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FY-1989 EPA Research Program Guide

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.

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FY-1989 EPA Research Program Guide

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

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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

Hazardous Air Pollutant Regulatory Activities

Environmental Engineering and Technology Demonstration

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 developent 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 electro-plating, 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	Robert Hangebrauck W. Gene Tucker	3,214.0	53
OEETD/HQ	Paul Shapiro Marshall Dick	641.3	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 toxicological research data on the mutagenic and carcinogenic activity and noncancerous 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 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 OHR/HQ	Richard Dickerson Susan Perlin	4,404.7	68

Hazardous Air Pollutant Regulatory Activities

Modeling, Monitoring Systems and Quality Assurance

The need for technology to monitor non-criteria contaminants at the regional, state, and local levels continues. EPA has developed monitoring stations to detect and measure non-criteria pollutants in Boston, Chicago, and Houston. 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 and gas chromatography/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 series of studies to monitor human exposure is being carried out, including the Integrated Air Cancer Project (IACP) and the Total Exposure Assessment Methodology (TEAM) studies. The IACP is studying wood smoke and mobile source emissions. The TEAM studies deal with human exposure to volatile organic compounds, pesticides, and particulates.

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	6,429.1	46
AREAL/RTP (CTF)	Larry Cupitt	1,726.1	26
OMMSQA/HQ (CTF)	Deran Pashayan	0.0	0
OMMSQA/HQ	Lance Wallace	403.7	54

Air

Hazardous Air Pollutant 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 fuel additives, diesel and gasoline exhausts, 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, then a draft health assessment document (HAD) is developed for review at a public workshop; (3) If the scientific peer review supports conclusions on significant health effects, then 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.

In addition, the scientific assessment program will also provide direct assessment support to Regions and States for Agency Air Toxics Strategy. This includes: (1) expanded 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 (2) expanded development in FY89 of inhalation reference dose (RfD) 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	3,083	56.2

Mobile Source Pollutant Regulatory Activities

Health Effects

The health effects program developed by the Health Effects Research Laboratory in mobile sources develops and validates techniques to produce dose-response data on the

toxic effects of carbon monoxide, and then use those techniques to produce dose-response information.

Clinical studies will be used to produce dose-response data on the toxic effects of low-level exposure to CO. The cardiac and respiratory effects of CO will be evaluated in human studies, as well as methods to related ambient CO levels to blood levels. Non-invasive techniques will be used to measure the cardiac effects of CO exposure. This information will be used in performing health risk assessments by the scientific assessment program.

Extramural funding will also be provided to the Health Effects Institute, sponsored jointly by EPA and the automobile industry to perform research on the health effects of pollutants related to mobile sources, i.e., diesel emissions, NO_2, CO, O_3, aldehydes, and alternative fuels.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Richard Dickerson	713.5	16
OHR/HQ	Susan Perlin		

Mobile Source Pollutant Regulatory Activities

Modeling, Monitoring Systems and Quality Assurance

The purpose of 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 low ambient temperature on the emission rates of criteria and non-criteria 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	466.0	61
OMMSQA/HQ	Wayne Ott	39.0	48
AREAL/RTP (CTF)	Frank Black	1,309.6	60
OMMSQA/HQ (CTF)	Deran Pashayan	0.0	0

National Ambient Air Quality Standards (NAAQS)

Modeling, Monitoring Systems and Quality Assurance

The Characterization, Transport, and Fate (CTF) portion of this program is responsible for conducting studies to determine the air pollution and meteorological factors that contribute to visibility reduction, and for developing information on the effects of particles on materials. Light extinction budget field studies will be performed to determine the contribution of various types of fine particles to visibility reduction and to determine the sources of the particles. Laboratory and field studies will be performed to identify and determine the significance of the volatile component. Visibility models will be developed.

Research on the effects of particles on materials 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 particulates 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.

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	3,261.2	54
EMSL/LV	James McElroy	340.0	29
OMMSQA/HQ	Marvin W. Bloch	70.0	100
AREAL/RTP (CTF)	William Wilson	337.4	27
OMMSQA/HQ	Deran Pashayan	0.0	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 to 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 non-carcinogenic 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 of function. Emphasis is currently placed on determining the acute and chronic effects of O_3 and NO_2 inhalation.

The heath 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	Richard Dickerson	13,992.9	31
OHR/HQ	Susan Perlin		

National Ambient Air Quality Standards (NAAQS)

Environmental Processes and Effects

This research provides scientific support of NAAQS by determining ozone impacts on forest systems of economic or ecological value. This work will use empirical methods to build observational data to show ozone impacts. Data is needed to evaluate effects of air quality standards to be set on forest exposure patterns to determine highest allowable ozone levels with least damage, and data is also needed to set control options and compliance monitoring. In addition, process directed studies to develop conceptual or predictive models to define multiple interactions between

levels of various climate stress factors, which include natural scientific explanation for forest responses, are needed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	Bill Hogseth	1,964.0	37.2
OEPER/HQ	Peter Jutro	39.7	11.8

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 FY89, work will continue on revision of the Carbon Monoxide and Oxides of Nitrogen AQCDs, and work will be initiated on a fine particle-visibility AQCD.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/RTP	Lester Grant	1,973.3	60.3

New Source Performance Standards and State Implementation Plans

Modeling, Monitoring Systems and Quality Assurance

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 is being developed 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.

Field and laboratory studies to further develop and test different Source Apportionment Methods (SAMs) are underway and will evaluate hybrid (chemical composition and meteorology) SAMs 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. Field, wind tunnel, and modeling studies are being used to develop the first generation SO_2 Complex Terrain Dispersion Model. 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. Quality Assurance for the source monitoring program is essential to ensuring that the 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	931.8	47
EMSL/LV	James McElroy	467.0	69
OMMSQA/HQ	Marvin W. Bloch	158.3	0
AREAL/RTP (CTF)	Frank Schiermeier Jack Shreffler	7,062.0	31
OMMSQA/HQ (CTF)	Deran Pashayan	329.9	55

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 Compound, 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 NO_x 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 emission reduction via flue gas cleanup will be planned.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Everett Plyer Robert Hangebrauck Jim Abbott	1,775.3	54
OEETD/HQ	Marshall Dick	118.9	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 mitigation strategies that can address multiple pollutants simultaneously through improved building design and management techniques.

Activities in FY89 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	429.0	44.3

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 needs to be factored into the total assessment of air pollution.

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 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	Richard Dickerson	1,016.1	6
OHR/HQ	Susan Perlin		

Indoor Air Pollution Activities

Modeling, Monitoring Systems and Quality Assurance

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.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	John Clements	765.7	24
OMMSQA/HQ	Lance Wallace	145.0	100

Stratospheric Ozone

Environmental Processes and Effects and Modeling, Monitoring Systems and Quality Assurance

In response to increasing public and scientific concern over the depletion of the stratospheric ozone layer, increased research will provide policy-relevant information for the terms of the Montreal Protocol and the Clean Air Act. Data from in-house, national, and international sources are being compiled and analyzed to produce a scientific assessment of the effects of continued release of gases that modify the concentration of stratospheric ozone, and to evaluate the alternatives that may be needed. The research addresses three areas: health effects, ecological effects, and welfare effects such as degradation of natural resources, visibility impairment, and materials damage.

Studies of the effects of UV-B radiation on terrestrial ecosystems will continue with an emphasis on determining the relationship between UV-B exposure and other widespread anthropogenic factors such as global climate change and tropospheric oxidants. Research will be conducted on UV-B effects on the marine food chain. Further studies addressing atmospheric processes and both industrial and biogenic emissions will occur.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	R. Lackey	4,371.6	4.2
ERL/NARR	N. Jaworski	301.2	17.0
ERL/ATH	R. Zepp	225.6	11.3
HERL/RTP	M. Moore	655.6	3.9
OEPER/HQ	R. Worrest	1,293.0	11.1
AREAL/RTP	S. Bromberg J. Bufalini	605.0	36.1
AEERL/RTP	W. Rhodes	801.2	6.4
OMMSQA/HQ	D. Pashayan	0.0	0.0

National Health and Nutrition Examination Survey (NHANES)

Health Effects

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 and 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		555.1	11
OHR/HQ	Susan Perlin		

Global Warning

Environmental Processes and Effects

Due to increasing national and international concern over the potential for drastic global climate change resulting from pollutants in the troposphere and stratosphere, the global climate program is being expanded. Ecological system sensitivities to climate changes are being studied and regional maps of the projected consequences of climate change are being developed. Ecological methods development will focus on estimating the potential changes in such major resources as forests and surface water availability and quality.

Emissions research includes beginning development and source/sink models for a variety of radiatively important

trace gases, evaluating existing emissions, and evaluating potential emissions management techniques. Atmospheric modeling is expanded to include estimates of regional consequences of tropospheric and stratospheric air quality changes

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OEPER/HQ	Anthony C. Janetos	1,624.4	5
OMMSQA/HQ	William Keith	975.6	0
OEETD/HQ	Paul Shapiro	382.8	0
ERL/COR	Robert Lackey	122.5	100
AREAL/RTP	Pete Finkelstein	51.2	100

Drinking Water

Health Effects of Drinking Water Contaminants

Health Effects

This research program provides dose-response data on organic and inorganic contaminants. It provides information on the best methods to obtain that data, and information on the interpretation of toxicological data for improving risk characterization.

Selected contaminants will be evaluated to assist in setting maximum contaminant levels or developing health advisories. Increasing emphasis will be on determining the health effects of exposure to disinfectants 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 and cardiovascular disease are underway.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Lyman Condie	6,778.4	43
OHR/HQ	Wade Talbot		

Health Effects of Drinking Water Contaminants

Scientific Assessment

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	729	58

Groundwater Research

Modeling, Monitoring Systems and Quality Assurance

This program will provide development of methods for locating abandoned wells, develop geophysical methods to detect and evaluate underground movement of fluids from injection wells and evaluate existing instruments and conduct research to develop new and advanced techniques for monitoring ground water. The program will also investigate the effects of seasonal variability on monitoring well network design(s). In addition, accurate and reliable total measurement systems will be developed through standardized methods, laboratory evaluation, and quality control procedures.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Robert Snelling	753.2	35
OMMSQA/HQ	Vernon J. Laurie	0.0	90

Ground Water

Environmental Processes and Effects

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	George Keeler	4,455.0	30
OEPER/HQ	Steve Cordle	364.7	43

Drinking Water Technology

Environmental Engineering and Technology Demonstration

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 removal of synthetic organic compounds, organics responsible for formation of trihalomethanes, inorganic and microbiological contaminants and on problems related to maintaining water quality in distribution systems. 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	5,216.7	63
OEETD/HQ	Lynnann Hitchens	0.0	0

Drinking Water Technology

Modeling, Monitoring Systems and Quality Assurance

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. 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	2,756.9	60
EMSL/LV	Robert Snelling	301.0	95
OMMSQA/HQ	Vernon Laurie	90.8	95

Water Quality Based Approach/Permitting

Modeling, Monitoring Systems and Quality Assurance

The monitoring research program develops chemical, physical, and biological methods for measuring site-specific and ambient water pollution concentrations. Most of this research is conducted in-house at EMSL-Cincinnati with a small portion being conducted at EMSL-LV.

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 metals in water. Research on biological monitoring methods also includes developing methods which screen toxic concentrations of pollutants in ambient waters, rather than identify 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	2,676.2	95
OMMSQA/HQ	Charles Plost	90.5	89

Water Quality Based Approach/Permitting

Environmental Processes and Effects

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; complex effluent testing procedures; and ecoregion and use attainability analyses. 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	920.0	65
ERL/COR	Spencer Peterson	1,280.6	48
ERL/DUL	Nelson Thomas	2,814.3	77
ERL/NARR	Norbert Jaworski	1,350.0	82
OEPER/HQ	Chieh Wu	320	100

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	221	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 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

permittees 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 its precision and accuracy.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	James Lichtenberg John Winter	1,278.0	98
OMMSQA/HQ	Charles Plost	112.6	100

Wastewater Treatment Technology

Environmental Engineering and Technology Demonstration

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 provided to support sludge regulation development and implementation. Focus is also on supporting the Innovative/Alternative technology program by evaluating and transferring information on emerging technologies, and by identifying the candidate facilities for potential 100% modification/replacement costs.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/CIN	John Convery	5,515.0	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.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	William Donaldson	320.9	100
OEPER/HQ	Chieh Wu	0	0

Health Effects

Wastewater Treatment Technology

Health effects research focuses on human health aspects of municipal 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 toxic risks of heavy metals and organic chemicals. A critical aspect of human exposure to municipal sludges is the potential close human contact from sludge distribution and marketing systems. Information from these studies will be part of a determination of the risks to the human population from sludge distribution and marketing.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/CIN	Bernard Daniel	650.2	100
OHR/HQ	Wade Talbot		

Scientific Assessment

Wastewater Treatment Technology

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.

Water Quality

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	427	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	3,680	77
ERL/GB	Rod Parish	120	100
ERL/DUL	Gilman Veith	1,760	25
OEPER/HQ	Sam Williams	415	77

Alternate Technologies

Environmental Engineering and Technology Demonstration

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 is being conducted to evaluate in-situ methods for the destruction/detoxification/containment of dioxins/furans and pollutants related to the production of dioxins and similar toxicants. Major investigation will involve the accelerated evaluation of the mobile incinerator and destruction tests of potassium polyethylene glycolates (KPEG) on wood treating wastes. The purpose of this research is to determine the economic viability of the technique and to establish: (a) test burn protocols; (b) health and safety protocol; (c) site-specific, risk assessment protocol; (d) an economic model for estimating the cost of treatment per unit of material processed; and (e) national and state permit protocol.

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 area 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	4,648.1	30
OEETD/HQ	P. E. desRosiers	490.6	37

Dioxin

Scientific Assessment

This program supports the activities of the Agency's dioxin program through research designed to fill gaps in the Agency's information base on dioxin in order to reduce the uncertainties in dioxin risk assessments. The specific projects include analysis of soil ingestion patterns in children, and investigation of the pharmacokinetics of 2,3,7,8-TCDD in rhesus monkeys as a model for pharmacokinetics in humans.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Alan Ehrlich	288	4

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	D. Oberacker	3,059.6	42
AEERL/RTP	R. Hall	154.3	100
OEETD/HQ	K. Jakobson	1,575.0	100

Health Effects

Incineration

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 inhalation toxicology of HWI/

MWC whole emissions after dilution using the EPA exposure chambers in connection with pilot scale incinerators.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Joellen Lewtas	1,598.9	41
OHR/HQ	Thomas Miller		

Incineration

Scientific Assessment

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	Larry Fradkin	398	37

Land Disposal

Environmental Engineering and Technology Demonstration

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	2,376.1	31
OEETD/HQ	K. Jakobson	80.5	100

Quality Assurance

Modeling, Monitoring Systems and Quality Assurance

To ensure that the data on which regulations and enforcement are based are accurate, QC samples will be provided to USEPA contractor, state, and local laboratories conducting RCRA monitoring. Calibration standards will be provided for Appendix IX compounds to USEPA 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. NBS traceability 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	Thomas Clark	662.8	15
EMSL/LV	Robert Snelling	728.1	30
AREAL/RTP	John Clements	179.9	50
OMMSQA/HQ	Vernon Laurie	368.9	10

Releases

Modeling, Monitoring Systems and Quality Assurance

In order to determine whether underground storage tanks (UST) containing hazardous materials 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 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 sensors 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	1,430.0	30
OMMSQA/HQ	Vernon Laurie		0

Releases

Environmental Engineering and Technology Demonstration

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.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/CIN	J. Farlow	1,892.8	
OEETD/HQ	C. Mitchell	118.9	37
	K. Jakobson	67.1	100

Releases

Environmental Processes and Effects

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	Harold G. Keeler	72.0	100

Waste Characterization

Environmental Processes and Effects

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 the land disposal banning rule 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	547.3	100
RSKERL/ADA	Harold G. Keeler	2,294.2	52
ERL/ATH	Rosemarie C. Russo	3,322.1	26.4
ERL/COR	Harold V. Kibby	238.1	58.0
OEPER/HQ	Will C. LaVeille	956.9	28.8

Waste Characterization

Scientific Assessment

This program provides chemical-specific health and environmental effects documents to support RCRA 3001 listing decisions. Support is also provided to the land disposal restruction program in the form of reference dose (formerly Acceptable Daily Intake) documentation. The OSWER's Treatment, Storage and Disposal Facility (TSDF) permitting effort 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	3,165	40

Waste Identification

Modeling, Monitoring Systems and Quality Assurance

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.

Hazardous Waste

Techniques for field monitoring of waste sites will be improved, including statistics for sampling design and evaluated standard methods. RCRA land disposal regulations require the establishment of a ground water 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 ground water, ambient water, and sludges. A flux chamber method will be evaluated to determine chemical volatility at waste sites.

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 will be developed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Thomas Clark	1,196.5	50
EMSL/LV	Robert Snelling	6,158.7	25
AREAL/RTP	John Clements	754.9	30
OMMSQA/HQ	Vernon Laurie	58.3	0

Biotechnology/Microbial and Biochemical Pest Control Agents

Environmental Engineering and Technology Demonstration

This research program plan addresses the three primary engineering-oriented research concerns posed by 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 sub-sections. The first addresses biologically based manufacturing processes, and 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 will be developed for PMN review under the first sub-program which permit assessment of the occurrence, magnitude, and degree of risk management applicable to deliberate and accidental releases from biologically-based manufacturing processes. Models will be developed along with an information base which the OTS can use as a guide for identification of potential hazards and implementation of safeguards for reduction of risk to acceptable levels.

Because genetically engineered microorganisms have already been developed for applications requiring deliberate release into the environment, the second sub-program addresses the development of procedures for assessing the safety aspects of engineering techniques for introducing these microorganisms into the environment. Information developed under this sub-program will allow the assessment of the risk of migration from the site and risk management techniques to prevent or minimize migration.

A number of applications will be addressed in the form of scenarios appropriate to the environmental conditions likely to be encountered at representative sites. 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); and other operations not contained in chemical processing equipment in the traditional sense.

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

In FY88, investigation by risk and failure analysis was continued on pump seals and safety units to predict release and exposure potential.

In FY89, advance sampling studies on decontamination technology will develop experimental procedures on kill-tank efficiency to ensure 100% kill. Evaluation of containment approaches will be completed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/CIN	John Burckle	265.4	15
OEETD/HQ	Bill McCarthy	11.6	5

Biotechnology/Microbial and Biochemical Pest Control Agents

Modeling, Monitoring Systems and Quality Assurance

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 validated and developed into guidelines for routine monitoring applications.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Gareth Pearson	230.0	25
OMMSQA/HQ	Michael Dellarco	0.0	0

Biotechnology/Microbial and Biochemical Pest Control Agents

Environmental Processes and Effects

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.

In addition, contained laboratory systems (microcosms) containing sediment, water, and indigenous microorganisms are used to assess the fate of GEMs in various ecosystems. These systems attempt to simulate interactions between microorganisms and surfaces. 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 address survival and growth of novel microorganisms. Questions such as 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	219.6	100
ERL/COR	T. Murphy	243.1	100
OEPER/HQ	Frederick Kutz	2,592.8	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	William F. Durham	328.4	49
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 and is a critical component of this risk assessment. How plants and animals or larger ecosystems are affected by toxic substances are also the subjects of this research effort. Research will identify important endpoints and mathematical modeling techniques (population; transport) will be applied to integrate data and depict risk. Input data will include such results as lab to field comparative responses, ecosystems resistence 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	306.9	100
ERL/COR	Thomas A. Murphy	109.8	100
ERL/DUL	Gilman Veith	71.4	100
ERL/GB	Raymond G. Wilhour	0.0	0
OEPER/HQ	Frederick W. Kutz	954.9	0

Ecology: Transport/Fate/Field Validation

Environmental Processes and Effects

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 chemical structure-activity techniques applied to plant responses (e.g., uptake). 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	877.4	100
ERL/GB	Raymond G. Wilhour	864.3	100
ERL/COR	Thomas A. Murphy	772.2	100

Exposure Monitoring

Modeling, Monitoring Systems and Quality Assurance

Research for exposure monitoring is dedicated to development, testing, and standardization of 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.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Gareth Pearson	1,318.2	40
AREAL/RTP	Gerald Akland	555.5	23
OMMSQA/HQ	Michael Dellarco	150.0	0

Health: Markers, Dosimetry, and Extrapolation

Health Effects

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	William F. Durham	4,381.1	34
OHR/HQ	Randall Bond		

Health: Markers, Dosimetry, and Extrapolation

Modeling, Monitoring Systems and Quality Assurance

This research evaluates 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. Field studies are used to validate and standardize biomarkers for routine applications in exposure monitoring. Monitoring results are correlated with human activity patterns to describe the sources of exposure.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Gareth Pearson	211.8	20
OMMSQA/HQ	Michael Dellarco	0.0	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	William F. Durham	1,564.5	27
OHR/HQ	Randall Bond		

Environmental Processes and Effects

Structure Activity Relationships

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 includes those data bases and mathematical models which are used for predicting 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 in the air. 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 predictions on toxic mechanisms and microbial biotransformation and metabolism. Expert systems are being applied to the SAR approach.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	368.3	100
ERL/DUL	Gilman Veith	525.8	66

Health Effects

Structure Activity Relationships

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	William F. Durham	932.7	44
OHR/HQ	Randall Bond		

Support for Toxic Substances Control Act (TSCA)

Modeling, Monitoring Systems and Quality Assurance

Quality assurance research efforts provide support to program activities. Research is conducted to evaluate the reliability and reproducibility of analytical methods for complex organic chemical compounds used in environmental monitoring field studies or networks, to produce reference chemicals and analytical spectra for chemical compound identification and to provide standardization procedures and guidelines for program offices field studies.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Tom Clark	203.7	11
EMSL/LV	Gareth Pearson	699.0	51
AREAL/RTP	John Clements	315.0	10
OMMSQA/HQ	Michael Dellarco	53.8	0

Support for Toxic Substances Control Act (TSCA)

Scientific Assessment

The scientific assessment program provides evaluations and assistance to the Office of Toxic Substances in the area of health risk assessments for cancer, mutagenicity, reproductive and developmental effects, and exposure. These activities will support decision-making under TSCA (i.e., existing chemicals program, PMN review, and test guidelines and test rules development).

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Harold Zenick	108.5	98.2

Engineering

Environmental Engineering and Technology Demonstration

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 Superfund Amendments and Reauthorization Act (SARA), Title III. 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.

Toxic Chemical Testing/Assessment

The new chemicals part of this toxics research program has been developed around both the unit operations, manufacturing and processing, and the "industrial setting." 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 of toxic compounds portion of this research program, 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, selected dyes are being investigated.

Agency AHERA guidance has been developed only by best engineering judgement. Research is underway to evaluate the effectiveness of current guidance which includes removal, and in situations where the asbestos-containing materials would be left in place, operations and maintenance procedures.

To satisfy the needs as expressed in AHERA, research efforts will also evaluate transportation and disposal options, and attempt to indicate the "least-burdensome" strategy when several "risk-free" options are available.

The program will eventually shift toward developing more cost-effective removal/containment technologies and toward addressing the broader area of control technology for all respirable and durable fibers, especially asbestos substitutes.

To provide for more reliable release estimates in accordance with the "Community Right to Know" reporting requirements of SARA Title III, a workshop is planned to survey and assess the various estimation techniques available, and develop a research strategy to upgrade the least-to-less reliable estimating techniques in a prioritized way.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/CI	Roger Wilmoth	1,371.9	15
OEETD/HQ	Bill McCarthy	80.1	10

Modeling, Monitoring Systems and Quality Assurance

Test Method Development

Test method development research seeks to provide improved 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 pollutant dose in the body and specific environmental media. New statistical techniques are developed for spectra analysis, for field study designs and for population sampling to improve routine monitoring.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Tom Clark	227.0	26
EMSL/LV	Gareth Pearson	440.6	20
AREAL/RTP	John Clements	274.9	21
OMMSQA/HQ	Michael Dellarco	92.1	100

Environmental Processes and Effects

Test Method Development

Environmental hazard assessment research focuses on developing, improving and validating single and multi-species toxicity tests for chronic and acute toxicity in aquatic ecosystems. The developed methods are validated in microcosms in the laboratory, and in natural and constructed field ecosystems to define their applicability in 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	152.1	100
ERL/GB	Raymond G. Wilhour	286.0	100
ERL/NARR	Norbert A. Jaworski	50.9	100

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	William F. Durham	1,537.0	64
OHR/HQ	Randall Bond		

Test Method Development

Scientific Assessment

The scientific assessment program will continue to develop assessment methods for cancer/non-cancer effects in humans caused by exposure to environmental chemicals. New issues will include reversibility and validation of weight-of-evidence schemes. Chemical-specific methods that can be used to assess heritable risks from chemical exposures will continue to be developed. Methods to reduce uncertainties associated with risk assessment will be continued.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Harold Zenick	235.2	55.3

Biotechnology/Microbial and Biochemical Pest Control Agents

Environmental Processes and Effects

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. Genetic 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	151.1	100
ERL/DUL	Gilman Veith	98.9	100
ERL/GB	Raymond G. Wilhour	460.6	100
OEPER/HQ	Frederick Kutz	912.3	0

Biotechnology/Microbial and Biochemical Pest Control Agents

Health Effects

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, 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	William F. Durham	895.6	34
OHR/HQ	Randall Bond		

Pesticides

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	60.4	100
ERL/DUL	Gilman Veith	216.3	100
ERL/GB	Raymond G. Wilhour	0.0	0
OEPER/HQ	Frederick Kutz	774.9	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 ensure that 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 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 concentrations will be improved with studies on pesticide sorption kinetics, transformations and mechanisms of degradation.

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	300.4	100
ERL/COR	Thomas A. Murphy	386.2	47
ERL/DUL	Gilman Veith	446.6	54
ERL/GB	Raymond G. Wilhour	878.7	77
OEPER/HQ	Frederick Kutz	916.1	29

Engineering

Environmental Engineering and Technology Demonstration

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 the 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. The Manual will serve as a basis for developing regulatory and training materials specific to sectors of the user community. It will eventually be adapted to serve as a user's reference.

Research will continue to evaluate and improve, as appropriate, existing disposal techniques and processes for destroying specific pesticide compounds for which the Agency has indemnified the manufacturer and taken possession of the product.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RREL/CIN	Michael Royer	837.4	40
	Ed Bates	1,378.3	25
OEETD/HQ	Bill McCarthy	39.0	8
	Kurt Jakobson	12.5	5

Pesticides

Exposure

Modeling, Monitoring Systems and Quality Assurance

The Non-Occupational Pesticide Exposure Study (NOPES) is being conducted to develop and test the Total Exposure Assessment Methodology (TEAM) approach for measurement of pesticides used routinely by the general population and seeks to relate exposure of the population to pesticide use patterns involving personal air, food, drinking water, and dermal exposure. This study will evaluate TEAM methods for pesticide exposure and determine if non-occupational pesticide usage in and about homes should be studied further as an important pollutant source.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	Gerald Akland	382.8	13
OMMSQA/HQ	Michael Dellarco	0	0

Health: Markers, Dosimetry and Extrapolation

Health Effects

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	William F. Durham	1,014.6	52
OHR/HQ	Randall Bond		

Health: Markers, Dosimetry and Extrapolation

Modeling, Monitoring Systems and Quality Assurance

A new program is being initiated with the goal of relating external dose to internal dose and to early indicators of disease states resulting from exposure to pesticide residues. Research studies are being carried out to define the relationship between biological indicators of exposure as well

as studies in dosimetry and extrapolation related to genetically mediated health effects.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	R. K. Mitchum	330.0	10
OMMSQA/HQ	Michael Dellarco	19.1	0

Support

Modeling, Monitoring Systems and Quality Assurance

The pesticides quality assurance program ensures the accuracy of the data which is attained through testing and analysis. This program maintains a pesticide repository of high purity chemicals which are used by more than 1,400 laboratories in the United States and in foreign countries. These samples are used as standard reference samples for internal quality control. In addition, interlaboratory comparison samples are prepared. Also, the program will provide samples of pesticide chemicals no longer produced, but still regulated, in the United States. Such reference samples are necessary to perform analyses in soil, plant, or animal tissues at the required degree of accuracy.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	R. K. Mitchum	596.4	57
OMMSQA/HQ	Michael Dellarco	0.0	0

Test Method Development

Environmental Processes and Effects

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 representatives or surrogate test species for long-term or short-term durations. These methods will help assess both exposure and effects (e.g., mortality and 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 establishing or modifying pesticides testing guidelines.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/GB	Raymond G. Wilhour	255.6	100

Test Method Development

Health Effects

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	William F. Durham	1,782.6	67
OHR/HQ	Randall Bond		

Test Methods Development

Scientific Assessment

The scientific assessment program will continue to develop assessment methods for cancer/non-cancer effects in humans caused by exposure to environmental chemicals. New issues will include reversibility and validation of weight-of-evidence schemes. Chemical-specific methods that can be used to assess heritable risks from chemical exposures will continue to be developed. Methods to reduce uncertainties associated with risk assessment will be continued.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Harold Zenick	535.2	36.2

Support for FIFRA Activities

Scientific Assessment

The scientific assessment program provides evaluations and assistance to the Office of Pesticide Programs in the area of health risk assessments for cancer, mutagenicity, reproductive and developmental effects and exposure. Support is also provided on a case-by-case basis with laboratory data audits. Methods to reduce uncertainties associated with risk assessment will be continued.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Harold Zenick	241.6	100
OHR/HQ	Randall Bond		

Develop and Evaluate LIMB Technology

Environmental Engineering and Technology Demonstration

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 1989 program will include: research on sorbent reaction mechanisms, prototype scale testing of the tangentially-fired experimental systems for extrapolating the performance to commercial scale, detailed analysis to identify potential operability and reliability problems, and operation and testing of the industry/EPA cofunded full scale demonstrations on wall-fired and tangentially-fired utility boilers.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Jim Abbott	3,412.0	30
OEETD/HQ	Marshall Dick	160.5	77

Establish Deposition Monitoring Data Base

Environmental Processes and Effects

The installation of the National Dry Deposition Network will continue. By the end of FY89 approximately 65 sites will be operational. 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) and determining snow chemistry representativeness and comparing rain gauges will have high priority. 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	4,225.8	71
OEPER/HQ	Barbara Levinson	1,059.9	17.2

Estimate Emissions from Man-Made Sources

Environmental Processes and Effects

This research effort gives primary emphasis to completing the development of a high quality emissions data base for calendar year 1985. SO_2, NO_x, 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	Michael Maxwell	3,228.3	35
OEPER/HQ	Dennis Trout	0.0	0

Evaluate Availability and Cost of Applicable Control Technology

Environmental Processes and Effects

This program assesses the engineering and economic potential of current and emerging technologies for removing acid deposition precursors from combustion and industrial sources. The work considers non-hardware approaches such as fuel switching as well as retrofit technologies such as the limestone injection multi-stage burner, E-SO_x and duct injection.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Michael Maxwell	354.9	35
OEPER/HQ	Dennis Trout	0.0	0

Understand and Quantify Effects on Material and Cultural Resources

Environmental Processes and Effects

The theoretical damage function for galvanized steel will be validated against field data. 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.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	John Spence	1,517.8	3.8
OEPER/HQ	Barbara Levinson	558.5	0.9

Understand and Quantify Aquatic Effects

Environmental Processes and Effects

The Aquatic Effects Research Program comprises the following activities: (1) Classification of sensitive waters and watersheds based on the analysis of the National Surface Water Survey data bases; (2) formulation of predictive regional aquatic chemistry models which incorporate episodic and non-episodic events; (3) development of biological response models for fish populations and other aquatic biota; (4) assessment of drinking water quality and possible health effects due to toxic metal mobilization and bioaccumulation in fish; (5) expansion of the Direct/Delayed Response Project (DDRP) research to include Mid Appalachian Region; (6) 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; and (7) initiation of a program to detect and monitor incipient changes in sensitive surface waters and watersheds.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	Dan McKenzie	11,600	4
EMSL/LV	Gareth Pearson	2,636	10
AREAL/RTP	Steven Bromberg Jack Durham	518	68
OEPER/HQ	Bill Fallon	3,533	8
ERL/DUL	John G. Eaton	460	4
EMSL/CI	Cornelius Weber	60.1	100

Understand and Quantify Terrestrial Effects

Environmental Processes and Effects

Research will be performed at several integrated, multi-disciplinary intensive research sites in spruce/fir, southern commercial, eastern hardwood, and western coniferous forest types. The effects of acidic deposition alone or in combination with associated pollutants will be considered in the light of hypothesized mechanisms. A vegetation survey and a central synthesis and integration activity will be undertaken in support of this research, and the design of future research.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	Dick Paur	3,200.6	3.0
ERL/COR	Robert A. Lackey	6,008.7	5.0
OEPER/HQ	John Malanchuk	1,363.4	21.0

Understanding Atmospheric Processes

Environmental Processes and Effects

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 gas 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 are being developed for the Regional Acid Deposition Model (RADM). A major field program has been planned to test and evaluate RADM.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AREAL/RTP	H. M. Barnes	9,157.3	6
OEPER/HQ	Dennis Trout	0.0	0

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

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 the 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 1989. 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/HQ	Peter Preuss	2,510.7	

Manage the Mandatory Quality Assurance Program

Modeling, Monitoring Systems and Quality Assurance

A significant portion of EPA's budget is spent on collecting environmental data. Quality assurance (QA) activities play an integral role in the planning and implementation of environmental data collection efforts 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 of the requisite quality.

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 QC system 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 of 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 audits,
- 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 is now essentially complete, and in FY 1989 QAMS

will proceed with full-scale implementation support and oversight.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OMMSQA/HQ	Stanley Blacker	1,705.8	50

Manage Visiting Scientists Program

Exploratory Research Core 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 1988, two 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 environmental science and engineering fellows to EPA facilities for the summer months to conduct environmental research projects. In FY 1988, 10 highly qualified fellows were sponsored.

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

Manage Exploratory Research Grant and Centers Programs

Exploratory Research Core Program

This program has two major components: the Research Grants Program and the Environmental Research Centers Program. 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 general "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. The Research Centers Program supports multidisciplinary research which is conducted in a university setting and focuses in areas of priority interest to EPA. For FY 1988, the following eight university research centers were sponsored:

Waste Elimination Research Center (Illinois Institute of Technology): study innovative technology and process modification to reduce industrial pollutants.

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

Ecosystems Research Center (Cornell University): identify and apply ecosystem principles to environmental management problems.

Marine Sciences Research Center (University of Rhode Island): assess marine ecosystems health, emphasizing exposure of marine organisms to toxics.

Advanced Control Technology Research Center (University of Illinois): study separation technology, thermal destruction, biological separation, and chemical detoxification.

Ground Water Research Center (University of Oklahoma, Oklahoma State University, and Rice University): study subsurface characterization, transport and fate, and ground-water horizon modeling.

Epidemiology Research Center (University of Pittsburgh): study basic epidemiology methods and airborne particulate health effects.

Hazardous Waste Research Center (Louisiana State University): study the design, construction, maintenance, operation, and closure of hazardous waste landfills.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Roger Cortesi	12,771	0

Consistent Risk Assessment

Scientific 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. Guidelines for the assessment of risks to the male and female reproductive systems are scheduled to be published in final form. Guidelines for neurotoxicity, for making and using exposure measurements, and for assessing certain risk from non-cancer health effects are expected to be proposed for public comments. Revisions or expansion of the current guidelines for cancer and developmental toxicity will be proposed. Work will continue on guidelines for ecological risk assessment.

Risk Assessment Forum—The Risk Assessment Forum, a group of senior scientists meet 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 assessment information contained in IRIS has been reviewed and agreed upon by EPA review groups of expert scientists. By the end of the year about 450 chemicals should be in the data base, and inhalation reference doses will be included for the first time.

Methods to reduce uncertainties associated with risk assessment are also funded within this program.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Harold Zenick	2,410.1	62.9

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 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 1988 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	7,279.7	4
OHR/HQ	Ken Sexton		

Radiation

Off-Site Monitoring Program

Modeling, Monitoring Systems and Quality Assurance

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 radionuclides standards and reference materials and through the conduct of laboratory intercomparison studies 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	163.2	100
OMMSQA/HQ	Michael Dellarco	0.0	0

Scientific Support for Radon Program

Environmental Engineering and Technology Demonstration

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, although radon mitigation techniques applicable to school buildings will also be assessed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	W. Gene Tucker	3,278.2	32
OEETD/HQ	Lynnann Hitchens	156.4	78

Provide Techniques and Procedures for Site and Situation Assessment

Modeling, Monitoring Systems and Quality Assurance

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 analytical techniques for determining hydraulic properties of soils.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CI	William Budde	452.4	45
AREAL/RTP	William McClenny	283.1	16
EMSL/LV	Ann Pitchford	2,033.4	22
OMMSQA/HQ	Thomas Baugh	0.0	0

Provide Techniques and Procedures for Site and Situation Assessment

Scientific 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 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	705	50

Superfund

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

Environmental Engineering and Technology Demonstration

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	28,675.5	9
OEETD/HQ	Kurt Jakobson	1,278.5	57

Provide Quality Assurance—Superfund Program Requirements

Modeling, Monitoring Systems and Quality Assurance

Effective remedial design/remedial actions at Superfund sites depends upon analytical data of known and appropriate quality. This program provides support to the Office of Emergency and Remedial Response's Contract Laboratory Program, 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/CI	John Winter	706.9	18
EMSL/LV	Larry Butler	4,016.1	17
OMMSQA	Thomas Baugh	0.0	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/CI	William Budde	420.6	25
AREAL/RTP	William McClenny	403.1	20
EMSL/LV	Ann Pitchford	1,477.9	18
OMMSQA/HQ	Thomas Baugh	0.0	0

Provide Technical Support to Enforcement, Program and Regions

Environmental Processes and Effects

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	889.2	21.3
ERL/Athens	Rosemarie C. Russo	450.0	0.0
ERL/Cor	Harold V. Kibby	658.8	28.8
ERL/Narr	Norbert A. Jaworski	620.0	0.0

Provide Technical Support to Enforcement, Program and Regional Offices

Scientific Assessment

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	758	59

Hazardous Substance Health, Risk and Detection

Modeling, Monitoring Systems and Quality Assurance

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 FY89 will focus on the development and standardization of field analytical and sampling methods; development of cost effective sampling designs and approaches; and development of techniques for managing and interpreting field data. For example, immunoassay systems for screening single compounds or classes of compounds and field portable systems such as fiber optics chemical sensors will be developed. To further promote their development, EPA will co-sponsor an international symposium on field screening methods scheduled for October, 1988 in Las Vegas, Nevada.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Ann Pitchford	1,834.1	5
OMMSQA/HQ	Thomas Baugh	0.0	0

Hazardous Substances Health Effects/Risk Assessment and Detection Research

Scientific Assessment

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 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. 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	Harold Zenick	2,192	9

Hazardous Substances Health Effects/Risk Assessment and Detection Research

Health Effects

Research develops data and methods to address risk uncertainties in the Superfund public health evaluation process. This 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	3,740.5	8

Support Reportable Quantity Regulatory Efforts

Scientific Assessment

Chemical-specific data are being provided on carcinogenicity and chronic effects to support the program office activities necessary to adjust, by regulation, the Reportable Quantities (RQ) for hazardous substances. These include completion of the original CERCLA hazardous substance list and the Extremely Hazardous Substances List, as well as listings in association with Section 3001 of 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	779	29

Innovative/Alternative Technology Research, Development, and Demonstration

Modeling, Monitoring Systems and Quality Assurance

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 and 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 groundwater 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	835.9	11
OMMSQA/HQ	Thomas Baugh	0.0	0

Evaluate Technologies to Manage Uncontrolled Waste Sites

Environmental Processes and Effects

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 and subject to final planning actions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RSKERL/Ada	Harold G. Keeler	128.5	100.0
ERL/Athens	Rosemarie C. Russo	75.1	100.0
ERL/GB	Hap Pritchard	75.5	100.0
OEPER/HQ	Will C. LaVeille	1,750.0	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 overvall 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

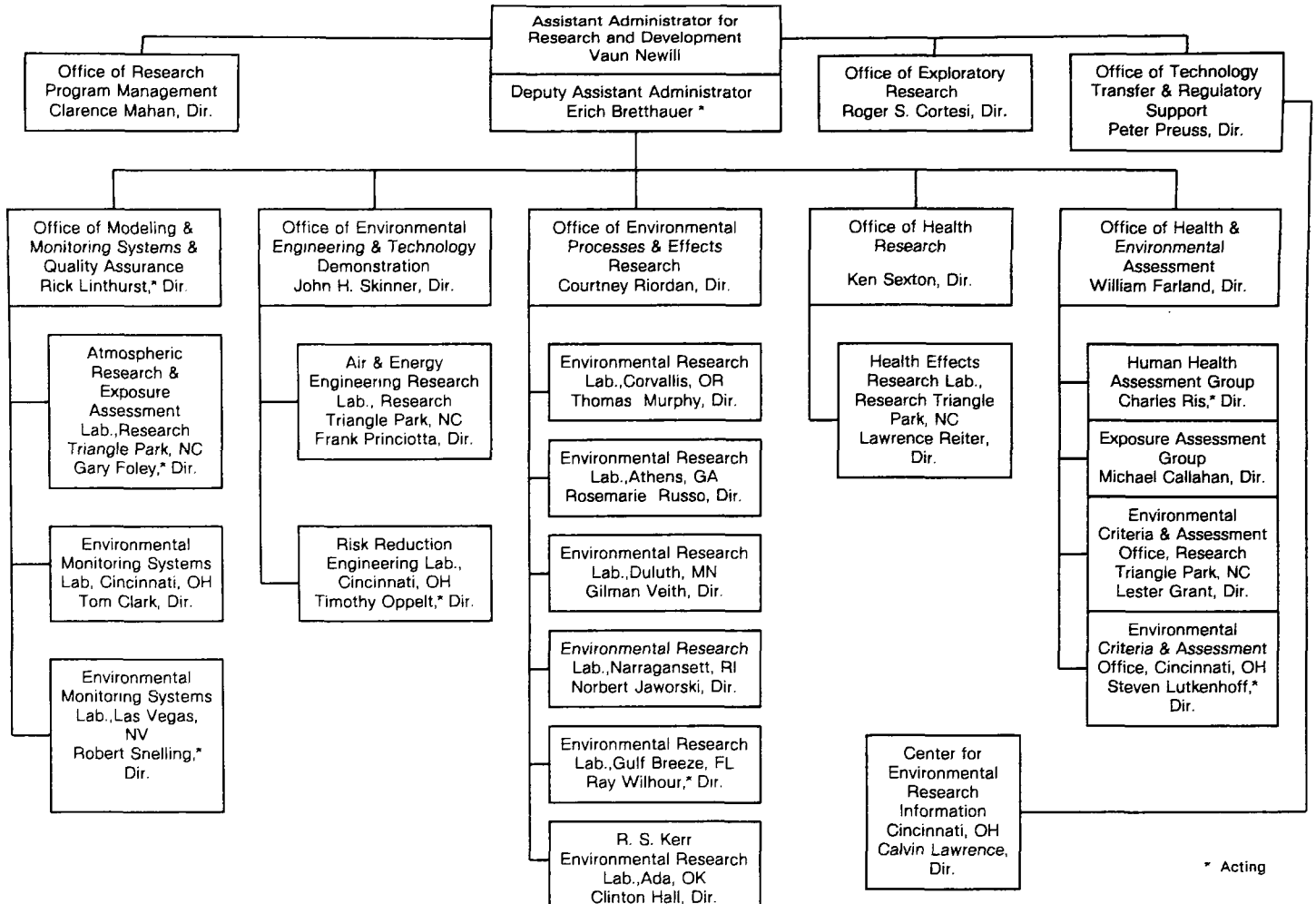
- Risk reduction research—to develop control technologies to treat, destroy, or contain pollutants and methods to reduce or eliminate the sources of pollutants or to prevent exposure to pollutants.

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 Vaun Newill
Deputy Assistant Administrator Erich Bretthauer *
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.
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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 John H. Skinner, Dir.
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Risk Reduction Engineering Lab., Cincinnati, OH Timothy Oppelt,* Dir.
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Office of Health & Environmental Assessment William Farland, Dir.
Human Health Assessment Group Charles Ris,* 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.

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FTS 8-684-7966

Senior ORD Official, Research Triangle Park

Support Services Office CML (919) 541-2613
Acting Director, Dennis O. Martin (MD-51) FTS 8-629-2613

Office of Research Program Management

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

Office of Exploratory Research

Director, Roger Cortesi (202) 382-5750
Headquarters, Washington, DC (RD-675)

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Director, Clarice Gaylord (202) 382-7473

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Director, Robert A. Papetti (202) 382-7473

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

Small Business Innovation Research Program
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Office of Technology Transfer and Regulatory Support

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Deputy Director, Irwin P. Baumel
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Program Operations Staff
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Atmospheric Research and Exposure Assessment Laboratory
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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 and ensuring ORD's delivery of products, (2) analyzing Agency scientific and technical issues to ensure integration across ORD offices and laboratories, (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 four core programs: a Competitive Research Grants Program, an Environmental 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 develops from an ecosystems perspective data and scientific and technological methods necessary to understand, predict, and manage the entry, movement, and disposition of residuals (including biologicals) in the environmental media—atmosphere, soil, ground water, and surface water—and in the food chain, and to determine

their effects of microbial and chemical pollutants, acid deposition, products of bioengineering, global climate changes, and loss of stratospheric ozone, to systems and decision modeling, wetlands, marine systems, terrestrial and surface freshwater environments, and ecological risk assessment methods. Another emphasis area focuses on the determination of the status of and changes in critical ecological resources, as represented by landscape systems in the United States and internationally. The Office provides technical support to the regions and the states in environmental science and technology to assist in problem solving, and transfers information and technology to users.

The Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma, conducts research on the chemical, physical, and biological processes that affect contaminant transport and transformation in subsurface environments. The focus of the Laboratory's research is on both groundwater quality protection and utilization of the natural assimilative capacity of the subsurface as a waste disposal medium.

The Environmental Research Laboratory, in Athens, Georgia, conducts fundamanetal and applied research required to predict and assess the human and environmental exposures and risks associated with conventional and toxic pollutants in water and soil ecosystems. This research is focused on the identification and characterization of the natural processes and environmental or chemical properties that affect the fate and effects of specific toxic substances, such as pesticides or metals, and on the development of state-of-the-art mathematical models for assessing and managing environmental pollution problems. The laboratory's Center for Exposure Assessment Modeling distributes computer programs for selected models and provides training and assistance for users in government, industry, and academia.

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 Nations' freshwater. Located on Lake Superior, the laboratory specializes in the toxicology of pesticides, industrial chemicals, and other pollutants in freshwater ecosystems. The laboratory has six major research programs and two stations, the large lakes research station at Grosse Ile, Michigan, and the Monticello ecological research station at Monticello, Minnesota, to help protect aquatic life.

The Great Lakes Porgram has primary responsibility for describing the fate and effects of pollutants in these waters. The Water Quality Criteria Program develops methods for setting numerical limits for industrial chemicals. The Complex Effluent Program provides cost-effective methods for managing the toxicity of wastewaters. The Structure Activity Program is aimed at developing computer methods for estimating the toxicity and fate of new chemicals from structure rather than testing. The Comparative Toxicology Program develops methods to extrapolate hazard assessment evidence between ecotoxicology and mammalian toxicology. The Ecosystem Effects Program provides methods for ecological risk assessment as well as critical ecosystem property assessment.

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 to 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 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) establishment, coordination, and review of 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 monitoring of pollutants in the environment; develops sampling strategies and techniques for monitoring hazardous waste leachates in soil and groundwater; develops remote sensing techniques; conducts human exposure monitoring and modeling studies covering several environmental media; evaluates analytical methods for the characterization and quantification of hazardous wastes; and provides quality assurance in support of the EPA's hazardous waste, "Superfund," pesticides and ionizing radiation, and acid deposition programs.

The Environmental Monitoring Systems Laboratory in Cincinnati, Ohio, has as its primary missions: (1) conducts research in the development, evaluation, and standardization of chemical and biological methods for environmental assessments; (2) conducts research for detecting, identifying and quantifying microbial pathogens found in environmental media; and (3) the operation of the USEPA Quality Assurance (QA) Program for water, wastewater, and related analyses in solid wastes/superfund/toxics.

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, 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.

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