United States
Environmental Protection
Agency

EPA/600/9-85/026
October 1985

Research and Development

EPA

FY-1986 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.

EPA/600/9-85/026
October 1985

FY-1986 EPA Research Program Guide

October 1, 1985 — September 30, 1986

U.S. EPA
MID-CONTINENT ECOLOGY DIVISION
LIBRARY
DULUTH, MN 55804

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

Contents

Introduction 3
How to Use the Program Guide 4
Air - Gases and Particles 5
Air - Oxidants 9
Air - Mobile Sources 13
Air - Hazardous Air Pollutants 15
Air - Stratospheric Modification 18
Drinking Water 19
Groundwater 21
Water Quality 22
Great Lakes 25
Municipal Wastewater 26
Industrial Wastewater 28
Energy 30
Hazardous Waste 33
Superfund 38
Toxic Substances 40
Pesticides 45
Radiation 48
Intermedia 49
ORD Organization 51
ORD Organizational Descriptions 56
ORD Office/Laboratory Abbreviations 61
ORD Key Contats 64
ORD Regional Contacts 67
EPA Regional Offices 68

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 fiscal year 1986, on how much we intend to spend on each program area, and on whom to contact for further details. More than 70 percent of our $320.5 million fiscal year 1986 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 to make their capabilities known to our research managers so that we all might gain from a sharing of experience and expertise. Please feel free to contact any of the parties listed in this report.

FY-1986 EPA Research Program Guide
(EPA/600/9-85/026)

This is a replacement for page 3 of the above cited publication.

Pleae affix this page over the one contained in the publication.

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 fiscal year 1985 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)
U.S. EPA
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
U.S. EPA
26 W. St. Clair
Cincinnati, OH 45268
CML (513) 569-7562
FTS 8-684-7562

Scientific Assessment

The main objective of the scientific assessment program for gases and particles is to develop *criteria documents* for sulfur oxides, particulate matter, and lead. Criteria documents are used in regulatory decision making related to setting or revision of National Ambient Air Quality Standards. Criteria documents summarize scientific data on the health and welfare effects of a specific pollutant.

The program is presently focussed on revising the air quality criteria document for lead (Pb). An external review draft of the Pb document, prepared by agency scientists and non-EPA expert consultants completed peer review by the Clean Air Scientific Advisory Committee (CASAC) of EPA's Science Advisory Board in 1984. The final document will be available in FY86 after the final CASAC meeting. In addition, technical evaluations will be provided to OAQPS to support the development of the NAAQS for lead, particulate matter, and sulfur oxides during 1986. The SO_x criteria document review is scheduled to begin after the current rulemaking on the NAAQS's is complete.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/RTP	Dennis Kotchmar	634	58
OHEA/HQ	Tom Miller	86	100

Health Effects

This research program has three major goals: to provide data on health effects of exposure to sulfur oxides, particles, and lead using both human and animal studies; to provide better models to extrapolate animal data to humans; and to develop improved test methods for research into the physiological response of humans to gaseous air pollutants and particles.

Much of the health effects research refines and improves the toxicological data base relevant to a *size-resolved particle standard.* Fine-mode particles, mostly in the 1-2 micron range, will be studied in normal and susceptible human and animal populations. Both human and animal dose-response studies will devote special attention to determining the deposition, clearance, and pulmonary function effects of particles, alone and in combination with ozone, NO_2, and SO_2. Most of the human work is done in-house, while many of the animal studies are done extramurally.

The *neurological consequences* of lead, especially at levels previously considered to be safe in children (<60 μg/dl), will be studied epidemiologically. Also, primate neurotoxicology studies will be performed extramurally. The significance of the effects noted will be evaluated for use in assessing health risks.

In 1986, work will be done to provide faster, more reliable, *extrapolation techniques* using animal data to predict human pulmonary and morphological responses to gas and particle exposure. About half of this work will be done by contract. Research will also provide data on biochemical, pulmonary, and cardiovascular disease and impairment in susceptible populations following SO_2 exposure.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Richard Dickerson	10,270.5	32
OHR/HQ	Karen Morehouse		

Environmental Engineering and Technology

Existing technology to control gaseous and particulate 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 regulatory and regulated entities will be provided by conducting assessments and fundamental research on technologies for reduction of stack emissions of SO_x and particulate matter (PM) as well as PM fugitive emissions.

Sulfur oxides (SO_x emissions reduction technology): In-house pilot efforts will emphasize evaluation of lower cost, more active sorbents and additives for spray drying and other dry scrubbing systems. Regional workshops are planned to present a recently developed inspection and performance evaluation manual for wet scrubbing systems. A symposium on SO_x emission reduction via flue gas cleanup will be conducted.

Particulate emissions reduction technology : In-house laboratory and pilot efforts will emphasize investigation of advanced concepts for lowering the costs of particulate control baghouses and electrostatic precipitators (ESPs). The range of work will include electrostatic augmentation of fabric filters (baghouses), larger diameter electrodes for ESPs, and simultaneous particulate/SO_x removal in existing ESPs. Extramural studies of controlling condensation aerosols and fugitive emissions will also be conducted. Symposia and workshops will be used to transfer the technology.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Everett Plyler	3,567.0	60
OEET/HQ	Paul Shapiro	179.0	60

Acid Deposition Environmental Monitoring and Quality Assurance

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 of regulatory action. The areas investigated extramurally include ambient and source methods development, quality assurance guidelines and procedures development, and audit materials preparation.

Ambient and source monitoring *methods* for gases and particulate matter pollutants will be developed and evaluated. Ambient methods development will focus on measuring particulate matter in support of anticipated changes to the National Ambient Air Quality Standards. Source methods will be developed and evaluated under field conditions. EPA researchers will continue to analyze the mass and chemical composition of filters collected through the Inhalable Particulate Network. Also, fiber filters from national, state and local air monitoring stations will be analyzed for mass and trace metals.

Quality Assurance (QA) support will be provided through a standards laboratory and repository of quality assurance materials. Routine and special *audits* will be conducted on laboratories making ambient and source measurements and on compressed gas vendors. Quality assurance 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.

The *Atmospheric Processes and Effects* objectives of this program are to develop air quality models in support of the National Ambient Air Quality Standards (NAAQS) and the prevention of significant deterioration (PSD), and to develop information on the effects of gases and particles on materials.

Model development research will focus on improved atmospheric dispersion parameters in air quality models, SO_2 air quality dispersion models for use in complex terrain and particulate dispersion models for use on urban, meso-, and regional scales. Procedures for computing dispersion from elevated sources and near-source dispersion models for use in complex terrain will be improved. A full-scale plume study of a three dimensional complex terrain area will continue. Work will improve urban and regional scale particulate models to support proposed revisions of State Implementation Plans (SIPs) for particulate matter. A regional scale particulate matter air quality model which will accurately describe the long-range transport of particles and alternative control strategies is being developed.

Second generation source apportionment methods (SAM) will be developed. Research will be initiated with the Peoples Republic of China to study the dispersion of pollutants. Studies on materials damage will develop estimates of the cost of air pollution in terms of damaged materials or accelerated maintenance schedules. Studies will also be conducted to determine the air pollution and meteorological factors that contribute to visibility reduction.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	John Puzak	4,725.6	56
EMSL/LV	James McElroy	607.8	39
ADEMQA/HQ	J. M. Shackelford	153.1	80
ASRL/RTP(APE)	Al Ellison	6,865.7	25
ADEMQA/HQ(APE)	William Keith	378.1	44

Air Oxidants

Scientific Assessment

Photochemical oxidants are secondary pollutants produced by chemical reactions in the atmosphere between primary pollutants, notably nitrogen oxides, and volatile organic compounds (VOC). Ozone (O_3) is by far the most abundant of the photochemical oxidants.

A *criteria document* evaluates the available scientific information on the health and welfare effects of a criteria pollutant and, as such, is the primary source of information used by EPA regulatory decision makers in reviewing and possibly revising the NAAQS. EPA scientists and expert consultants are developing draft chapters for the ozone/photochemical oxidants criteria document. This document critically assesses data on health effects from ozone and pollutant mixtures and environmental effects related to crop loss. An external review draft was published in August, 1984. CASAC review will be completed during late 1985 or early 1986. The final criteria document will be completed during 1986. In addition, the next review of the nitrogen oxides criteria document will begin in 1986.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/RTP	Beverly Tilton	760	43
OHEA/HQ	Tom Miller	87	100

Health Effects

This program has two major goals: to provide data from human and animal studies on a full range of health effects of O_3 and NO_2 exposure, and to provide better models to extrapolate animal data to humans.

The health effects *data* from this program are incorporated into EPA criteria documents which are used to set and revise standards for photochemical oxidants. Research provides data on the degree to which oxidants cause or exacerbate the development of non-carcinogenic chronic disease. Animal, human clinical, and epidemiology studies are performed. Biological endpoints to be examined include development of cardiovascular or pulmonary disease, aggravation of existing conditions, changes in biochemistry and host defense mechanisms, and changes in pulmonary structure or function. Emphasis is currently placed on determining the acute and chronic effects of NO_2 inhalation.

Tests will be run 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 exposure to ozone and NO_2. Animal dose-response studies, many

performed extramurally, will concentrate on the effects of chronic exposure of rodents to oxidants.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Richard Dickerson	4,400.4	30
OHR/HQ	Karen Morehouse		

Environmental Engineering and Technology

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 both VOC and NO_x emissions.

Volatile Organic Compounds (VOCs) are a major cause of non-attainment of National Ambient Air Quality Standards. Extramural research will evaluate *VOC abatement technology* such as carbon adsorption, thermal oxidation, and catalytic oxidation. Of particular interest will be effective and affordable control methods for small VOC-emitting industries. Field tests of process modifications for VOC emission reduction from printing and coating operations will be conducted jointly with industry.

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. These sources account for about 67% of the nation's stationary source NO_x emissions. Prior work 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 I.C. engines or gas turbines). This program, to support OAQPS standards setting activities in FY87, 88 and 89, will assess low NO_x heavy oil burner (precombustor) technology for industrial boilers and for the combustion of highly nitrated waste fuels. Work on a coal-fired precombustor burner for high NO_x/SO_x control will be continued. The program will evaluate in-furnace NO_x reduction (reburning by secondary fuel injection) technology on small scale gas-, oil-, and coal-fired combustors. It will complete in-house tests of selective catalytic reduction (SCR) systems for internal combustion engines. Basic NO_x control techniques, selected from those available and those under development, can soon be integrated into combination systems to achieve the greatest possible NO_x reduction for these sources.

Fundamental research on *combustion processes* will also be conducted to improve the technical basis for estimating achievable emissions, to help develop NO_x-SO_x emissions reduction technologies and to support development of an industrial boiler NSPS.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	W. Gene Tucker Robert E. Hall	2,842.3	34
OEET/HQ	Kurt Jakobson	144.3	60

Environmental Processes and Effects

Research will continue to determine ozone impacts on crop yield due to crop genotype (cultivar) and climatic influence and dymanics (such as moisture) of varying ozone exposure patterns. Crop average, and soil moisture interactions with exposure dynamics will be emphasized. Process directed studies will develop conceptual or predictive models to define multiple interactions between levels of various stress factors. Field validated models will be used to predict yield effects of single or multiple experimental variables.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR OEPER/HQ	Dave Tingey Kenneth Hood	2,125	30

Acid Deposition Environmental Monitoring and Quality Assurance

Research activities in this area emphasize the development of monitoring *methods* and the provision of quality assurance *samples* and support. EPA's *monitoring methodology* for oxidant precursors will include the evaluation of volatile organic compound monitoring methodology and the preparation of an operations manual and performance guidelines for commercial monitoring instruments. Laser technology to measure aerosol mass associated with oxidant transport will be provided as technical support to the regions. The National Bureau of Standards will assist with the development of standard reference material.

Quality Assurance for the oxidants research program is essential to ensuring that the data used for regulatory and enforcement decisions is accurate. Reference samples, gas samples, permeation devices and flow rates standards traceable to NBS will be supplied to the user community. Short-term monitoring support will be provided to the OQAPS and the EPA regional offices for use in review of State Implementation Plans for air transport model development.

Air Oxidants

The *Atmospheric Processes and Effects* portion of this program is to develop and validate air quality models that predict the formation of photochemical oxidants (primarily ozone) in the atmosphere, and to determine the economic impacts of ozone on agriculture.

Air quality models predicting the air quality impacts associated with air pollutant abatement strategies are used in the evaluation and development of State Implementation Plans for the control of photochemical oxidants. Two major types of ozone air quality models are under investigation: urban scale which focuses on local air quality impacts and regional scale which addresses the long range transport phenomena of ozone and its precursors (volatile organic compounds and nitrogen oxides). Over the next few years, emphasis will be placed on developing better chemical mechanism within the models for describing ozone formation in the atmosphere. Also, a second generation regional scale model for ozone will be tested and evaluated using the Northeast Regional Oxidant Study (NEROS) air quality data base.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	John Puzak	657.1	53
EMSL/LV	James L. McElroy	219.0	79
ADEMQA/HQ	J. M. Shackelford	0	0
ASRL/RTP(APE)	Basil Dimitriades	2,326.4	33
ADEMQA/HQ(APE)	Deran Pashayan	127.4	80

Air Mobile Sources

Scientific Assessment

The Clean Air Act requires the agency to prescribe emission standards for carbon monoxide, hydrocarbons, and oxides of nitrogen for heavy-duty and light-duty vehicles. To do this, the agency requires information on the chemical composition of fuels, fuel additives, and diesel and gasoline exhausts, as well as information on actual human exposure to motor vehicle pollutants.

The scientific assessment program will continue to support the development of the carbon monoxide NAAQS during FY 86 by providing technical evaluations for OAQPS. In addition, the next review of the carbon monoxide Air Quality Criteria document will begin in FY86.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/RTP	James Raub	294	38
OHEA/HQ	Tom Miller	32	100

Health Effects

The health effects program funded 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 uses 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 will a method to relate 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.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Richard Dickerson	3,685.3	13
OHR/HQ	Donna Kuroda		

Acid Deposition Environmental Monitoring and Quality Assurance

Research in this area will focus on development of methodology for determining population exposures to carbon monoxide (CO) and other vehicular air pollutants. Field studies conducted in Washington, DC, and Denver, Colorado, have provided extensive human CO exposure data bases. Data from previous microenvironmental and population exposure field studies for CO will be reviewed, and data from these studies that can be utilized in other

topic areas, such as human activity patterns, will be evaluated in detail. Models relating commuter exposures to roadway types, traffic volume, model year, vehicle age, and average speed will be tested and evaluated. The human exposure methodology developed for CO will be adapted, where possible, to other vehicular air pollutants. The general exposure-human activity pattern models (SHAPE and NEM) will be evaluated with data from past ORD exposure field studies. An improved exposure-activity pattern model will be constructed from data from previous field studies, including the Denver-Washington, DC, CO exposure field studies, and previous activity pattern-time budget studies.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	G. Akland	626.2	52
ADEMQA/HQ	Wayne Ott	47.4	90
ASRL/RTP(APE)	Frank Black	1,279.2	41
ADEMQA/HQ(APE)	William Keith	6.9	0

Scientific Assessment

Scientific assessments of hazardous air pollutants (HAP) encompass all known research findings concerning the health and environmental effects of particular substances and/or their transformation products, as well as background information on physical and chemical properties, sources, emissions, transport and transformation, and ambient concentrations.

The current agency strategy for evaluating hazardous air pollutants calls for assessing the toxicity of various chemical substances. The assessment approach involves preparation of Tier I Health Effects Summaries and Comprehensive Health Assessment Documents on Chemicals nominated by OAQPS. In addition, during FY86, the Scientific Assessment program will provide direct assessment support to Regions and States for the new Agency Air Toxics Strategy.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Jerry Stara	89	47
ECAO/RTP	Michael Berry	1,243	39
OHEA/HQ	Tom Miller	2,255	60

Health Effects

The health research program in hazardous air pollutants (HAPs) has three goals: to develop and validate methods to produce dose-response data on the toxic effects of HAPs, to produce the dose-response data on the toxic effects of HAPs, and to develop models which improve our ability to use dose-response data in risk assessments. Extramural research will support efforts in all three areas.

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.

In *dose-response* toxicological research, data on the mutagenic and carcinogenic activity of potential HAPs will be determined. These HAPs will be selected based upon assessments prepared by the Office of Health and Environmental Assessment (OHEA). The effects of selected chemicals suspected of being hazardous to the nervous system will be studied.

Animal *models* of respiratory physiology and function will be developed to provide more reliable methods for estimating specific doses to critical lung tissues. Models of neurologic toxicity will be developed involving physical,

chemical, and behavioral tests to predict human responses to insult from potential HAPs.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Richard Dickerson	3,004.5	59
OHR/HQ	Donna Kuroda		

Environmental Engineering and Technology

The engineering program for hazardous air pollutants (HAP) is comprised of three parts: (1) to assess various industrial and combustion sources of HAPs to determine the magnitude of emissions and to assess the capability of technologies to reduce or eliminate HAP emissions, (2) to conduct source-related measurements and participate in the management of the Agency's Integrated Air Cancer Project, and (3) to assess the emissions from and controllability of sources of indoor air pollutants.

Conventional devices for controlling particulate and VOC emissions will be evaluated for their effectiveness in controlling specific HAPs from industrial and combustion sources. Research will be initiated on cleaner-burning wood stoves, with inherently low emissions of HAPs, for practical and energy-efficient residential use.

Field and laboratory measurements of hazardous substances, especially mutagenic substances from residential wood stoves will be made as part of the field studies of the Integrated Air Cancer Project. Various designs of catalyst-equipped and conventional stoves will be tested.

Laboratory measurements of organic pollutant emissions from unvented space heaters, building materials, and consumer products will be continued from indoor air quality projects initiated earlier. A field study to demonstrate the effectiveness of low-cost methods to reduce radon concentrations in homes will also be continued. Further work to develop indoor air quality models is also planned.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	W. Gene Tucker	1,020.8	35
OEET/HQ	Paul Shapiro	80.8	70

Acid Deposition Environmental Monitoring and Quality Assurance

At present, there is a particular need for technology to monitor non-criteria contaminants at the regional, state, and local level. EPA maintains a monitoring station for non-criteria pollutants in Philadelphia. This station will function as a focal point for development and evaluation of methods for the characterization of monitoring methods. Stationary source methods will be evaluated and validated. This will involve measurement of instrument drift, establishing control limits, defining out-of-control limits, and specifying corrective action and alternate methods. Focus will be on developing and assessing advanced methods for concentrating and analyzing samples. The advanced methods to be evaluated are: cryogenic preconcentration, tuneable atomic line molecular spectrometry, and gas chromatography/fourier transfer infrared spectrometry. The methods that will be evaluated at the center were developed from our extramural program.

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.

Methods development for monitoring indoor air quality will continue. Emphasis will be placed on evaluating devices to measure particulates, NO_2, and formaldehyde. A multipollutant field survey will be designed and implemented.

The goal of the *Atmospheric Processes and Effects* research is to provide information on the *atmospheric transport, transformation* , and *fate* of hazardous air pollutants. The information is used in preparing health assessment documents to determine if the chemicals present a hazard. 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 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.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/RTP	John Clements Steve Bromberg	7,049.8	24
ASRL/RTP(APE)	Larry Cupitt	940.9	31
ADEMQA/HQ(APE)	Deran Pashayan	25.4	0
ADEMQA/HQ	Wayne Bloch	218.8	56

Stratospheric Modification

The stratospheric modification research program will investigate the effects of pollutants on stratospheric ozone, the resulting ultraviolet-B radiation characteristics and of enhanced ultraviolet-B radiation on important crops and aquatic food-chain organisms. The program will continue coordination of federal research activities in this area, will update the comprehensive assessment of the state of science, will deliver the required biennial report to Congress, and will provide up-to-date information so that the most current data will be available for policy and regulatory decisions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ADEMQA/HQ	William Keith	900	0

Drinking Water

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. Health assessment documentation will be prepared for various chemicals and responses to public comments made on 1985 health assessment documents will be performed during 1986.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Michael Dourson	313	76
OHEA/HQ	Thomas Gleason	160	100

Health Effects

This research program provides dose-response data on organic, inorganic, and microbiological contaminants. It provides information on the best methods to obtain that data, and information on the best methods to perform risk assessments.

Selected contaminants will be evaluated (chlorinated ethanes, xylene, dichloropropane, trichloroethylene, tetrachloroethylene, haloacetylnitriles, trichloropropane, chlorobenzene, and barium) for possibly 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 complex mixtures. Focus will also be on concentrating, isolating, and identifying infectious disease agents in drinking water. In addition, epidemiology studies on drinking water disinfectants and radon are being conducted.

Finally, in conjunction with the Centers for Disease Control, research will design methods to identify and evaluate outbreaks of waterborne infectious diseases in order to aid the states in alleviating any emergency affecting public water systems.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/CIN	Elmer Akin	9,762.2	33.6
OHR/HQ	David Kleffman	0	0

Environmental Engineering and Technology

To support revision of the national drinking water standards, this program provides data on the technologies available, what they can attain in terms of drinking water quality, and what they cost. Focus is on removal of volatile organic compounds, organics formed during treatment,

naturally occurring 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
WERL/CIN	Robert Clark	4,900	40
OEET/HQ	Bala Krishnan	171	100

Acid Deposition Environmental Monitoring and Quality Assurance

This program will provide the overview for the Agencywide 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 provide methods development and 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. In addition, the following groundwater program will be provided; development of a method to locate abandoned wells; development of geophysical methods to detect and evaluate underground movement of fluids from injection wells; evaluation and development of fiber optics techniques for monitoring groundwater; development of accurate and reliable total measurement systems through the development of standardized methods, laboratory evaluation, performance evaluation and quality control sample development, sample testing and verification; and provide quality control procedures and guidelines.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Robert Booth	2,303.2	45
EMSL/LV	Erich Bretthauer	1,208.9	32
ADEMQA/HQ	Vernon Laurie	77.9	78

Groundwater

Environmental Processes and Effects

Ground water is a major source of drinking water for the nation. This research program seeks to improve methods for determining the transport and transformation of contaminants in the subsurface, methods for predicting the behavior of pollutants in aquifers based on site-specific subsurface characteristics and on characteristics of the pollutants. In addition, research will evaluate *in-situ* aquifer reclamation methods.

Extramural efforts will be directed toward several areas. Methods will be developed for determining not only the quantity and type of subsurface microorganisms, but also their activity in terms of potential for biotransformation of pollutants. Methods will also be developed for *in-situ* detection of other subsurface parameters important to predicting pollutant behavior. Biological, physical/chemical, and hydrologic processes and their interrelations in the subsurface will be studied to develop mathematical representations that can be included in models. Subsurface (site-specific) characteristics that influence such processes will be determined. Finally, promising reclamation methods (e.g., biotransformation) will be studied at laboratory scale and evaluated at one field site.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RSKERL/ADA	George Keeler	4,960	23
OEPER/HQ	Steve Cordle	404	35

Water Quality

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, evaluate *site-specific* health *hazards* as required by the states and EPA, and prepare evaluations for Section 301(g) permit modification requests.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Michael Dourson	219	59
OHEA/HQ	Thomas Gleason	67	100

Health Effects

Investigators will use existing short-term tests for carcinogenic, mutagenic, and reproductive effects to determine whether or not a site receiving a large number of chemical contaminants into ambient waters is a public health risk. Health effect indicators for shellfish growing waters, are being developed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/CIN	Lyman Condie	888.1	41
OHR/HQ	David Kleffman		

Environmental Engineering and Technology

This program develops data correlating sludge treatment processes with environmental impacts for use in determining appropriate treatment levels for sludge prior to ocean dumping as well as treatment levels for wastewater discharged through ocean outfalls.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/Cin	Fred Bishop	370	100
OEET/HQ	Bala Krishnan	65	100

Environmental Processes and Effects

This program has two objectives: support for a water quality-based regulatory approach, and support for environmentally sound ocean disposal of wastes.

A *water quality-based* approach to pollution control provides for correction of ambient water quality problems

that remain after mandated minimum pollution control technology (e.g., secondary treatment, effluent guidelines) is in place. This requires the ability to translate water quality standards into specific effluent condition and discharge limitations for municipalities and industry. Research will be undertaken to provide the necessary information base and scientific tools, including: site-specific criteria modification protocols, contaminated sediment assessment techniques, wasteload allocation techniques, complex effluent bioassays, biomonitoring methods, and use attainability analyses.

If *ocean disposal* is to become an acceptable waste management option, there is a need to provide decision-makers with rationale and procedures which are both expeditious and 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. The research program in ocean disposal will develop techniques and data for evaluating the impacts of alternative disposal strategies to identify the optimal approach for both ocean dumping and discharge from ocean outfalls. Emphasis will be given to: development of a hazard assessment procedure to define the probability of harm to the marine environment resulting from the ocean disposal of wastes; development of procedures for predicting bioaccumulation of contaminants from sediments and sewage sludge and determination of the linkage between tissue residues and biological effects; and development of procedures to satisfy monitoring needs for permit, surveillance, and hazard assessment application for coastal and deep water sites.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Robert Swank	1,347	64
ERL/COR	Spencer Peterson	608	77
ERL/DUL	Nelson Thomas	2,917	82
ERL/NARR	William Brungs	5,166	72
ERL/GB	Thomas Duke	266	62
OEPER/HQ	Sam Williams	859	76

Acid Deposition Environmental Monitoring 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 on *chemical* measurement methods emphasizes standardization of measurement and quality assurance methods for priority toxic pollutants, as well as increasing the sensitivity of methods for measuring toxic metals in

water. Research on *biological* monitoring methods emphasizes methods for screening toxic concentrations of pollutants in ambient waters, characterizing the biological condition of ambient waters, provision of quality assurance procedures to analyze chronic and acute toxicological effects, and standardization of microbial and viral sampling and analysis methods. Research on *physical* measurement methods concentrates on documenting the validity and accuracy of sampling regimes and flow-sensing equipment. The *quality assurance* program provides quality control calibration materials and procedures for standardization of chemical and biological analysis. Virus sample preservation and assay protocols will be standardized.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Cornelius Weber James Lichtenberg John Winter	824.2	56
EMSL/LV	Wesley Kinney	186.7	74
ADEMQA/HQ	Charles Plost	85.4	92

Great Lakes

Environmental Processes and Effects

This program will develop and test methods to measure, describe, and predict the sources, distribution, movement, dynamics, and effects of toxic substances on nearshore areas and harbors for "areas of concern" identified by the US/Canada Water Quality Agreement. Emphasis will be given to problems involving in-place pollutants. 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/DUL	Norbert Jaworski	1,097	56
OEPER/HQ	Sam Williams	20	11

Municipal Wastewater

Scientific Assessment

The scientific assessment program provides health assessment profiles to support regulatory decisionmaking on the effective treatment, conversion, use and disposal of municipal sludge. Preliminary data profiles and hazard indices are being prepared for a number of contaminants of municipal sludge.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Steven Lutkenhoff	68	100
OHEA/HQ	Thomas Gleason	21	100

Health Effects

Health effects research focuses on human health aspects of municipal sludge disposal. The information from these areas 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 the fate of pathogenic organisms, particularly parasites and viruses, and 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. Studies of the occurrence of pathogens and chemicals in these systems are underway. Information from these studies will be part of a determination of the feasibility of epidemiological evaluation of risks to the human population from sludge distribution and marketing.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/CIN	Elmer Akin	1,970.8	52.5
OHR/HQ	W. Wade Talbot		

Environmental Engineering and Technology

Revisions to the Clean Water Act provide incentives for the use of innovative wastewater treatment technology. This research program will provide engineering support to the innovative technologies and sludge management programs, and on techniques to improve the reliability of wastewater treatment plants.

In the area of *innovative/alternative* (I/A) technologies, assistance will be provided to the construction grant program in reviewing project plans, recommending innovative technologies, and in making available detailed planning, engineering and analytical assistance for innovative technology. Technical evaluations of full-scale

operational projects will produce feedback information of designing, energy, capital, and operation and maintenance costs. Also, a new effort will evaluate reasons for failure of I/A projects for the 100% modification/replacement program.

Engineering support of *municipal sludge management* is provided in two areas—treatment and disposal. In the treatment area, emphasis will be on innovative stabilization, digestion and thermal conversion processes that are more efficient in reducing the volume of sludge. Research in the disposal area will focus on characterizing the mechanisms controlling the uptake and the transformation of toxic organics and pathogenic organisms in sludge-amended soils. Overall emphasis is to provide the engineering information on sludge management options to support implementation of the Agency's new sludge disposal regulations.

In the *compliance achievement* support program, emphasis will be on providing design and cost information on two low cost upgrading methods through the integration of high biomass reactors and improved air aeration technology.

Evaluations of the *toxics treatability* of various municipal processes will be carried out. Toxicity reduction evaluation procedures will be developed to support the Agency's "Policy for Development of Water Quality-Based Permit Limitations."

In the area of *water quality planning and regulation support*, the engineering data base necessary for states to assess various control options and water quality impacts to achieve national water quality goals at optimum cost savings will be provided.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/CIN	James Kreissl (I/A) Joseph Farrell (sludge) Carl Brunner (upgrading) Fred Bishop (toxics) Lew Rossman (WQ)	5,970.9	25
OEET/HQ	Tom Pheiffer (HQ)	352.7	100

Industrial Wastewater

Environmental Engineering and Technology

This program supports Agency regulatory activities relating to control of specific pollutants or toxicity in industrial wastewater discharges. Efforts will supply data to enable permitting authorities to issue BPJ discharge permits for industry to meet water quality based standards in the most cost-effective manner possible. During 1985 this will be accomplished by means of laboratory and pilot plant scale evaluations of biological (particularly anaerobic) and physical/chemical wastewater treatment methods. This work will focus on complex, highly toxic wastewaters such as dye and pigment manufacturing, aluminum smelters, and organic chemicals production.

Also, efforts will provide manuals and methods for conducting site specific toxicity reduction evaluations (TRE's) to be used by permitting authorities to issue discharge permits to industry, based on a toxicity as a major parameter, particularly in the case of multiple industrial contributions. The TRE method will be developed by identifying the inplant sources of aquatic toxicity, measuring stream toxicity, identifying industrial contributors and recommending control alternatives. The complete method will be verified at specific sites in conjunction with OMSQA and is applicable to complex effluents not easily controlled by the WQA chemical-by-chemical approach. Initial efforts will include toxicity reduction for pesticide manufacture, inorganic chemicals, and petrochemicals.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/CIN	Alden Christianson	762.7	20
OEET/HQ	Don Tang	80.6	100

Environmental Processes and Effects

This research will maintain and update the existing GC/MS tape library and permit the development of new analytical databases of toxic pollutants found in wastewaters. An advanced database management system (DBMS) for the identification of toxic pollutants not currently in reference collections will also be developed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Wayne Anderson	311	100
OEPER/HQ	Chieh Wu		

Industrial Wastewater

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

Quality Assurance activities include the Discharge Monitoring Report Quality Assurance (DMRQA) study; preparation and distribution of repository, quality control, and performance evaluation samples; and 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 J. Lichtenberg John A. Winter	1,249.8	66
ADEMQA/HQ	Charles Plost	128.6	87

Energy

Acid Rain

The acid rain program supports research in seven areas: estimating emissions, understanding atmospheric processes, monitoring, analyzing aquatic effects, analyzing terrestrial effects, quantifying effects on materials, evaluating control techniques, and producing integrated assessments.

A. *Estimating Emissions from Man-Made Sources*: Primary emphasis is being given to the development of a high quality emissions data base for calendar year 1985. SO_2, NO_x and VOCs 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 and assessment.

B. *Understanding Atmospheric Processes*: This research is designed to improve our capability to examine and predict the movement and atmospheric chemistry of air masses. Field studies, using chemical tracers of emissions, recently developed gas measuring instruments, and extensive monitoring may be undertaken to study the movement and transformation of acids and precursors from sources to receptors. Modules will be developed for the acid deposition regional model.

C. *Developing a Deposition Monitoring Data Base*: Efforts will involve development of real-time precipitation measurement methods, quality assurance and data system support, and analysis of the spatial and temporal variation of data.

D. *Quantifying Aquatic Effects*: Research will survey lake chemistries in the western U.S. and stream chemistry in the Northeast and Southeast as part of the National Surface Water Survey (NSWS). The Direct/Delayed Response Program will survey soils in watersheds in the Northeast and Southeast to predict rates of surface water acidification on the basis of cation supply and sulfate absorption.

E. *Quantifying Terrestrial Effects*: Several integrated, multidisciplinary intensitve research sites will be established in spruce/fir, southern commercial, eastern hardwood and western coniferous forest types. The effects of acidic deposition, heavy metals and oxidants will be considered. Methodologies for a broad scale vegetation survey will be further developed.

F. *Quantifying the Effects on Materials and Cultural Resources*: The statistical models for calculating materials-at-risk will be evaluated and refined, a general model for physical damage function will be produced. The experimental program for concrete studies will be designed, and chamber studies of paint deterioration produced.

G. *Assessment Control Technologies*: This program assesses the engineering and economic potential of emerging technologies for removing acid deposition precursors from combustion sources. The work considers non-hardware approaches such as fuel switching as well as retrofit technologies such as the limestone injection multi-stage burner.

H. *Integration and Research Assessments*: This program responds to questions that cut across several research objectives by supporting integrated assessment functions, evaluation of regional effects, characterization of mass flows, assessment of control strategies, assessment of potentially sensitive areas, and economic analysis of damage or benefits versus costs of controlling emissions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Gene Meier (D)	6,040.	10
EMSL/RTP	Thomas Hauser (B)	5,723.7	17
AEERL/RTP	David Mobley (C)	2,989.	10
ASRL/RTP	Jack Durham (A)	7,854.8	11
ERL/COR	Ray Wilhour (E)	21,900.4	10
ERL/DUL	John Eaton (F)	390.	15
ADEMQA/HQ	Gary Foley (G,H)	11,899.	14

Environmental Engineering and Technology

This area is supporting two types of research: the development for commercialization of an integrated NO_x/SO_x control technology—Limestone Injection through a Multistage Burner (LIMB), and evaluation of pollutants from proposed synfuel facilities and alternate energy sources.

The *LIMB control technology* can substantially reduce both NO_x and SO_x 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 1985 program will include: research on sorbent reaction mechanisms, research at the small bench and pilot scale for a wide range of fuel types, 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, planning and site preparation for the industry/EPA cofunded full scale demonstrations on wall-fired utility boilers.

To control *synfuel pollutants* ORD provides special support to the regional and state permitting process and review of EISs and environmental monitoring plans of SFC

sponsored projects through special studies and technical assistance. Direct consultation will be provided to SFC's process developers as required by the Energy Security Act, Section 131(e) which identifies EPA as one of the consulting agencies to SFC. Limited evaluation will be made of discharge characterization and controls on key problem areas at SFC sponsored plants or other operating plants. Efforts will be initiated on a data management and interpretation system for monitoring data from SFC plants. Research will provide for the evaluation of reduced sulfur species control for oil shale and coal based technologies and codisposal of oil shale solid wastes with process waters.

The laboratory at RTP is responsible for the evaluation of synfuel processes and characterization of the emissions, waste streams, and control technologies. This includes coal based synthetic fuels, oil shale, tar sands, geothermal and other energy-related technologies.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
AEERL/RTP	Robert Hangebrauck Jim Abbott	5,078.8	10
OEET/HQ	Kurt Jakobson Gregory Ondich	475.9	70

Environmental Processes and Effects

The Agency's Cold Climate Research Program defines the impacts of oil and gas development, mining activities, and atmospheric pollution on arctic and sub-arctic environments and proposes mitigative measures. Projects in the FY86 program include: (1) assessing the impact of oil development on coastal tundra wetlands of the Alaska North Slope; (2) determining the impacts of placer mining on surface waters; (3) improving air models for application to North Slope problems; and (4) evaluating the urban woodsmoke problems.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/COR	James McCarty	400	0
OEPER/HQ	Patricia Neuschatz		

Hazardous Wastes

Scientific Assessment

This program provides assessments of the health effects and risks arising from hazardous wastes; improved methods for performing such assessments; and, chemical-specific health summaries. These are supplied to the EPA's Office of Solid Waste (OSW) to support a variety of regulatory activities and to OSW, EPA regional offices and the states for use in evaluating permit and enforcement actions.

One type of *assessment*, the health and environmental effects profile, characterizes a waste and assesses the hazards posed to humans or the environment by exposure to it. The profiles support decisions on listing or delisting a chemical as a hazardous waste. Most of this work is done by extramural contract.

In addition, an in-house team develops *methods* to assess the extent of human health effects and human exposure to complex hazardous wastes. These methods support efforts to assess and refine proposed RCRA permits and to prepare supporting documentation for enforcement decisions. Finally, to support the prevention and containment of hazardous spills, extramural contractors develop chemical-specific *health summaries* for use in evaluating alternatives for dealing with hazardous spill contaminants.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Christopher DeRosa	1,664	24
OHEA/HQ	Tom Miller	2,000	36

Health Effects

Listing of substances under the Resource Conservation and Recovery Act (RCRA) requires the ability to characterize the potential health hazards of wastes. This research program focuses on developing a three-level biological testing battery of short-term tests to make determinations of the potential health hazard of manufacturing process residues. Emphasis will be on recognizing complex mixtures as hazardous wastes for disposal purposes. This current research is to develop a screen for Level 1 of a three-level testing battery. This prescreen protocol, will be an abbreviated and inexpensive screen for large numbers of RCRA samples. The screen will provide a rapid and sensitive prioritizing assessment of the potential toxicity of RCRA samples. Levels 2 and 3 of the testing battery will not be the subject of research in this current plan.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	Richard Phillips	1,748.4	46.7
OHR/HQ	W. Wade Talbot		

Hazardous Wastes

Environmental Processes and Effects

Cost-effective decisions on regulation of hazardous wastes require methods for determining which waste constituents are hazardous, the potential impacts on human health and the environment of various disposal and regulatory options, and the suitability of sites proposed for disposal facilities. In addition, field-validated methods for quickly assessing the potential impacts of hazardous material releases (spills) on the environment are needed for decisions on counter-measures.

For determining whether wastes are hazardous, ERL/Duluth is adapting quantitative structure-activity relationship methods, developed for predicting the *toxicity* of single chemicals for use on multi-chemical wastes. RSKERL/Ada is developing microcosm (e.g., soil column) technology which will provide a relatively fast and inexpensive determination of the potential for wastes to move in the subsurface environment and thus to contaminate an aquifer.

Models are being developed to determine the exposure of humans and the environment to hazardous wastes. RSKERL/Ada is developing, improving, and field-evaluating ground-water models, while ERL/Athens is coordinating ground water and other routes of exposure (surface water, air) into multimedia methods which can predict exposure on a consistent basis through multiple routes.

Criteria developed by RSKERL/Ada for site selection and evaluation based on hydrogeological factors will be evaluated in several hydrogeological settings in cooperation with the U.S. Geological Survey in FY86. RSKERL/Ada is also developing a comprehensive technical data base on new and existing technologies for *land treatment of hazardous wastes* for which incineration or conventional land disposal are inappropriate, infeasible, or ineffective.

For *assessment* of the potential hazard of materials released into the terrestrial or aquatic environment, ERL/Corvallis is developing and evaluating a multitrophic-level bioassay protocol. In FY86 the protocol will be evaluated at additional field sites, and the protocol will be augmented with selected alternative testing techniques.

Three studies will be continued to assist the Agency in defining the threat from dioxin contamination: its bioavailability in fish, its potential for human exposure through the food chain, and its mobility and persistence in soils and ground water.

Hazardous Wastes

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	2,729	21
RSKERL/ADA	George Keeler	3,719	32
ERL/COR	Spencer A. Peterson	588	63
ERL/DUL	Philip M. Cook	1,585	42
OEPER/HQ	Will C. LaVeille	396	54

Environmental Engineering and Technology

This program develops information on control technologies, how they function, and whether they will, in fact, allow hazardous waste disposal facilities to meet performance standards.

In order to develop performance standards for the treatment, storage, and disposal of hazardous wastes it is necessary to understand the *operational characteristics* of the different kinds of treatment and disposal available. Methods for use in measurement protocols will be developed to determine incinerator destruction efficiency and to continuously monitor control technology. 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 developed 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.

Incineration Research focuses on four areas: characterizing performance of existing thermal destruction 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 these programs are verified in full-scale field tests. The program examines conventional incineration as well as high temperature industrial processes.

The treatment program examines both existing and emerging alternative techniques for treating or detoxifying hazardous materials. Emphasis is being 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* and pollutants related to the production of dioxins and similar toxicants. One major investigation will involve the

accelerated evaluation of the mobile incinerator at the Denney Farm site near Verona, Missouri. 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.

Finally, to provide technical support in preventing and containing hazardous *spills*, reports will be issued summarizing research on the evaluation of specialized equipment and techniques for prevention, control, removal, and disposal of hazardous releases.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HWERL/CIN	E. Oppelt N. Schomaker A. Klee I. Wilder	18,696	24
OEET/HQ	M. Dick P. E. des Rosiers D. Berg	849	39

Acid Deposition Environmental Monitoring and Quality Assurance

To improve procedures to *characterize* wastes for listing under RCRA, research will develop methods for characterizing and detecting particular wastes and providing criteria for determining if those wastes constitute a potential hazard. 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.

Techniques for *field monitoring* of hazardous waste sites will be improved, including statistics for sampling design and evaluated standard methods for media sampling. Of particular importance is subsurface monitoring of sites and investigation of new techniques for monitoring soils, and biota, ambient air, and waste incinerator emissions.

To support RCRA permitting and enforcement activities, research is developing *screening methods*, biological monitoring methods, and developing remote monitoring techniques. A substantial extramural effort will be directed toward validating waste incinerator test methods for volatile and semi-volatile organic compounds and monitors for carbon monoxide and total hydrocarbons on waste incinerator stacks.

To support prevention and containment of hazardous releases, work will be done to develop techniques and methods to gather and *analyze* data through such means as aerial photos, and thermal and multispectral imagery

techniques for site characterization. Tasks will identify spills, spill movement, and to assist in cleanup operations.

Finally, to ensure that the data on which regulation and enforcement are based is accurate, *quality assurance* efforts will include distribution of analytical and standards reference materials, on-site field audits of sampling efforts, laboratory performance evaluations and support in methods used.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Robert Booth	2,397.2	25
EMSL/LV	Erich Bretthauer	8,392.0	27
EMSL/RTP	Thomas Hauser	1,152.8	21
ADEMQA/HQ	John Koutsandreas	1,575.7	18

Superfund

Scientific Assessment

This program provides technical support to the Office of Emergency and Remedial Response (OERR) for use in establishing and implementing regulations mandated by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as well as technical support and assessment methods development for the Office of Waste Programs Enforcement (OWPE) for use in enforcement decisions. This program produces *rapid response health summaries*, for use by on-scene coordinators after hazardous materials spills or other emergency response situations. Evaluation of these chemical-specific summaries should permit a determination of potential hazards. The literature search is done by extramural contract. In addition, *health effects data* are being gathered from the scientific literature and used to rank health risks posed by individual chemicals. The final ratings are one factor among several used in determining a *"reportable quantity"* for each chemical. The majority of this work is done by extramural contract.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Christopher DeRosa	530	24
OHEA/HQ	Thomas Gleason	585	37

Environmental Engineering and Technology

Clean-up of uncontrolled hazardous waste sites requires technologies for response and remedial action, for protecting the personnel involved and for supporting enforcement actions.

The R&D support 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 handbooks 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 advice and consultation will be provided to the regional programs and the Office of Waste Programs Enforcement for *enforcement* support.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HWERL/CIN	Ronald Hill I. Wilder	6,351	30
OEET/HQ	Ray Thacker	145	100

Superfund

Environmental Processes and Effects

This activity provides technical expertise and services to EPA Regional Offices, state governments, and the Environmental Response Team. Ground water related assistance includes training or advice on use of assessment models, soil and ground water sampling and analytical techniques, and application of hydrogeological principles to contaminant transport and fate. Bioassessment related assistance focuses on evaluation and application of the protocol to leachate and contaminated soil samples to assist in site surveys and completeness of clean up/remedial actions.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
RSKERL/ADA	George Keeler	358	22
ERL/COR	Spencer A. Peterson	303	48
OEPER/HQ	Will C. LaVeille		

Acid Deposition Environmental Monitoring and Quality Assurance

This program supports the National Contracts Laboratory Program and three major activities: situation assessments, quality assurance and enforcement and technical assistance.

Between 50 and 60 laboratories are involved in the National Contracts Laboratory Program which will perform the analytical tests for *site and situation assessment*. The ORD program will ensure the quality of the data from these laboratories through on-site laboratory evaluations, blind samples analyses, quarterly reviews and a 10 percent data audit. Remote sensing provides detailed data on sites to help the Superfund Office to prioritize sites and determine methods of clean-up. Air monitoring assessment and sampling methods will be evaluated for use in field assessment of hazardous waste sites.

The *Quality Assurance* program will provide the basis to estimate the scientific accuracy of the data acquired by Superfund.

Enforcement cases will be provided with increased monitoring expertise to ensure that clean-up by industry is consistent with proved scientific protocols. Also, geophysical monitoring and a referee laboratory to provide quick turnaround will be available to the regions and the program office.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/LV	Erich Bretthauer	3,560.8	24
EMSL/RTP	Thomas Hauser	475.0	18
EMSL/CIN	Robert Booth	615.0	29
ADEMQA/HQ	Robert Holmes	100.0	72

Toxic Substances

Scientific Assessment

The scientific assessment research program relating to toxic substances provides overview of scientific documents, and develops uniform methodologies for performing risk assessments. To provide an *overview* of scientific documents, carcinogenicity, mutagenicity, adverse reproductive effects and exposure assessments are reviewed upon request from the Office of Toxic Substances. Newly developed data are being gathered to improve *risk assessment* methodologies and to ensure continuity throughout the Agency in the use of risk assessment methods. Mutagenicity, carcinogenicity and exposure *methods* are being revised and reproductive effects methods are being developed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Tom Miller	730	29

Health Effects

This research program identifies and quantifies risks to human health from toxic substances through test method development for provision of dose response data to be used in risk assessment methods development and structure-activity model development.

Testing methodology research has three purposes: to determine which laboratory tests best predict the human response, to determine the chemical reactivity of metabolic intermediate compounds, and to improve biological mathematical extrapolation models.

Risk Assessment activities are directed primarily toward improving methods to predict toxicity based upon similarities in chemical structure, improving extrapolations from high-dose to low-dose, and improving extrapolations from animal species to humans. This includes the development of biological markers which are measurable indicators of exposure, susceptibility, and effect of the molecular level. By combining epidemiologic studies with exposure markers, it may be possible to predict the human health risks from exposures to toxic material more precisely.

Research into *structure-activity* relationships will be used to develop methods which can use data on molecular structure descriptors or combinations to predict genetic and carcinogenic activities using pattern recognition and statistical techniques. Also, we will construct a chemical data base in several areas of toxicological responses and relate each to effects upon individual organ systems.

Toxic Substances

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	William F. Durham	14,510.2	25
OHR/HQ	Charles Mitchell		

Environmental Engineering and Technology

The areas of focus in this research program are: the identification and evaluation of alternatives to mitigate release and exposure of chemicals which will be used by the Agency in regulating the manufacture and use of existing chemicals; the development of predictive capabilities to be used in assessing release and exposure in the review of Premanufacturing Notices (PMN's) for new chemicals as required by TSCA; and the assessment of physical, chemical and biological techniques and devices to contain and destroy genetically engineered organisms under TSCA.

Alternatives to mitigate release and exposure of specific existing chemicals will be defined in cooperation with industry, through the evaluation and adaptation of control measures related to the release in the workplace and into the environment of the chemicals during their life cycles. Technologies, management practices, and personal protective equipment to limit the release and exposure of chemicals will be evaluated.

Models to predict the release and exposure of different classes of new chemicals will be developed in cooperation with industry. The models will address different chemical unit operations, unit processes and physical/chemical properties of chemicals and predict potential exposure and release levels as well as best control measures to mitigate release and exposure of new chemicals. Pilot scale testing for the treatability of classes of potentially toxic chemicals will be conducted to validate these predictive models for waste streams.

A program to support PMN review related to genetically engineered organisms will be conducted through technology and engineering assessments of the potential for environmental contamination, and physical, chemical and biological techniques and devices to contain and destroy these organisms. Engineering safety and quality control programs will be emphasized.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/CIN	Clyde Dempsey	3,374.5	40
OEET/HQ	Don Tang	219.8	100

Toxic Substances

Environmental Processes and Effects

Determination of the movement, transformation, and ultimate disposition of toxic substances and genetically engineered organisms in all environmental media, and how plant and animal organisms and larger ecosystems in these media are affected by toxic substances, are the subjects of this research effort. This involves specific activities for developing and validating tests and methodologies for assessing environmental hazards and exposure, integrating these into risk assessments, developing structure-activity relationships (SAR) for rapid estimation of the fate and effects of new chemicals and providing technical assistance on specific existing chemical evaluations and rule makings.

Environmental hazard assessment research focuses on the development, improvement, and validation of single and multi-species toxicity tests (including acute and chronic toxicity), bioconcentration assays, comparative toxicological relationships using fish, indirect human exposure methods, and system-level process organisms. The developed methods are validated in both laboratory (microcosm) and field ecosystem environments in order to define their applicability to real-world situations.

Studies on *environmental exposure assessment* will develop tests and mathematical models of chemical transport, transformation and fate in order to determine the concentrations of toxic substances in various environmental media and to relate these to actual terrestrial environments, modeling accumulation of toxic chemicals in food chains, and developing soil core microcosms for determining chemical fate and biodegradation processes. Laboratory and field studies are conducted as a final improvement/verification step.

Environmental risk assessment studies on the linkage of environmental exposure and hazard assessment techniques, and development of methods to evaluate risks associated with genetically engineered organisms have been initiated.

Structure-activity relationship research develops methodologies based upon molecular structure characteristics to rapidly assess the environmental fate and toxicity of new chemicals. Structure-activity correlations include those for bioaccumulation, toxicity, and fate. Activities also include development of data bases on plant uptake, fate of organic chemicals, toxicity to fish, and reactivity of chemicals in air.

Technical assistance is provided to the Office of Toxic Substances on complex problems relating to environmental fate, exposure, effects, hazards, and the environmental risk of toxic chemicals as necessary for risk assessment.

Toxic Substances

Activities in this program are carried out at six field laboratories. Their locations as well as the kinds of research they conduct are as follows:

- ERL/Athens - transport and transformation of organic and inorganic substances in freshwater and multi-media environments, and development of SAR regarding fate of chemicals;
- ERL/Duluth - effects of toxic substances in freshwater environments, and development of SAR regarding effects of new chemicals;
- ERL/Narragansett - chemical fate and effects in marine environments;
- ERL/Corvallis - fate and effects of toxic substances and genetically engineered organisms in terrestrial environments;
- RSKERL/Ada - terrestrial subsurface fate of chemicals;
- ERL/Gulf Breeze - fate and effects of chemicals and genetically engineered organisms in estuarine/marine environments.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	1,983.5	82
ERL/COR	Thomas A. Murphy	2,672.0	36
ERL/DUL	Norbert A. Jaworski	1,092.3	60
ERL/NARR	William A. Brungs	308.5	61
ERL/GB	Henry F. Enos	2,916.5	44
OEPER/HQ	Fredrick W. Kutz	3,277.4	12

Acid Deposition Environmental Monitoring and Quality Assurance

Efforts to protect human health from the adverse impacts of environmental exposure to toxic substances are supported by EPA research to improve monitoring capabilities, to more accurately determine exposure to chemicals, and to provide quality assurance. This research includes the development of new statistical techniques and sampling design methods and development of total exposure methods to improve exposure and risk assessments required by the Toxic Substances Control Act.

Research related to monitoring human and environmental *exposure* to chemicals involves analytical methods development for biological tissues and identification of the multi-media/multi-pathway transport and transformation processes. These processes are identified through monitoring data, and through monitoring systems capable of linking environmental concentrations and personal exposures to chemicals present in the environment. This exposure program requires the development of

chemical methods to determine the extent of total exposure and field testing of sampling and monitoring techniques for chemicals of interest.

Quality Assurance efforts are dedicated to assuring the quality of measurement methods, field monitoring systems, and associated protocols. Under this program, methods will be evaluated for assuring the quality sampling of analyzing volatile organic compounds which are currently difficult to isolate. Biological quality assurance will be emphasized and deliverables will include production of biological reference materials for use in Office of Toxic Substances national biological monitoring network.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
EMSL/CIN	Robert Booth	171.6	0
EMSL/RTP	Thomas Hauser	1,885.4	13
EMSL/LV	Erich Bretthauer	3,650.6	26
ADEMQA/HQ	Michael Dellarco	312.3	54

Pesticides

Scientific Assessment

In support of EPA's role in regulating pesticides, EPA's researchers prepare and review risk assessment documents for carcinogenicity, mutagenicity, adverse reproductive effects and exposure for pesticide compounds as requested by OPP. Risk assessment methods for mutagenicity, carcinogenicity, reproductive effects and exposure (dermal and inhalation) are being updated. Environmental risk assessment protocols are also being developed.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OHEA/HQ	Tom Miller	781	52

Health Effects

This program develops methods to determine health endpoint and health effects, methods to determine risk, and ways to provide quality assurance.

To define the *health endpoints* of pesticides which are of concern, data will be provided on the immunological effects of biological pesticides on mammalian cells. In addition, research will investigate how pesticides affect children differently from adults.

In order to identify the *health effects* of pesticides, EPA requires industry to supply specific pesticide data. EPA's research in this area develops test protocols and health assay methods for industry to use to produce that data. During FY86, additional test methods will be developed in the areas of reproduction/teratology, mutagenesis/carcinogenicity (genotoxic effects), neurotoxicology and immunotoxicology.

Research also develops methods to improve *risk assessment* to determine whether a pesticide poses unreasonable adverse risk to the public health and the environment.

A computerized data management and analysis system for mutagenic/carcinogenic testing of pesticides will continue to be developed and applied to assist in finding solutions to specific toxicological problems.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
HERL/RTP	William F. Durham	4,000.8	44
OHR/HQ	Charles T. Mitchell		

Environmental Engineering and Technology

This research program supports the Office of Pesticides Regulatory Program in making determinations as to whether or not certain types of protective clothing reduce exposure to pesticides during application. Laboratory studies will be initiated on the permeability and penetrability by highly toxic pesticide compounds for various fabric and rubber

compounds used for protective clothing. This work will establish effects of wearing apparel degradation and decontamination (e.g., laundering) on pesticide retention and on continued protective capability of the fabrics.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
WERL/CIN	Alden Christianson	874.3	5
OEET/HQ	Don Tang	35.1	100

Environmental Processes and Effects

This research program is designed to determine the environmental transport, degradation, fate and effects of certain pesticides; to assess the environmental exposures; and to assess hazard and associated risks. *Environmental effects* research develops methods and field-evaluates predictive techniques to estimate the effects of biological control agents and chemical pesticides on non-target biota in aquatic and/or terrestrial environments. Extramural research will be sponsored through EPA laboratories in Gulf Breeze, FL, Corvallis, OR, and Duluth, MN on field evaluation of pesticide hazard assessment techniques.

To help to *assess environmental exposure* to pesticides, additional techniques will be developed to estimate adverse pesticide exposure in aquatic and terrestrial environments. Such determinations will include pesticide distribution and exposure levels in ecosystems in various physical habitats, such as in soil, and includes studies on sediment chemical measurements and sorption kinetics. Extramural research through EPA laboratories in Athens and Gulf Breeze will focus on evaluation of predictive (modelling) techniques for environmental exposure in the field.

In support of Agency development of *environmental risk assessment* capabilities, this research program will examine environmental risk assessment methods for selected populations or their surrogates. Methods will be developed to perform assessments by integrating new or existing exposure and effects data into models. These methods are used by EPA in analyzing the data submitted by industry to determine the risks and benefits from pesticide use. In addition, *technical assistance* is provided to the Office of Pesticides Programs on complex problems relating to environmental fate, exposure, effects, and hazards as necessary for risk assessment. Several field laboratories conduct pesticide research. These are:

- ERL/Athens - transport and transformation of pesticides in freshwater and multi-media environments;
- ERL/Corvallis - exposure and effects of pesticides in terrestrial environments;

Pesticides

- ERL/Duluth - effects of pesticides in freshwater environments;
- ERL/Gulf Breeze - pesticide fate and effects in marine/estuarine environments.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	414.9	64
ERL/COR	Thomas A. Murphy	773.6	45
ERL/DUL	Norbert A. Jaworski	619.9	50
ERL/GB	Henry Enos	1,523.0	83
OEPER/HQ	Fredrick W. Kutz	1,363.3	30

Acid Deposition Environmental Monitoring 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	1,178.5	31
EMSL/RTP	Thomas Hauser	392.4	0
ADEMQA/HQ	Jim Shackelford	17.3	0

Radiation

Acid Deposition Environmental Monitoring and Quality Assurance

The overall goal of the research program in radiation is to provide the scientifically credible data necessary to assess public exposure to nonionizing 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	199.5	91
ADEMQA/HQ	Jim Shackelford	13	0

Intermedia

Scientific Assessment

The scientific assessment program provides uniform Agency-wide guidance on, and assures the consistency of, exposure and risk assessments that support regulatory decisionmaking by EPA. The Agency is developing guidelines for the assessment of exposure and risk from chemical compounds during 1986.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
ECAO/CIN	Jerry Stara	218	54
OHEA/HQ	Alan Ehrlich	946	69

Exploratory Research Core Program

There are three major components to the exploratory research program: a research grants program, a centers program, and a visiting scientists program. The research grants program supports research initiated by individual investigators in areas of priority interest to the Agency which are published annually in a "Solicitation for Research Grant Proposals." For FY86, proposals are solicited in the areas of (1) environmental ecology, biology, and microbiology, (2) environmental health, (3) environmental engineering, and (4) environmental chemistry, physics and measurements. The research centers program supports multidisciplinary research which is conducted in a university setting and focuses in areas of priority interest to EPA. For FY86, the following eight university research centers are 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): 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.

The visiting scientists program has two components: a summer fellows program and a distinguished visiting scientists program. The summer fellows program is carried out in conjunction with the American Association for the Advancement of Sciences and sponsors environmental science and engineering fellows for the summer months. In FY85, 24 highly qualified fellows were sponsored to conduct research at EPA. The distinguished visiting scientists program attracts distinguished senior scientists into the Agency for 1 to 3 years to assist in strengthening the Agency's science policy and research program. In FY85, nine new visiting scientists were sponsored to conduct research in ORD laboratories.

Office or Laboratory	Contact	Total Funds ($k)	Percent In-House
OER/HQ	Roger Cortesi	15,813.9	4

ORD Organization

The Office of Research and Development is responsible for research, development, and demonstration programs in pollution sources, fate, and health and welfare effects; waste management and utilization technology; environmental sciences; and monitoring systems. Please note, the list below includes both commercial (CML) and Federal (FTS) telephone numbers. Where only one number is listed, it serves both purposes.

Assistant Administrator for Research and Development

Acting, Donald J. Ehreth Headquarters, Washington, DC (RD-672)	(202) 382-7676

Deputy Assistant Administrator

Donald J. Ehreth	(202) 382-7676

Senior ORD Official, Cincinnati

David G. Stephan Cincinnati, OH 45268	(513) 569-7418 FTS 8-684-7418
Support Services Office Director, Robert N. Carr	(513) 569-7966 FTS 8-684-7966

Senior ORD Official, Research Triangle Park

Thomas R. Hauser Research Triangle Park, NC 27711	CML (919) 541-2106 FTS 8-629-2106
Support Services Office Director, Paul Kenline (MD-51)	CML (919) 541-2613 FTS 8-629-2613

Office of Research Program Management

Director, Samuel Rondberg Headquarters, Washington, DC (RD-674)	(202) 382-7500
Operations Office Director, Alan Neuschatz	(202) 382-7500
Administrative Management Staff Chief, Bernard E. McMahon	(202) 382-7462
Planning Staff Chief, Kay Pettitt	(202) 382-2597
Program Coordination Staff Acting Chief, Alfred A. Galli	(202) 382-7468
Regional Services Staff Chief, Michael Mastracci	(202) 382-7667
Information Systems Staff Acting Director, Clifford Moore	(202) 382-7466
Center for Environmental Research Information Director, Calvin O. Lawrence Cincinnati, OH 45268	(513) 569-7394 FTS 8-684-7394

Office of Exploratory Research

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

Research Grants Staff
Director, Clarice Gaylord (202) 382-7473

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

Visiting Scientists Program
Coordinator, Robert A. Papetti (202) 382-7473

Office of Health Research

Director, Robert L. Dixon (202)382-5900
Deputy Director, (Vacant)
Headquarters, Washington, DC (RD-683)

Program Operations Staff
Director, Tom Veirs (202) 382-5891

Water and Toxics Division
Acting Director, John Fowle (202) 382-5895

Air, Noise and Radiation Division
Acting Director, Hugh McKinnon (202) 382-5893

Health Effects Research Laboratory
Director, F. Gordon Hueter (MD-51) CML (919) 541-2281
Acting Deputy Director, Judith A. Graham FTS 8-629-2281
Research Triangle Park, NC 27711

Office of Acid Deposition, Environmental Monitoring, and Quality Assurance

Director, Courtney Riordan (202) 382-5767
Deputy Director, Matthew Bills
Headquarters, Washington, DC (RD-680)

Program Operations Staff
Director, Paul Palm (202) 382-5761

Quality Assurance Management Staff
Director, Stanley Blacker (202) 382-5763

Environmental Monitoring Systems Division
Director, Charles Brunot (202) 382-5776

Acid Deposition and Atmospheric Research Division
Acting Director, Gary J. Foley (202) 475-8930

Environmental Monitoring Systems Laboratory
Director, Thomas Hauser (MD-75) CML (919) 541-2106
Deputy Director, Jack C. Puzak FTS 8-629-2106
Research Triangle Park, NC 27711

Environmental Monitoring and Support Laboratory
Director, Robert L. Booth (513) 569-7301
Deputy Director, Thomas A.Clark FTS 8-684-7301
Cincinnati, OH 45268

Environmental Monitoring Systems Laboratory
Director, Erich W. Bretthauer CML (702) 798-2525
Deputy Director, (Vacant) FTS 8-545-2525
P.O. Box 15027
Las Vegas, NV 89114

Vint Hill Station
Director, Vernon Webb CML (703) 347-6224
P.O. Box 1587, Building 166 FTS 8-557-3110
Warrenton, VA 22186

Atmospheric Sciences Research Laboratory
Director, A. H. Ellison CML (919) 541-2191
Deputy Director, Jack H. Shreffler FTS 8-629-2191
Research Triangle Park, NC 27711

Office of Health and Environmental Assessment

Director, Elizabeth L. Anderson (202) 382-7317
Acting Deputy Director, Peter Voytek (202) 382-7315
Associate Director for Management
and Quality Control, Paul A. Martin (202) 382-7315
Headquarters, Washington, DC (RD-689)

Program Operations Staff
Director, Mary Holland (202) 382-7311

Cancer Assessment Group
Acting Director, Robert McGaughy (202) 382-5952

Exposure Assessment Group
Director, James Falco (202) 475-8909

Reproductive Effects Assessment Group
Director, Peter Voytek (202) 382-7303

Environmental Criteria and Assessment Office
Director, Lester Grant (MD-52) CML (919) 541-4173
Research Triangle Park, NC 27711 FTS 8-629-4173

Environmental Criteria and Assessment Office
Director, Jerry F. Stara (513) 569-7531
Cincinnati, OH 45268 FTS 8-684-7531

Office of Environmental Engineering and Technology

Director John H. Skinner (202) 382-2600
Headquarters, Washington, DC (RD-681)

Program Operations Staff
Director, Charles B. Oakley (202) 382-2580

Technical Programs Division
Director, Darwin R. Wright (202) 382-5747

Air and Energy Engineering Research Laboratory
Director, Frank Princiotta (MD-60) CML (919) 541-2821
Deputy Director, Chick Craig FTS 8-629-2821
Research Triangle Park, NC 27711

Hazardous Waste Engineering Research Laboratory
Director, David G. Stephan (513) 569-7418
Deputy Director, William Cawley FTS 8-684-7418
Cincinnati, OH 45268

Release Control Branch
Director, Ira Wilder CML (201) 321-6600
Edison, NJ 08817 FTS 8-340-6600

Water Engineering Research Laboratory
Director, Francis Mayo (513) 569-7951
Deputy Director, Lou Lefke FTS 8-684-7951
Cincinnati, OH 45268

Office of Environmental Processes and Effects Research

Acting Director, James W. Falco (202) 382-5950
Deputy Director, (Vacant)
Headquarters, Washington, DC (RD-682)

Special Assistant
David J. Graham (202) 382-5960

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

Water and Land Division
Director, Herbert B. Quinn (202) 382-5940

Toxics and Pesticides Division
Acting Director, Fredrick W Kutz (202) 382-5967

Field Laboratories

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

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

Office of Research Operations CML (404) 546-3145
Acting Director, George Baughman FTS 8-250-3145

Office of Program Operations CML (404) 546-3127
Director, (Vacant) FTS 8-250-3127

Environmental Research Laboratory
Director, Thomas A. Murphy CML (503) 757-4601
Deputy Director, James C. McCarty FTS 8-420-4601
200 SW 35th Street
Corvallis OR 97333

Environmental Research Laboratory Director, Norbert A. Jaworski Associate Director for Research, Gilman D. Veith 6201 Congdon Boulevard Duluth, MN 55804	CML (218) 727-6692 FTS 8-783-9549
Monticello Field Station Box 500 Monticello, MN 55362	CML only (612) 295-5145
Large Lakes Research Station 9311 Groh Road Grosse Ile, MI 48138	CML (313) 675-5000 FTS 8-226-7811
Environmental Research Laboratory Director, William A. Brungs Deputy Director, Richard L. Garnas South Ferry Road Narragansett, RI 02882	CML (401) 789-1071 FTS 8-838-5087
Hatfield Marine Science Center Newport, OR 97365	CML only (503) 867-4041
Environmental Research Laboratory Director, Henry F. Enos Deputy Director, Andrew J. McErlean Sabine Island Gulf Breeze, FL 32561	CML (904) 932-5333 FTS 8-686-9011

ORD Organizational Descriptions

Office of Exploratory Research

The Office of Exploratory Research is responsible for planning, administering and managing research in response to EPA priorities as articulated by agency planning mechanisms and ORD's research committees. Its responsibilities include: analyzing and assessing long-range environmental research trends and problems; planning, administering, managing and evaluating EPA's anticipatory and extramural research through competitive grants and centers of excellence programs; supervising and supporting visiting scientists and summer fellows programs; managing small business innovative research activities; identifying federal workforce training programs to be used by state and local governments; and assuring the participation of minority institutions in environmental research and development activities.

Office of Environmental Engineering and Technology

The Office of Environmental Engineering and Technology 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 Hazardous Waste Engineering Research 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.

The Water Engineering Research Laboratory in Cincinnati, Ohio, 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 four 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
- Extrapolation from animal data to human effects, from high to low doses, and from acute toxicity to long-term effects

The Health Effects Research Laboratory (HERL) with divisions in Research Triangle Park, North Carolina and Cincinnati, Ohio, conducts the 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 inhalation toxicology, genetic toxicology, neurotoxicology, developmental and reproductive toxicology, microbiology, epidemiology, and biometry.

Office of Environmental Processes and Effects Research

The Office of Environmental Processes and Effects Research develops the scientific and technological methods and data necessary to understand, predict, and manage the entry, movement, and fate of pollutants in the environment and the food chain, and to determine the effects of pollutants upon nonhuman organisms and ecosystems.

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 ground-water 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 fundamental 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 Water Quality Modeling distributes computer programs for eight models and provides training and assistance for users in government, industry, and academia.

The Environmental Research Laboratory in Corvallis, Oregon, determines the effects of pollution on terrestrial and freshwater ecosystems—linking air, land, and water. Studies include air pollutant and acid rain effects on terrestrial and aquatic ecosystems, toxic effects of chemicals and products of biotechnology on plants and animals in terrestrial and aquatic ecosystems, restorative efforts for dying lakes, the effects of pollution on wetlands, the ecological effects of runoff, and impacts of energy/natural resources development in cold climates.

The Environmental Research Laboratory in Duluth, Minnesota, is responsible for developing national water quality criteria for the freshwater environment and has the primary research responsibility for describing the fate and effects of pollutants in the Great Lakes. Located on Lake Superior, the laboratory specializes in the toxicology of pesticides, industrial chemicals, and other pollutants in freshwater ecosystems. The Laboratory is involved in four major research areas. These are: (1) the water quality criteria program which develops the methodology for deriving numerical limits for industrial chemicals for the protection of aquatic life; (2) the complex effluent program which seeks to develop cost-effective methods for managing the toxicity of wastewaters; (3) the structure-activity program which seeks to develop predictive technologies for estimating toxicity and fate of new chemicals; and (4) the surrogate species program which is the EPA bridge between ecotoxicology and mammalian toxicology studies.

The Environmental Research Laboratory in Narragansett, Rhode Island, studies the impacts of point and indirect pollution on marine and estuarine ecosystems. Emphasis is on determining physical, chemical, and biological processes as they influence the fate, distribution, and effects of complex effluents and contaminated sediments or sludge. This research provides the scientific support for Agency decisions on regulating ocean outfalls and other point sources, nutrient management and near coastal and offshore disposal of wastes by dumping or incineration.

The Environmental Research Laboratory in Gulf Breeze, Florida, conducts research on toxicological test guidelines and systems and the exposure-effects relationships of pesticides, toxic substances, and products of biotechnology

in marine, coastal, and estuarine ecosystems. Emphasis is on the development, evaluation, and application of techniques and test systems for measuring and predicting the transport, fate, and biological and ecosystem effects of pesticides and toxic substances, including products of biotechnology.

Office of Acid Deposition Environmental Monitoring and Quality Assurance

This Office is responsible for: (a) monitoring the cause and effects of acid deposition; (b) research and development on the causes, effects and corrective steps for the acid deposition phenomenon; (c) research with respect to the transport and fate of pollutants which are released into the atmosphere; (d) development and demonstration of techniques and methods to measure exposure and to relate ambient concentrations to exposure by critical receptors; (e) 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; (f) establishment, direction and coordination of agency-wide Quality Assurance Program; and (g) 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 Research Triangle Park, North Carolina, develops methods to measure and monitor pollutants in ambient air and emissions sources; operates the quality assurance program for measurement of air pollutants, develops techniques to assess population exposure to air pollutants; and, characterizes non-criteria pollutants in air.

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, 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 programs.

The Environmental Monitoring and Support Laboratory in Cincinnati, Ohio, standardizes analytical test procedures to identify and measure major pollutants and microorganisms of health significance in drinking water, ambient receiving waters, and municipal and industrial

effluents; operates the quality assurance program for the monitoring data on water pollutants; develops screening methods for use at hazardous waste sites; and provides technical support to water and waste monitoring programs.

The Atmospheric Sciences Research Laboratory in Research Triangle Park, North Carolina, determines the effects of air pollution on the atmosphere, and subsequent effects on air and water quality and land use. It also assesses the effects of pollution on weather and climate, and develops mathematical models for relating pollution emissions to air quality and for forecasting potential air pollution crises.

Office of Health and Environmental Assessment

The Office of Health and Environmental Assessment is responsible for an agency-wide program to provide a scientific foundation for evaluating 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 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. Additionally, 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 are also provided.

ORD Office/Laboratory Abbreviations

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

ECAO/CIN Environmental Criteria and Assessment Office
Cincinnati, OH 45268
CML (513) 569-7532
FTS 8-684-7532

ECAO/RTP Environmental Criteria and Assessment Office
Research Triangle Park, NC 27711
CML (919) 541-4173
FTS 8-629-4173

ESML/CIN Environmental Monitoring and Support Laboratory
Cincinnati, OH 45268
CML (513) 569-7301
FTS 8-684-7301

EMSL/LV Environmental Monitoring Systems Laboratory
P.O. Box 15027
Las Vegas, NV 89114
CML (702) 798-2100
FTS 8-545-2100

EMSL/RTP Environmental Monitoring Systems Laboratory
Research Triangle Park, NC 27711
CML (919) 541-2106
FTS 8-629-2106

ERL/ATH Environmental Research Laboratory
College Station Road
Athens, GA 30613
CML (404) 546-3154
FTS 8-250-3154

ERL/COR Environmental Research Laboratory
200 SW 35th Street
Corvallis, OR 97333
CML (503) 757-4601
FTS 8-420-4601

ERL/DUL Environmental Research Laboratory
6201 Congdon Boulevard
Duluth, MN 55804
CML (218) 727-6692
FTS 8-783-9550

ERL/GB Environmental Research Laboratory
Sabine Island
Gulf Breeze, FL 32561
CML (904) 932-5311
FTS 8-686-9011

ERL/NARR Environmental Research Laboratory
South Ferry Road
Narragansett, RI 02882
CML (401) 789-1071
FTS 8-838-5087

ASRL/RTP Atmospheric Sciences Research Laboratory
Research Triangle Park, NC 27711
CML (919) 541-2191
FTS 8-629-2191

HERL/RTP Health Effects Research Laboratory
Research Triangle Park, NC 27711
CML (919) 541-2281
FTS 8-629-2281

HWERL/CIN Hazardous Waste Engineering Research Laboratory
Cincinnati, OH 45268
(513) 569-7418
FTS 8-684-7418

AEERL/RTP Air and Energy Engineering Research Laboratory
Research Triangle Park, NC 27711
CML (919) 541-2821
FTS 8-629-2821

WERL/CIN Water Engineering Research Laboratory
Cincinnati, OH 45268
CML (513) 569-7951
FTS 8-684-7951

OEET/HQ Office of Environmental Engineering and Technology
(RD-681)
Washington, DC 20460
(202) 382-2600

OEPER/HQ Office of Environmental Processes and Effects Research
(RD-682)
Washington, DC 20460
(202) 382-5950

OER/HQ Office of Exploratory Research
(RD-675)
Washington, DC 20460
(202) 382-5750

OHEA/HQ Office of Health and Environmental Assessment
(RD-689)
Washington, DC 20460
(202) 382-7317

OHR/HQ	Office of Health Research (RD-683) Washington, DC 20460 (202) 382-5900
ADEMQA/ HQ	Acid Deposition Environmental Monitoring and Quality Assurance (RD-680) Washington, DC 20460 (202) 382-5767
RSKERL/ ADA	Robert S. Kerr Environmental Research Laboratory P.O. Box 1198 Ada, OK 74820 CML (405) 332-8800 FTS 8-743-2011

ORD Key Contacts

	Telephone
Abbott, Jim	CML (919) 541-3443 FTS 8-629-3443
Akin, Elmer W.	CML (513) 569-7401 FTS 8-684-7401
Akland, G.	CML (919) 541-2346 FTS 8-629-2346
Anderson, Wayne	CML (404) 546-3453 FTS 8-250-3453
Berry, Michael	CML (919) 541-4172 FTS 8-629-4172
Bishop, Fred	CML (513) 569-7629 FTS 8-684-7629
Black, Frank	CML (919) 541-3037 FTS 8-629-3037
Bloch, Wayne	(202) 382-5772
Booth, Robert	CML (513) 569-7301 FTS 8-684-7301
Bretthauer, Erich	CML (702) 798-2525 FTS 8-545-2525
Bromberg, Steve	CML (919) 541-2919 FTS 8-629-2919
Brungs, William A.	CML (401) 789-1071 FTS 8-838-5087
Brunner, Carl	CML (513) 569-7652 FTS 8-684-7652
Christianson, Alden	CML (513) 569-7406 FTS 8-684-7406
Clark, Robert	CML (513) 569-7201 FTS 8-684-7201
Clements, John	CML (919) 541-2454 FTS 8-629-2454
Condie, Lyman	CML (513) 569-7211 FTS 8-684-7211
Cook, Philip M.	CML (218) 727-6692 FTS 8-783-9523
Cordle, Steven	(202) 382-5940
Cortesi, Roger	(202) 382-5750
Costa, Charles	CML (702) 798-2305 FTS 8-545-2305
Cupitt, Larry	CML (919) 541-2878 FTS 8-629-2878
Dellarco, Michael	(202) 382-5772
Dempsey, Clyde	CML (513) 569-7504 FTS 8-684-7504
DeRosa, Christopher	CML (513) 569-7534 FTS 8-684-7534
DeRosiers, Paul	(202) 382-5747
Dick, Marshall	(202) 382-5747
Dickerson, Richard	CML (919) 541-2909 FTS 8-629-2909
Dimitriades, Basil	CML (919) 541-2706 FTS 8-629-2706
Dourson, Michael	CML (513) 569-7544 FTS 8-684-7544
Duke, Tom	CML (904) 932-5311 FTS 8-686-9011
Durham, Jack	CML (919) 541-2183 FTS 8-629-2183
Durham, William F.	CML (919) 541-2909 FTS 8-629-2909
Eaton, John	CML (218) 727-9557 FTS 8-783-9557
Ellison, Alfred	CML (919) 541-2191 FTS 8-629-2191
Enos, Henry F.	CML (904) 932-5311 FTS 8-686-9011
Ehrlich, Alan	(202) 382-5954
Farrell, Joseph	CML (513) 569-7652 FTS 8-684-7652
Foley, Gary	(202) 475-8930
Gleason, Thomas	(202) 382-5740
Hall, Robert E.	CML (919) 541-2477 FTS 8-629-2477
Hangebrauck, R. P	CML (919) 541-4134 FTS 8-629-4134
Hauser, Thomas	CML (919) 541-2106 FTS 8-629-2106
Hill, Ronald D.	CML (513) 569-7861 FTS 8-684-7861
Holmes, Robert	(202) 382-5772
Hood, Ken	(202) 382-5967
Jakobson, Kurt	(202) 382-2583
Jaworski, Norbert A.	CML (218) 727-6692 FTS 8-783-9550

	Telephone
Jungers, Joellen L.	CML (919) 541-3849 FTS 8-629-3849
Keeler, George	CML (405) 332-8800 FTS 8-743-2212
Keith, William	(202) 382-5716
Kinney, Wesley	CML (702) 798-2358 FTS 8-545-2358
Klee, Al	CML (513) 569-7493 FTS 8-684-7493
Kleffman, David	(202) 382-5895
Kotchmar, Dennis	CML (919) 541-4158 FTS 8-629-4158
Koutsandreas, John	(202) 382-5772
Kreissl, James	CML (513) 569-7641 FTS 8-684-7641
Krishnan, Bala	(202) 382-2683
Kuroda, Donna	(202) 382-5895
Kutz, Frederick W.	(202) 382-5967
Laurie, Vernon	(202) 382-5772
Laveille, Will C.	(202) 382-5990
Lichtenberg, James	CML (513) 569-7306 FTS 8-684-7306
Lutkenhoff, Steven	CML (513) 569-7533 FTS 8-684-7533
McElroy, James L.	CML (702) 798-2361 FTS 8-545-2361
Meier, Gene	CML (702) 798-2534 FTS 8-545-2534
Miller, Tom	(202) 382-3139
Mitchell, Charles	(202) 382-5895
Mitchum, R. K.	CML (702) 798-2103 FTS 8-545-2103
Mobley, David	CML (919) 541-2612 FTS 8-629-2612
Morehouse, Karen	(202) 382-5893
Murphy, Thomas A.	CML (503) 757-4601 FTS 8-420-4601
Neuschatz, Patricia M.	(202) 382-5962
Ondich, Gregory	(202) 382-2583
Oppelt, E.	CML (513) 569-7696 FTS 8-684-7696

	Telephone
Ott, Wayne	(202) 382-5772
Pashayan, Deran	(202) 475-8936
Peterson, Spencer	CML (503) 757-4605 FTS 8-420-4605
Pheiffer, Tom	(202) 382-2583
Phillips, Richard	CML (919) 541-2771 FTS 8-629-2771
Plost, Charles	(202) 382-5772
Plyler, Everett	CML (919) 541-2918 FTS 8-629-2918
Puzak, John	CML (919) 541-2106 FTS 8-629-2106
Raub, James	CML (919) 541-4157 FTS 8-629-4157
Rossman, Lewis	CML (513) 569-7603 FTS 8-684-7603
Russo, Rosemarie C.	CML (404) 546-3134 FTS 8-250-3134
Schomaker, Norbert	CML (513) 569-7871 FTS 8-684-7871
Shackelford, J. M.	(202) 382-5772
Shapiro, Paul	(202) 382-2583
Stara, Jerry	CML (513) 569-7531 FTS 8-684-7531
Swank, Robert	CML (404) 546-3476 FTS 8-250-3476
Talbot, W. Wade	(202) 382-5895
Tang, Don	(202) 382-2583
Thacker, Ray	(202) 382-5747
Thomas, Nelson	CML (218) 727-6692 FTS 8-783-9702
Tilton, Beverly	CML (919) 541-4161 FTS 8-629-4161
Tingery, Dave	CML (503) 757-4621 FTS 8-420-4621
Tucker, W. Gene	CML (919) 541-2746 FTS 8-629-2746
Weber, Cornelius	CML (513) 569-7337 FTS 8-684-7337
Wilhour, Ray	CML (503) 757-4634 FTS 8-420-4634

	Telephone
Williams, Sam	(202) 382-5979
Winter, John	CML (513) 569-7325 FTS 8-684-7325
Wu, Chieh	(202) 382-5940

ORD Regional Contacts

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

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

Director, Michael L. Mastracci (202) 382-7667
Regional Services Staff (RD-674)
Washington, DC 20460

Regional Liaison Officers	**Telephone**
Gerald Rausa Regional Services Staff Washington, DC 20460	(202) 382-7667
Morris Altschuler Regional Services Staff Washington, DC 20460	(202) 382-7667
Eugene Harris Hazardous Waste Engineering Research Laboratory Environmental Protection Agency Cincinnati, OH 45268	CML (513) 569-7862 FTS 8-684-7862
Gilbert D. Potter Environmental Monitoring Systems Laboratory Environmental Protection Agency P.O. Box 15027 Las Vegas, NV 89114	CML (702) 798-2321 FTS 8-545-2321

EPA Regional Offices

Region 1	Environmental Protection Agency Room 2203 John F. Kennedy Federal Building Boston, Massachusetts 02203	Connecticut Maine Massachusetts New Hampshire Rhode Island Vermont
	Regional Administrator Michael R. Deland	(617) 223-7210
	Deputy Regional Administrator Paul G. Keough	(617) 223-5424
	Office of Public Affairs Director Brooke C. Cook	(617) 223-5752
Region 2	Environmental Protection Agency Room 900 26 Federal Plaza New York, New York 10278	New Jersey New York Puerto Rico Virgin Islands
	Regional Administrator Christopher Daggett	(212) 264-2525
	Deputy Regional Administrator William J. Muszynski	(212) 264-0396
	Office of Public Affairs Director James R. Marshall	(212) 264-2515
Region 3	Environmental Protection Agency 841 Chestnut St. Philadelphia, Pennsylvania 19107	Delaware District of Columbia Maryland Pennsylvania West Virginia Virginia
	Regional Administrator James M. Seif	(215) 597-9814
	Deputy Regional Administrator Stanley L. Laskowski	(215) 597-9812
	Office of Public Affairs Director Janet Luffy	(215) 597-9370

Region 4	Environmental Protection Agency 345 Courtland Street, N.E. Atlanta, Georgia 30365	Alabama Florida Georgia Kentucky Mississippi North Carolina South Carolina Tennessee
	Regional Administrator Jack E. Ravan	CML (404) 881-4727 FTS 8-257-4727
	Deputy Regional Administrator John A. Little	CML (404) 881-4727 FTS 8-257-4727
	Office of Public Affairs Director Frank Redmond	CML (404) 881-2013 FTS 8-257-2013
Region 5	Environmental Protection Agency 230 S. Dearborn Chicago, Illinois 60604	Illinois Indiana Michigan Minnesota Ohio Wisconsin
	Regional Administrator Valdas V. Adamkus	(312) 353-2000
	Deputy Regional Administrator Alan Levin	(312) 353-2000
	Office of Public Affairs Director Jon Grand	(312) 353-2072
Region 6	Environmental Protection Agency 1201 Elm Street First International Building Dallas, Texas 75270	Arkansas Louisiana New Mexico Oklahoma Texas
	Regional Administrator Dick Whittington	CML (214) 767-2600 FTS 8-729-2600
	Deputy Regional Administrator Frances E. Phillips	CML (214) 767-2600 FTS 8-729-2600
	Office of Public Affairs Director Philip Charles	CML (214) 767-2630 FTS 8-729-2630
Region 7	Environmental Protection Agency 726 Minnesota Avenue Kansas City, Kansas 66101	Iowa Kansas Missouri Nebraska

	Regional Administrator Morris Kay	CML (913) 236-2800 FTS 8-757-2800
	Deputy Regional Administrator William W. Rice	CML (913) 236-2800 FTS 8-757-2800
	Office of Public Affairs Director Rowena Michaels	CML (913) 236-2803 FTS 8-757-2803
Region 8	Environmental Protection Agency Suite 900 1860 Lincoln Street Denver, Colorado 80295	Colorado Montana North Dakota South Dakota Utah Wyoming
	Regional Administrator John G. Welles	CML (303) 293-1603 FTS 8-564-1603
	Deputy Regional Administrator Alexandria Smith	CML (303) 293-1603 FTS 8-564-1603
	Office of Public Affairs Director Doris Sande	CML (303) 293-1692 FTS 8-564-1692
Region 9	Environmental Protection Agency 215 Fremont Street San Francisco, California 94105	Arizona California Hawaii Nevada
	Regional Administrator Judith E. Ayres	(415) 454-8153
	Deputy Regional Administrator John C. Wise	(415) 454-8153
	Office of Public Affairs Director Dranna M. Wieman	(415) 454-8083
Region 10	Environmental Protection Agency 1200 6th Avenue Seattle, Washington 98101	Alaska Idaho Washington Oregon
	Regional Administrator Ernesta B. Barnes	CML (206) 442-5810 FTS 8-399-5810
	Deputy Regional Administrator L. Edwin Coate	CML (206) 442-1220 FTS 8-399-1220
	Regional Press Office Robert Jacobson	CML (206) 442-1465 FTS 8-399-1465