syndrome." Field and clinical studies will continue to evaluate cotinine as a biochemical marker for nicotine.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Ila Cote	1,036.4	6
OHR/HQ	Susan Perlin		

Modeling, Monitoring Systems and Quality Assurance

Indoor Air Pollution Activities

Indoor air research consists of development and testing of monitoring devices and the design and implementation of field studies to identify and quantitate pollutants indoors. This research supports investigation of pollutant sources, human exposures and health effects.

Methods development research investigates monitoring devices for pollution monitoring levels in homes. Results are used to produce information regarding proper use (sample locations and sample times) and performance limitations of these devices. This research will continue to develop and test these devices, especially personal monitors, in other microenvironments (buildings, vehicles, etc.).

Field studies to investigate spatial and temporal variations in indoor air quality will be designed and implemented in conjunction with an intensive review of data needs. The program will emphasize research on "sick building" where elevated levels of pollutants can be observed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	Gerald Akland	669.0	18
OMMSQA/HQ	Lance Wallace	0	0

Environmental Engineering and Technology Demonstration

Indoor Air Pollution Activities

The goal of the Indoor Air Quality program is to develop information on (1) pollutant emission rates from major sources, (2) indoor pollutant levels, including chemical composition/concentration, resulting from these sources, and (3) the control of the pollutant levels by source modification, air cleaning, and/or ventilation.

The information will be used to (a) conduct risk assessments of indoor pollutants or sources, and (b) produce public information documents on source emission testing protocols, emission factors, and alternatives for controlling indoor air quality.

Source emissions will be evaluated in small and large test chambers, as well as test houses, to determine the impact of critical variables (e.g., ventilation rate, temperature, humidity, source/sink interactions) on emission rates and pollutant levels. The performance and cost effectiveness of control techniques, both commercially available and new/innovative, will be determined. Models will be developed and used to evaluate the effect of source characteristics, environmental variables, ventilation parameters, and air cleaner effectiveness on the levels of indoor pollutants.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Gene Tucker	1,626.8	50
OEETD/HQ	Marshall Dick	150	80

Environmental Engineering and Technology Demonstration

Stratospheric Ozone

The Air and Energy Engineering Research Laboratory (AEERL) has an ongoing program to address the implementation of the Montreal Protocol and the U.S. regulation on ozone depleting substances. AEERL has been working with industry to achieve a voluntary standard that will allow recycling of automotive air-conditioning refrigerant and to facilitate use of recycling equipment in repair shops. AEERL intends to conduct a similar effort with industry on large stationary refrigeration systems.

In 1990, AEERL with co-funding from the Electric Power Research Institute will be determining properties of new chemicals that might be useful as replacements for the fully halogenated chlorofluorocarbons (CFCs) and halons. Where successful properties are found, preliminary testing will be done to ascertain their applicability to certain end-uses. Results will be made available to industry for their consideration in further development of the chemical and/or its uses.

One of the largest uses of CFCs is in refrigeration systems. CFCs are used as the refrigerant and in the insulation of the systems. Refrigeration systems through their energy use are also contributors to CO_2 emissions which affect global warming. EPA is working with industry and other government agencies to explore the use of alternative refrigerants using a different thermal cycle with redesigned hardware which will also improve energy efficiency. At the same time, methods of improving the insulation without use of CFCs is being evaluated.

Halons are important fire extinguishants. AEERL is working with industry and other government agencies including the Department of Defense in a program to determine critical uses of halons and alternatives to current uses. Alternatives may involve new chemicals or new fire protection systems such as redesign of delivery or containment systems. 1990 should see a better understanding of the problems and definition of a program to address them.

Nitrous oxide is also an important chemical in the balance of stratospheric ozone. In 1989, AEERL participated in a program to obtain estimates of nitrous oxide emissions from anthropogenic fossil fuel combustion sources. This resulted in discovery of a sampling artifact which had led to erroneous reporting of nitrous oxide levels in the past by many researchers. Work is now being done to improve the sampling methodology and to utilize the methodology to determine the true significance of fossil fuel combustion to nitrous oxide emissions for current technology and systems under development.

Implementation of the Montreal Protocol may also require an ability to detect CFCs in products which are imported to a country and to have an agreed upon destruction protocol for CFCs for which a country wishes to obtain credit.

AEERL has been providing a limited effort in each of these areas in support of international meetings in preparation for technical assessments which will be conducted in 1990 under the Montreal Protocol provisions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	William Rhodes	1,000.0	10
OEETD/HQ	Marshall Dick	0	0

Health Effects

National Health and Nutrition Examination Survey (NHANES)

The third National Health and Nutrition Examination Survey (NHANES-III) is one of a series of surveys conducted by the National Center for Health Statistics (NCHS) for the purpose of producing vital and health statistics for the United States. Six NHANES studies have been completed since 1960. NHANES-III will be conducted for six years, from 1988-1994. During this time, approximately 40,000 Americans ages 2 months and over will be randomly selected from households, interviewed and invited to participate in medical examinations at mobile examination centers. Approximately 30,000 individuals will undergo the medical examination which includes a physical examination and diagnostic and biochemical testing. The sample is a statistically representative sample of Americans with oversampling of the very young, the elderly, Blacks and Hispanics.

Some of the topics to be studied in NHANES-III are nutrition status monitoring, osteoporosis, arthritis, respiratory and cardiovascular disease, diabetes, gallstone disease, AIDS, kidney disease, and growth and development of children.

Research and public health goals include the following: (1) estimating the prevalence of disease

and risk factors; (2) estimating the incidence of certain diseases; (3) estimating the prevalence of functional impairment; (4) providing population reference distributions of health characteristics including growth and development; (5) monitoring secular changes in diseases and risk factors; and (6) identifying new risk factors for disease and reasons for secular trends in health.

EPA and other Federal agencies have collaborated with NCHS in previous NHANES studies and in NHANES-III. EPA has participated in the planning of NHANES-III and has funded two specific research areas: neurotoxic disorders and pulmonary function.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP			
OHR/HQ	Susan Perlin	560.0	10.7

Environmental Processes and Effects

Global Change Research

Increased atmospheric concentrations of carbon dioxide and other radiatively important trace gases (methane, nitrous oxide, chlorofluorocarbons, etc.) have raised concerns about potential climate change among the general public and members of the scientific community. Additionally, concerns about decreasing stratospheric ozone have emerged. Scientific information on global change, including both climate change and stratospheric ozone influences, is required to assist decision makers in developing sound policies. However, much uncertainty exists about how these global changes derive from or may impact specific geographic regions, ecological systems, and human activities.

Emissions of greenhouse gases have been increasing, so clearly, understanding of sources and sinks must be improved, to evaluate the relative contribution of anthropogenic and natural sources of these gases. In addition, chemical transformations that occur in the troposphere and stratosphere, and which help determine the net radiative forcing that results in the green house

effect, will be studied. Development of a second-generation carbon emissions model is also currently ongoing. This research, in close conjunction with the Department of Energy, will develop a global model capable of handling emissions scenarios with more sophistication than is currently available, allowing more realistic assessment of the consequences of making specific changes in emissions rates.

Ecological effects are important potential consequences of climate change. Research into these potential effects is ongoing, with a focus on the relation between climatic conditions and boundaries between major ecosystems, such as between forests and grasslands. When completed, this research should provide insight for resource managers into the magnitude of latitudinal and longitudinal shifts of major ecosystems that might be associated with specific climatic changes.

Another important research effort is the investigation of effects of decreasing stratospheric ozone that allows increased ultraviolet flux (UV-B) at the earth's surface. Research conducted under the Agency's stratospheric ozone depletion program will continue in terrestrial and aquatic ecosystems, human health, and emissions and mitigative solutions. Studies of the effects of UV-B radiation on terrestrial ecosystems will continue with an emphasis on determining the relationship between UV-B dose and other anthropogenic factors such as global climate change. Research will also continue on UV-B effects on the marine food web and biogeochemical cycling. Further evaluation will be made of alternate compounds to CFCs and halons, and in technologies to replace those used for such purposes as refrigeration, insulation, and fire extinguishment. Research will continue on developing ways to reduce emissions of chemicals that contribute to stratospheric ozone depletion, including CFCs, halons, and nitrous oxide, and to transfer technology within the U.S. and to developing nations. Support for determining the effect or need for modification of the Montreal Protocol will continue, in cooperation with other nations.

While research on potential causes and consequences of global change is important,

research on possible options for adapting to or mitigating change is also important. Opportunities exist for technological advances, such as intensive reforestation, or energy efficiency and conservation, and these should be explored, particularly if they have additional environmental benefits. The potential for reducing emissions will be a major focus of ORD effort. These technologies include both biological approaches, such as reforestation, and industry-related analyses, such as increased energy efficiency.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OEPER/HQ	Anthony C. Janetos Robert C. Worrest	19,647	13
AREAL/RTP	Peter L. Finkelstein Richard D. Stern		
ERL/ATH	Richard G. Zepp		
ERL/COR	Peter A. Beedlow		
ERL/DUL	John G. Eaton		
ERL/NARR	Henry A. Walker		

Environmental Engineering and Technology Demonstration

Global Climate Change

As a result of increased national and international concern regarding potential significant changes in global climate, OEETD has expanded its program in this area. The expanded global emissions and control program, which is integrated with the OEPER program, consists of three major elements: Emissions, Models, and Mitigation. Emissions research includes development of global and regional emission factors, activities, and functions for anthropogenic and biogeogenic sources, to prepare accurate current emissions inventories of radiatively important trace gases. Modeling activities include development of models to generate future global emission estimates and to predict the impact of potential policy and mitigation strategies on these global emissions. Mitigation activities include assessment of emissions management techniques and their applicability to industrialized and developing countries, and selected development and demonstration of promising techniques to

accelerate their commercialization and application to reduce emissions of radiatively important trace gases.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Richard Stern	2,000.00	10
OEETD/HQ	Marshall Dick	0	0

Health Effects

Health Effects Institute

A significant part of the health effects research on mobile source emissions is conducted through the Congressionally mandated Health Effects Institute (HEI). HEI is jointly sponsored by EPA, through extramural funding, and the automobile industry to perform research on the health effects of pollutants related to mobile sources.

The research focuses on various mobile source-related pollutants, including carbon monoxide, oxidants (ozone and nitrogen dioxide), diesel exhaust and alternative fuels such as methanol. Important areas of health research conducted by HEI include: development and use of biological markers; identification and characterization of susceptible populations; determination of dose to target tissue; assessment of susceptibility to infection; examination of mechanisms of injury and/or disease; and evaluation of neurotoxicological and behavioral effects.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP			
OHR/HQ	Susan Perlin	3,000.0	0

Health Effects

Health Effects of Drinking Water Contaminants

This research program provides dose-response data on organic and inorganic contaminants found in drinking water. In addition, toxicological methods are developed and validated for the purpose of improving the relevance of toxicological data to regulatory issues and to improve the risk characterization process.

Increasing emphasis will be on determining the health effects of exposure to disinfectants and their by-products. Research will focus on determining the health effects resulting from exposure to alternative disinfectants (e.g., ozone, chloramine) and their by-products. Work will be done to improve methods for extrapolating health effects research data in order to assess the risks associated with simultaneous exposure to multiple chemicals in binary and complex mixtures. Epidemiology studies on the relationship between disinfectants and cancer cardiovascular disease, and reproductive effects will be conducted.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Jack Fowle	6,640.6	48
OHR/HQ	David Kleffman		

Scientific Assessment

Health Effects of Drinking Water Contaminants

Revision of national drinking water regulations and health advisory guidance given to the States requires an assessment of the potential hazard to human health from exposure to chemicals in drinking water. The health assessment documents prepared under this program take the form of both criteria documents and health advisories. These documents are assessments of the health effects of exposure to contaminants in drinking water. They specifically evaluate the relevant scientific data describing the physical and chemical properties, the pharmacokinetics, the health effects in animals and humans, and the mechanisms of toxicity. The health assessments are prepared for

various chemicals as requested by EPA's Office of Drinking Water (ODW). This risk assessment process enables ODW to establish a Maximum Contaminant Level Goal (MCLG), representing a level designed to preclude the risk of an adverse effect on human health.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	785	58

Modeling, Monitoring Systems and Quality Assurance

Groundwater Research

Geophysical research will be conducted for mapping and monitoring fluid movement from injection wells; for detecting near-surface contamination from abandoned wells and movement along fracture zones; and, for the evaluation of seismic hazards associated with the underground injection process. In support of EPA's Wellhead Protection Program, guidance on monitoring strategies for Wellhead Protection Areas will be prepared and case studies for monitoring system design will be developed. Additional research will involve the quantification of the spatial characteristics of pollutants in drinking water and the application of modeling techniques to assist in groundwater quality sampling decisions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Robert Snelling	973.5	35
OMMSQA/HQ	Chris Saint	0	0

Environmental Processes and Effects

Ground Water

Ground water is a major source of drinking water for the nation. This research program provides both technical information and improved methods for predicting contamination movement and transformation. The research focuses on methods development for and studies of subsurface transport and fate processes such as biological transformation, oxidation-reduction, hydrolysis,

and ion exchange. Facilitated transport research will address complex mixture processes such as multiphase transport and solvent composition effects on sorption. In addition, micelle- and DOC/colloid-aided transport will be addressed. The results of the research will allow better human exposure assessments from ground-water contamination. This research is closely coordinated with that in Hazardous Waste, Superfund, and Pesticides.

Research to determine the cost-effectiveness of *in-situ* aquifer restoration techniques will potentially lead to cleanup where previously the cost was prohibitive. Promising laboratory techniques will be evaluated on actual contamination incidents.

Field evaluation of techniques for determining the mechanical integrity and adequacy of construction of injection wells will occur. Work to develop technological alternatives for regulating Class V wells will continue.

Methods will be developed for risk assessments in wellhead protection areas, and technical transfer activities associated with this and other programs will be emphasized.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RSKERL/ADA	James McNabb	4,779.7	29
OEPER/HQ	Barbara Levinson	493.4	66
ERL/ATH	Lee Mulkey	338.6	20

Environmental Engineering and Technology Demonstration

Drinking Water Technology

To support revision of the national drinking-water standards, this program provides data on the technologies available, what they can attain in terms of drinking-water quality, and what they cost. Focus is on the removal of synthetic organic compounds, organics responsible for the formation for disinfection by-products with emphasis on ozone, inorganic and microbiological contaminants, drinking-water residuals, and on problems related to maintaining water quality in distribution systems including corrosion and

assimilable organic carbon (AOC) studies. Emphasis will be on developing cost information for treatment processes and for entire water systems. Evaluation will also be made of the tradeoffs in planning for rehabilitation of older water systems. In addition, efforts will be made to address the problems of small utilities and to assist the states and municipalities in complying with maximum contaminant levels.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/Cin	Robert Clark	5,400	63
OEETD/HQ	Bill McCarthy	0	0

Modeling, Monitoring Systems and Quality Assurance

Drinking Water Technology

This program will provide support for the Agency-wide mandatory quality assurance program. The ten regional laboratories will be evaluated annually in support of the National Interim Primary Drinking Water Regulations monitoring certification program. This program will also conduct methods development research and provide analytical procedures to produce precise and accurate total measurement systems for chemical, radiochemical and microbiological analysis, and will investigate the application of innovative technologies to the analysis of drinking water contaminants. It will provide technically and economically feasible analytical procedures to monitor contaminants for use by the Agency, States, municipalities, and operators of public drinking water systems.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Thomas Clark	2,765.1	60
EMSL/LV	Robert Snelling	308.7	95
OMMSQA/HQ	Chris Saint	0	0

Modeling, Monitoring Systems and Quality Assurance

Water Quality Based Approach/Permitting

The monitoring research program develops chemical, physical, and biological methods for measuring site-specific and ambient water pollutant concentrations.

Research emphasizes new measurement method standardization and development of quality assurance support such as guidelines, calibration materials, and performance audits. Additionally, research seeks to extend the sensitivity of chemical methods for measuring toxic chemicals in water. Research on biological monitoring methods also includes developing methods which screen toxic concentrations of pollutants in ambient waters, rather than identifying specific substances. Quality assurance procedures for chronic and acute toxicological effects monitoring, standardization of microbial, viral sampling, and analysis methods are provided. Virus sample preservation and assay protocols will be standardized. Research on physical measurement methods concentrates on documenting the validity and accuracy of sampling and analysis regimes. The quality assurance program which provides quality control calibration materials and procedures for standardization of chemical and biological analysis also conducts two audits of analytical methods performance yearly.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Cornelius Weber James Lichtenberg John Winter	1,921.3	95
OMMSQA/HQ	Chris Saint	0	0

Environmental Processes and Effects

Water Quality Based Approach/Permitting

A water quality-based approach to pollution control provides for correction of ambient water quality problems that remain after mandated pollution control technology (e.g., secondary treatment, effluent guidelines) is in place. This requires the ability to translate water quality

standards into specific effluent conditions and discharge limitations for municipalities and industries. Research will be undertaken to provide the necessary information and scientific tools, including: water quality criteria development/ modification protocols; contaminated sediment assessment techniques; wasteload allocation techniques: and complex effluent testing procedures. Research on the water quality functions of wetlands, and cumulative effects of wetlands loss and the impacts of mitigation of wetlands will also be conducted.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Robert Swank	880.0	82
ERL/COR	Tom Murphy	696	83
ERL/DUL	Nelson Thomas	2,972.7	81
ERL/NARR	Norbert Jaworski	1,570	74
OEPER/HQ	Chieh Wu	1,129.5	31

Water Quality Based Approach/Permitting

Scientific Assessment

EPA's overall research program with regard to water quality emphasizes development of the scientific and technical base to help States develop site-specific standards and to conduct use-attainability analyses. The scientific assessment program will provide guidance for assessing the risk of human exposure to mixtures of toxic chemicals, and evaluate site-specific health hazards as required by the States and EPA. As a part of this effort, EPA develops documentation for the specific risk assessments.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	255	68

Industrial Wastewater Treatment Technology

Modeling, Monitoring Systems and Quality Assurance

Research will support the Agency in the implementation of technology-based effluent limitation regulations and the modification of enforcement activities as required by water quality-based permit adjustments. Methods standardization research will be directed to the

improvement of precision, accuracy, and method detection limit of existing regulated inorganic and organic contaminants. Research will also validate and correct analytical methods for the analysis of high priority industrial wastewater components as well as evaluate alternative analytical methods to support the National Pollution Discharge Elimination System (NPDES) program.

Quality assurance activities include conducting both the target survey and full audit of some 7,000 major NPDES permitees for the annual Discharge Monitoring Report Quality Assurance (DMRQA) study; maintenance of a repository for distribution of calibration, quality control, and performance evaluation samples; and the conduct of performance evaluation studies. The research program will support NPDES quality assurance by providing quality control samples and protocols and by maintaining the standards repository, including auditing monitoring systems data reliability, DMRQA, and documentation of precision and accuracy.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	James Lichtenberg John Winter	813.6	98
OMMSQA/HQ	Chris Saint	0	0

Environmental Engineering and Technology Demonstration

Wastewater Treatment Technology

The wastewater technology research program provides the technical information and engineering assistance needed to develop and implement the regulations and guidance for disposal of sludge and control of pollution from municipal treatment plants to bring plants into compliance with state discharge permits. This program also provides the research in industrial wastewater characterization and control technology needed to support the National Pollutant Discharge Elimination System. The program focuses on toxicity reduction evaluations to support the development of water quality-based permit limitations in municipal wastewaters, and best conventional technology and best available

technology limitations in industrial wastewaters. Design, cost and performance information for sludge stabilization, pathogen reduction, and dewatering processes will be proved to support sludge regulation implementation and refinement. Focus is also on supporting the new wastewater treatment technologies development and infrastructure protection.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/Cin	Clyde Dial	5,777.0	40
OEETD/HQ	Don Tang	0.0	0

Environmental Processes and Effects

Wastewater Treatment Technology

This research will identify and determine distribution of unlisted chemicals in industrial wastewaters. Compounds that can be identified by empirical mass spectra matching as well as those that elude identification by this technique will be included. This research will also study the biological functions of constructed wetlands in the treatment of wastewater from small community and acid mine drainage.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	William Donaldson	303.1	100
ERL/COR	Larry Kapustka	85.0	0
ERL/DUL	William Sanville	90.0	0
OEPER/HQ	Chieh Wu	0	0

Health Effects

Wastewater Treatment Technology

Health effects research focuses on human health aspects of municipal wastewater and sludge disposal. The data from these studies are used by the Agency for formulation of regulations, permits, and guidelines under the Clean Water Act. One emphasis, at present, is on land use and disposal of municipal sludges which requires careful assessment of the effects on human health of exposure to pollutants contained in the sludges.

Research will focus on developing and validating a battery of short-term tests for predicting the potential health effects from exposure to complex mixtures in wastewaters and sludge.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/CIN	Jack Fowle	496.3	100
OHR/HQ	David Kleffman		

Wastewater Treatment Technology

Scientific Assessment

The scientific assessment program provides risk assessment methodologies for chemicals and pathogens in support of regulatory decision making on the use and disposal of municipal sludge. Numerical criteria and/or management practices for pollutants in sludge are developed based on the risk assessment methodologies. The use and disposal options are landfilling, land application (including distribution and marketing), incineration, ocean disposal, and surface impoundment.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	367	25

Marine, Estuaries, and Lakes

Environmental Processes and Effects

This program has three components: ocean disposal, coastal waters, and Great Lakes.

To support ocean disposal permit decisions, there is a need to provide decision makers with rationale and procedures which are scientifically sound. These should provide guidance for the acquisition of information and the interpretation of this information in order to support ocean disposal permit decisions. Under the ocean disposal research program, emphasis will be given to the development and testing of procedures to better evaluate the impacts of ocean disposal actions; development of procedures to satisfy monitoring needs for permit, surveillance, and

hazard assessment application; and development of procedures for predicting the bioaccumulation of contaminants and evaluation of the significance of bioaccumulation processes, resultant tissue residues and biological effects.

Methods for better source control decisions in the NPDES and construction grants program are needed for estuaries and near coastal waters. Emphasis will be given to the development/testing of biomarker assessment methods, development of wasteload allocation models for estuaries, studies of ecosystem recovery, and eutrophication.

The Great Lakes research program will measure, describe and predict the distribution, movement, fate, and effects of toxic substances in nearshore "areas of concern" identified by the US/Canada Water Quality Agreement. Emphasis will be given to problems involving in-place pollutants and mass balance modeling. This program will also provide the International Joint Commission (IJC), the Great Lakes National Program Office (GLNPO), EPA Regions and Great Lakes states with technical support and research data synthesis related to activities under the US/Canada Water Quality Agreement.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/NARR	Norbert Jaworski	4,088	70
ERL/GB	Rod Parish	122.9	100
ERL/DUL	Gilman Veith	1,807.0	25
OEPER/HQ	Sam Williams	433.8	60

Modeling, Monitoring Systems and Quality Assurance

Marine, Estuaries, and Lakes

The aim of this program is to develop, evaluate, and validate standardized chemical, biological and microbiological methods for the analysis of contaminants in marine, estuarine and other salt water matrices. The near-coastal areas of the U.S. are economically some of our richest and most sensitive ecosystems. Standardized methods are needed by the Regions for the National Estuaries Program and other activities.

Currently, EPA does not have standardized methods and reference materials for monitoring

and regulation of chemical constituents and pollutants in marine and estuarine waters and sediments.

Available methods will be reviewed for applicability in marine and estuarine environments and revised as necessary. Methods not applicable will be modified or new methods development initiated, as needed, using state-of-the-art technology. On-going methods development activities and plans for new methods research will be reviewed and modified, if appropriate, to include marine and estuarine methods. Research will be conducted to determine the applicability of existing nutrient, metal, trace elements, and biological materials for use as quality control and performance evaluation samples. Application of these quality assurance materials to marine and estuarine waters will be coordinated with the Regions and the ORD Office of Environmental Processes and Effects' marine laboratory.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Thomas Clark	790.9	60
OMMSQA/HQ	Chris Saint	0	0

Environmental Engineering and Technology Demonstration

Alternate Technologies

The Treatment program examines both existing and emerging alternative techniques for treating or detoxifying hazardous materials. Emphasis continues to be placed on those waste streams which will be banned from land disposal facilities.

Research and demonstration of existing and emerging technologies will be conducted for those waste streams assigned high priority by OSWER, waste streams which are difficult to cost-effectively treat by available technology and waste with high potential for hazardous air emissions. Emphasis will be on characterization and pilot-scale testing of newly listed hazardous waste streams. Assistance in the review of permits for alternative technologies in the technical assistance and project monitoring for such projects will be provided.

A major portion of the research is now devoted to reducing the production of pollutants at their source. Major investigation will be conducted to define assessment techniques to measure the reduction in quantities of pollutants produced and to identify potential areas for pollutant reduction. Evaluation of technologies for reducing the pollutants discharged will be conducted.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/Cin	J. Convery C. Rogers H. Freeman	7,951.9	20
OEETD/HQ	K. Jakobson	500	33

Environmental Engineering and Technology Demonstration

Incineration

Incineration research focuses on four areas: characterizing performance of existing thermal technologies; developing methods of rapid cost-effective compliance monitoring of these facilities; characterizing the products of incomplete combustion and their formation conditions; and developing methods to predict performance to avoid process failure and control process reliability. The research is conducted at laboratory

and pilot-scale facilities in Cincinnati, Research Triangle Park, and Jefferson, Arkansas. The hypotheses from this program are verified in full-scale field tests. The program examines conventional incineration as well as high temperature industrial processes.

Research on the incineration of municipal waste will also be conducted to determine the effectiveness of the process in destroying the hazardous components of the waste and to determine the characteristics of the ash produced.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/CIN	C. Dempsey	3,087.9	33
AEERL/RTP	R.Hall	400	100
OEETD/HQ	K. Jakobson	200.0	100

Incineration

Health Effects

Research on the potential carcinogenic and non-carcinogenic health effects of emissions and residues from hazardous waste incineration (HWI) and municipal waste combustion (MWC) will focus on the following objectives: Perform a comparative assessment of the mutagenicity and carcinogenicity of the products of incomplete combustion (PICs) from HWI in comparison to MWC and other industrial and residential combustion sources. Identify the principal mutagenic/carcinogenic chemicals in HWI and MWC emissions by using bioassay-directed chemical characterization. Determine the relationship between exposure, tissue dose and target cell (DNA) dosimetry for the purpose of providing data needed for risk assessment. Support the evaluation of engineering and control technology parameters by using short-term bioassays in the evaluation of these parameters to determine operational conditions which will minimize risk. Provide a comparative assessment of waste disposal alternatives. Evaluate the toxicity of HWI and MWC emissions, collected after dilution, in *in vivo* target cell bioassays and short-term *in vivo* assays. Evaluate the bioavailability of metals from soil ingestion.

Hazardous Waste

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Joellen Lewtas	1,480.2	44
OHR/HQ	Thomas Miller		

Scientific Assessment

Incineration

A comprehensive risk assessment methodology for municipal waste incineration is being developed in this program to include the appropriate methods for assessing the risks resulting from the use of municipal waste incineration as well as assessing the risks remaining after the waste has been burned.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	398	25

Environmental Engineering and Technology Demonstration

Land Disposal

With regard to land disposal, synthetic and clay liners will be studied and the effectiveness of alternative closure and monitoring procedures for surface impoundments will be investigated. Technical Resource Documents will be updated for use by regional and state agencies for permitting hazardous waste disposal facilities and for enforcing applicable regulations. This program will update documents for disposal facility design, operation, maintenance, and closure.

Research is also being conducted to characterize air emissions from hazardous waste treatment, storage, and disposal facilities and to assess methods to control them.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/CIN	N. Schomaker	2,377.0	31
OEETD/HQ	K. Jakobson	100	100

Modeling, Monitoring Systems and Quality Assurance

Quality Assurance

To ensure that the data on which regulations and enforcement are based are accurate, quality control (QC) samples will be provided to EPA contractor, state, and local laboratories conducting RCRA monitoring. Calibration standards will also be provided for Appendix IX compounds to EPA contractor, state, and local laboratories. Natural matrix, liquid and solid performance evaluation samples will be developed and distributed to RCRA contractors, EPA, and state laboratories conducting RCRA hazardous waste analyses. Performance evaluation (PE) materials that contain the pollutants of interest at the levels encountered in the environment will be developed. Statistical data on the laboratory evaluations will be reported to the Office of Solid Waste. Referee laboratory analyses on all RCRA samples will be conducted. Traceability to National Institute for Standards and Technology for PE, QC, and method validation study samples prepared for RCRA monitoring activities will be provided.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	John Winter	708.8	11
EMSL/LV	Robert Snelling	752.4	25
AREAL/RTP	William Mitchell	207.9	27
OMMSQA/HQ	Thomas Baugh	0	0

Modeling, Monitoring Systems and Quality Assurance

Releases

In order to determine whether underground storage tanks (UST) containing hazardous wastes are leaking, an evaluation of basic leak detection monitoring methods for outside an UST will be conducted. This will include: the establishment of candidate performance criteria for several classes of monitoring techniques; the development of a test protocol for determination of the performance criteria; and testing of the "most promising" leak detection methods to validate the test procedure and to establish that instrumentation presently exists which can meet the candidate performance criteria.

Network design for the placement of leak detection devices will focus on the excavation zone around tanks with emphasis on vapor monitoring. However, monitoring in the saturated zone and in native soils will also be considered.

Field measurements will be conducted and existing private and local/state experiences with leak detection will be investigated. Technical guidance will use a panel of experts to develop a "decision tree" approach to provide guidance for the many and varied sites throughout the country. New technologies for leak detection monitoring, such as fiber optics and geochemical sensors, will be evaluated.

The Clean Water Act (Section 311) mandates that Spill Prevention Control and Countermeasure plans be prepared for all facilities engaged in the production, storage, processing, and distribution of hazardous materials. EPA regional offices are responsible for ensuring compliance.

The OMMSQA provides remote sensing techniques for monitoring. Support will be provided to the Regions for the development and revision of monitoring techniques.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Robert Snelling	1,135.5	23
OMMSQA/HQ	Thomas Baugh	0	0

Environmental Engineering and Technology Demonstration

Releases

Underground storage tank (UST) research is evaluating prevention, detection, and corrective action technologies to identify cost-effective, reliable techniques and equipment for USTs. Early work is producing state-of-the-art documents for each type of technology. The primary focus of ongoing work is the evaluation of leak detection technologies at a test apparatus in Edison, NJ, and the targeting of high potential technologies for improved performance. Best engineering practices for leak prevention, the detection of leaks, and site cleanup will be documented.

Hazardous Waste

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/CIN	J. Farlow	1,787.9	20
OEETD/HQ	R. Nalesnick	200.0	50

Environmental Processes and Effects

Releases

Within this activity, research is conducted to address evaluation of cleanup techniques for unplanned releases of hazardous wastes, i.e., the determination of the applicability and cost-effectiveness of *in-situ* reclamation techniques for unsaturated-zone and ground-water contamination resulting from leaking underground storage tanks and other hazardous waste sources.

At RSKERL/Ada, coordinated laboratory and field tests of biological, physical, and chemical methods, previously tried at hazardous waste sites, are being conducted to determine their cost and applicability to cleanup of pollutants from leaking underground storage tanks.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RSKERL/ADA	James F. McNabb	80.8	100

Modeling, Monitoring Systems and Quality Assurance

Modeling and Monitoring Releases

The purpose of the program is to develop and evaluate pollution plume models and process monitoring techniques that assist State and local governments, planning committees, industry and private citizens assess and respond to risks posed by hazardous substance releases. The Agency now requires reporting of all releases into the environment. The regulated community, as well as state and local governments, require tools for accurately reporting releases and predicting their paths. Advances in the state-of-the-art for dispersion modeling will be undertaken in order to develop more realistic treatment of atmospheric releases. A rigorous, standardized, statistically meaningful methodology for model evaluation is

required to validate the accuracy of new models. Capabilities will be developed to monitor the air space around known suspected sites of volatile organic compound releases.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	William McClenney	90.0	0
OMMSQA/HQ	Thomas Baugh	0	0

Environmental Processes and Effects

Waste Characterization

Regulation of hazardous wastes in the most cost-effective manner requires methods and data for predicting toxicity of waste materials and evaluating the concentrations of these materials at some point of exposure, and then integrating these methods for different media into single evaluation techniques which incorporate uncertainty into the predictions.

ERL/Duluth is developing procedures and data to evaluate waste characteristics and closure criteria for impacts on aquatic habitats and lifeforms. Batteries of toxicity tests, protocols for identifying which components in a mixture actually cause toxic responses, and predictive effects models for single waste constituents are being developed.

Providing field-evaluated methods and data to predict the concentrations of hazardous chemicals in the subsurface environment from the treatment, storage, or disposal of wastes is the thrust of the program at RSKERL/Ada. Physical, chemical, and biological processes that govern the transport rate, transformation, and fate of wastes are evaluated and their mechanisms are described in mathematical models. These, in turn, are evaluated through field experiments.

Integrated, multimedia mathematical models and data are being developed by ERL/Athens for implementing land disposal decisions and evaluating waste management and treatment needs based on potential human health and environmental impacts. Probabilistic techniques are developed and used to address uncertainty.

The various media models are coupled to produce both screening-level and more site-specific multimedia exposure assessment packages.

ERL/Corvallis is evaluating the biological hazard associated with contaminated soils, water, and sediments and is determining the bioavailability (including uptake, translocation, and metabolism) of hazardous chemicals by plants and animals. Multimedia protocols are being tested and field validated in various environmental settings at waste and spill sites.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/DUL	Philip M. Cook	594.7	100
RSKERL/ADA	James F. McNabb	2,432.7	54.8
ERL/ATH	Rosemarie C. Russo	3,197.6	29.6
ERL/COR	Lawrence Kapustka	214.7	53.4
OEPER/HQ	Will C. LaVeille	924.7	32.6

Scientific Assessment

Waste Characterization

This program provides chemical-specific health and environmental effects documents to support Resource Conservation and Recovery Act (RCRA) 3001 listing decisions. Support is also provided to the land disposal restruction program in the form of reference dose documentation. The permitting effort of the Treatment, Storage, and Disposal Facility (TSDF), Office of Solid Waste and Emergency Response (OSWER), is supported by providing technical evaluations and assessments of specific issues that arise in that process. Efforts to refine risk assessment methods and provide risk assessment tools related to hazardous waste are also conducted in this program.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Christopher DeRosa	2,302	43

Modeling, Monitoring Systems and Quality Assurance

Waste Identification

To improve procedures to characterize wastes for listing under RCRA, research will be conducted to develop methods for characterizing and detecting particular wastes and providing criteria for determining if those wastes constitute a potential hazard. The lack of standardized methods emphasizes the immediate need for a comprehensive program to assure that data of known quality are being collected. Methods will be tested for application to highly toxic wastes in soil and sediments, for detection of organics in the ambient air of waste disposal facilities, and for determining the reactions of wastes in all media. A validation of the analytical methods contained in the SW-846 document is being conducted.

Techniques for field monitoring of waste sites will be improved, including statistics for sampling design and evaluated standard methods. RCRA and disposal regulations require the establishment of a groundwater monitoring program at most facilities, including detection and compliance of saturated and vadose zone monitoring. Of particular importance is subsurface monitoring of sites and investigation of new techniques for monitoring soils, and biota, ambient air, and waste incineration emissions. Methods will be developed to detect trace metals in groundwater, ambient water, and sludges.

Efforts will be directed toward validating waste incinerator test methods for principal organic hazardous constituents from waste incinerator stacks. Validated methods for continuous monitoring of carbon monoxide and hydrochloric acid emissions from incinerators will be developed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	William Budde	914.6	45
EMSL/LV	Robert Snelling	5,742.4	30
AREAL/RTP	John Clements	566.6	17
OMMSQA/HQ	Thomas Baugh	0	0

Environmental Processes and Effects

Biotechnology

The biotechnology research effort is concerned with interactions between microorganisms and ecological processes in an attempt to develop comprehensive knowledge of the biochemical, physiological, and genetic mechanisms involved. The program will examine the potential environmental risk associated with the application of genetically engineered microorganisms (GEMs).

Assessment of environmental impacts of GEMs requires reliable methodologies for their identification and enumeration in environmental samples. The methods must address the analytical and operative criteria required for any monitoring program. They must be sensitive and specific to differentiate GEMs from the background of indigenous organisms. They have to be feasible, accurate, reproducible, and widely applicable since samples will differ greatly from one another, such as leaf surfaces and freshwater reservoirs.

Contained aquatic and terrestrial laboratory systems (microcosms) are used to assess the fate of GEMs in various ecosystems. The fate of microbes in microcosms is compared with fate in natural systems to assess the validity of laboratory data.

Research in this area applies techniques of molecular and classical genetics to ecological studies to assess survival and growth of novel microorganisms. Questions of specific niche requirements, selective advantages of new genotypes, and potential for causing harmful effects to populations, ecosystems, or processes will be examined. The research also addresses genetic stability of altered microorganisms, including transmissibility of plasmids and other genetic information *in situ*. All extramural monies will be expended by the laboratories subsequent to final planning actions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/GB	Raymond G. Wilhour	889.3	27
ERL/COR	Thomas Murphy	222.2	100
OEPER/HQ	Sam Williams	2,782.2	0

Environmental Engineering and Technology Demonstration

Biotechnology/Microbial and Biochemical Pest Control Agents

This research program plan addresses the three primary engineering-oriented research concerns posed by the Office of Toxic Substances (OTS) in its implementation of the Premanufacturing Notice (PMN) process of the Toxic Substances Control Act (TSCA):

- mechanisms of accidental or deliberate release of the modified genome or organism from the site of production (e.g., in effluents);
- availability and effectiveness of containment controls or destruction techniques; and
- worker exposure, particularly due to aerosols.

In order to satisfy these concerns, the program is divided into two programs. The first addresses biologically based manufacturing processes, the second addresses deliberate application to a specific environmental area in a remedial action to destroy or detoxify another pollutant present in that environment.

Data bases are being developed for assisting with the PMN review under the first sub-program. These will permit assessment of the occurrence, magnitude, and degree of risk management applicable to deliberate and accidental release from biologically based manufacturing processes. Models are being developed along with an information base which OTS will use as a guide for identification of potential hazards and implementation of safeguards for reduction of risk to acceptable levels.

Because genetically engineered microorganisms (GEMs) have already been developed for applications requiring deliberate release into the environment, the second subprogram addresses the development of procedures for assessing the safety aspects of the engineering techniques for introducing these microorganisms into the environment. Information being developed will allow an assessment of the risk of migration from the site

and of the management techniques to prevent or minimize this migration.

A number of application techniques will be addressed using scenarios appropriate to the environment likely to be encountered, (e.g., farmland). Applications considered for evaluation include: agricultural formulations; pollutant clean-up and control (spills, landfills, contaminated sediments, oil spills); tertiary oil recovery; in-situ mineral recovery (metals leaching, oil shale).

The engineering assessment protocols for release and exposure are being structured to account for several sets or combinations of various biological properties, or subsets, and appropriate applications involving deliberate environmental release. Further effort is being devoted to identifying specific data (chemical, physical, and biological) that will be required as inputs to the engineering risk-assessment protocol so that data can specifically be developed and submitted as part of the PMN review procedures.

Finally, from advance sampling studies on decontamination technology, experimental procedures on kill-tank efficiency, to ensure 100% kill are being developed. Evaluation of containment approaches will be completed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/Cin	John Burckle	520	
OEETD/HQ	Bill McCarthy	0	15

Modeling, Monitoring Systems and Quality Assurance

Biotechnology/Microbial and Biochemical Pest Control Agents

This research evaluates and standardizes monitoring methodology to identify and quantify release of genetically engineered microorganisms or biotechnology products into the environment. Standardized procedures are developed into guidelines for routine monitoring applications to assess either human exposure or environmental impact of Genetically Engineered Microorganisms (GEMS) release.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Stephen Hern	262.0	24
OMMSQA/HQ	Michael Dellarco	0.0	0

Biotechnology/Microbial and Biochemical Pest Control Agents

Health Effects

Biotechnology research is aimed at the development of methods to evaluate the potential health hazards of genetically engineered organisms and the products of these microorganisms. Potential mechanisms of action and screening methods for adverse mechanisms are being investigated. Models are being developed to assess the potential dispersal capability of genetically engineered genes.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Hal Zenick	487.4	32.5
OHR/HQ	Randall Bond		

Ecology: Ecotoxicity and Risk Assessment

Environmental Processes and Effects

Environmental risk assessment studies on the linkage of environmental exposure and ecotoxicology hazard assessment techniques, and development of methods to evaluate risks continues. The goal is to be able to predict toxic risk to varied ecosystems and components within acceptable limits of uncertainty.

The ecotoxicology studies include the movement, transformation and ultimate disposition of toxic substances in all environmental media as a critical component of risk assessment. How plants and animals or ecosystems are affected by toxic substances are also the subjects of this research effort. Research goals include the identification of important endpoints and development of mathematical modeling techniques (population; transport) to integrate data and depict risk. Input data will include such results as lab to field comparative

responses, measurements of ecosystem resistance and resilience, population changes (mortality; feeding behavior), biota uptake and system recovery. The validated predictive tools and the results will be used in regulatory decision-making and as a guide to formulating regulatory criteria and standards. All extramural monies will be expended by participating laboratories subsequent to final planning actions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	345.8	100
ERL/COR	Thomas A. Murphy	72.3	100
ERL/DUL	Gilman Veith	113.7	100
ERL/GB	Raymond G. Wilhour	0.0	0
OEPER/HQ	Sam Williams	986.0	0
ERL/NARR	Norbert Jaworski	13.3	100

Environmental Processes and Effects

Ecology: Transport/Fate/Field Validation

This research encompasses the determination of the effects, movement, transformation, and ultimate disposition of toxic substances and their degradation products that inadvertently enter into all environmental media. This program provides information on how plants and animals and larger ecosystems are affected by exposure to toxic substances caused by accidents in commerce and industry. Specific activities include developing and validating techniques for assessing hazards, exposure and estimation of the fate of existing chemicals.

Information developed in the above studies provides data necessary for hazard and exposure assessments and for designing mathematical models of chemical transport, transformation and fate. Research addresses such problem areas as: intermedia transfer, characteristics of chemicals (e.g., chemical kinetics/hydrolysis rate constants) and the processes of the receiving environment; comparative toxicological responses; system level effects (e.g., community alterations); effects of toxicants on animal and plant development and applied chemical structure-activity techniques, methods for measuring ecosystem recovery and abiotic transformation. Research results help the

Agency to determine potential adverse impacts of toxicants and to help formulate preventative or remedial actions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie A. Russo	840.6	100
ERL/GB	Raymond G. Wilhour	851.7	100
ERL/COR	Thomas A. Murphy	783.3	100

Modeling, Monitoring Systems and Quality Assurance

Exposure Monitoring

Research for exposure monitoring is dedicated to development, testing, and standardizing monitoring methods to estimate total human exposure and population exposures. Human activity patterns are studied to improve estimates of exposure. Total human exposure data are used to construct models to estimate an individual's pollutant exposure in all media. Microenvironment studies are conducted to fill data gaps.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Stephen Hern	1,259.0	43
AREAL/RTP	Dale Pahl	533.1	20
OMMSQA/HQ	Michael Dellarco	0	0

Health Effects

Health: Markers, Dosimetry, and Extrapolation

This research is aimed at providing techniques to reduce the uncertainties in risk assessments. Techniques are needed to extrapolate between adverse effects seen in animal species and human health effects and between high doses used in animal toxicity testing and low doses typical of environmental exposure. Dosimetry models are being developed for oral, dermal, and inhalation routes of exposure. Biological markers research focuses on the development of indicators of biological dose and resulting effects for eventual application to studies of human populations.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Hal Zenick	4,445.1	34.8
OHR/HQ	Randall Bond		

Health: Markers, Dosimetry, and Extrapolation

Modeling, Monitoring Systems and Quality Assurance

This research evaluates physiological, biochemical, genetic and immunologic techniques as indicators of human exposure to chemical pollutants. These biomarkers are tested for sensitivity, selectivity and reliability in human exposure monitoring systems.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Stephen Hern	268.2	30
OMMSQA/HQ	Michael Dellarco	0	0

Special Human Data Needs

Health Effects

This research is designed to provide information to assist in identifying and regulating existing chemicals with potential human health risks. Research focuses on developing epidemiological and biostatistical methods. Efforts in biochemical epidemiology are underway to identify and evaluate biomonitoring and screening methods for potential application to human environmental epidemiology.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Hal Zenick	1,483.7	23.6
OHR/HQ	Randall Bond		

Structure Activity Relationships

Environmental Processes and Effects

This research is designed to determine the disposition of new toxic chemicals in all environmental media and to determine if selected plants and animals might be affected. This

involves developing structure-activity relationships (SAR) with methodologies based upon molecular structure characteristics to rapidly assess the environmental fate and toxicity of new chemicals. Structure-activity develops those data bases and mathematical models which are used for predicting exposure, bioaccumulation, toxicity, and fate. Activities include the development of data bases on plant uptake, fate of organic chemicals, toxicity to fish and reactivity of chemicals (e.g., photolytic, electrophilic, nucleophilic). Integrated into this research is data on transport and transformation of both organic and inorganic substances in freshwater and multimedia environments and application of SAR to predict effects of new chemicals on biota. The latter includes determination of and predictions on toxic mechanisms and microbial transformation and metabolism. Expert systems are being applied to the SAR approach. Computer based predictive programs are in use in regulatory evaluations.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	351.2	100
ERL/DUL	Gilman Veith	516.4	65

Structure Activity Relationships

Health Effects

Methods are being developed to use combinations of descriptions based on molecular structure to predict enzymatic, genetic, carcinogenic, and other activities of new chemicals to support section 5 of TSCA. Techniques include pattern recognition and statistical and thermodynamic analyses. In addition, chemical data bases are being constructed for use in predicting toxicological responses for new chemicals with similar structures.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Hal Zenick	972.8	46.5
OHR/HQ	Randall Bond		

Toxic Chemical Testing/Assessment

Modeling, Monitoring Systems and Quality Assurance

Support for Toxic Substances Control Act (TSCA)

Quality assurance research is conducted to support routine monitoring and assessment. Studies are underway to evaluate the data used in environmental monitoring field studies and networks for risk assessments. Reference chemicals and analytical spectra for chemical compound identification are produced to provide standardization procedures and guidelines for program offices field studies.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	John Winter	196.0	15
EMSL/LV	Stephen Hern	444.0	31
OMMSQA/HQ	Michael Dellarco	0	0

Scientific Assessment

Support for Toxic Substances Control Act (TSCA)

The scientific assessment program provides support to the Office of Toxic Substances in the area of assessments of cancer, mutagenicity, adverse reproductive/developmental effects, and exposure. These activities support decision-making under TSCA (i.e., existing chemicals, Preliminary Manufacturing Notice (PMN) review, and test guidelines and test rules development).

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	William Farland	120.7	96.2

Environmental Engineering and Technology Demonstration

Engineering

This program supports the Office of Toxic Substances (OTS) in its implementation of the Toxic Substances Control Act (TSCA), Asbestos Hazard Emergency Response Act (AHERA), and Title III of the Superfund Amendments and Reauthorization Act (SARA). The program focuses

on the development of predictive capabilities to be used in assessing release and exposure levels for the review of Premanufacturing Notices (PMNs) for new chemicals, and the techniques and controls for ensuring "no risk" exposure to existing chemicals.

The "new chemicals" subprogram has developed the manufacturing and processing of these chemicals from both the unit operations and "an industrial-setting" perspective. Research in the operations area has focused on drying and filtration equipment. Emphasis has been placed on the frequency of exposure, and the magnitude and duration of inhalation and dermal exposure levels in the work place. Additional emphasis has been directed toward simulating the "real-world" environment.

Research in the industrial-settings area has been concentrated on those manufacturing scenarios found in the polymer processing industry. Emphasis has been directed toward exposures associated with the off-gassing of monomers, degradation products, and polymer additives.

In the fate assessment subprogram, emphasis has been placed on water soluble compounds which, ultimately are subjected to secondary wastewater treatment, and in particular, activated sludge treatment. Based on the high numbers of azo-dye PMN submissions, these dyes remain a priority for investigation.

In the past, agency guidance has been developed from the best- engineering judgment concept. Research is continuing to evaluate the effectiveness of current guidance which includes removal, and in situations where the asbestos-containing materials is to be left in place, operations and maintenance procedures.

To satisfy the needs of AHERA, efforts will evaluate transportation and disposal options, and attempt to indicate the "least-burdensome" strategy when several "risk-free" options are available. Over the next three years, the program will shift toward developing cost-effective removal/containment technologies and addressing the broader area of controlling all harmful respirable and durable fibers.

Toxic Chemical Testing/Assessment

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/Cin	Roger Wilmoth	2,400	25
OEETD/HQ	Bill McCarthy	0	0

Environmental Processes and Effects

Test Method Development

To assess environmental hazards, research focuses on developing, improving and validating single and multi-species toxicity tests for chronic and acute toxicity in aquatic ecosystems. The developed methods support development of testing guidelines for TSCA and provide basic data for determining exposure and appropriate endpoints that can be related to real-world situations.

Test methods development for aquatic biota provides new or modified bioassays which support toxicological evaluations on such concerns as uptake from contaminated sediments, extrapolations from species to species and determining carcinogenic potentials of chemicals.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/DUL	Gilman Veith	145.5	100
ERL/GB	Raymond G. Wilhour	281.5	100

Modeling, Monitoring Systems and Quality Assurance

Test Method Development

Test method development research is conducted to improve procedures to identify and quantitate chemical compounds of interest. Emphasis is placed on development of biological and chemical procedures to measure chemicals in different media including biological monitoring and immunochemical procedures. New statistical techniques are developed for spectra analysis.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Stephen Hern	610.0	41
AREAL/RTP	Dale Pahl	277.0	22
OMMSQA/HQ	Michael Dellarco	0	0

Toxic Chemical Testing/Assessment

Health Effects

Test Method Development

Under the Toxic Substances Control Act, EPA must provide industry with guidance to test chemicals for potential hazards to public health. In order to base regulatory decisions on the best possible data, reliable test methods must be developed for incorporation into test guidelines. The goal of this research is to develop short-term, cost-effective, predictive methods for detecting the toxic effects of chemicals. These test systems include both *in vitro* and *in vivo* methods and bioassays for predicting adverse health effects such as alterations in reproductive and developmental processes and immunotoxic and neurotoxic effects.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Hal Zenick	1,486.6	66
OHR/HQ	Randall Bond		

Scientific Assessment

Emergency Planning and Community Right to Know

In support of Superfund Amendments and Reauthorization Act (SARA) Title III, Section 313, the scientific assessment program prepares profiles and incorporates them into the Integrated Risk Information System (IRIS) to provide information to various governmental agencies and the public on the health effects of chemicals released into the environment.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	William Farland	50.0	0

Modeling, Monitoring Systems and Quality Assurance

Asbestos

Research is being conducted to develop and standardize analytical methods for identification of airborne asbestos fibers in indoor micro-environments and for sampling and analysis of floor tiles which may contain asbestos.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	Dale Pahl	537.3	8
OMMSQA/HQ	Michael Dellarco	0.0	0

Modeling, Monitoring Systems and Quality Assurance

SARA Title III

Research is conducted to identify methods to detect release of chemicals on the SARA Title III list into the environment and to develop human exposure monitoring procedures to assess human exposure to chemicals released from these installations.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	John Winter	339.4	20
OMMSQA/HQ	Michael Dellarco	0.0	0

Environmental Processes and Effects

Biotechnology/Microbial and Biochemical Pest Control Agents

This portion of the research program is planned to develop or improve bioassay methodologies for determining the effects of biological control agents or biochemical agents (e.g., hormones, pheromones) on non-target biotic receptors. The application of the methods assists in establishing testing guidelines and in registering and controlling the use of these control agents. Agents of interest include both genetically altered and unaltered bacteria, viruses and fungi. Parameters to be studied include routes of exposure, methods to recover or identify the agents and to estimate virulence, toxicity and infectivity. Survival, growth, persistence and effects plus controlling abiotic factors are of concern. Generic transfer and stability associated with genetically engineered microorganisms (GEMs) will be investigated. Special handling and monitoring methods and systems will be studied. All extramural monies will be expended by the laboratories subsequent to final planning actions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	Thomas A. Murphy	184.4	100
ERL/DUL	Gilman Veith	103.6	100
ERL/GB	Raymond G. Wilhour	867.8	60
OEPER/HQ	Sam Williams	1,103.1	0

Health Effects

Biotechnology/Microbial and Biochemical Pest Control Agents

Models will be developed on potential interaction of microbial agents and the mammalian cell. Goals are (1) the determination of the ability of microbial agents to replicate in mammalian cells, and (2) to provoke immune responses in non-target (mammalian) hosts. Methods will also be developed using monoclonal antibodies and biotinated DNA probes to enable the identification of genetic material from microbial pesticides in non-target sites such as mammalian cells *in vitro* and *in vivo*. Research will also focus on the effects

of genetically engineered pesticides on mammalian organisms.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Hal Zenick	1,139.4	34.7
OHR/HQ	Randall Bond		

Ecology: Ecotoxicity and Risk Assessment

Environmental Processes and Effects

To register or re-register pesticides it is necessary to develop a focused risk assessment process for integrating hazard and exposure assessments into models which express the probability of risk to important non-human populations. This facet of the research program develops environmental risk assessment methodology by combining impact data using existing or new models to express risk as a probability with estimates of the associated uncertainty.

New endpoint responses will be studied encompassing ecosystem structures and function. Selected wildlife and microbial populations will be used to reflect population changes and other changes that influence risk evaluations. Other parameters that affect model integrity will be studied (e.g., species susceptibility; chemical routes of exposure and uptake and residues). Modeling will be supported through data integration and model calibration and validation will be supported through field studies which includes all media. All extramural monies will be expended by the participating laboratories subsequent to final planning actions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	0.0	0
ERL/COR	Thomas A. Murphy	50.3	100
ERL/DUL	Gilman Veith	129.5	100
ERL/GB	Raymond G. Wilhour	0.0	0
OEPER/HQ	Sam Williams	780.0	0

Ecology: Transport/Fate/Field Validation

Environmental Processes and Effects

Research will concentrate on the development, refinement and validation of techniques and models to measure and predict pesticide transport,

degradation, exposure, effects and fate in the environment. Laboratory and field studies will be conducted to substantiate the applicability of methods and mathematical models and to determine if results are valid and reflect environmental responses under natural conditions. Data from these studies will be used to assess pesticide hazards to surrogate species, populations and communities representative of aquatic (i.e., estuarine) and terrestrial habitats.

These investigations will include analysis of abiotic influences on study results and on various chemical and physical factors and processes. Sorption, leaching and bioaccumulation will be evaluated. Ground water contamination and associated processes will be explored and remedial actions sought. Predictive techniques for exposure assessment technology will be improved with studies on pesticide sorption kinetics, transformations, structure reactivity correlations and mechanisms of degradation. Terrestrial ecotoxicology studies will include development of data and methods to assess and predict stress impacts on wildlife (e.g., bird) populations.

Information and data including assessments and predictive tools, evaluations of assessment criteria, models and user manuals, workshops and reviews are applied to support the Agency's regulatory actions.

All extramural monies will be expended by the laboratories subsequent to final planning actions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	341.2	100
ERL/COR	Thomas A. Murphy	501.3	33
ERL/DUL	Gilman Veith	562.6	64
ERL/GB	Raymond G. Wilhour	949.1	78
OEPER/HQ	Sam Williams	914.3	41

Environmental Engineering and Technology Demonstration

Engineering

This program which supports the Office of Pesticide Programs (OPP) consists of two major areas: protective clothing and disposal technology. Several areas of protective clothing research are concluding which will provide a "Guidance

Manual for Selecting Protective Clothing for Agricultural Pesticide Operations." This manual will serve as a reference document for OPP to use in protective-clothing issues related to OPP's regulatory and training activities. This manual will include standard test methods and performance data from both laboratory and field tests.

OEETD will continue to evaluate existing disposal techniques and processes for destroying specific pesticide classes, develop a treatability database applicable to pesticides and their disposal, and develop improved container reuse technology including a test method to ensure compliance with existing regulations.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/Cin	Michael Royer	1,200	35
OEETD/HQ	Bill McCarthy	0	0

Modeling, Monitoring Systems and Quality Assurance

Exposure

Research is being conducted to develop and test the Total Exposure Assessment Methodology (TEAM) approach for measurement of exposure to pesticides residues in children for pesticides used routinely by the general population. Exposure of children to pesticides via personal air, food, drinking water, and dermal exposure will be studied using TEAM methods.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	Andrew Bond	206.0	6
EMSL/LV	Stephen Hern	165.4	13
OMMSQA/HQ	Michael Dellarco	0	0

Health Effects

Health: Markers, Dosimetry and Extrapolation

This research focuses on developing animal models to assess health risks and improve methodology for extrapolating results of animal toxicity studies into risk estimates for humans.

Studies will include evaluation of interspecies differences in the dermal absorption of pesticides, examination of structure-activity relationships, examination of metabolic differences between species which may contribute to teratogenic outcomes, and the investigation of potential interactions between alterations in maternal health status and susceptibility to pesticide exposures. Additionally, a computerized data management system which analyzes genetic data will continue to be developed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Hal Zenick	1,091.5	55
OHR/HQ	Randall Bond		

Modeling, Monitoring Systems and Quality Assurance

Health: Markers, Dosimetry and Extrapolation

Research is being conducted to relate external dose to internal dose and to identify onset of disease states resulting from exposure to pesticide residues. Research studies are being carried out to define the relationship between biological indicators of exposure and dose.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Stephen Hern	532.0	45
OMMSQA/HQ	Michael Dellarco	0	0

Modeling, Monitoring Systems and Quality Assurance

Support

The pesticides quality assurance program ensures the accuracy of the data which is attained through testing and analysis. This program conducts quality assurance research and maintains a Pesticide Repository of high purity chemicals. Federal and State laboratories use these samples as standard reference for internal quality control. Research is conducted to develop procedures to ensure control in environmental monitoring studies and analysis of samples for pesticide

residues. Efforts will be initiated in FY90 to assess the merits of privitizing the Pesticides Repository.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	John Winter	294.7	0
OMMSQA/HQ	Michael Dellarco	0.0	0

Environmental Processes and Effects

Test Method Development

Laboratory studies will develop, improve and validate bioassay methodologies to be used as standardized pesticide testing protocols for aquatic organisms. Various methods will be geared to testing chosen life stages of endemic fishes and crustaceans or surrogate test species for long-term or short-term durations. These methods will help assess both exposure and effects (e.g., metabolic, mortality or teratogenic response) of pesticides and pesticide ingredients under acute and chronic conditions and some may be used for monitoring particular pesticides or sensitive biota and for predicting response. Influencing environmental factors which may modify testing results will be studied to establish confidence limits for the methods under given conditions. The methods will contribute to establishment of early detection of hazards and provide sensitive, rapid and inexpensive evaluation techniques.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/GB	Raymond G. Wilhour	282.5	100

Health Effects

Test Method Development

This research involves developing and refining bioassays for the detection of adverse alterations in the development of reproductive processes in animals which allow for more accurate evaluations of reproductive development and function. Techniques are also being developed, validated, refined and implemented for

determining human genetic effects caused by exposure to chemical carcinogens and mutagens. Additionally, methods are being developed to determine the neurotoxicity and immunotoxicity of pesticides.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Hal Zenick	1,790.8	70
OHR/HQ	Randall Bond		

Scientific Assessment

Support for Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) Activities

The scientific assessment program provides support to the Office of Pesticide Programs in the area of assessments of cancer, mutagenicity, adverse reproductive/ developmental effects, and exposure. Support is also provided on a case-by-case basis with laboratory data audits.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	William Farland	145.0	100

Environmental Engineering and Technology Demonstration

Develop and Evaluate LIMB Technology

This area is supporting the evaluation of alternative acid rain control technologies: specifically the development and commercialization of an integrated NO_x/SO_2 control technology—The Limestone Injection Multistage Burner (LIMB).

The LIMB control technology can substantially reduce both NO_x and SO_2 emissions while at the same time reducing the costs for control. A systematic development is underway to bring the LIMB technology to the point where industry would be willing to commercialize it. The 1990 program will include: research on sorbent reaction mechanisms, detailed analysis to identify potential operability and reliability problems, and operation and testing of the industry/EPA cofunded full scale demonstration on a tangentially-fired utility boiler.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Mike Maxwell	3,403.2	30
OEETD/HQ	Marshall Dick	150	77

Environmental Processes and Effects

Establish Deposition Monitoring Data Base

EPA's National Dry Acid Deposition Network will consist of 51 operational sites. The quantification of subgrid variability of dry deposition will continue with particular attention to areas of complex vegetation and terrain.

In the wet deposition area, development of better wet collectors (buckets) will be completed. Quality assurance, data systems support, and analyses of spatial and temporal variation of data are an integral part of the program.

A state of science paper will be written for the 1990 assessment.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	Steven Bromberg Ken Knapp	3,371.7	4
OEPER/HQ	Craig Hillock	1,011.6	15

Environmental Processes and Effects

Estimate Emissions from Man-Made Sources

This research effort gives primary emphasis to the development of a high quality emissions data base for calendar year 1992. SO2, NOx, and VOC are the emission species of principal interest. Models to forecast emission trends and costs of various control programs are being developed. These economic sectoral models and the emissions inventories will be used to support regional and national policy analysis including the NAPAP 1990 assessment.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	David Mobley	2,100.6	13
OEPER/HQ	Larry Montgomery	471.1	6

Environmental Processes and Effects

Understand and Quantify Effects on Material and Cultural Resources

Chamber and field studies for paint/substrate systems will continue in order to make the link between microscopic damage and macro-damage (peeling, cracking, blistering, etc). A state of the science report will be written for the 1990 assessment. The program will terminate at the end of FY 90.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	John Spence	12.0	100
OEPER/HQ	Paul Ringold	827.8	1

Environmental Processes and Effects

Understand and Quantify Aquatic Effects

The Aquatic Effects Research Program comprises the following activities: (1) completion of Phase II of the National Surface Water Survey; (2) formulation of predictive regional aquatic chemistry models which incorporate episodic and non-episodic events; (3) completion of the Direct/Delayed Response Project (DDRP) research in the Mid Appalachian Region; (4) operation of a

prototype intensively studied watershed site in Maine to collect data for use in testing predictive models of watershed response to acid deposition; (5) completion of a whole lake manipulation study in Wisconsin; and (6) completion of the NAPAP Integrated Assessment and State of Sciences documents.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	Dixon Landers	8,106.6	6
EMSL/LV	Gareth Pearson	584.0	14
AREAL/RTP	Steven Bromberg	70.0	0
ERL/DUL	John Eaton	172.5	13
OEPER/HQ	Bill Fallon	1,932.5	8

Environmental Processes and Effects

Understand and Quantify Terrestrial Effects

Research will be performed at several integrated multidisciplinary research sites, mostly in eastern spruce/fir, southern commercial, and eastern hardwood forest types. The research will explore, in part, the relationship between forest dieback and reduced growth due to the exposure and deposition of airborne chemicals thought to be factors in acidic deposition. These studies will be congruent with other work to quantify and evaluate the extent and magnitude of recent changes in forest condition. Results of this research will be encompassed in a detailed evaluation of S, N, and associated pollutants on forest response. Models will be developed to project forest response under various alternative deposition scenarios.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	Ralph Baumgardner	1,663.0	2
ERL/COR	Robert Lackey	3,166.0	5
OEPER/HQ	Kenneth Hood	1,362.9	10
EMSL/LV	Bob Snelling	6.0	100

Environmental Processes and Effects

Understanding Atmospheric Processes

This research is designed to improve our capability to examine and predict the atmospheric transport, chemical transformation and the wet and dry deposition of acidic substances emitted into the atmosphere. Laboratory and field studies, using airborne and surface measuring instruments, and an extensive deposition monitoring network is being undertaken to study the movement and transformation of acids and their precursors from sources to receptors. Modules which mathematically simulate the atmospheric processes have been developed for the Regional Acid Deposition Model (RADM). A major field program is currently underway to test and evaluate RADM. RADM will be applied to analyze potential emission control scenarios.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	Jim Vickery	7,738.0	18
OEPER/HQ	Alistair Leslie	1,328.6	16
AEERL/RTP	David Mobley	24.0	100

Technology Transfer, Regulatory Support and Regional Operations Activities

Manage ORD's Technology Transfer, Regulatory Support and Regional Operations Activities

The Office of Technology Transfer and Regulatory Support (OTTRS) has oversight of three outreach activities: ORD participation in the Agency's regulatory development process to ensure its scientific defensibility; a comprehensive and systematic ORD technology transfer effort with emphasis on state and local governments and industry; and more effective assistance by ORD to EPA Regional Offices. Through its Regional Scientist Program, OTTRS is to have a scientist in each EPA Region by 1990. The Director advises the Assistant Administrator on the priority science-policy issues and the regulatory support provided directly to Program Offices by ORD scientists and engineers. OTTRS also oversees the establishment and improvement of ORD program effectiveness through technology transfer and ORD-specific implementation of the 1986 Technology Transfer Act and the increased attention to Regional Office needs and networking of national issues.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OTTRS	Peter Preuss	8,300	

Modeling, Monitoring Systems and Quality Assurance

Manage the Mandatory Quality Assurance Program

Each year, EPA devotes more than $500 million to environmental data operations. Quality assurance (QA) activities play an integral role in the planning and implementation of these operations, and in the evaluation of the resulting data. By means of their QA programs, EPA organizations can enjoy substantial resource savings, because they collect only those data that are needed, and because they can be sure that the data they collect are appropriate for their intended use.

Quality assurance is the process of management review and oversight at the

planning, implementation, and completion stages of an environmental data collection activity to assure that data provided by a line operation to data users are of the quality needed and claimed. Quality assurance should not be confused with quality control (QC); QC includes those activities required during data collection to produce the data quality desired and to document the quality of the collected data (e.g., sample spikes and blanks).

Quality assurance programs consist of specific activities conducted before, during and after environmental data collection. During the planning of an environmental data collection program, QA activities focus on assuring that the quality of the data needed by data users has been defined, and that a QCsystem has been designed for measuring the quality of the data being collected. During the implementation of a data collection effort, QA activities ensure that the QC system is operating and that problems found by QC are corrected. After environmental data are collected, QA activities focus on assessing the quality of the data obtained. Here, one determines whether the data obtained are adequate to support data-dependent regulatory decisions or research hypotheses.

The Quality Assurance Management Staff (QAMS) is charged with overseeing the quality assurance activities of the Agency. QAMS came into being in May 1979, when the Agency recognized the need for formalizing an Agency-wide quality assurance program for all environmental data collection activities. More recently, with the issuance EPA Order 5360.1 in April 1984, the Agency's quality assurance program has been significantly strengthened and broadened. The Order mandates that QA be an integral part of all environmental data collection activities, from planning through implementation and review.

The Order identifies the activities basic to the implementation of a QA program. These include:

- requiring QA in all Agency-supported environmental data collection activities,
- defining Data Quality Objectives,

- developing quality assurance program and project plans,
- conducting management and technical audits and reviews,
- implementing corrective actions based on the audits,
- establishing achievable data quality limits for methods cited in EPA regulations,
- developing and adopting technical guidelines for assessing data quality, and
- providing for QA training.

In recent years, the Agency's QA activities have focused on identifying the basic elements that are essential to effective quality assurance for environmental data. QAMS has put considerable emphasis on issuing guidance defining these key elements and describing their importance in the efficient and effective expenditure of resources assigned to environmental data collection. This guidance development phase has now been completed, and in FY 1990 QAMS will continue with full-scale implementation support and oversight.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OMMSQA/HQ	Stanley Blacker	1,722.8	52

Exploratory Research Core Program

Visiting Scientists Program

The Visiting Scientists Program has two components: a competitive visiting scientists and engineers program and a summer fellowship program. The objective of the Visiting Scientists and Engineers Program is to attract accomplished visitors into the Agency for 1 to 3 years to assist in strengthening the Agency's science policy and research program. Candidates are sought through annual advertisements in nationally known scientific and engineering publications. They are then subjected to a rigorous peer review from which only the top candidates are recommended

for assignment to an EPA laboratory. In FY 1989 four candidates passed peer review.

The Summer Fellows Program is carried out in cooperation with the American Association for the Advancement of Science and sponsors the assignment of post-doctoral and mid-career environmental science and engineering fellows to EPA facilities for the summer months to conduct environmental research projects. In FY 1989, 10 highly qualified fellows were sponsored.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Roger Cortesi	195	0

Exploratory Research Core Program

Exploratory Research Centers

The purpose of the Research Program is to provide dedicated support over several years to multidisciplinary research in topics of interest to EPA. The first solicitation in 1980 resulted in eight such research centers. These centers were established between 1980 and 1981 and have operated continuously since then. Scheduled funding of the centers terminates in 1990 and 1991. The Agency is reevaluating the design of the Centers Program. Several significant changes are contemplated. These changes will be reflected in new solicitations for proposals to be published in 1990.

The centers which are currently operating are listed below:

Industrial Waste Elimination Center (Illinois Institute of Technology)—studies innovative technology and process modification to reduce industrial pollutants

Intermedia Transport Research Center (University of California at Los Angeles)—defines chemical and physical processes governing pollutant exchange at air-land and air-water boundaries

Ecosystems Research Center (Cornell University)—identifies and applies ecosystem principles to environmental management problems

Marine Sciences Research Center (University of Rhode Island)—assesses marine ecosystems health, emphasizing exposure of marine organisms to toxics

Advanced Control Technology Research Center (University of Illinois)—studies separation technology, thermal destruction, biological separation, and chemical detoxification

Ground Water Research Center (Rice University, Oklahoma State University, and the University of Oklahoma)—studies subsurface characterization, transport and fate, and ground water horizon modeling

Environmental Epidemiology Research Center (University of Pittsburgh)—studies basic epidemiology methods and airborne particulate health effects studies

Hazardous Waste Research Center (Louisiana State University)—conducts research to develop advanced technologies for the destruction, detoxification, recovery, or containment of hazardous wastes

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Roger Cortesi	4,400	0

Exploratory Research Core Program

Exploratory Research Grants

The Research Grants Program supports research initiated by individual investigators in areas of priority interest to the Agency. Research proposals are solicited via two mechanisms: (1) the "Solicitation for Research Proposals" which is published each year and invites proposals in broadly defined areas of environmental science and engineering, and (2) the Request for Applications (RFA) which is a more targeted solicitation mechanism which requests proposals in well-defined areas of particular interest to the Agency. All proposals received in response to either mechanism are subjected to a rigorous peer panel review. In addition, those responding to the general solicitation must undergo an Agency relevance review. Areas in which research

proposals will be requested in FY 1989 under the general solicitation include: environmental biology, environmental health, environmental engineering and environmental chemistry and physics.

In an effort to provide more support to minority institutions for the conduct of basic environmental research, the Research Grants Program makes available pre-application assistance for minority faculty at Historically Black Colleges and Universities through its Minority Institutions Assistance Program. Whether or not this assistance is used, however, research proposals received under this program are reviewed along with proposals received under the general solicitation and in accordance with the standards applied thereunder.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Roger Cortesi	18,200	0

Small Business Innovation Research (SBIR) Program

Exploratory Research Core Program

Public Law 97-219 requires EPA to devote 1.25% of its extramural research and development budget to Small Business Innovation Research (SBIR). The SBIR Program funds, via contracts, small businesses with ideas relevant to EPA's mission. The program focuses exclusively on projects in control technology or process instrumentation development. Proposals are solicited in the fall of each year for Phase I research. Phase I research consists of feasibility studies which are supported at a level of up to $50,000. Of these Phase I studies, the best are selected for Phase II studies where actual product development is started. Phase II studies are supported up to a level of $150,000. To date, half of the Phase I efforts have been supported in Phase II. Results from the SBIR Program are expected to lead to the commercial development of a product or process used in pollution control. In fiscal year 1989 the SBIR budget was about $2.5 million.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Walter Preston	2,500	0

Research to Improve Health Risk Assessment (RIHRA) (Health)

Health Effects

The Environmental Protection Agency (EPA) relies on quantitative risk assessments of human health effects to guide the regulatory decision-making process in carrying out the mandates given to EPA under existing environmental legislation. The utility of the risk-based decision making process is dependent upon the accuracy of available effects data and on our ability to extrapolate this information to man. In situations where the scientific data is insufficient, the risk manager is presented with a broad range of possible risks upon which to base his decision. This uncertainty has significant impacts and ramifications for the regulatory process in terms of balancing human health risks against other societal needs.

The primary objective of the RIRHA program is to develop a systematic and integrated research program to improve the scientific basis supporting health risk assessments. Emphasis is being placed on identifying and addressing the significant uncertainties inherent in the risk assessment process. This program will provide critical information on the relationship between exposure (applied dose), dose to target tissue (delivered dose), and associated health effects. Both laboratory and field research will be conducted that will improve our understanding of basic biological mechanisms, especially as it relates from one set of circumstances to another. Research will address four major areas: (1) Analysis of Uncertainty in Risk Assessments, (2) Integrated Exposure Assessment, (3) Physiologically Based Pharmacokinetic Models, and (4) Biologically Based Dose-Response Models.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Larry Reiter	7,234.6	3.8
OHR/HQ	Ken Sexton		

Radiation

Modeling, Monitoring Systems and Quality Assurance

Off-Site Monitoring Program

The overall goal of the research program is to provide the scientifically credible data necessary to assess public exposure to non-ionizing radiation and to man-made radioactive materials and to allow decisions to be made regarding control of that exposure.

In addition, this program provides quality assurance for the Agency's programs for monitoring radiation in the environment. These are supported by providing a common source of radionuclide standards and reference materials, and through laboratory intercomparison studies conducted to assure data of known quality from analyses of environmental samples such as milk, water, air and food.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Charles Costa	289.4	100
OMMSQA/HQ	Deran Pashayan	0.0	0

Environmental Engineering and Technology Demonstration

Scientific Support for Radon Program

This engineering program for radiation supports the Agency's Radon Action Program. It is directed at developing and demonstrating cost-effective methods for reducing radon in houses and other structures. The results of these tests, along with analysis of the findings of others, are provided to the States, private sector organizations (such as builders and contractors), and to homeowners. The research will continue to extend the number of techniques, the housing substructure types and the locations for testing. The research focuses primarily on radon mitigation techniques for existing houses and prevention techniques for new construction. Radon mitigation techniques applicable to school buildings will also be assessed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Alfred Craig	3,518.2	32
OEETD/HQ	Marshall Dick	150	78

Modeling, Monitoring Systems and Quality Assurance

Provide Techniques and Procedures for Site and Situation Assessment

Analytical protocols, sampling techniques, monitoring methods, and data interpretation approaches useful for characterizing air, surface and ground water, wastes, and soils at Superfund sites will be developed, evaluated, and demonstrated. These methods include air monitoring techniques for ambient and source sampling; analytical sample preparation methods; geophysical methods such as high resolution seismic reflection to assist in subsurface characterization; x-ray fluorescence measurements of metal concentrations; remote sensing techniques and geographic information systems for collection and analysis of present and historical site data; soil core preparation procedures; portable gas chromatography for volatiles analysis; personal computer-based geostatistics computer programs; and hydraulic properties of soils.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	William Budde	473.8	51
AREAL/RTP	William McClenny	244.1	24
EMSL/LV	Ann Pitchford	1,895.1	38
OMMSQA/HQ	Thomas Baugh	0	0

Scientific Assessment

Provide Techniques and Procedures for Site and Situation Assessment

Site-, chemical- and situation-specific exposure and risk assessments are being prepared to assist the Program Office and Regions in evaluating the alternative courses of action and regulatory strategies that might be applied at uncontrolled Superfund sites. Activities include development of health and environmental effects assessments for the chemicals most frequently found at candidate sites, participation in the development or review of toxicological profiles, and provision of rapid response health assessments in a short time frame.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Christopher DeRosa	716	53

Environmental Engineering and Technology Demonstration

Clean-up of Uncontrolled Hazardous Waste Sites Requires Technologies for Response and Remedial Action, for Protecting the Personnel Involved and for Supporting Enforcement Actions

This research program develops and evaluates clean-up technology, demonstrating proto-type equipment such as mobile incineration systems and mobile soil washing systems. Remedial technology will be assessed and technical reports provided which will include design data and cost information. Engineering expertise will be applied to the assessment of uncontrolled hazardous waste site situations to assist the Office of Emergency and Remedial Response, Regions and others in the development of corrective measure options. Manuals will be developed establishing personnel safety protocols and evaluating equipment and techniques, especially for decontamination of equipment and personnel. In addition, short-term, quick turn-around technical programs and consultation will be provided to the regional programs and the Office of Waste Programs Enforcement for enforcement support.

The Superfund Innovative Technology Evaluation (SITE) program has been established to enhance the development and demonstration, and thereby establish the commercial availability, of innovative technologies as alternatives to containment systems. The primary goal of the SITE program is to field evaluate these technologies at Superfund sites in order to develop reliable cost and performance data.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/CIN	R. Hill S.James	30,200	9
OEETD/HQ	R. Nalesnick	1,500.0	75

Provide Quality Assurance—Superfund Program Requirements

Modeling, Monitoring Systems and Quality Assurance

Effective remedial design/remedial actions at Superfund sites depend upon analytical data of known and appropriate quality. This program provides support to the Office of Emergency and Remedial Response's Contract Laboratory Program (CLP), which is responsible for most contract chemical analyses under the Superfund program. Support is provided to the CLP in numerous ways. Quality assurance reference materials, such as calibration standards, quality control samples, and performance evaluation samples are designed, prepared, and distributed according to uniform and consistent protocols for analysis by contract laboratories. The analytical data generated by the laboratories are audited in order to assess intra- and inter-laboratory performance and method performance. These data are maintained in the Quality Assurance/Quality Control Data Base. Pre- and post-award on-site contract laboratory inspections are performed to complement the performance evaluations. Based on method performance data, existing analytical protocols are reviewed and improved. A quick response referee laboratory service is provided for use of the EPA Regions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	John Winter	1,260.6	13
EMSL/LV	Llew Williams	3,231.2	25
OMMSQA/HQ	Thomas Baugh	0	0

Provide Technical Support to Enforcement, Program, and Regions

Modeling, Monitoring Systems and Quality Assurance

Site specific monitoring and characterization for all media in support of Superfund investigations is provided to the Agency as part of the Technical Support Program. State-of-the-art monitoring and analytical techniques, as well as thorough quality assurance are essential, especially in enforcement cases. Many monitoring and characterization support activities are provided on an as-requested

basis. These include remote sensing for historical and current site assessment; air, surface- and ground-water, and soils monitoring for site characterization; and analytical chemistry support. Additional support provided includes advice/assistance on sampling methods, design of sampling plans, and analytical method modification. The full range of quality assurance/quality control assistance is offered including design and review of quality assurance plans, provision of quality control materials, and data analysis and interpretation.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	William Budde	410.0	28
AREAL/RTP	William McClenny	388.2	22
EMSL/LV	Shelly Evans	1,405.7	24
OMMSQA/HQ	Thomas Baugh	0	0

Environmental Processes and Effects

Provide Technical Support to Enforcement, Program and Regions

This function provides rapid technical expertise and services to the Office of Waste Programs Enforcement, the Office of Emergency and Remedial Response, Regional Offices, the Environmental Response Team, Department of Justice, and state governments.

Laboratory personnel and facilities are available on a "when and where requested" basis to provide site- and case-specific technical support. Assistance includes training or advice on use of sampling and analytical techniques and on use of appropriate assessment models, including those for ecological risk estimation. In addition, a clearinghouse for information on remedial action technologies, methods, case histories, etc., will be established. Bioassessment assistance will focus on evaluation and application of the protocol to leachate and contaminated soil samples and performing environmental assays. Technical support will also be provided on contaminated marine coastal areas and on polluted sediment remediation. A multimedia, human exposure/risk assessment methodology for prioritizing candidate

remedial action sites in terms of their threats to human health will be developed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RSKERL/ADA	M. Richard Scalf	879.5	31.3
ERL/ATH	Rosemarie C. Russo	500.0	22.4
ERL/COR	Lawrence Kapustka	667.5	39.4
ERL/NARR	Norbert A. Jaworski	647.0	17.3
ERL/DUL	Douglas W. Kuehl	100.0	0.0

Scientific Assessment

Provide Technical Support to Enforcement, Program and Regional Offices

Site- and chemical-specific health assessments are being provided to support Enforcement Office needs for the remedial planning and cost recovery efforts. Assessments provided range from brief hazard summaries to detailed and peer-reviewed documents used in negotiations and litigation.

Risk assessments developed by Regional Offices are reviewed for consistency, technical quality, and adherence to Agency risk assessment guidelines. Technical support on risk assessments is provided to the States and Regions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Kevin Garrahan	594	49

Modeling, Monitoring Systems and Quality Assurance

Hazardous Substance Health, Risk and Detection

The purpose of this program is to develop and evaluate monitoring techniques and systems which are rapid and inexpensive, fill technical voids, integrate monitoring systems into multi-media site assessments, and are as specific, selective and sensitive as possible. Section 311c of the Superfund Amendments and Reauthorization Act authorizes EPA to conduct research "with respect to...detection of hazardous substances in the environment." These innovative approaches

offer potentially significant cost and time savings to Superfund site investigations.

Activities for FY 1990 will focus on the development and standardization of field analytical technology and sampling methods; development of cost effective sampling designs and approaches; and development of techniques for managing and interpreting field data. For example, immunoassay technology for screening single compounds or classes of compounds and field portable systems such as fiber optics chemical sensors will be developed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Eric Koglin	1,777.1	13
OMMSQA/HQ	Thomas Baugh	0	0

Scientific Assessment

Hazardous Substances Health Effects/Risk Assessment and Detection Research

This program fulfills, in part, the Agency's responsibilities under the new Section 311(c) to establish a research program to assess, detect, and evaluate effects on, and risk to, human health from hazardous substances. It enhances the Agency's internal research capabilities relative to Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) assessment activities. The scientific assessment research program, specifically, is integrated with the health effects program, and is developing data and procedures to fill information and assessment gaps that exist in the various phases of the Superfund public health evaluation process, e.g., toxicity assessment, risk characterization, and exposure assessment. Test methods are being developed to allow evaluation of the hazard potential of waste mixtures and to assess complex exposure. Screening techniques for early detection of adverse health effects are being developed as are improved measurement techniques for non-cancer health endpoints such as reproductive effects. Extensive programs in pharmacokinetic modeling and exposure assessment methodology development are also underway.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Michael Callahan	2,181	9

Hazardous Substances Health Effects/Risk Assessment and Detection Research

Health Effects

Research develops data and methods to improve the Superfund public health evaluation process, evaluate the health effects associated with cleanup options, and develops biomonitoring methods. The Superfund risk assessment process involves assessment of toxicity, exposure, and dose in support of the characterization of risk. The research provides improved health evaluation measures to detect, assess, and evaluate the risks to human health from hazardous substances as needed for Superfund removal and remedial cleanup decisions.

Research will develop test methods needed to evaluate the hazard potential of waste mixtures, screening techniques for early detection of adverse health effects, and improved measurement of health endpoints particularly non-cancer endpoints such as reproductive effects and neurotoxicity. Predictive techniques that can reduce the uncertainties in risk assessment caused by data limitations will be developed and site-specific data will be generated in response to requests from the Office of Emergency and Remedial Response, the Office of Waste Programs Enforcement and EPA Regional Offices.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP OHR/HQ	Robert Dyer Thomas Miller	3,779.2	9.9

Superfund Reportable Quantity Regulatory Efforts

Scientific Assessment

Chemical-specific data are being provided on carcinogenicity and chronic effects to support Program Office activities necessary to adjust, by

regulation, the Reportable Quantities (RQ) for hazardous substances. These include completion of the Extremely Hazardous Substances List, consideration of Superfund Amendments and Reauthorization Act (SARA) Title III Section 313 chemicals for listing as CERCLA hazardous substances, listings in association with Section 3001 of Resource Conservation and Recovery Act (RCRA) support for designation of new substances, and review of old RQ calculations.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Alan Ehrlich	684	21

Modeling, Monitoring Systems and Quality Assurance

Innovative/Alternative Technology Research, Development, and Demonstration

Section 311b of the Superfund Amendments and Reauthorization Act requires EPA to conduct the Superfund Innovative Technology Evaluation (SITE) Program, which seeks to accelerate the application of promising new technologies to Superfund problems. Pursuant to this program, the Office of Modeling, Monitoring Systems, and Quality Assurance is demonstrating and evaluating promising monitoring technologies. Examples of technologies being considered for demonstration include fiber optics chemical sensors for ground water contamination, immunoassay systems for organics contamination, cannisters for air sampling, x-ray fluorescence for rapid metals screening, geophysical equipment for remote sensing of buried waste, and cone penetrometers for rapid and extended depth soil sampling.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Eric Koglin	776.2	15
OMMSQA/HQ	Thomas Baugh	0	0

Environmental Processes and Effects

Evaluate Technologies to Manage Uncontrolled Waste Sites

This research activity is focused on evaluating both naturally occurring and improved microorganisms for the degradation of hazardous substances. Present knowledge and available biodegradation technology will be expanded to enable this cleanup technique to be advanced as a viable option to existing chemical and physical remediation processes.

To effect cleanup of hazardous chemicals in the environment, the metabolism of indigenous microorganisms will be enhanced and genetically engineered microbial strains with novel biodegradation characteristics will be constructed. Methods and principles for their application will be developed and potential ecological risks determined. The program will identify high priority chemical structures for study, develop gene banks of novel capabilities, and develop approaches for rapid biodegradation. All extramural monies will be expended by the participating laboratories subject to final planning actions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RSKERL/ADA	James F. McNabb	190.0	100.0
ERL/ATH	Rosemarie C. Russo	112.0	100.0
ERL/GB	Hap Pritchard	110.0	100.0
OEPER/HQ	Will C. LaVeille	1,750.0	0.0

Exploratory Research Core Program

Manage Hazardous Substance Research Centers Program

Authorized by the 1986 amendments to the Superfund Act, the Hazardous Substance Research Centers (HSRC) program supports five university-based research centers across the country. Several features of the HSRC approach make it unique among federally-sponsored research centers programs. First, the program has a "Think globally, act locally" philosophy. This is demonstrated by the "Region-Pair" concept which drives each center. Whatever the research focus of

a particular center is, the center has a responsibility to address problems of particular interest to a specific area of the country corresponding to two contiguous Federal Regions or "Region- Pairs". Although the results of the center's research may have universal applicability, research supported by the center must be of critical importance to the region-pair. To ensure this, representatives from the local area are members of all of the required advisory committees for the center.

Another significant difference between this program and others is that the HSRC centers are required to commit between 10 and 20% of their funds to the development and conduct of an active technology transfer program. This, too, must be designed to address priority information needs of the states in the region- pair.

Finally, the recipients are required to dedicate a large percentage of their own resources to the operation of the center. At least 20% of the total center's resources must be provided by the recipient. This ensures a continuing commitment to the success of the venture by the universities involved.

The centers, which consist of multi-university consortiums, were selected through a competitive peer review process and were put in place in February 1989. Each center has an eight-year life expectancy and receives approximately $1.0 million annually from EPA. The lead institution of each consortium and the main research focus of each center are described below:

Region-Pair 1-2: New Jersey Institute of Technology: incineration and in-situ remediation and treatment techniques

Region-Pair 3-5: The University of Michigan: bioremediation of organics

Region-Pair 4-6: North Carolina State University: waste minimization and waste management

Region-Pair 7-8: Kansas State University: extraction of metals and mining wastes and removal of pesticide residues from soil, water, and groundwater

Region-Pair 9-10: Stanford University: physical, chemical, and biological treatment of surface and subsurface contaminants

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Roger Cortesi	5,000	0

Small Business Innovation Research (SBIR) Program—Superfund

Exploratory Research Core Program

EPA is required to devote 1.25% of its extramural budget to Small Business Innovation Research (SBIR). The SBIR Program funds, via contracts, small businesses with ideas relevant to EPA's mission. The program focuses exclusively on hazardous substance projects. Proposals are solicited in the fall of each year for Phase I research. Phase I research consists of feasibility studies which are supported at a level of up to $50,000. Of these Phase I studies, the best are selected for Phase II studies where actual product development is started. Phase II studies are supported up to a level of $150,000. Results from the SBIR Program are expected to lead to the commercial development of a product or process used in pollution control.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Walter Preston	792	0

Superfund Research Grants

Exploratory Research Core Program

The superfund research grants program supports research initiated by individual investigators in areas of priority interest to the Agency. Research proposals are solicited via the Request for Applications (RFA), which is a targeted solicitation mechanism that identifies Agency research needs in well-defined areas. Only proposals which specifically address those needs are accepted for review and possible funding.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Roger Cortesi	2,500	0

Scientific Assessment

Consistent Risk Assessment

The scientific assessment program provides uniform Agency-wide guidance on, and assures the consistency of, exposure and risk assessments that support regulatory decision making by EPA.

The program consists of three major components—Risk Assessment Guidelines, the Risk Assessment Forum, and the Integrated Risk Information System.

Risk Assessment Guidelines—Work will continue on the development of Agency-wide risk assessment guidelines. New final guidelines will be published for exposure measurements, male and female reproductive effects, and amendments for the 1986 developmental toxicity guidelines. The Agency will propose new guidelines for neurotoxicity, quantitative guidance for non-cancer health effects, and amendments to the cancer guidelines issued in 1986.

Risk Assessment Forum—The Risk Assessment Forum, a group of senior scientists, meets regularly to promote consensus on risk assessment issues and to ensure that this consensus is incorporated into appropriate risk assessment guidance.

Integrated Risk Information System (IRIS)—EPA's Integrated Risk Information System (IRIS) is an electronic data base of summary health risk information and regulatory information on chemical substances. Primarily intended to serve as a guide for EPA staff when assessing the health risk posed by a chemical, IRIS is available to EPA contractors, state and international environmental agencies, other federal agencies, universities and other risk assessors. This Agency-wide system is readily accessible on E-mail. The health information contained in IRIS has been reviewed and agreed upon by EPA review groups of expert scientists. By the end of the year about 600 chemicals should be in the data base, including some Superfund Amendments and Reauthorization Act (SARA) Title III right- to-know chemicals.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	William Farland	4,262.6	57

Modeling, Monitoring Systems and Quality Assurance

Total Human Exposure

At present, EPA lacks information on human exposure to virtually all chemicals of critical importance to public health. Knowing the number of people exposed and their level of exposure is essential for estimating risk. Without this knowledge, it is currently impossible to make adequate risk assessments, nor can we prioritize the major sources and pathways of exposure. This new long-term program is aimed at developing an exposure data base to serve as a foundation for exposure assessment, and, consequently, risk management strategies.

The goal is to measure and predict human exposures and assess trends in human exposure to chemicals of importance to the Agency. Specific objectives include: (1) developing methodologies for exposure measurement and modeling; (2) characterizing representative microenvironments on a national scale; (3) defining regional and nationwide activity patterns; (4) measuring exposure and body burden directly in field studies; (5) determining the major sources of exposure—including air, drinking water, and food—and their contribution to risk; (6) developing and validating exposure models and exposure-dose relationships; (7) providing a comprehensive national data base on exposure for use of the Agency and the environmental community; (8) monitoring nationwide trends and regional differences in human exposure and activity patterns; and (9) assessing the effectiveness of regulations by observing these trends in total exposure.

Initially, this program will stress five major areas: (1) measurement methods development for personal monitoring and microenvironmental characterization; (2) chemical characterization of representative microenvironments (air, food, soil, water); (3) documentation of human activity patterns; (4) development and validation of predictive exposure models; and (5) direct measurement of exposure to validate models.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	Gerald Akland	2,400.0	30
EMSL/LV	Gareth Pearson	1,000.0	12
EMSL/CIN	Al Dufour	225.0	0
OMMSQA/HQ	Lance Wallace	0	0

Ecological Trends

Modeling, Monitoring Systems and Quality Assurance

This program will identify, collect, organize, and analyze environmental monitoring data and report periodically to the Administrator, Congress, and the public on the current status and trends in indicators of the condition of the nation's ecological resources. This will allow EPA to better assess the status and extent of current environmental problems, by providing diagnostic clues as to the cause of these problems, by establishing baseline conditions against which future change can be measured, and by assessing the degree to which regulatory programs, singly or together, protect the nation's ecological resources. The Environmental Monitoring and Assessment Program (EMAP) will focus on regional- and national-scale problems and will target program outputs at EPA officials who must respond to Congress and the public and senior managers who must direct EPA's finite resources where they will be most beneficial.

Scientifically, EMAP will: (1) identify, characterize, classify, and quantify the ecological resources at risk; (2) design statistical sampling frames that provide unbiased estimates of environmental conditions on a regional basis; (3) identify, evaluate, and develop indicators of ecological condition; (4) operational monitoring programs at a national level for resources of greatest concern; and (5) develop data management and quality assurance systems that allow timely analysis and periodic reporting of program results.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OMMSQA/HQ	Rick Linthurst	7,800.0	38
AREAL/RTP	Jay Messer	0	0

Overview

Introduction

The primary goal of the U.S. Environmental Protection Agency is to mitigate the adverse impacts of pollution on human health and the environment. Toward that end, Agency management must make decisions regarding the development of policy, guidance, standards, regulations, and the appropriate tools for implementing pollution abatement strategies. It is the primary mission of the Office of Research and Development (ORD) to provide high quality, timely scientific and technical information in the service of Agency goals. The Agency's research program is conducted through 12 environmental laboratories across the country, employing some 2000 people, with an annual budget of about $375 million. The research focuses on areas targetted by the planning process as needing additional emphasis in order to provide the information required for Agency decision making.

Research Perspectives

The overall planning process engenders an applied research and development program focused on answering key scientific and technical questions related to EPA's decision making, short-term scientific and technical studies supporting immediate regulatory and enforcement decisions, and a longer-term research program that extends the knowledge base of environmental science and anticipates environmental problems.

The core research and development program is focused on the following functional areas:

- Health effects research—to determine the adverse effects of pollutants on human health
- Ecological effects research—to determine the adverse effects of pollutants on ecosystems
- Environmental process and fate research—to understand how pollutants are transported and modified as they move through soils, ground and surface waters, and the atmosphere
- Environmental monitoring research—to develop methods of identifying pollutants in the environment and measuring exposure to such substances
- Risk assessment research—to develop methods to integrate information on pollutant sources, fate and transport, exposure, and health and ecological effects in order to assess the overall risk posed by a pollutant or a group of pollutants

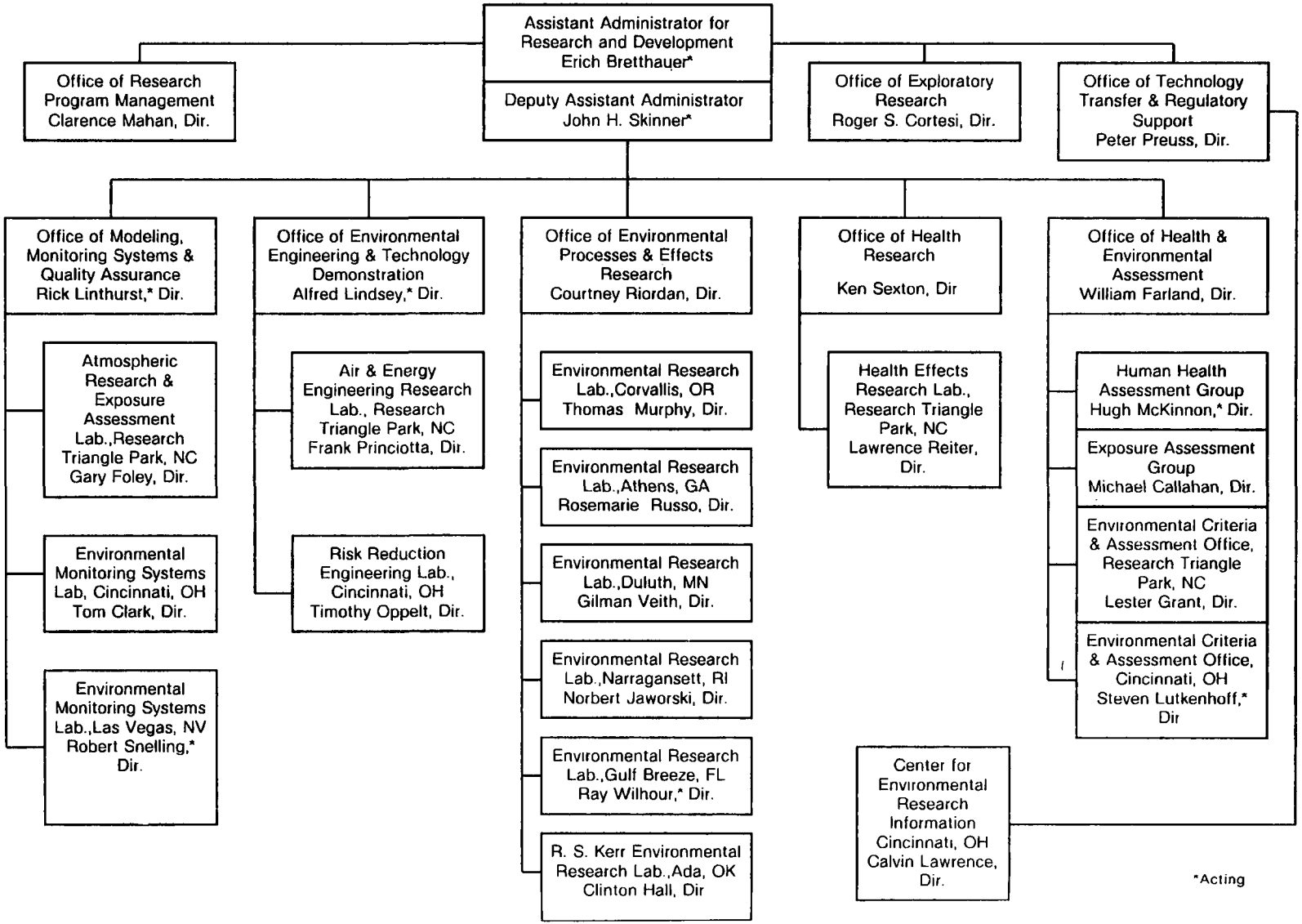
- Risk reduction research—to develop control technologies to treat, destroy, or contain pollutants and methods to reduce or eliminate the sources of pollutants or to prevent exposure to pollutants.

In addition to functional areas, several cross-media problems also categorize the total ORD program. Those cross- media problems receiving special emphasis at present and for the foreseeable future and the Agency programs most concerned are:

- Global climate change (air, water, hazardous waste);
- Total and human exposure assessment (air, water, hazardous waste/superfund, pesticides/toxic substances);
- Wetlands (water, hazardous waste/superfund);
- Accidental releases (air, water, hazardous waste/superfund);
- Comparative risk for complex mixtures (air, water, hazardous waste/superfund, pesticides/toxic substances);
- Technology Transfer (all); and
- Biotechnology (air, water, pesticides/toxic substances).

Conclusions

ORD's ongoing activities evolve from a process of mediation between research concepts and regulatory/programmatic applications, as well as from a growing fund of commonly held priorities and core values. As the Agency continues to refine strategies for addressing increasingly complex environmental problems, the goal of ORD is to affect those strategies with sound science, sound judgment, and vision.


Assistant Administrator for Research and Development Erich Bretthauer*
Deputy Assistant Administrator John H. Skinner*
Office of Research Program Management Clarence Mahan, Dir.
Office of Exploratory Research Roger S. Cortesi, Dir.
Office of Technology Transfer & Regulatory Support Peter Preuss, Dir.
Office of Modeling, Monitoring Systems & Quality Assurance Rick Linthurst,* Dir.
Atmospheric Research & Exposure Assessment Lab.,Research Triangle Park, NC Gary Foley, Dir.
Environmental Monitoring Systems Lab, Cincinnati, OH Tom Clark, Dir.
Environmental Monitoring Systems Lab.,Las Vegas, NV Robert Snelling,* Dir.
Office of Environmental Engineering & Technology Demonstration Alfred Lindsey,* Dir.
Air & Energy Engineering Research Lab., Research Triangle Park, NC Frank Princiotta, Dir.
Risk Reduction Engineering Lab., Cincinnati, OH Timothy Oppelt, Dir.
Office of Environmental Processes & Effects Research Courtney Riordan, Dir.
Environmental Research Lab.,Corvallis, OR Thomas Murphy, Dir.
Environmental Research Lab.,Athens, GA Rosemarie Russo, Dir.
Environmental Research Lab.,Duluth, MN Gilman Veith, Dir.
Environmental Research Lab.,Narragansett, RI Norbert Jaworski, Dir.
Environmental Research Lab.,Gulf Breeze, FL Ray Wilhour,* Dir.
R. S. Kerr Environmental Research Lab.,Ada, OK Clinton Hall, Dir
Office of Health Research Ken Sexton, Dir
Health Effects Research Lab., Research Triangle Park, NC Lawrence Reiter, Dir.
Office of Health & Environmental Assessment William Farland, Dir.
Human Health Assessment Group Hugh McKinnon,* Dir.
Exposure Assessment Group Michael Callahan, Dir.
Environmental Criteria & Assessment Office, Research Triangle Park, NC Lester Grant, Dir.
Environmental Criteria & Assessment Office, Cincinnati, OH Steven Lutkenhoff,* Dir
Center for Environmental Research Information Cincinnati, OH Calvin Lawrence, Dir.
*Acting

ORD Organization

Please note, the list below includes both commercial (CML) and Federal (FTS) telephone numbers. Where only one number is listed, it serves both purposes.

Assistant Administrator for Research and Development

Erich Bretthauer (Acting) Headquarters, Washington, DC (RD-672)	(202) 382-7676

Deputy Assistant Administrator

John H. Skinner (Acting)	(202) 382-7676

Senior ORD Official, Cincinnati

Francis T. Mayo Cincinnati, OH 45268	CML (513) 569-7951 FTS 8-684-7951
Support Services Office Director, Robert N. Carr	CML (513) 569-7966 FTS 8-684-7966

Senior ORD Official, Research Triangle Park

Ralph H. Hazel (MD-50) Research Triangle Park, NC 27711	CML (919) 541-0179 FTS 8-629-0179

Office of Research Program Management

Director, Clarence E. Mahan Headquarters, Washington, DC (RD-674)	(202) 382-7500

Office of Exploratory Research

Director, Roger Cortesi Headquarters, Washington, DC (RD-675)	(202) 382-5750
Research Grants Staff Director, Robert Papetti	(202) 382-7473

Research Centers Program
Acting Director, Karen Morehouse (202) 382-5750

Visiting Scientists Program
Coordinator, Alvin Edwards (202) 382-7473

Small Business Innovation Research Program
Director, Walter Preston (202) 383-7445

Office of Technology Transfer and Regulatory Support

Director, Peter W. Preuss (202) 382-7669
Headquarters, Washington, DC (RD-672)

Regulatory Support, Staff
Director, Jay Benforado (202) 382-7669

Technology Transfer Staff
Director, Jack Stanton (202) 382-7671

Center for Environmental Research Information (CERI)
Director, Calvin Lawrence CML (513) 569-7391
Cincinnati, OH 45268 FTS 8-684-7391

Regional Operations Staff
Director, David Klauder (202) 382-7667
Regional Scientist Program Coordinator,
Mike Moore (202) 382-7667

Office of Health Research

Director, Ken Sexton (202)382-5900
Deputy Director, (Vacant)
Headquarters, Washington, DC (RD-683)

Program Operations Staff
Director, Mary Ellen Radzikowski (202) 382-5891

Environmental Health Research Staff
Director, David Kleffman (202) 382-5893

Health Effects Research Laboratory
Director, Lawrence W. Reiter (MD-51) CML (919) 541-2281
Deputy Director, Harold Zenick FTS 8-629-2281

ORD Organization

Office of Modeling, Monitoring Systems and Quality Assurance

Acting Director, Rick A. Linthurst Deputy Director, H. Matthew Bills Headquarters, Washington, DC (RD-680)	(202) 382-5767
Program Operations Staff Director, Paul D. Palm	(202) 382-5761
Quality Assurance Management Staff Director, Stanley Blacker	(202) 382-5763
Modeling and Monitoring Systems Staff Director, Frederick W. Kutz	(202) 382-5776
Atmospheric Research and Exposure Assessment Laboratory Director, Gary J. Foley Acting Deputy Director, Larry T. Cupitt Research Triangle Park, NC 27711	CML (919) 541-2106 FTS 8-629-2106
Environmental Monitoring Systems Laboratory Director, Thomas A. Clark Deputy Director, Gerald D. McKee Cincinnati, OH 45268	CML (513) 569-7301 FTS 8-684-7301
Environmental Monitoring Systems Laboratory Acting Director, Robert N. Snelling Acting Deputy Director, Harold Kibby P.O. Box 93478 Las Vegas, NV 89193-3478	CML (702) 798-2525 FTS 8-545-2525
Vint Hill Station Director, John Montanari P.O. Box 1587, Building 166 Warrenton, VA 22186	CML (703) 347-6224 FTS 8-557-3110

Office of Health and Environmental Assessment

Director, Willilam H. Farland Headquarters, Washington, DC (RD-689)	CML (202) 382-7315 FTS 8-382-7315
Program Operations Staff Chief, Barry Goldfarb	CML (202) 382-7311 FTS 8-382-7311

ORD Organization

Program Liaison Staff Chief, Jerry Moore	CML (202) 382-7323 FTS 8-382-7323
Technical Information Staff Chief, Marie Pfaff	CML (202) 382-7345 FTS 8-382-7345
Human Health Assessment Group Acting Director, Hugh McKinnon	CML (202) 382-7338 FTS 8-382-7338
Exposure Assessment Group Director, Michael Callahan	CML (202) 475-8909 FTS 8-475-8909
Environmental Criteria and Assessment Office Director, Lester Grant (MD-52) Research Triangle Park, NC 27711	CML (919) 541-4173 FTS 8-629-4173
Environmental Criteria and Assessment Office Acting Director, Steven D. Lutkenhoff Cincinnati, OH 45268	CML (513) 569-7531 FTS 8-684-7531

Office of Environmental Engineering and Technology Demonstration

Acting Director, Alfred Lindsey Acting Deputy Director, Stephen Lingle Headquarters, Washington, DC (RD-681)	(202) 382-2600
Program Development Staff Director, Greg Ondich	(202) 382-5748
Program Management Staff Director, Al Galli Deputy Director, Steve Jackson	(202) 382-2583
Field Laboratories	
Air and Energy Engineering Research Laboratory Director, Frank Princiotta (MD-60) Deputy Director, Blair Martin Research Triangle Park, NC 27711	CML (919) 541-2821 FTS 8-629-2821

Risk Reduction Engineering Laboratory
Director, E. Timothy Oppelt — CML (513) 569-7418
Deputy Director, John Convery — FTS 8-684-7418
Cincinnati, OH 45268

Releases Control Branch
Director, Jack Farlow — CML (201) 321-6600
Edison, NJ 08817 — FTS 8-340-6600

Office of Environmental Processes and Effects Research

Director, Courtney Riordan — (202) 382-5950
Deputy Director, Michael W. Slimak
Headquarters, Washington, DC (RD-682)

Program Operations Staff
Director, Patricia M. Neuschatz — (202) 382-5962

Terrestrial and Ground Water Effects Staff
Director, Jack Durham — (202) 475-8930

Marine, Freshwater and Modeling Staff
Acting Director, Anthony Janetos — (202) 382-5791

Field Laboratories

Robert S. Kerr Environmental Research Laboratory
Director, Clinton W. Hall — CML (405) 332-8800
P.O. Box 1198 — FTS 8-743-2224
Ada, OK 74820

Environmental Research Laboratory
Director, Rosemarie C. Russo — CML (404) 546-3134
College Station Road — FTS 8-250-3134
Athens, GA 30613

Office of Research Operations — CML (404) 546-3128
Director, Robert R. Swank — FTS 8-250-3128

Office of Program Operations — CML (404) 546-3430
Director, Roger K. NeeSmith — FTS 8-250-3430

ORD Organization

Environmental Research Laboratory Director, Thomas A. Murphy Deputy Director, (Vacant) 200 SW 35th Street Corvallis, OR 97333	CML (503) 757-4601 FTS 8-420-4601
Environmental Research Laboratory Director, Gilman D. Veith Associate Director for Research, Philip M. Cook 6201 Congdon Boulevard Duluth, MN 55804	CML (218) 727-6692 FTS 8-780-5550
Monticello Field Station Box 500 Monticello, MN 55362	CML only (612) 295-5145
Large Lakes Research Station 9311 Groh Road Grosse Ile, MI 48138	CML (313) 675-5000 FTS 8-226-7811
Environmental Research Laboratory Director, Norbert A. Jaworski Deputy Director, (Vacant) South Ferry Road Narragansett, RI 02882	CML (401) 782-3001 FTS 8-838-6001
Hatfield Marine Science Center Newport, OR 97365	CML only (503) 867-4041
Environmental Research Laboratory Director, (Vacant) Deputy Director, Raymond G. Wilhour Senior Science Advisor, Andrew J. McErlean Sabine Island Gulf Breeze, FL 32561	CML (904) 932-5333 FTS 8-686-9011

ORD Organizational Descriptions

Office of Technology Transfer and Regulatory Support

The Office of Technology Transfer and Regulatory Support (OTTRS) is responsible for integrating ORD's scientific and engineering information and expertise into EPA's regulatory decision-making process and disseminating the results to EPA's Regional Offices. OTTRS also transfers ORD's information and technology to State and local organizations involved in environmental protection. This Office provides overall management and coordination of the ORD technology transfer program. Specific responsibilities include: (1) facilitating and promoting the transfer of technology and technical information and understanding to State and local users (2) analyzing Agency scientific and technical issues to ensure appropriate integration within the Agency's regulatory program activities, (3) implementing a comprehensive national program to facilitate dissemination and exchange of scientific or technical information resulting from ORD's research and development programs through the Center for Environmental Research Information (CERI), and (4) conducting a program which places ORD scientists in EPA Regional Offices on a rotational basis.

Office of Exploratory Research

The Office of Exploratory Research (OER) is responsible for planning, administering, managing and evaluating EPA's exploratory research program in general and, in particular, its extramural grant research in response to Agency priorities as established by Agency planning mechanisms. Its basic objective is to support research aimed at developing a better basic scientific understanding of the environment and its inherent problems. OER accomplishes this objective through five core programs: a Competitive Research Grants Program, an Environmental Research Centers Program, a Hazardous Substance Research Centers Program, a Visiting Scientists Program and a Small Business Innovation Research Program. Separate descriptions of these programs are provided elsewhere in this research guide. In addition to the core programs, OER administers other programs

which are not supported by research and development funds but are nonetheless important to the accomplishment of the OER objective. They include:

- A Minority Fellowship Program which awards fellowships to college seniors and graduate students enrolled on a full-time basis at Historically Black Colleges and Universities and majoring in curricula that could be applied to the solution of environmental problems.
- A Minority Summer Intern Program which extends to recipients of fellowships under the Minority Fellowship Program the opportunity for on-hands experience in the area of their academic training by way of a summer internship at an EPA or other environmental facility. (Both the Minority Fellowship Program and the Minority Summer Intern Program are components of the Minority Institutions Assistance Program, which is briefly described elsewhere in this document.)
- The Agency's Senior Environmental Employment Program (SEE) which utilizes the skills and talents of older Americans to meet employment needs of environmental programs.
- The Federal Workforce Training Program which coordinates ORD's participation in workforce training programs used by state and local governments.
- The Scientific and Technological Achievement Awards Program which gives recognition and makes monetary awards to EPA/ORD laboratory scientists and researchers for outstanding contributions to environmental research.

Office of Environmental Engineering and Technology Demonstration

The Office of Environmental Engineering and Technology Demonstration is responsible for the assessment and the development of methods for control of the environmental and socio-economic impacts of municipal and industrial operations and of energy and mineral resource extraction, processing, conversion, and utilization systems.

The Risk Reduction Engineering Laboratory in Cincinnati, Ohio, investigates ways to prevent, control, and treat hazardous wastes and Superfund related activities. This includes defining and characterizing sources of pollution, catalyzing advances in the state-of-the-art of pollution control, providing engineering concepts for cost-effective engineering solutions to difficult pollution problems and early-warning of emerging sources of pollution.

It also investigates, develops and demonstrates cost-effective methods for the treatment and management of municipal wastewater and sludges and urban runoff; and of industrial processing and manufacturing and toxic discharges; and the development of technology and management systems for the treatment, distribution and presentation of public drinking water supplies.

The Air and Energy Engineering Research Laboratory in Research Triangle Park, North Carolina, catalyzes the development of control technologies and process modifications needed to establish and meet standards for air emissions in a timely and cost-effective manner, and supports EPA's regulatory and enforcement programs. The Laboratory also environmentally assesses the manufacture of synthetic fuels and other current and emerging energy sources.

Office of Health Research

The Office of Health Research is responsible for developing and evaluating toxicity test methods and for providing toxicity data to enable the Agency to accurately identify hazards and determine human risk from environmental exposure. To fulfill this mission, research is conducted in three major areas:

— Toxicity test method development

— Generation of dose-response data

— Development of methods to use data from toxicity testing and dose-response studies to estimate human morbidity and mortality; including extrapolation from animal data to human effects, from high to low doses, from

acute toxicity to long-term effects, and from exposure to dose.

The Health Effects Research Laboratory (HERL) with divisions in Research Triangle Park, North Carolina and Cincinnati, Ohio, conducts research, both intramurally and extramurally, which is responsive to these goals. Physical, biological and chemical agents are studied; and research is conducted in the scientific disciplines of pulmonary toxicology, genetic toxicology, neurotoxicology, developmental and reproductive toxicology, and epidemiology and biometry. Research to improve the quality of health risk assessment is being conducted through the development of pharmacokinetic and biologically based models. These models are being developed to more accurately predict the relationship between environmental concentration, target tissue dose and ultimate health effect.

Office of Environmental Processes and Effects Research

The Office of Environmental Processes and Effects Research is responsible for the administration of a broad range of ecological research programs. These programs are structured to provide the scientific data and technological methods necessary to understand, predict, and control the entry and movement of pollutants into the environment and to determine the effects of such substances on organisms and ecosystems. The information and research products resulting from these programs are directly applicable to fulfilling the Agency's regulatory responsibilities.

Research is conducted within the full realm of environmental media—atmosphere, soil, ground water, surface water, and coastal and marine waters. Major areas of study include toxic substances, hazardous waste, pesticides, acid deposition, biotechnology, global climate change, stratospheric ozone, wetlands, water quality, ecological risk assessment,and status of critical ecological resources—particularly coastal ecosystems. The Office actively provides technical support in environmental science and technology

to regions and States in order to assist in problem solving and to transfer information and technology to local users.

The Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma, serves as U.S. EPA's center for ground water research, focusing its efforts on studies of the transport and fate of contaminants in the subsurface, development of methodologies for protection and restoration of ground-water quality, and evaluation of the applicability and limitations of using natural soil and subsurface processes for the treatment of hazardous wastes. Subsurface transport and fate information is incorporated into mathematical models for use in predicting the transport and fate of contaminants in the subsurface. Efforts to support the immediate needs and activities of EPA's operating programs are focused on the Underground Injection Control Program, the Wellhead Protection Program and the Hazardous Waste and Superfund Programs. RSKERL's Technology Support Program provides decision-makers with a source of information on subsurface fate and transport of contaminants and *in situ* remediation technologies, as well as the associated expert assistance required to effectively use this information.

The Environmental Research Laboratory in Athens, Georgia, conducts and manages fundamental and applied research to predict and assess the human and environmental exposures and risks associated with the release of conventional and toxic pollutants in water and soil. The research focus is predictive ecological science—predictive pollutant fate, predictive exposure assessment, and predictive ecological risk assessment and eco-resource management.

The research identifies and characterizes the natural biological and chemical processes that affect the environmental fate and effects of specific toxic substances, such as pesticides or metals. The results are applied in state-of-the-art mathematical models for assessing and managing environmental pollution problems. Emphasized research areas in FY90 are biospheric feedback in global warming, ecological risk assessment, sediment quality evaluation, and artificial

intelligence-expert systems for predicting chemical reactivity.

EPA's Center for Exposure Assessment Modeling (CEAM) an internationally known center of modeling expertise located at the Athens Lab, provides models, training, and applications support for exposure evaluation and ecological risk assessment. CEAM assists the Agency and States in environmental risk-based decisions concerning the protection of surface water, soil, ground water, and air.

The Environmental Research Laboratory in Corvallis, Oregon, conducts research on terrestrial and watershed ecology and assesses the comprehensive ecological impact of inland pollution and other environmental changes caused by man. This includes the ecological effects of airborne pollutants, such as acid deposition; the ecological effects of global climate UV-B changes; the effects of toxic chemicals on terrestrial plants, animals, and ecosystems; the assessment and restoration of contaminated or degraded environments; the characterization and assessment of the vulnerability of ecological systems such as wetlands, to human impacts; and the ecological risks from the terrestrial release of bioengineered organisms and other biological control agents.

The Environmental Research Laboratory in Duluth, Minnesota, is primarily responsible for developing water quality criteria for the Nation's freshwaters. The mission of this laboratory is to develop methods for predicting and assessing the effects of pollutants and pollution activities on freshwater resources. Located on Lake Superior, the laboratory specializes in the toxicology of pesticides, industrial chemicals and hazardous substances. The laboratory has diversified research programs and two research stations (Grosse Ile, MI—Great Lakes Research—and Monticello, MN—Wetlands/Ecological Research) in carrying out its mission.

ERL-Duluth continues to conduct its research in surface freshwater systems, both flowing and lakes, including the Great Lakes and Freshwater Wetlands. Research programs center on stresses from water criteria pollutants, xenobiotics, and

biological stressors including climate changes and sediments. Investigations focus on the impact of these stresses through a risk assessment/reduction framework including (1) stress/source assessment, (2) classify/characterize, (3) hazard identification, (4) stressor/close response, (5) resiliency/recovery, (6) quantitative risk characterization, and (7) mitigation option analysis.

The Environmental Research Laboratory at Narragansett, Rhode Island, along with its Pacific Coast laboratory in Newport, Oregon, is the Agency's National Marine Environmental Quality Research Laboratory. The Laboratory's research and development efforts support primarily the EPA's Office of Water, Office of Emergency and Remedial Response, and the Office of Air and Radiation. The Laboratory efforts respond mainly to legislative requirements of the Clean Water Act, the Marine Protection, Research and Sanctuaries Act, and the Superfund Reauthorization Act. Major emphasis is placed on providing the scientific base for environmental criteria, waste disposal practices, environmental analysis/impacts, assessments and marine and estuarine risk assessments for regulatory activities of responsible offices.

The principal core areas of the Laboratory reflect its major strengths and are critical to accomplish the Laboratory's mission and the Agency's risk assessment approach to environmental protection. The Laboratory's core disciplines are: Environmental Chemistry, Transports and Fate, Biological and Ecological Effects, Biomonitoring, Ecological Risk Assessment and Multidisciplinary Information Management.

The Laboratory is responsible for the following research program areas: (1) marine and estuarine disposal, discharge of (and recovery from) complex wastes, dredged materials, and other wastes; (2) water use designation and derivation of criteria for marine and estuarine water and sediment; (3) environmental assessment of ocean disposal and discharges of wastes and wastewaters; (4) technical and research support for evaluating remediation options at proposed and designated marine/estuarine Superfund sites; and (5)

research on the effects of global warming and the depletion of stratospheric ozone on marine systems. Technical assistance, technology transfer, and investigations of an emergency nature, e.g., spills of toxic material, also are provided to aid EPA offices in evaluating environmental threats posed by toxicants, other pollutants, and physical modifications along the Mid and North Atlantic, West Coasts, and other geographic locations. Technical assistance is also provided to other Federal agencies, states, municipalities, and industry.

The Environmental Research Laboratory in Gulf Breeze, Florida, has broad research objectives which include the development of scientific information necessary for (1) formulation of guidelines, standards, and strategies for management of hazardous materials in the near-coastal marine environment, (2) definition of current ecological "health" status and prediction of changes in ecological structure and function, and (3) description of cause(s) of aberrant conditions or observed changes in ecological status. Research is primarily devoted to chemical compounds and biological products regulated by EPA's Office of Pesticides and Toxic Substances, the Office of Water Programs, and the Office of Solid Waste and Emergency Response.

Research programs specifically addressed by the Laboratory include (1) definition and evaluation of factors and mechanisms that affect biodegradation rates and bioaccumulation potential in food-webs; (2) development of procedures and evaluation protocols for the biological treatment of hazardous wastes; (3) determination of effects of carcinogens, mutagens, and teratogens in aquatic species (organisms and populations); (4) development of principles and applications of ecotoxicology, including measurements and predictions of the fate and effects of chemicals and biotechnological products on estuarine organisms, populations, communities, and associated ecological structure and function; (5) development and verification of methods and data that allow extrapolation of effects from laboratory observations to field situations, within and among species, populations,

communities, and ecosystems; and (6) development of methods to evaluate the environmental risk of toxic chemicals and products of biotechnology to the marine environment.

Office of Modeling, Monitoring Systems and Quality Assurance

The Office of Modeling, Monitoring Systems and Quality Assurance (OMMSQA) is responsible for: (a) research with respect to the characterization, transport, and fate of pollutants which are released into the atmosphere; (b) development and demonstration of techniques and methods to monitor and model human and ecological exposure and to relate ambient concentrations to exposure by critical receptors; (c) research, development and demonstration of new monitoring methods, systems, techniques, and equipment for detection, identification and characterization of pollutants at the source and in the ambient environment and for use as reference or standard monitoring methods; (d) management and oversight of the Agency-wide quality assurance program; and (e) development and provision of quality assurance methods, techniques and material including validation and standardization of analytical methods, sampling techniques, quality control methods, standard reference materials, and techniques for data collection, evaluation and interpretation.

The Environmental Monitoring Systems Laboratory in Las Vegas, Nevada, conducts research and development programs related to: (a) monitoring of pollutants in the environments; (b) developing sampling strategies and techniques for monitoring hazardous waste leachates in soil and groundwater; (c) developing remote sensing techniques; (d) conducting human exposure monitoring and modeling studies covering several environmental media; (e) evaluating analytical methods for the characterization and quantification of hazardous wastes; and (f) providing quality assurance in support of the EPA's hazardous waste, Superfund, pesticides, ionizing radiation, and acid deposition programs.

The Environmental Monitoring Systems Laboratory in Cincinnati, Ohio, has as its primary missions: (a) conducts research in the development, evaluation, and standardization of chemical and biological methods for environmental assessments; (b) conducts research for detecting, identifying and quantifying microbial pathogens found in environmental media; and (c) provides quality assurance in support of the wastewater, and related solid wastes, Superfund, and toxics programs.

The Atmospheric Research and Exposure Assessment Laboratory in Research Triangle Park, North Carolina, conducts intramural and extramural research programs through laboratory and field research in chemical, physical, and biological sciences to: (a) characterize and quantify present and future ambient air pollutant levels and resultant exposures to humans and ecosystems on local, regional, and global scales; (b) develop and validate models to predict changes in air pollution levels and air pollutant exposures and determine the relationships among the factors affected by predicted and observed changes; (c) determine source-to-receptor relationships relating to ambient air quality and air pollutant exposures, developing predictive models to be used for assessments of regulatory alternatives derived from these relationships, directly or indirectly; and (d) conduct long-term research in the areas of atmospheric methods, quality assurance, field monitoring, biomarkers, spatial statistics, exposure assessment, human activity patterns, and modeling research.

Office of Health and Environmental Assessment

The Office of Health and Environmental Assessment (OHEA) is responsible for assessing the effects of environmental pollutants in varying exposure situations on human health and ecological systems and determining the degree of risks from these exposures. The risk assessments performed by OHEA are used by the Agency as the scientific basis for regulatory and enforcement decisions. OHEA's responsibilities also include the development of risk assessment guidelines and

methodologies, and recommendations for new research efforts that will better support future EPA risk assessment activities and research that will reduce the uncertainties in EPA risk assessment activities.

Comprehensive methodologies are prepared for health assessments of both single chemicals and complex mixtures. Technical assistance to various Agency programs and Regional Offices concerning acceptable pollutant levels and dose-response relations is also provided.

The Office includes four organizational groups:

The Human Health Assessment Group provides state-of-the-art methodology, guidance, and procedures on the health risks associated with suspected cancer-causing agents and the risks associated with chemicals that are suspected of causing detrimental reproductive effects, including mutagenic, teratogenic, and other adverse reproductive outcomes and reduced fertility; assures quality and consistency in the Agency's scientific risk assessments; provides advice on proposed testing requirements for adequate risk assessments; and prepares independent risk assessments.

The Exposure Assessment Group provides advice on the exposure characteristics and factors of agents that are suspected of causing detrimental health effects; provides state-of-the-art methodology, guidance, and procedures for exposure determinations; assures quality and consistency in the Agency's exposure assessments, and prepares independent assessments of exposure and recommendations concerning the exposure potential of specific agents.

The Environmental Criteria and Assessment Office in Research Triangle Park, North Carolina, is responsible for preparing air quality criteria documents and air pollutant health assessment documents for use in Agency regulatory activities, as well as legislatively required health-related reports.

The Environmental Criteria and Assessment Office in Cincinnati, Ohio, prepares health and hazard assessment documents on water pollution and solid and hazardous wastes and hazardous air pollutants.

ORD Office/Laboratory Abbreviations

CERI/CIN	Center for Environmental Research Information Cincinnati, OH 45268 CML (513) 569-7391 FTS 8-684-7391
ECAO/CIN	Environmental Criteria and Assessment Office Cincinnati, OH 45268 CML (513) 569-7531 FTS 8-684-7531
ECAO/RTP	Environmental Criteria and Assessment Office Research Triangle Park, NC 27711 CML (919) 541-4173 FTS 8-629-4173
EMSL/CIN	Environmental Monitoring Systems Laboratory Cincinnati, OH 45268 CML (513) 569-7301 FTS 8-684-7301
EMSL/LV	Environmental Monitoring Systems Laboratory P.O. Box 93478 Las Vegas, NV 89193-3478 CML (702) 798-2100 FTS 8-545-2100
AREAL/RTP	Atmospheric Research and Exposure Assessment Laboratory Research Triangle Park, NC 27711 CML (919) 541-2106 FTS 8-629-2106
RSKERL/ADA	Robert S. Kerr Environmental Research Laboratory P.O. Box 1198 Ada, OK 74820 CML (405) 332-8800 FTS 8-743-2224
ERL/ATH	Environmental Research Laboratory College Station Road Athens, GA 30613 CML (404) 546-3134 FTS 8-250-3134

ORD Office/Laboratory Abbreviations

ERL/COR	Environmental Research Laboratory 200 SW 35th Street Corvallis, OR 97333 CML (503) 757-4601 FTS 8-420-4601
ERL/DUL	Environmental Research Laboratory 6201 Congdon Boulevard Duluth, MN 55804 CML (218) 727-6692 FTS 8-780-5550
ERL/GB	Environmental Research Laboratory Sabine Island Gulf Breeze, FL 32561 CML (904) 932-5311 FTS 8-686-9011
ERL/NARR	Environmental Research Laboratory South Ferry Road Narragansett, RI 02882 CML (401) 782-3000 FTS 8-838-6000
HERL/RTP	Health Effects Research Laboratory Research Triangle Park, NC 27711 CML (919) 541-2281 FTS 8-629-2281
RREL/CIN	Risk Reduction Engineering Laboratory Cincinnati, OH 45268 CML (513) 569-7418 FTS 8-684-7418
AEERL/RTP	Air and Energy Engineering Research Laboratory Research Triangle Park, NC 27711 CML (919) 541-2821 FTS 8-629-2821
OEETD/HQ	Office of Environmental Engineering and Technology Demonstration (RD-681) Washington, DC 20460 (202) 382-2600

ORD Office/Laboratory Abbreviations

OEPER/HQ	Office of Environmental Processes and Effects Research (RD-682) Washington, DC 20460 (202) 382-5950
OER/HQ	Office of Exploratory Research (RD-675) Washington, DC 20460 (202) 382-5750
OHEA/HQ	Office of Health and Environmental Assessment (RD-689) Washington, DC 20460 (202) 382-7315
OHR/HQ	Office of Health Research (RD-683) Washington, DC 20460 (202) 382-5900
OMMSQA/HQ	Office of Modeling, Monitoring Systems and Quality Assurance (RD-680) Washington, DC 20460 (202) 382-5767
OTTRS/HQ	Office of Technology Transfer and Regulatory Support (H-8105) Washington, DC 20460 (202) 382-7669

ORD Key Contacts

	Telephone
Abbott, Jim	CML (919) 541-3443 FTS 8-629-3443
Akland, Gerald	CML (919) 541-2346 FTS 8-629-2346
Barnes, H. M.	CML (919) 541-2184 FTS 8-629-2184
Bates, Ed	CML (513) 569-7774 FTS 8-684-7774
Baugh, Thomas	CML (202) 382-5776 FTS 8-382-5776
Benforado, Jay	CML (202) 382-7449 FTS 8-382-7449
Bishop, Fred	CML (513) 569-7629 FTS 8-684-7629
Black, Frank	CML (919) 541-3037 FTS 8-629-3037
Blacker, Stanley	CML (202) 382-5763 FTS 8-382-5763
Bond, Andrew	CML (919) 541-4329 FTS 8-629-4329
Bond, Randall	CML (202) 382-5893 FTS 8-382-5893
Bromberg, Steve	CML (919) 541-2919 FTS 8-629-2919
Brunner, Carl	CML (513) 569-7655 FTS 8-684-7655
Budde, William	CML (513) 569-7309 FTS 8-569-7309
Bufalni, Joseph	CML (919) 541-2706 FTS 8-629-2706
Burckle, John	CML (513) 569-7506 FTS 8-684-7506
Butler, Larry	CML (702) 798-2114 FTS 8-545-2114
Clark, Robert	CML (513) 569-7201 FTS 8-684-7201
Clark, Thomas A.	CML (513) 569-7301 FTS 8-684-7301
Clements, John	CML (919) 541-2188 FTS 8-629-2188
Convery, John	CML (513) 569-7601 FTS 8-684-7601
Cook, Don	CML (202) 382-5982 FTS 8-382-5982
Cook, Philip M.	CML (218) 720-5572 FTS 8-780-5572
Cordle, Steven	CML (202) 382-5940 FTS 8-382-5940
Cortesi, Roger	CML (202) 382-5750 FTS 8-382-5750
Costa, Charles	CML (702) 798-2305 FTS 8-545-2305
Cote, Ila	CML (919) 541-4922 FTS 8-629-4922
Craig, Alfred B.	CML (919) 541-2821 FTS 8-629-2821
Cupitt, Larry	CML (919) 541-2107 FTS 8-629-2107
Daniel, Bernie	CML (513) 569-7411 FTS 8-684-7411
Dellarco, Michael	CML (202) 382-5794 FTS 8-382-5794
Dempsey, Clyde	CML (513) 569-7504 FTS 8-684-7504
DeRosa, Christopher	CML (513) 569-7531 FTS 8-684-7531
desRosiers, Paul	CML (202) 382-2722 FTS 8-382-2722
Dick, Marshall	CML (202) 382-2583 FTS 8-382-2583
Donaldson, William	CML (404) 546-3184 FTS 8-250-3184
Dufour, Alfred	CML (513) 569-7218 FTS 8-684-7218
Duke, Tom	CML (904) 932-5311 FTS 8-686-9011
Dyer, Robert	CML (919) 541-2760 FTS 8-629-2760
Eaton, John	CML (218) 720-5557 FTS 8-780-5557
Ehrlich, Alan	CML (202) 382-7315 FTS 8-382-7315
Evans, Shelly	CML (702) 798-2270 FTS 8-545-2270
Fallon, William	CML (202) 382-5739 FTS 8-382-5739
Farland, William	CML (202) 382-5898 FTS 8-382-5898

ORD Key Contacts

	Telephone
Farlow, John	CML (201) 321-6635 FTS 8-340-6635
Farrell, Joseph	CML (513) 569-7645 FTS 8-684-7645
Finkelstein, Pete	CML (919) 541-2347 FTS 8-629-2347
Foley, Gary	CML (919) 541-2106 FTS 8-629-2106
Fowle, Jack	CML (919) 541-2281 FTS 8-629-2281
Fradkin, Larry	CML (513) 569-7584 FTS 8-684-7584
Freeman, Harry	CML (513) 569-7529 FTS 8-684-7529
Garrahan, Kevin	CML (202) 382-2588 FTS 8-382-2588
Grant, Lester	CML (919) 541-4173 FTS 8-629-4173
Hall, Robert E.	CML (919) 541-2477 FTS 8-629-2477
Hangebrauck, R. P.	CML (919) 541-4134 FTS 8-629-4134
Hern, Stephen	CML (702) 798-2594 FTS 8-545-2594
Hill, Ronald D.	CML (513) 569-7861 FTS 8-684-7861
Hitchens, Lynnann	CML (202) 382-2583 FTS 8-382-2583
Hogsett, William	CML (503) 755-4632 FTS 8-420-4632
Hood, Ken	CML (202) 382-5967 FTS 8-382-5967
Jakobson, Kurt	CML (202) 382-5748 FTS 8-382-5748
Janetos, Anthony	CML (202) 382-5791 FTS 8-382-5791
Jaworski, Norbert A.	CML (401) 782-3000 FTS 8-838-6000
Jones, Julian	CML (919) 541-2489 FTS 8-629-2489
Jutro, Peter	CML (202) 382-5600 FTS 8-382-5600
Kapustka, Lawrence	CML (503) 757-4606 FTS 8-420-4606

	Telephone
Keeler, George	CML (405) 332-8800 FTS 8-743-2212
Kibby, Harold	CML (503) 757-4625 FTS 8-420-4625
Klauder, David	CMS (202) 382-7667 FTS 8-382-7667
Klee, Al	CML (513) 569-7493 FTS 8-684-7493
Kleffman, David	CML (202) 382-5893 FTS 8-382-5893
Knapp, Kenneth	CML (919) 541-3085 FTS 8-629-3085
Koglin, Eric	CML (702) 798-2237 FTS 8-545-2237
Kreissl, James	CML (513) 569-7611 FTS 8-684-7611
Krishnan, Bala	CML (202) 382-2613 FTS 8-382-2613
Kutz, Frederick W.	CML (202) 382-5776 FTS 8-382-5776
Kuehl, Douglas W.	CML (218) 720-5511 FTS 8-780-5511
Lackey, Robert A.	CML (503) 757-4600 FTS 8-420-4600
Laveille, Will C.	CML (202) 382-5990 FTS 8-382-5990
Levinson, Barbara	CML (202) 382-5983 FTS 8-382-5983
Lewtas, Joellen	CML (919) 541-3849 FTS 8-629-3849
Lichtenberg, James	CML (513) 569-7306 FTS 8-684-7306
Lindsey, Alfred	CML (202) 382-4073 FTS 8-382-4073
Linthurst, Rick	CML (202) 382-5767 FTS 8-382-5767
Lykins, Ben	CML (513) 569-7460 FTS 8-684-7460
Malanchuk, John L.	CML (202) 382-5600 FTS 8-382-5600
Maxwell, Michael	CML (919) 541-3091 FTS 8-629-3091
McCarthy, Bill	CML (202) 382-2605 FTS 8-382-2605

ORD Key Contacts

	Telephone
McCarty, James C.	CML (503) 757-4601 FTS 8-420-4601
McClenny, William	CML (914) 541-3158 FTS 8-629-3152
McElroy, James L.	CML (702) 798-2361 FTS 8-545-2361
McKee, Gerald	CML (513) 569-7303 FTS 8-684-7303
McKenzie, Daniel	CML (503) 757-4666 FTS 8-420-4666
McNabb, James F.	CML (405) 332-8800 FTS 8-743-2216
Messer, Jay	CML (919) 541-0150 FTS 8-629-0150
Miller, Thomas	CML (202) 382-5893 FTS 8-382-5893
Mitchell, William	CML (919) 541-2769 FTS 8-629-2769
Mitchum, R. K.	CML (702) 798-2103 FTS 8-545-2103
Moore, Martha	CML (919) 541-3933 FTS 8-629-3933
Moore, Michael	CML (202) 382-7667 FTS 8-382-7667
Mullin, Cynthia	CML (513) 569-7523 FTS 8-684-7523
Murphy, Thomas A.	CML (503) 757-4601 FTS 8-420-4601
Oberacker, Donald	CML (513) 569-7523 FTS 8-684-7523
Oppelt, Timothy.	CML (513) 569-7896 FTS 8-684-7896
Ott, Wayne	CML (202) 382-5793 FTS 8-382-5793
Pahl, Dale	CML (919) 541-1851 FTS 8-629-1851
Parish, Rod	CML (904) 932-5311 FTS 8-686-9011
Pashayan, Deran	CML (202) 475-8936 FTS 8-475-8936
Patton, Dorothy	CML (202) 475-6743 FTS 8-475-6743
Paur, Dick	CML (919) 541-3131 FTS 8-629-3131

	Telephone
Pearson, Gareth	CML (702) 798-2203 FTS 8-545-2203
Perlin, Susan	CML (202) 382-5893 FTS 8-382-5893
Peterson, Spencer	CML (503) 757-4605 FTS 8-420-4605
Pitchford, Ann	CML (702) 798-2366 FTS 8-545-2366
Plyler, Everett	CML (919) 541-2918 FTS 8-629-2918
Preston, Walter	CML (202) 382-7445 FTS 8-382-7445
Preuss, Peter	CML (202) 382-7669 FTS 8-382-7669
Reiter, Larry	CML (919) 541-2281 FTS 8-629-2281
Rhodes, William	CML (919) 541-2853 FTS 8-629-2853
Rogers, Charles	CML (513) 569-7757 FTS 8-684-7757
Rossman, Lewis	CML (513) 569-7603 FTS 8-684-7603
Royer, Michael	CML (201) 321-6633 FTS 8-340-6633
Russo, Rosemarie, C.	CML (404) 546-3134 FTS 8-250-3134
Saint, Chris	CML (202) 382-5776 FTS 8-382-5776
Schiermeier, Francis	CML (919) 541-4541 FTS 8-629-4541
Schomaker, Norbert	CML (513) 569-7871 FTS 8-684-7871
Schonbrod, Robert	CML (702) 798-2100 FTS 8-545-2229
Sexton, Ken	CML (202) 382-5900 FTS 8-382-5900
Shapiro, Paul	CML (202) 382-2583 FTS 8-382-2583
Shreffler, Jack	CML (919) 541-2194 FTS 8-629-2194
Snelling, Robert	CML (702) 798-2525 FTS 8-545-2525
Sorg, Tom	CML (513) 569-7370 FTS 8-684-7370

ORD Key Contacts

	Telephone
Spence, John J.	CML (919) 541-2649 FTS 8-629-2649
Stanton, John J.	CML (202) 382-7669 FTS 8-382-7669
Stevens, Al	CML (513) 569-7342 FTS 8-684-7342
Swank, Robert	CML (404) 546-3134 FTS 8-250-3134
Tang, Don	CML (202) 382-2621 FTS 8-382-2621
Thomas, Nelson	CML (218) 720-5550 FTS 8-780-5550
Tingey, Dave	CML (503) 757-4621 FTS 8-420-4621
Trout, Dennis	CML (202) 382-5991 FTS 8-382-5991
Tucker, W. Gene	CML (919) 541-2746 FTS 8-629-2746
Valcovic, Lawrence	CML (202) 382-7303 FTS 8-382-7303
Veith, Gilman	CML (218) 720-5550 FTS 8-780-5550
Wallace, Lance	CML (202) 382-5776 FTS 8-382-5776
Weber, Cornelius	CML (513) 527-8350 FTS 8-778-8350
Wilhour, Raymond	CML (904) 932-5311 FTS 8-686-9011
Williams, Llew	CML (702) 798-2138 FTS 8-545-2138
Williams, Sam	CML (202) 382-5967 FTS 8-382-5967
Wilmoth, Roger	CML (513) 569-7509 FTS 8-684-7509
Wilson, William	CML (919) 541-2551 FTS 8-629-2551
Winter, John	CML (513) 569-7325 FTS 8-684-7325
Worlund, John	CML (702) 798-2656 FTS 8-545-2656
Worrest, Robert	CML (202) 382-5981 FTS 8-382-5981
Wu, Chieh	CML (202) 382-5977 FTS 8-382-5977
Zenick, Harold	CML (919) 541-2281 FTS 8-629-2281
Zepp, Richard	CML (404) 564-3428 FTS 8-250-3428

ORD Regional Contacts

The Office of Research and Development's Regional Operations Staff is responsible for planning, coordinating, and reviewing a program to provide inter-communication and assistance on all matters of mutual interest and/or responsibility of the Agency's Regional Offices and the Office of Research and Development.

Finally, for further information regarding EPA technical assistance, or for additional copies of this report, please contact:

Director, David Klauder (202) 382-7667
Regional Operations Staff (RD-672)
Washington, DC 20460

	Telephone
Regional Liaison Officer, Morris Altschuler Regional Operations Staff Washington, DC 20460	(202) 382-7667
Coordinator, Regional Scientist Program, Mike Moore Washington, DC 20460	(202) 382-7667

ORD/OTTRS Regional Scientists

Louis J. Blume, Region V
Chicago, IL 60604

Dermont Bouchard, Region VII
Kansas City, KA 66101

Gregory A. Kew, Region I
Boston, MA 02203

H. George Keeler, Region VI
Dallas, TX 75270

Norman Kulujian, Region III
Philadelphia, PA 19107

Richard Moraski, Region VIII
Denver, CO 80202-2405

Spencer Peterson, Region X
Seattle, WA 98101

EPA Regional Offices

Region 1	Environmental Protection Agency Room 2203 John F. Kennedy Federal Building Boston, Massachusetts 02203 CML (617) 565-3424 FTS 8-835-3424	Connecticut Maine Massachusetts New Hampshire Rhode Island Vermont
Region 2	Environmental Protection Agency Room 900 26 Federal Plaza New York, New York 10278 (212) 264-2515 FTS 8-264-2515	New Jersey New York Puerto Rico Virgin Islands
Region 3	Environmental Protection Agency 841 Chestnut St. Philadelphia, Pennsylvania 19107 (215) 597-9370 FTS 8-597-9370	Delaware District of Columbia Maryland Pennsylvania West Virginia Virginia
Region 4	Environmental Protection Agency 345 Courtland Street, N.E. Atlanta, Georgia 30365 CML (404) 347-3004 FTS 8-257-3004	Alabama Florida Georgia Kentucky Mississippi North Carolina South Carolina Tennessee
Region 5	Environmental Protection Agency 230 S. Dearborn Chicago, Illinois 60604 (312) 353-2073 FTS 8-353-2073	Illinois Indiana Michigan Minnesota Ohio Wisconsin
Region 6	Environmental Protection Agency 1445 Ross Ave. 12th Floor, Suite 1200 Dallas, Texas 75202 CML (214) 655-2200 FTS 8-255-2200	Arkansas Louisiana New Mexico Oklahoma Texas

EPA Regional Offices

Region 7	Environmental Protection Agency 726 Minnesota Avenue Kansas City, Kansas 66101 CML (913) 236-2803 FTS 8-757-2803	Iowa Kansas Missouri Nebraska
Region 8	Environmental Protection Agency 999 18th Street Suite 500 Denver, Colorado 80202-2405 CML (303) 293-1692 FTS 8-564-1692	Colorado Montana North Dakota South Dakota Utah Wyoming
Region 9	Environmental Protection Agency 215 Fremont Street San Francisco, California 94105 CML (415) 974-7767 FTS 8-454-7767	Arizona California Hawaii Nevada Guam American Samoa
Region 10	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101 CML (206) 442-1465 FTS 8-399-1465	Alaska Idaho Washington Oregon