

# **FY-1991 EPA Research Program Guide**

October 1, 1990 — September 30, 1991

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

# Notice

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

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# Introduction

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

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

# How to Use the Program Guide

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

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

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

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

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

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



## **Environmental Engineering and Technology Demonstration**

### *Hazardous Air Pollutant Regulatory Activities*

The engineering program for hazardous air pollutants addresses problems in the industrial, commercial, governmental (e.g., military), and public sectors. The program is comprised of four parts: (1) prevention of Hazardous Air Pollutant/Volatile Organic Compound emissions; (2) assessment and enhancement of existing control devices; (3) development and demonstration of innovative new prevention and control approaches; and (4) direct engineering technical support.

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

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

Enhanced control of HAP, VOC, and PM-10 involves improving existing controls as well as developing and evaluating new, high-tech control technologies. Such new, advanced technologies may make control possible where it was not feasible before, e.g., small point and area sources. The program also involves work with source-oriented controls for problem sources such as woodstoves and municipal waste incinerators.

An important component of the program is the assessment and enhancement of existing types of generic air toxic control such as carbon adsorption, catalytic oxidation, and particle controls. In addition, new technologies such as the corona destruction process will be developed and assessed.

Technical support includes direct support to state and local agencies and EPA Regional Offices through operation of the Control Technology Center. It also includes source assessment (source-related measurements) to help define the magnitude and character of air toxic emissions,

especially as related to application of prevention options and controls.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AEERL/RTP	Wade Ponder	3,837.7	40
OEETD/HQ	Marshall Dick	241	75

## *Hazardous Air Pollutant Regulatory Activities*

### **Health Effects**

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

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

More broadly, there is a need to evaluate whether prolonged exposures to ambient levels of potential HAPs pose a significant health risk. Primary research approaches are animal toxicology and dosimetry studies. EPA researchers will develop methods to provide data on the genetic, developmental, and neurotoxic effects of HAPs. Emphasis of this research will be on the toxic components of gaseous-aerosol complex mixtures and source emissions. Emphasis is also shifting towards research that will resolve generic extrapolation issues, such as route-to-route extrapolation, and extrapolation across dose concentrations and durations.

Dose-response data on the mutagenic and carcinogenic activity and noncancer endpoints including neurotoxicity, physiological, and pulmonary health effects of potential HAPs will be determined. These HAPs will be selected based upon assessments prepared by the Office of Health and Environmental Assessment (OHEA) and research needs identified by the Office of Air Quality, Planning, and Standards (OAQPS). The effects of selected chemicals suspected of being

hazardous to the nervous system will be studied. The dose-exposure research will provide quantitative information on the relationship between dose (body burden) and human exposure to toxic pollutants.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Ila Cote Susan Perlin	4,046.9	71.4

## Modeling, Monitoring Systems and Quality Assurance

### *Hazardous Air Pollutant Regulatory Activities*

The need for technology to monitor non-criteria contaminants at the regional, state, and local levels continues. Broad-based stationary source screening methods, generic methods and specific methods for some of the 191 hazardous pollutants covered in Title III of the new Clean Air Act will be emphasized. Stationary source methods will be evaluated and validated. In addition, certain advanced ambient methods will be evaluated, including cryogenic preconcentrations, gas chromatography and Fourier transform infrared (FTIR) spectrometry.

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

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

In the Characterization, Transport, and Fate (CTF) research program, laboratory and field studies will be conducted to determine the atmospheric lifetimes and transformation products of hazardous air pollutants; to determine deposition and removal rates of hazardous chemicals; and to identify the factors responsible for concentration levels and spatial and temporal (i.e., seasonal) variability of selected volatile

organic compounds. Also, research studies will examine the atmospheric chemical and physical processes that are important in producing mutagenic compounds in the atmosphere. The information obtained from this program is used for preparing health assessment documents to determine if chemicals in the atmosphere present a hazard.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AREAL/RTP	John Clements Larry Cupitt	2,927.4	50
OMMSQA/HQ	William Keith		

## Scientific Assessment

### *Hazardous Air Pollutant (HAP) Regulatory Activities*

The hazardous air pollutant scientific assessment program of the Office of Health and Environmental Assessment (OHEA) has four major elements: (1) health assessments, (2) research to improve methodologies for these assessments, (3) technological/information transfer, and (4) expert consultation to the Office of Air and Radiation (OAR) on all the above elements. During FY91, major emphasis will be placed on implementation of programs that are responsive to new requirements of the Clean Air Act Amendments. The exact nature of the scientific assessment program is dependent on the final language of the Amendments, but even at this point the assessment program can be broadly structured to respond.

Health assessment activities will focus on the list of 191 air-toxics in the Clean Air Act Amendments and OAR information needs relative to their decisions on negligible risk, residual risk, and designation of lesser quantity cut-offs. Cancer unit risks will be developed for those listed air toxics that have not already been evaluated. Chronic reference concentrations (RFC) will be developed for non-cancer effects. As a methodology for acute RFC becomes available from the research program, acute RFC's will be developed. Draft

RFC's are submitted to the EPA-wide Verification Committee, co-chaired by OHEA. After verification or determination that the data base is inadequate for an RFC, the appropriate information is entered into IRIS. Those listed chemicals having data bases inadequate to meet the criteria for RFC development will be identified. OHEA will provide support to the Office of Air Quality Planning and Standards (OAQPS) in identifying risks for these chemicals. Another aspect of the program is to complete health assessment documents and other documents in progress in FY90.

A research program is being conducted to improve methodologies for risk assessment of air toxics. The focus is on non-cancer health effects and the RFC methodology. The research is designed to enhance the scientific foundation of assumptions inherent in all assessments and to increase the utility of the assessments to the program offices. This involves: (1) improving the quantitative bases for uncertainty assumptions in the chronic RFC method so that ultimately some key assumptions can be replaced with actual values, (2) developing an acute RFD method, and (3) developing procedures to assess risks above the RFC. Based on results from this research, the RFC methodology will be revised and subjected to expert peer review and Agency review prior to completion and EPA-wide implementation. OHEA, jointly with OAQPS, operates the Air Risk Information Support Center (Air RISC). This Center provides information on health risks of air toxics to state and local air pollution agencies as well as to EPA Regions. Rapid response is achieved via a hot-line operation. Numerous types of technical guidance are also provided.

OHEA also acts as technical consultants to OAR on air toxics health issues. After the passage of the Clean Air Act Amendments, this role will increase as OHEA provides expert review on listing/delisting decisions.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ECAO/RTP	Lester Grant	3,917.6	47.0

## *Mobile Source Pollutant Regulatory Activities*

### Health Effects

The health effects research program for mobile sources provides health effects data for selected emissions and transformation products associated with motor vehicles. One goal of the research conducted by the Health Effects Research Laboratory is to develop methods and data that can be used to characterize the risk of mobile source emissions as a component of the total human exposure to carcinogens and mutagens. Methods will be developed to apportion the potential cancer risk from alternative engine and fuel types. The work will include the assessment of DNA adducts as biomarkers of exposure, dosimetry, or cancer risk from mobile source emissions in comparative mutagenesis and tumorigenesis bioassay systems *in vitro* and *in vivo*. The work also includes an examination of the impact of alternative fuels and their emissions on human health, with the focus on pharmacokinetics, developmental effects, reproductive effects, neurotoxicity and mutagenic activity of methanol exposure.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Ila Cote Susan Perlin	322.9	33.6

## *Mobile Source Pollutant Regulatory Activities*

### Modeling, Monitoring Systems and Quality Assurance

The major effort in this program is to characterize the emissions from motor vehicles using traditional fuels as well as alternative fuels, such as methanol, compressed natural gas or reformulated gasoline. Laboratory studies of the impact of ambient temperature on the emission

rates of regulated and unregulated pollutants from light duty motor vehicles will continue. Emphasis will be directed to the composition of organic emissions. Studies of the relationship between fuel composition, including gasoline and gasoline-alcohol blends, and the composition and rate of tailpipe, evaporative, and refueling emissions will continue. Other programs will emphasize the development of analytical procedures suitable for real-time measurement of motor vehicle emissions. Procedures for determination of the operating condition of motor vehicle emission control devices will be evaluated. Programs for examination, development, and improvement of procedures for apportionment of observed ambient pollution to motor vehicles will be conducted.

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

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

assumptions incorporated in the NAAQS Exposure Model (NEM) will be undertaken. The purpose of the research will be to improve the accuracy and reliability of the Agency's exposure assessment methodology for mobile source pollutants.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AREAL/RTP	Ken Knapp Dale Pahl	1,688.3	39
OMMSQA/HQ	Frank Black William Keith		

## *Mobile Sources*

### **Scientific Assessment**

The Office of Health and Environmental Assessment (OHEA) is providing management of the ORD Alternative Fuels Research Program and scientific assessments of major issues related to EPA's development of policies and regulations on alternative fuels. OHEA is coordinating ORD activities to develop a Research Strategy that describes research needed to quantitatively assess the human health, ecosystem, and global warming effects of alternative fuels (e.g. methanol, ethanol, compressed natural gas, and reformulated gasolines) compared to conventional gasoline and diesel fuels. This Strategy is intended to provide broad guidance to development of targeted research programs within ORD as well as other scientific institutions which have an interest in alternative fuels. The ORD Research Plan for Alternative Fuels is also being developed. It is based on the Strategy and describes what research ORD would conduct at several levels of resources. Both the Strategy and the Plan will be reviewed by the Science Advisory Board and by the public, before the final documents are developed.

As part of the scientific assessment portion of ORD's Alternative Fuels Program, OHEA will develop assessments of key health and ecosystem issues and provide overall coordination of the



program within and outside EPA. This will entail the development of major health and ecosystem assessments of the alternative fuels and gasoline. These documents will be subjected to expert scientific review at workshops, as well as public and Science Advisory Board reviews. Assessments of additional topics (i.e., accidental ingestion of alternative fuels by children, the health impacts of alterations in ozone levels resulting from fuel switching, and predicted occurrences of large accidental spills of alternative fuels into aquatic systems) will also be developed, along with interpretive reports of findings from the ORD research program. This assessment program will begin in FY91 with the initiation of one major assessment.

Another key element is to coordinate the research program with all interested scientific institutions (i.e., federal, private, academic and international). As one step in this process, OHEA will hold an international meeting on alternative fuels in FY91, to which these institutions will be invited to describe their programs and recent research results, thereby substantially improving communication. A proceedings of the meeting will be developed.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ECAO/RTP	Judith Graham	267.8	53.0

## *National Ambient Air Quality Standards (NAAQS)*

### **Modeling, Monitoring Systems and Quality Assurance**

The purpose of this program is to provide scientific information on atmospheric processes and monitoring methodologies to support the Agency's regulatory program on National Ambient Air Quality Standards (NAAQS). The current program will focus on inhalable particulate matter, fine particles and acid aerosols research.

Under the Monitoring Systems and Quality Assurance portion of this program, improved air pollution monitoring methods are being developed to help determine air quality trends, support

compliance with standards, and meet enforcement needs. The data from these methods are often used as the basis for regulatory action. The areas investigated include ambient methods development, quality assurance guidelines and audit materials preparation.

Ambient methods development will focus on measuring particulate matter in support of anticipated changes to the National Ambient Air Quality Standards (NAAQS). Researchers will analyze visibility data and its relationship to mass and composition data from the Eastern Fine Particle Visibility Network.

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AREAL/RTP	William Wilson	1,895.1	24
EMSL/LV	Marc Pitchford	171.1	29
OMMSQA/HQ	William Keith		

## *National Ambient Air Quality Standards (NAAQS)*

### Health Effects

This research program has three major goals: (1) to provide data on health effects of exposures to O<sub>3</sub>, NO<sub>2</sub>, CO, sulfur oxides, particles, acid aerosols and lead using both human and animal studies; (2) to provide better models to extrapolate from animals to humans; and (3) to develop improved test methods for research into the physiological responses of humans to the primary air pollutants.

Health effects research is conducted to refine and improve the toxicological and epidemiological data base relevant to criteria pollutants. Both human and animal-dose response studies, as well

as mathematical modeling, will be given special attention to determine the deposition, clearance, and pulmonary function effects of particles, alone and in combination with ozone, NO<sub>2</sub> and SO<sub>2</sub>.

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

Animal, human clinical and epidemiology studies will provide data to determine the extent to which the primary air pollutants cause or exacerbate the development of noncarcinogenic chronic disease. Effects are studied in both healthy and sensitive (e.g., asthmatic) individuals. Biological endpoints to be examined include development of cardiovascular or pulmonary disease, aggravation of existing conditions, changes in biochemistry and host defense mechanisms, and changes in pulmonary structure or function. Emphasis is currently placed on determining the acute and chronic effects of O<sub>3</sub> and NO<sub>2</sub> inhalation.

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Ila Cote Susan Perlin	13,395.6	30.8

## *National Ambient Air Quality Standards (NAAQS)*

### **Environmental Processes and Effects**

This research provides scientific support of NAAQS by determining the effects of ozone on forests, with emphasis on species of economic

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/COR	Bill Hogsett	1,860.6	40
OEPER/HQ	Paul Ringold	1,006.8	60

## *National Ambient Air Quality Standards (NAAQS)*

### **Scientific Assessment**

The main objective of the NAAQS scientific assessment program is to review and revise criteria documents for sulfur oxides, particulate matter, nitrogen oxides, ozone and other photochemical oxidants, carbon monoxide, and lead. Air Quality Criteria Documents (AQCDs) are mandated by the Clean Air Act and, as directed by the Act, are revised at 5-year intervals. These documents are evaluations of the available scientific information on the health and welfare effects of criteria pollutants. As such, criteria documents are the primary source of information used by EPA regulatory decision makers in setting or revising the NAAQS.

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

Docket and are published concurrently with the proposed regulatory decisions.

In FY91, work will continue on revision of the Carbon Monoxide and Oxides of Nitrogen AQCDs and on the assembling and updating of data bases concerning ozone, acid aerosols, lead, and fine particle-visibility relationships.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ECAO/RTP	Lester Grant	1,975.8	57.0

## Modeling, Monitoring Systems and Quality Assurance

### *New Source Performance Standards and State Implementation Plans*

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

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

Field and laboratory studies to further develop and test different source apportionment methods (SAMs) are underway and will evaluate hybrid SAM models with chemical composition and meteorology for apportionment of regional aerosols. In view of the revised particulate air

quality standard based on inhalable particulates, field, smog chamber, wind tunnel, water channel, and laboratory studies are being used to develop and evaluate chemistry and dispersion components of urban scale particulate air quality models. Research is continuing to develop a first generation regional particulate air quality model (RPM).

Additional research in the monitoring systems and quality assurance area emphasize the development of monitoring methods and provision of quality assurance samples and support. EPA's monitoring methodologies for source air pollutants will include evaluation, methods improvement, preparation of operating guidance and manuals for developed and commercial monitoring instruments. A major effort will be conducted to evaluate methods for PM<sub>10</sub> monitors. Quality assurance for the source monitoring program is essential to ensuring that only data of known accuracy and precision are used for regulatory and enforcement decisions. Reference samples will be provided and audits of laboratories making source measurements will be continued.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AREAL/RTP	John Clements Jack Shreffler Francis Schiermeier	6,455.1	38
EMSL/LV OMMSQA/HQ	James McElroy William Keith	452.6	43

## *New Source Performance Standards and State Implementation Plans*

### **Environmental Engineering and Technology Demonstration**

Research in this program supports the development of New Source Performance Standards (NSPS) and State Implementation Plans by aiding in the development of pollutant control technology which is cost-effective and energy-efficient. The focus of the research is on the reduction of Volatile Organic Compounds, NO<sub>x</sub>, and SO<sub>x</sub> emissions.

Volatile Organic Compounds (VOCs) are a major cause of non-attainment of the National

Ambient Air Quality Standards for ozone. Extramural research will evaluate VOC abatement technology such as adsorption, thermal oxidation, and catalytic oxidation. Of particular interest will be effective and affordable prevention and control methods for small VOC-emitting industries.

Combustion modification methods of controlling  $\text{NO}_x$  and other emissions will be evaluated to determine combustion modification (CM) methods for reducing  $\text{NO}_x$  emissions and improving the performance of utility and industrial boilers. Prior research has proven that CM methods can be effective for control of  $\text{NO}_x$  as well as other emissions, if each method is tailored to the characteristics of the specific combustion equipment (e.g., stoker or package boilers, coal or oil burners, and internal combustion engines or gas turbines). Research will evaluate an in-furnace  $\text{NO}_x$  reduction technique called reburning which involves injection of fuel downstream of the primary combustion zone. In-house reburning experiments on pilot-scale combustors will be continued and field test projects in a full-scale coal-fired utility boiler will be started. In-house tests of selective catalytic reduction (SCR) systems for internal combustion engines will be completed.

Existing technology to control gaseous pollutants is expensive. For new utility sources, approximately 30% of boiler costs are attributable to air pollution control. Design and performance data for low cost, high-reliability emission reduction technology are needed to support the Agency's regulatory functions. Technical support to regulated entities will be provided by conducting assessments and fundamental research on technologies for reduction of stack emissions of sulfur dioxide ( $\text{SO}_2$ ).

$\text{SO}_x$  emissions reduction technology will focus on demonstrating dry sorbent injection technology with its potential for 55 to 70 percent control and also on an advanced process that can be coupled with sorbent injection to efficiently utilize unreacted sorbent and provide for 90 percent  $\text{SO}_2$  control. These processes will be suitable for both retrofit and new applications and will be candidates for consideration in acid rain control

implementation strategies. A coordinated in-house and extramural pilot-scale effort will provide essential direct support to the technology demonstration programs especially in the area of sorbent reactivity and process optimization. These efforts will provide test data which will be used to design key process equipment for the advanced SO<sub>2</sub> removal process. Quality technology transfer will continue to be given high priority to ensure that results of the SO<sub>2</sub> control program are expeditiously and effectively made available to potential users for consideration in their implementation strategies.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AEERL/RTP	Jim Abbott Everett Plyler	2,448.6	54
OEETD/HQ	Marshall Dick	281.1	90

## Scientific Assessment

### *Indoor Air Pollution Activities*

EPA's indoor air research program is geared to identify, characterize, and rank indoor air problems, and to assess and implement appropriate mitigation strategies. EPA's research and analytical activities will pursue both source-specific and generic approaches to indoor air pollution. From a source-specific standpoint, the Agency will identify high-risk pollutant sources and characterize the exposures and health risks of various populations to those sources. At the same time the Agency will also pursue broad, cross-cutting strategies to assess the total exposure of people to indoor air pollutants and to develop mitigation strategies that can address multiple pollutants simultaneously through improved building design and management techniques.

Activities in FY91 in the area of scientific assessment include the continued development of risk characterization methodology to assess noncancer health effects; develop and apply methods to assess exposures to both single compounds and mixtures; continue comprehensive review of biocontaminants in indoor air; develop portable, comprehensive test kit for initial



screening of indoor air quality problems; update and publish Indoor Air Reference Bibliography.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ECAO/RTP	Michael Berry	775	39.0

## *Indoor Air Pollution Activities*

### **Health Effects**

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

A balanced program involving humans, laboratory animals, and bioassay approaches will be maintained to better understand "sick building syndrome." The approach to study the effects of indoor air is broad. Genetic bioassay studies of the combustion products from indoor air sources, including environmental tobacco smoke and kerosene heaters, will be conducted in chambers, test homes, and targeted field studies to provide a comparative estimate of the potential cancer risk from various sources. Human clinical studies of volatile organic compounds will continue to be conducted in chambers to determine effects related to the "sick building syndrome." Field and clinical studies will continue to evaluate cotinine as a biochemical marker for nicotine. Work will be conducted to start characterizing people with chemical hypersensitivities. This work will be critical to understanding the physiological basis for multiple chemical sensitivity.

# Air

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Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Ila Cote Susan Perlin	1,135.6	5.5

## Modeling, Monitoring Systems and Quality Assurance

### *Indoor Air Pollution Activities*

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

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AREAL/RTP	Ross Highsmith	1,189.0	9
EMSL/CIN	Alfred Dufour	200.0	45
OMMSQA/HQ	William Keith	0	0

## Environmental Processes and Effects

### *Global Change Research*

Increased atmospheric concentrations of carbon dioxide and other radiatively important trace gases (methane, nitrous oxide, chlorofluorocarbons, etc.) have raised concerns about potential climate change among the general

public and members of the scientific community. Additionally, concerns about decreasing stratospheric ozone have emerged. Scientific information on global change, including both climate change and stratospheric ozone influences, is required to assist decision makers in developing sound policies. However, much uncertainty exists about how these global changes derive from or may impact specific geographic regions, ecological systems, and human activities.

Emissions of greenhouse gases have been increasing, so clearly, understanding of sources and sinks must be improved, to evaluate the relative contribution of anthropogenic and natural sources of these gases. In addition, chemical transformations that occur in the troposphere and stratosphere, and which help determine the net radiative forcing that results in the green house effect, will be studied. Development of a second-generation carbon emissions model is also currently ongoing. This research, in close conjunction with the Department of Energy, will develop a global model capable of handling emissions scenarios with more sophistication than is currently available, allowing more realistic assessment of the consequences of making specific changes in emissions rates.

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

Another important research effort is the investigation of effects of decreasing stratospheric ozone that allows increased ultraviolet flux (UV-B) at the earth's surface. Research conducted under the Agency's stratospheric ozone depletion program will continue on terrestrial and aquatic ecosystems, human health, and emissions and mitigative solutions. Studies of the effects of UV-B radiation on terrestrial ecosystems will emphasize determining the relationship between UV-B dose

and other anthropogenic factors such as global climate change. Research will also stress UV-B effects on the marine food web and biogeochemical cycling. Further evaluation will be made of alternative compounds to CFCs and halons, and in technologies to replace those used for such purposes as refrigeration, insulation, and fire extinguishment. Research will also continue on developing ways to reduce emissions of chemicals that contribute to stratospheric ozone depletion, including CFCs, halons, and nitrous oxide, and to transfer technology within the U.S. and to developing nations. Support for the Vienna Convention for the Protection of the Ozone Layer and the renegotiated Montreal Protocol will continue, in cooperation with other nations.

While research on potential causes and consequences of global change is important, research on possible options for adapting to or mitigating change is also important. Opportunities exist for technological advances, such as intensive reforestation, and other sequestration and biomass utilization techniques to replace fossil fuels. The potential for reducing greenhouse gas emissions will also be a major focus of ORD. These technologies include biological approaches for methane and nitrogen oxides as well as novel control/utilization techniques for methane.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OEPR/HQ	Anthony C. Janetos Robert C. Worrest John T. Sigmon	26,000	13
AREAL/RTP	Jack H. Shrefler		
AEERL/RTP	James H. Abbott William J. Rhodes		
ERL/ATH	Richard G. Zepp Lee A. Mulkey		
ERL/COR	David T. Tingey Peter A. Beedlow		
ERL/NARR	Henry A. Walker Henry Lee II		

## Environmental Engineering and Technology Demonstration

### Global Climate Change

As a result of increased national and international concern regarding potential significant changes in global climate, OEETD has expanded its program in this area. The expanded global emissions and control program, which is an integral part of the ORD program, consists of two major elements: emissions and mitigation. Emissions research includes development of global and regional emission factors, activities, and functions for anthropogenic and biogenic sources of radiatively important trace gases. The mitigation program includes assessment of emissions management techniques and their applicability to industrialized and developing countries, and selected development and demonstration of promising techniques to accelerate their commercialization and application to reduce emissions of radiatively important trace gases. Initial mitigation activities will center on technology to reduce anthropogenic emissions of methane (e.g., from coal mines, landfills, and natural gas systems) and on biomass utilization. The biomass utilization research will focus on harvesting, preparation, and combustion of biomass fuel and sequestration of biomass in useful products.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AEERL/RTP OEETD/HQ	David Mobley Marshall Dick	4,500.00	10

## Health Effects

### Health Effects Institute

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

The research focuses on various mobile source-related pollutants, including carbon monoxide, oxidants (ozone and nitrogen dioxide), diesel

exhaust and alternative fuels such as methanol. Important areas of health research conducted by HEI include: development and use of biological markers; identification and characterization of susceptible populations; determination of dose to target tissue; assessment of susceptibility to infection; examination of mechanisms of injury and/or disease; and evaluation of neurotoxicological and behavioral effects. HEI is expanding its research on the health effects of alternative fuels by sponsoring several methanol inhalation studies in rats and monkeys that focus on metabolism, pharmacokinetics, and behavioral developmental effects of offspring exposed in utero.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP	Ila Cote	3,000.0	0

# Drinking Water

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## *Health Effects of Drinking Water Contaminants*

### **Health Effects**

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

Research will focus on determining the health effects resulting from exposure to chlorine disinfectants and their by-products. Work will be done to improve methods for extrapolating health effects research data in order to assess the risks associated with simultaneous exposure to multiple chemicals in binary and complex mixtures. Epidemiology studies on the relationship between disinfectants and cancer, and reproductive effects will be conducted.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Jack Fowle Rebecca Calderon	6,263.2	53.4

## *Health Effects of Drinking Water Contaminants*

### **Scientific Assessment**

Revision of national drinking water regulations and health advisory guidance given to the States requires an assessment of the potential hazard to human health from exposure to chemicals in drinking water. The health assessment documents prepared under this program take the form of both criteria documents and health advisories. These documents are assessments of the health effects of exposure to contaminants in drinking water. They specifically evaluate the relevant scientific data describing the physical and chemical properties, the pharmacokinetics, the health effects in animals and humans, and the mechanisms of toxicity. The health assessments are prepared for various chemicals as requested by EPA's Office of Drinking Water (ODW). This risk assessment

# Drinking Water

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process enables ODW to establish a Maximum Contaminant Level Goal (MCLG), representing a level designed to preclude the risk of an adverse effect on human health.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	931.2	71.2

## Modeling, Monitoring Systems and Quality Assurance

### *Ground Water Research*

Geophysical research will be conducted for mapping and monitoring fluid movement from injection wells; for detecting near-surface contamination from abandoned wells and movement along fracture zones; and, for the evaluation of seismic hazards associated with the underground injection process. In support of EPA's Wellhead Protection Program, guidance on monitoring system design will be developed. Additional research will involve the quantification of the spatial characteristics of pollutants in drinking water and the application of modeling techniques to assist in groundwater quality sampling decisions, including methods for using the Geographic Information System (GIS) for enhancing data management and analyses.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV OMMSQA/HQ	Robert Snelling Tom Pfeiffer	1,067.7	35

## Environmental Processes and Effects

### *Ground Water*

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



# Drinking Water

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

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

Methods will be developed for delineating wellhead protection areas and for performing risk assessments in wellhead protection areas. In addition, technology transfer activities associated with this and other programs will be emphasized.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RSKERL/ADA	James McNabb	3,733.2	35
OEPER/HQ	Barbara Levinson	840.2	61
ERL/ATH	Lee Mulkey	309.2	22

## *Drinking Water Technology*

### **Environmental Engineering and Technology Demonstration**

This program supports the revisions in the National Drinking Water Standards. Technology performance and cost data, to support maximum contaminant standards under the Safe Drinking Water Act and its Amendments, is obtained through ongoing treatment research and evaluations.

Focus is on treatment to control physical and chemical contaminants and microbiological contamination. Research in treatment technology addresses removal of: disinfection byproducts and their precursors, inorganic contaminants, maintaining water quality in the distribution system, and developing supporting cost data.

# Drinking Water

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Major treatment occurrence issues include:

- Assessing formation mechanisms and conditions for disinfection byproducts.
- Evaluating control techniques for the byproducts.
- Developing and evaluating technology for small systems, including point-of-use/point-of-entry treatment device evaluation.
- Evaluating alternative disinfection processes.
- Evaluating technology on corrosion of lead and copper.
- Investigations into means of reducing lead in hard and soft drinking water.
- Evaluation of point-of-entry systems for radon removal and inactivation of cryptosporidium oocysts.
- Developing cost information for treatment processes and entire systems. Evaluations will also be made of the tradeoffs in planning for rehabilitation of older water systems.

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

## Modeling, Monitoring Systems and Quality Assurance

### *Drinking Water Technology*

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

# Drinking Water

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monitor contaminants for use by the Agency, States, municipalities, and operators of public drinking water systems.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	Thomas Clark	2,648.4	60
EMSL/LV	Robert Snelling	336.3	95
OMMSQA/HQ	Tom Pheiffer		

# Water Quality

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## Modeling, Monitoring Systems and Quality Assurance

### *Water Quality Based Approach/Permitting*

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	James Lazorchak William Budde John Winter	1,058.4	95
OMMSQA/HQ	Tom Pheiffer		

### *Water Quality Based Approach/Permitting*

## Environmental Processes and Effects

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

# Water Quality

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/ATH	John Rogers	970	82
ERL/COR	Tom Murphy	653.1	82
ERL/DUL	Nelson Thomas	3,244.4	80
ERL/NARR	Norbert Jaworski	1,790	68
OEPER/HQ	Chieh Wu	2,546.3	25

## Scientific Assessment

### *Water Quality Based Approach/Permitting*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	399.7	85.4

## Modeling, Monitoring Systems and Quality Assurance

### *Industrial Wastewater Treatment Technology*

Research will support the Agency in the implementation of technology-based effluent limitation regulations and the modification of

# Water Quality

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enforcement activities as required by water quality-based permit adjustments. Methods standardization research will be directed to the improvement of precision, accuracy, and method detection limits of existing regulated inorganic and organic contaminants and biological limits. Research will also validate and correct analytical and biological methods for the analysis of high priority industrial wastewater components as well as evaluate alternative analytical methods to support the National Pollution Discharge Elimination System (NPDES) program.

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	James Lazorchak William Budde John Winter	848.4	98
OMMSQA/HQ	Tom Pfeiffer		

## Environmental Engineering and Technology Demonstration

### *Wastewater Treatment Technology*

The wastewater technology research program provides the technical information and engineering assistance needed to develop and implement the regulations and guidance for disposal of sludge and control of pollution from municipal treatment plants to bring plants into compliance with state discharge permits. This program also provides the research in industrial wastewater characterization and control

# Water Quality

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technology needed to support the National Pollutant Discharge Elimination System. The program focuses on toxicity reduction evaluations to support the development of water quality-based permit limitations in municipal wastewaters, and best conventional technology and best available technology limitations in industrial wastewaters. Design, cost and performance information for sludge stabilization, pathogen reduction, and dewatering processes will be provided to support sludge regulation implementation and refinement. Emphasis is also on supporting the new wastewater treatment technologies development and infrastructure protection, particularly with regard to small communities.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RREL/Cin OEETD/HQ	Subhas Sikdar Don Tang	5,777.0	40

## Environmental Processes and Effects

### *Wastewater Treatment Technology*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/ATH	William Donaldson	152.2	100
ERL/COR	Richard Olson	85.4	0
ERL/DUL	William Sanville	90.4	0
OEPER/HQ	Chieh Wu		

## Health Effects

### *Wastewater Treatment Technology*

Health effects research focuses on human health aspects of municipal wastewater and sludge

# Water Quality

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disposal. The data from these studies are used by the Agency for formulation of regulations, permits, and guidelines under the Clean Water Act. One emphasis, at present, is on land use and disposal of municipal sludges which requires careful assessment of the effects on human health of exposure to pollutants contained in the sludges. Research will focus on developing and validating a battery of short-term tests for predicting the potential health effects from exposure to complex mixtures in wastewaters and sludge.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/CIN OHR/HQ	Jack Fowle Rebecca Calderon	362.4	100

## Scientific Assessment

### *Wastewater Treatment Technology*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	367.8	31.0

## Environmental Processes and Effects

### *Marine, Estuaries, and Lakes*

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

To support ocean disposal permit decisions, there is a need to provide decision makers with rationale and procedures which are scientifically sound. These should provide guidance for the acquisition of information and the interpretation



# Water Quality

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of this information in order to support ocean disposal permit decisions. Under the ocean disposal research program, emphasis will be given to the development and testing of procedures to better evaluate the impacts of ocean disposal actions; development of procedures to satisfy monitoring needs for permit, surveillance, and hazard assessment application; and development of procedures for predicting the bioaccumulation of contaminants and evaluation of the significance of bioaccumulation processes, resultant tissue residues and biological effects.

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/NARR	Norbert Jaworski	3,742.9	80
ERL/GB	Rod Parish	210.9	75
ERL/DUL	Gilman Veith	1,787.7	25
OEPR/HQ	Sam Williams	400.1	45

## Modeling, Monitoring Systems and Quality Assurance

### *Marine, Estuaries, and Lakes*

The aim of this program is to develop, evaluate, and validate standardized chemical, biological and microbiological methods for the analysis of contaminants and biological integrity in marine,

# Water Quality

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estuarine and other salt water matrices. The near and coastal areas of the U.S. are economically some of our richest and most sensitive ecosystems. Standardized methods are needed by the Regions for the National Estuaries Program and other activities.

Currently, EPA does not have standardized methods and reference materials for monitoring, assessment and regulation of chemical constituents and pollutants in marine and estuarine waters and sediments.

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN OMMSQA/HQ	Thomas Clark Tom Pheiffer	704.0	60

# Hazardous Waste

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## Environmental Engineering and Technology Demonstration

### *Alternate Technologies*

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

Research and demonstration of existing and emerging technologies will be conducted for those waste streams assigned high priority by OSWER, waste streams which are difficult to cost-effectively treat by available technology, and waste streams with high potential for hazardous air emissions. Emphasis will be on characterization and pilot-scale testing of newly listed hazardous waste streams. Assistance in the review of permits for alternative technologies and project monitoring for evaluation of such technologies will be provided. Other types of information transfer activities such as workshops, seminars, and guidance documents will be prepared in conjunction with the Center for Environmental Research Information.

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RREL/Cin	R. Hill C. Brunner H. Freeman	7,951.9	20
OEETD/HQ	B. Krishnan	500	33

### *Incineration*

## Environmental Engineering and Technology Demonstration

The incineration research program focuses on the problem areas of organic destruction and metals partitioning and industries characterizing performance of existing thermal technologies; developing methods of rapid cost-effective

# Hazardous Waste

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compliance monitoring of these facilities; characterizing the products of incomplete combustion and their formation and destruction and control conditions; and developing methods to predict performance to avoid process failure and control process reliability. In addition, technical assistance on specific regulatory or remediation requirements is provided. The research is conducted at laboratory-, pilot-, and full-scale operations which simulate actual incineration/boilers/kilns. Pilot-scale facilities are located at Research Triangle Park and Jefferson, Arkansas. The hypotheses from this program are verified in full-scale field tests. The program examines conventional incineration as well as high temperature industrial processes.

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RREL/CIN	C. Dempsey	1,012.9	33
AEERL/RTP	R. Hall	300.0	100
OEETD/HQ	B. Krishnan	200.0	100

## *Incineration*

### Health Effects

Research on this issue focuses on improving the assessment of risks from emissions and residuals of hazardous waste management practices, especially incineration. Current efforts are focused on research to explore the relationship between exposure to disposed incineration residuals containing metals and dose to target tissues. This pharmacokinetics research improves our understanding of the principles governing dosimetry of metals for risk assessment.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Robert Dyer Thomas Miller	876.8	54

# Hazardous Waste

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## Environmental Engineering and Technology Demonstration

### *Land Disposal*

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RREL/CIN	R. Landreth	2,377.0	31
OEETD/HQ	B. Krishnan	100.0	100

## Environmental Engineering and Technology Demonstration

### *Pollution Prevention*

The Pollution Prevention Research Program supports the development and demonstration of low and non-waste production technologies, and encourages the development of products that do not present environmental problems relevant to their manufacture, use, and disposal. The overall goal of the program is to support the adoption of techniques and technologies that result in the elimination of pollution at the source of its production, as opposed to controlling pollution through increasingly stringent treatment options.

Major elements of the program include a program to demonstrate innovative waste reduction technologies carried out in cooperation with state and local waste reduction programs, a program to encourage the adoption of pollution prevention techniques in other federal agencies, and a program to encourage the use of waste minimization assessments to identify waste reduction opportunities at industrial sites. This last program has produced a generic assessment

# Hazardous Waste

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manual and pollution prevention guides in seven industries.

Future activities under the PPRP will highlight socioeconomic studies, anticipatory research to identify future opportunities for pollution prevention strategies, and technology transfer.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RREL/Cin OEETD/HQ	Harry Freeman B. Krishnan	3,500	0

## *Municipal Solid Waste*

### Health Effects

Research on the potential carcinogenic and non-carcinogenic health effects of emissions and residues from municipal waste combustion (MWC) will focus on the following objectives: Perform a comparative assessment of the mutagenicity and carcinogenicity of the emission products from MWC in comparison to other industrial and residential combustion sources. Identify the principal mutagenic/carcinogenic chemicals in MWC emissions by using bioassay-directed chemical characterization. Support the evaluation of engineering and control technology parameters by using short-term bioassays in the evaluation of these parameters to determine operational conditions which will minimize risk. Evaluate the toxicity of MWC emissions, collected after dilution, in *in vivo* target cell bioassays and short-term *in vivo* assays.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Robert Dyer Thomas Miller	895.2	54

## *Municipal Solid Waste*

### Scientific Assessment

The comprehensive risk assessment methodology will be applied in site-specific cases. A baseline field evaluation study of the municipal waste combustor in Rutland, Vermont will be completed.

# Hazardous Waste

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Work will begin on comparative risk assessment of various thermal destruction options.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ECAO/CIN	Cynthia Sonich-Mullin	604	25.0

## Environmental Engineering and Technology Demonstration

### *Municipal Solid Waste*

ORD is expanding research in municipal solid waste (MSW) management. Research will focus on techniques for improving strategic planning, source reduction recycling and improving long-term performance of land disposal units. Municipal waste combustion (MWC) research will continue to provide the scientific bases for air emission regulations; evaluation of mercury emissions, CDD/CDF formation and gas and heterogenous phase organic pollutant reaction; and assess potential effects of materials recovery on MWC processes. MWC residue research will emphasize the environmental effects of using the residues as useful products, sources of toxic constituents in MSW that affect residue characteristics, and speciation of the toxic constituents in the ashes. MITE, ORD's program to demonstrate and evaluate innovative technologies for improving municipal solid waste, will focus on demonstrating processes for converting secondary materials into useful commercial products.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RREL/Cin	R. Landreth	3,933.1	35
AEERL/RTP	R. Hall	1,161.0	35
OEETD/HQ	B. Krishnan	1,000	100

## Modeling, Monitoring Systems and Quality Assurance

### *Municipal Solid Waste Monitoring*

Support is provided to the Office of Solid Waste (OSW) to improve the siting and monitoring of municipal waste combustion disposal facilities and to identify key groundwater monitoring issues

# Hazardous Waste

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pertaining to municipal waste combustion ash disposal facilities.

The 1984 amendments to RCRA require the EPA to revise, where necessary, the criteria for Subtitle D facilities; however, technical information in the monitoring area is needed to support regulatory development. Further, in many coastal areas, municipal disposal facilities are located in or near wet environments, posing special environmental problems. Questions concerning the environmental adequacy of municipal waste combustion disposal are delaying the construction of needed combustion disposal capacity.

Existing data on leachate characteristics and ground-water contamination around types of Subtitle D facilities and municipal waste combustion ash monofils are being collected on a continuous basis and evaluated. Ground-water monitoring parameters for ash landfills will be developed. Potential indicators of biological contamination will be identified.

Wet environments will receive special emphasis with an evaluation of siting practices relative to wet environments. Methods for monitoring in or near wet environments are being evaluated.

Existing published and unpublished environmental monitoring data for environmental impacts of monofil and co-disposal ash disposal facilities are being identified and evaluated. Existing municipal waste combustion disposal facilities sites are being characterized and evaluated. Monitoring and site characterization guidance and an expert system for permit writers will be developed.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV	Eugene Meier	733.9	11
OMMSQA/HQ	Ken Sala		



# Hazardous Waste

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## Modeling, Monitoring Systems and Quality Assurance

### *Quality Assurance*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	William Budde	451.0	16
EMSL/LV	Eugene Meier	476.3	36
AREAL/RTP	William Mitchell	148.8	49
OMMSQA/HQ	Ken Sala		

## Modeling, Monitoring Systems and Quality Assurance

### *Releases*

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

# Hazardous Waste

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exists which can meet the candidate performance criteria.

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

New technologies for leak detection monitoring, such as fiber optics and geochemical sensors, will be evaluated. Methods for monitoring underground storage tanks will be developed and validated, with emphasis on monitoring during bioremediation, soil venting and passive remediation.

The Clean Water Act (Section 311) mandates that Spill Prevention Control and Countermeasure plans be prepared for all facilities engaged in the production, storage, processing, and distribution of hazardous materials. The OMMSQA provides remote sensing support to EPA regional offices for SPCC surveys, planning and emergency response activities.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV	Eugene Meier	1,444.6	26
OMMSQA/HQ	Ken Sala		

## Environmental Engineering and Technology Demonstration

### *Releases*

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

# Hazardous Waste

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

## *Releases*

### **Environmental Processes and Effects**

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RSKERL/ADA	James F. McNabb	93.7	100

## *Waste Characterization*

### **Environmental Processes and Effects**

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

ERL/Duluth is developing procedures and data to evaluate waste characteristics and closure criteria for impacts on aquatic habitats and life forms. Methods are being developed for assessing effects of waste mixtures and constituents on aquatic organisms and on habitats. Protocols for applying these approaches to field sites are being generated.

# Hazardous Waste

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

Integrated, multimedia methods and data are being developed by ERL/Athens for implementing waste management decisions and evaluating waste management, treatment, and disposal systems based on potential human health and environmental impacts. Probabilistic techniques are developed and used to address uncertainty. The various media models are coupled to produce both screening-level and more site-specific multimedia exposure assessment packages.

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/DUL	Philip M. Cook	691.4	100
RSKERL/ADA	James F. McNabb	2,405.0	58.4
ERL/ATH	Rosemarie C. Russo	2,504.2	27.0
ERL/COR	Bill A. Williams	254.4	58.7
OEPER/HQ	Will C. LaVeille	1,223.8	42.4

## *Waste Characterization*

### **Scientific Assessment**

This program provides chemical-specific health and environmental effects documents to support Resource Conservation and Recovery Act (RCRA) 3001 listing decisions. Support is also provided to

# Hazardous Waste

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the land disposal restruction program in the form of reference dose documentation. The permitting effort for Treatment, Storage, and Disposal Facilities (TSDF), Office of Solid Waste and Emergency Response (OSWER), is supported by providing technical evaluations and assessments of specific issues that arise in that process. Efforts to refine risk assessment methods and provide risk assessment tools related to hazardous waste are also conducted in this program.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ECAO/CIN	Bruce Peirano	2,266	47.0

## Modeling, Monitoring Systems and Quality Assurance

### *Waste Identification*

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

Techniques for field monitoring of waste sites will be improved, including statistics for sampling design and for sample handling. RCRA land disposal regulations require the establishment of a groundwater monitoring program at most facilities, including detection and compliance of saturated and vadose zone monitoring. Of particular importance is subsurface monitoring of sites and investigation of new techniques for monitoring soils, and biota, ambient air, and waste incineration emissions. Methods will be

# Hazardous Waste

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developed to detect trace metals in groundwater, ambient water, and sludges.

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	William Budde	629.5	57
EMSL/LV	Eugene Meier	4,418.6	34
AREAL/RTP	William Mitchell	513.6	31
OMMSQA/HQ	Ken Sala		

# Toxic Substances

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## Biotechnology

### Environmental Processes and Effects

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

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

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/GB	Robert Menzer	224.4	100
ERL/COR	Thomas Murphy	260.0	100
OEPEH/HQ	Sam Williams	2,977.1	0

# Toxic Substances

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## **Environmental Engineering and Technology Demonstration**

### *Biotechnology/Microbial and Biochemical Pest Control Agents*

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

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

In order to satisfy these concerns, the program is divided into two sub-programs. The first addresses biologically-based manufacturing processes; the second addresses deliberate application to a specific environmental area.

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

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



# Toxic Substances

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

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

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

## *Biotechnology/Microbial and Biochemical Pest Control Agents*

### **Modeling, Monitoring Systems and Quality Assurance**

This research evaluates and standardizes sampling methodology to identify and quantify release of microorganisms or biotechnology products into the environment. Standardized procedures are developed and used to produce guidelines to assess human exposure and environmental impact of Genetically Engineered Microorganisms (GEMS) release.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV OMMSQA/HQ	Stephen Hern Laurie Schuda	238.2	25

# Toxic Substances

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## Environmental Processes and Effects

### *Ecology: Ecotoxicity and Risk Assessment*

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

The ecotoxicology studies include the movement, transformation and ultimate disposition of toxic substances in all environmental media as a critical component of risk assessment. How plants and animals or ecosystems and biological interactions are affected by toxic substances are also the subjects of this research effort. Research goals include the identification of important endpoints and development of mathematical modeling techniques (population; transport) to integrate data and depict risk. Input data will include such results as lab to field comparative responses, measurements of ecosystem resistance and resilience, recovery, population changes (mortality; feeding behavior), biota uptake and susceptibility. Techniques such as quotient-based approaches at various scales of system complexity and causative factors affecting variations in toxicity data (taxonomic considerations) and modeling results will be studied. The validated predictive tools and the results will be used in regulatory decision-making and as a guide to formulating regulatory criteria and standards. All extramural monies will be expended by participating laboratories subsequent to final planning actions.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	411.7	100
ERL/COR	Thomas A. Murphy	84.5	100
ERL/DUL	Gilman Veith	167.5	100
ERL/GB	Raymond G. Wilhour	0.0	0
OEPER/HQ	Sam Williams	1,880.2	35
ERL/NARR	Norbert Jaworski	112.7	100

# Toxic Substances

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## Environmental Processes and Effects

### *Ecology: Transport/Fate/Field Validation*

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/ATH	Rosemarie A. Russo	903.8	100
ERL/GB	Robert Menzer	733.0	100
ERL/COR	Thomas A. Murphy	826.0	100

## Modeling, Monitoring Systems and Quality Assurance

### *Exposure Monitoring*

Research for exposure monitoring is dedicated to development, testing, and standardizing monitoring methods to estimate total human exposure and population exposures. Human

# Toxic Substances

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activity patterns are studied to improve estimates of exposure. Human exposure data are used to construct models to estimate an individual's pollutant exposure in all media. Microenvironment studies are conducted to fill data gaps.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV	Stephen Hern	1,175.6	45
AREAL/RTP	Dale Pahl	521.5	20
OMMSQA/HQ	Laurie Schuda	100.0	25

## *Health: Markers, Dosimetry, and Extrapolation*

### Health Effects

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP	Elaine Grose	4,377.7	36.7
OHR/HQ	Randall Bond		

## *Health: Markers, Dosimetry, and Extrapolation*

### Modeling, Monitoring Systems and Quality Assurance

This research evaluates physiological, biochemical, genetic and immunologic techniques as indicators of human exposure to chemical pollutants. Biomarkers are tested for sensitivity, selectivity and reliability to indicate episodes of pollutant exposure.

# Toxic Substances

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Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV OMMSQA/HQ	Stephen Hern Laurie Schuda	322.5	30

## *Special Human Data Needs*

### **Health Effects**

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Elaine Grose Randall Bond	1,541.9	26.5

## *Structure Activity Relationships*

### **Environmental Processes and Effects**

This research is designed to determine the disposition of new toxic chemicals in all environmental media and to determine if selected plants and animals might be affected. This involves developing structure-activity relationships (SAR) with methodologies based upon molecular structure characteristics to rapidly assess the environmental fate and toxicity of new chemicals. Structure-activity develops those data bases and mathematical models which are used for predicting exposure, bioaccumulation, toxicity, fate, and other parameters. Activities include the development of data bases on plant uptake, fate of organic chemicals, toxicity to fish and reactivity of chemicals (e.g., photolytic, electrophilic, nucleophilic). Integrated into this research is data on transport and transformation of both organic and inorganic substances in freshwater and multimedia environments and application of SAR to predict effects of new

# Toxic Substances

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chemicals on biota. The latter includes determination of and predictions on toxic mechanisms and microbial transformation and metabolism. Expert systems are being applied to the SAR approach. Computer based predictive programs are in use in regulatory evaluations.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	379.2	100
ERL/DÜL	Gilman Veith	677.4	64

## *Structure Activity Relationships*

### Health Effects

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP	Elaine Grose	1.031.1	49.5
OHR/HQ	Randall Bond		

## *Support for Toxic Substances Control Act (TSCA)*

### Modeling, Monitoring Systems and Quality Assurance

Quality assurance research is conducted to support routine monitoring and assessment. Studies are underway to evaluate exposure models and the use of computer aided technology to estimate exposure and risk. Reference chemicals and analytical spectra for chemical compound identification are produced to provide

# Toxic Substances

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standardization procedures and guidelines for program offices field studies.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	John Winter	346.6	20
EMSL/LV	Stephen Hern	365.1	35
OMMSQA/HQ	Laurie Schuda		

## *Support for Toxic Substances Control Act (TSCA)*

### **Scientific Assessment**

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OHEA/HQ	Hugh McKinnon	377.0	72.1

## *Engineering*

### **Environmental Engineering and Technology Demonstration**

This program supports the Office of Toxic Substances (OTS) in its implementation of the Toxic Substances Control Act (TSCA), Asbestos Hazard Emergency Response Act (AHERA), and Title III of the Superfund Amendments and Reauthorization Act (SARA). The program focuses on the development of predictive capabilities to be used in assessing release and exposure levels for the review of Premanufacturing Notices (PMNs) for new chemicals, and the techniques and controls for ensuring "no risk" exposure to existing chemicals.

The "new chemicals" sub-program is evaluating the manufacturing and processing of these chemicals from both the unit operations and "an industrial-setting" perspective. Research in the

# Toxic Substances

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operations area has focused on drying and filtration equipment. Emphasis has been placed on the frequency of exposure and the magnitude and duration of inhalation and dermal exposure levels in the work place. Additional emphasis has been directed toward simulating the "real-world" environment.

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

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

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

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

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



# Toxic Substances

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## Environmental Processes and Effects

### *Test Method Development*

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/DUL	Gilman Veith	214.6	100
ERL/GB	Robert Menzer	231.0	100

## Modeling, Monitoring Systems and Quality Assurance

### *Test Method Development*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV	Stephen Hern	607.2	45
AREAL/RTP	Dale Pahl	200.4	25
OMMSQA/HQ	Laurie Schuda		

## Health Effects

### *Test Method Development*

Under the Toxic Substances Control Act, EPA must provide industry with guidance to test

# Toxic Substances

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Elaine Grose Randall Bond	1,771.6	70

## *Emergency Planning and Community Right to Know*

### **Scientific Assessment**

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OHEA/HQ	Hugh McKinnon	50.0	0

## *Asbestos*

### **Modeling, Monitoring Systems and Quality Assurance**

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

# Toxic Substances

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Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AREAL/RTP OMMSQA/HQ	Dale Pahl Michael Dellarco	480.6	10

## Modeling, Monitoring Systems and Quality Assurance

### *SARA Title III*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN OMMSQA/HQ	John Winter Laurie Schuda	343.4	20

# Pesticides

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## Environmental Processes and Effects

### Biotechnology/Microbial and Biochemical Pest Control Agents

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/COR	Thomas A. Murphy	189.1	100
ERL/DUL	Gilman Veith	119.3	100
ERL/GB	Robert Menzer	569.9	60
OEPER/HQ	Sam Williams	1,450.0	0

## Health Effects

### Biotechnology/Microbial and Biochemical Pest Control Agents

Models will continue to be developed on potential interaction of microbial agents and the mammalian cell. Goals are (1) the determination of the ability of microbial agents to replicate in mammalian cells, and (2) to provoke immune responses in non-target (mammalian) hosts. Methods will also be developed to identify genetic material from microbial pesticides in non-target sites such as mammalian cells *in vitro* and *in vivo*.

# Pesticides

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Elaine Grose Randall Bond	1,976.3	28

## Environmental Processes and Effects

### *Ecology: Ecotoxicity and Risk Assessment*

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

New endpoint responses will be studied encompassing ecosystem structures and function. Selected wildlife and microbial populations will be used to reflect population changes and other changes that influence risk evaluations. Other parameters that affect model integrity will be studied (e.g., species susceptibility; chemical routes of exposure and uptake and residues). Modeling will be supported through data integration and model calibration and validation will be supported through field studies that include all media. A pesticide ranking index and registry system is being developed as a tool for assessing selected aquatic systems. All extramural monies will be expended by the

# Pesticides

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participating laboratories subsequent to final planning actions.

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

## *Ecology: Transport/Fate/Field Validation*

### **Environmental Processes and Effects**

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

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

Information and data including assessments and predictive tools, evaluations of assessment

# Pesticides

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criteria, models and user manuals, workshops and reviews are applied to support the Agency's regulatory actions.

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/ATH	Rosemarie C. Russo	539.1	63
ERL/COR	Thomas A. Murphy	543.3	26
ERL/DUL	Gilman Veith	589.5	63
ERL/GB	Raymond G. Wilhour	986.5	76
OEPR/HQ	Sam Williams	1,398.8	41

## Environmental Engineering and Technology Demonstration

### *Engineering*

This program, which supports the Office of Pesticide Programs (OPP), consists of two major areas: protective clothing and disposal technology. Several areas of protective clothing research are concluding which will provide a "Guidance Manual for Selecting Protective Clothing for Agricultural Pesticide Operations." This manual will serve as a reference document for OPP to use in protective-clothing issues related to OPP's regulatory and training activities. This manual will include standard test methods and performance data from both laboratory and field tests. Work on protective clothing is being phased out.

OEETD will continue to evaluate existing disposal techniques and processes for destroying specific pesticide classes, develop a treatability database applicable to pesticides and their disposal, and develop improved container reuse technology including a test method to ensure compliance with existing regulations. A major effort in this area, in conjunction with OPTS, is evaluation of the effect of "burning" pesticide bags.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RREL/Cin OEETD/HQ	Glenn Shaul Bill McCarthy	342.9	60

# Pesticides

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## Modeling, Monitoring Systems and Quality Assurance

### *Exposure*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AREAL/RTP	Dale Pahl	201.1	5
EMSL/LV	Stephen Hern	158.7	15
OMMSQA/HQ	Michael Dellarco		

### *Health: Markers, Dosimetry and Extrapolation*

## Health Effects

This research focuses on developing animal models to assess health risks and improve methodology for extrapolating results of animal toxicity studies into risk estimates for humans. Studies include evaluation of interspecies differences in the dermal absorption of pesticides, examination of structure-activity relationships, examination of metabolic differences between species which may contribute to teratogenic outcomes, and the investigation of potential interactions between alterations in maternal health status and susceptibility to pesticide exposures.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP	Elaine Grose	1,120.8	56.4
OHR/HQ	Randall Bond		

## Modeling, Monitoring Systems and Quality Assurance

### *Health: Markers, Dosimetry and Extrapolation*

Research is being conducted to relate external dose to internal dose and to identify onset of



# Pesticides

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disease states resulting from exposure to pesticide residues. Research studies are being carried out to define the relationship between biological indicators of exposure and dose.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV	Stephen Hern	521.4	45
OMMSQA/HQ	Michael Dellarco		

## *Support*

### **Modeling, Monitoring Systems and Quality Assurance**

The pesticides quality assurance program ensures the accuracy of the data which is attained through testing and analysis. The program conducts quality assurance research and maintains a Pesticide Repository of high purity chemicals. Federal and State laboratories use these samples as standard reference for internal quality control. Research is conducted to develop procedures to ensure control in environmental monitoring studies and analysis of samples for pesticide residues. Efforts will be initiated in FY90 to assess the merits of privatizing the Pesticides Repository.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	John Winter	254.4	0
OMMSQA/HQ	Michael Dellarco		

## *Test Method Development*

### **Environmental Processes and Effects**

Laboratory studies will develop, improve and validate bioassay methodologies to be used as standardized pesticide testing protocols for aquatic organisms. Various methods will be geared to testing chosen life stages of endemic fishes and crustaceans or surrogate test species for long-term or short-term durations. These methods will help assess both exposure and effects (e.g., metabolic, mortality or teratogenic response) to pesticides and pesticide ingredients under acute and chronic conditions and some may be used for monitoring particular pesticides or sensitive biota and for

# Pesticides

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predicting response. Influencing environmental factors which may modify testing results will be studied to establish confidence limits for the methods under given conditions. The methods will contribute to establishment of early detection of hazards and provide sensitive, rapid and inexpensive evaluation techniques.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/GB	Robert Menzer	328.2	100

## *Test Method Development*

### Health Effects

This research involves developing and refining bioassays for the detection of adverse alterations in the development of reproductive processes in animals which allow for more accurate evaluations of reproductive development and function. Techniques are also being developed, validated, refined and implemented for determining human genetic effects caused by exposure to chemicals. Additionally, methods are being developed to determine the neurotoxicity and immunotoxicity of pesticides.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Elaine Grose Randall Bond	2,063.9	73.7

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

### Scientific Assessment

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OHEA/HQ	Hugh McKinnon	296.5	100

## Multimedia—Core

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### *National Health and Nutrition Examination Survey (NHANES-III)*

#### **Health Effects**

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

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

Research and public health goals include the following: (1) estimating the prevalence of disease and risk factors; (2) estimating the incidence of certain diseases; (3) estimating the prevalence of functional impairment; (4) providing population reference distributions of health characteristics including growth and development; (5) monitoring secular changes in diseases and risk factors; and (6) identifying new risk factors for disease and reasons for secular trends in health.

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OHR/HQ	Susan Perlin	585.0	14.5

# Multimedia—Core

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## *Center for Environmental Epidemiology Research*

### **Health Effects**

This program responds to a major recommendation of the EPA Science Advisory Board which indicated that the agency should initiate a program of epidemiologic research. The program is examining the current state of environmental epidemiology in order to identify critical areas of research. The initial program focus is on epidemiologic strategies for the study of airborne pollutants and their effects on the lung.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Rebecca Calderon	250.0	0

## *Exploratory Research Grants*

### **Exploratory Research**

The Research Grants Program supports research initiated by individual investigators in areas of priority interest to the Agency. Research proposals are solicited via two mechanisms: (1) the "Solicitation for Research Proposals" which is published each year and invites proposals in broadly defined areas of environmental science and engineering, and (2) the Request for Applications (RFA) which is a more targeted solicitation mechanism which requests proposals in well-defined areas of particular interest to the Agency. All proposals received in response to either mechanism are subjected to a rigorous peer panel review. In addition, those responding to the general solicitation must undergo an Agency relevance review. Areas in which research proposals will be requested in FY 1991 under the general solicitation include: environmental biology, environmental health, environmental engineering, environmental chemistry and physics, and socioeconomics.

In an effort to provide more support to minority institutions for the conduct of basic environmental research, the Research Grants Program makes available pre-application assistance for minority faculty at Historically Black Colleges and

## Multimedia—Core

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Universities through its Minority Institutions Assistance Program. Whether or not this assistance is used, however, research proposals received under this program are reviewed along with proposals received under the general solicitation and in accordance with the standards applied thereunder.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OER/HQ	Roger Cortesi	28,200	0

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

#### Health Effects

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

The primary objective of the RIRHA program is to develop a systematic and integrated research program to improve the scientific basis supporting health risk assessments. Emphasis is being placed on identifying and addressing the significant uncertainties inherent in the risk assessment process. This program will provide critical information on the relationship between exposure (applied dose), dose to target tissue (delivered dose), and associated health effects. Both laboratory and field research will be conducted that will improve our understanding of basic biological mechanisms, especially as it relates from one set of circumstances to another. Research

## Multimedia—Core

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will address four major areas: (1) Analysis of Uncertainty in Risk Assessments, (2) Integrated Exposure Assessment, (3) Physiologically Based Pharmacokinetic Models, and (4) Biologically Based Dose-Response Models.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Larry Reiter Ken Sexton	7,353.2	3.8

### *Total Human Exposure*

#### **Health Effects**

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

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

# Multimedia—Core

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

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

## Modeling, Monitoring Systems and Quality Assurance

### *Ecological Trends*

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

Scientifically, EMAP will: (1) identify, characterize, classify, and quantify the ecological resources at risk; (2) design statistical sampling frames that provide unbiased estimates of environmental conditions on a regional basis; (3) identify, evaluate, and develop indicators of

## Multimedia—Core

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ecological condition; (4) develop operational monitoring programs at a national level for resources of greatest concern; and (5) develop data management and quality assurance systems that allow timely analysis and periodic reporting of program results.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	Bob Graves	364.1	27.9
ERL/COR	Dan McKenzie	6,795.7	6.0
ERL/DUL	Steve Hedtke	364.1	27.9
ERL/GB	Kevin Sommers	3,724.1	2.7
EMSL/LV	Bruce Jones	5,833.5	10.5
ERL/NARR	John Paul	3,874.9	7.9
OEPER/HQ	Courtney Riordan	500.0	0.0
OMMSQA/HQ	Rick Linthurst	4,725.2	10.4
AREAL/RTP	Jay Messer	1,354.5	22.5

### *Reducing Uncertainty in Ecological Risk Assessment*

#### **Modeling, Monitoring Systems and Quality Assurance**

The goal of the program is to model the expected response of representative estuaries in the region in response to alternative risk management options as an example of a systems level approach to ecological risk assessment.

In order to evaluate the uncertainty associated with the temporal variability in indicators of ecosystems condition, a field study is being undertaken in the estuarine resources of a mid-Atlantic prototype region. This activity will be conducted in cooperation with the ecological status and trends program (EMAP) and NOAA, and will target exposure and condition indicators and their response to changing pollutant levels. Ancillary data needed to run and evaluate the transport and effects models that will be applied to status and trends data is also being collected as part of this effort. Analyses of the data from the first year of field data from the prototype region will seek correlations among indicators that could identify possible causes of poor condition and will report the condition of estuaries in the prototype region. An effort to develop a risk characterization framework for assessing exposure and effects is



currently underway. Sensitivity analyses are being performed and new multi-variate techniques are being developed that will reduce uncertainty in detecting regional changes and better evaluate effects models that can be used in ecological risk assessment.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ERL/NARR	John Paul	3,000	0
OMMSQA/HQ	Chris Saint		

## Exploratory Research

### Exploratory Research Centers

The purpose of the Exploratory Research Centers Program is to provide dedicated support over several years to fundamental, multidisciplinary research in topics of interest to the environmental community. The first solicitation in 1980 resulted in eight such research centers. These centers were established between 1980 and 1981 and have operated continuously since then. The eight original centers are currently being phased out. A solicitation to establish four new centers funded at \$1.0 million per year, was published in the spring of 1990. The new centers should be in place by June 1991. Scheduled funding of the centers terminates in 1991 and 1992.

The centers which are currently operating are listed below:

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

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

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

*Marine Sciences Research Center* (University of Rhode Island)—assesses marine ecosystems

health, emphasizing exposure of marine organisms to toxics

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

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

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OER/HQ	Roger Cortesi	4,600	0

Modeling,  
Monitoring  
Systems  
and Quality  
Assurance

*National Institute of Ecological Research*

As part of its report titled "Future Risk: Research Strategies for the 1990's", the EPA's Science Advisory Board (SAB) recommended that:

"EPA should provide Federal leadership for a national program of ecological research by establishing and funding an Environmental Research Institute."

EPA has responded to this recommendation by initiating planning for a National Institute of Ecological Research. The goals of the Institute are to monitor, understand, and predict ecosystem response to anthropogenically induced stress. The level of effort needed to reach these goals will require more funds than EPA alone is likely to be able to provide. The structure of the Institute provides a mechanism for leveraging and/or acquiring support from both the private sector and other Federal agencies.

# Multimedia—Core

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The planning for a national institute of ecological sciences will assess appropriate mechanisms for implementing and operating an institute. A number of implementation options will be developed based on the outcome of a series of public meetings and hearings and input from several prominent universities. A group of leading scientists will be selected to evaluate these options in terms of their feasibility, chance of success, and their potential to improve the state of science.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OMMSQA/HQ	Rick Linthurst	600.0	0

# Multimedia

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## Environmental Processes and Effects

### *China Program*

This research program, which is conducted under the 1980 US-PRC Environmental Protection Protocol, studies the relationship of lung cancer and indoor coal smoke pollution in a rural setting. The program will begin to shift its focus to a study of children's respiratory health across a wide gradient of particulate, acid, and sulfur oxide exposures in several Chinese cities. The focus in 1991 is on performing a full-scale study in Xuan-Wei to determine levels of indoor pollution exposure to compare to the broadly varying observed lung cancer rates there. In addition, a pilot study is beginning as part of a five-year multi-city study of lung function and respiratory health in children. The full scale study will likely begin in 1991 as well. In addition, there is research underway on environmental processes and effects of pollution on aquatic organisms, ground water and water pollution fate and transport models.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AREAL/RTP	William Wilson	208.4	0
ERL/ADA	Lowell Leach	124.0	83
ERL/ATH	Rosemarie Russo	247.0	56
ERL/DUL	Nelson Thomas	154.0	56
HERL/RTP	Robert Chapman	305.1	44
OEPER/HQS	Chieh Wu		

## Health Effects

### *Task Force on Environmental Cancer and Heart and Lung Disease*

The Task Force is evaluating the link between environmental factors and human diseases. Research recommendations are being provided by the Task Force to involved agencies based upon research needs identified by scientists who participate in workshops on topics that are selected by the Task Force. A report is being prepared on Environmental Health Risk Education and a workshop is being held on environmental exposure data bases.

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Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Tom Miller	300.0	0

## *Harvard Study*

### Health Effects

This research program identifies and selects post-doctoral research fellows and visiting scientists to work with Harvard faculty members on research projects that address critical environmental problems that face society.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP OHR/HQ	Randy Bond	250.0	0

## *Consistent Risk Assessment*

### Scientific Assessment

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

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

*Risk Assessment Guidelines*—Work will continue on the development of Agency-wide assessment guidelines. Proposed guidelines on exposure and health effects will be issued as final guidance. Efforts are also being devoted to development of new guidance related to pharmacokinetics and ecotoxicity.

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

*Integrated Risk Information System (IRIS)*—EPA's Integrated Risk Information System (IRIS) is an electronic data base of summary health risk

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information and regulatory information on chemical substances. Primarily intended to serve as a guide for EPA staff when assessing the health risk posed by a chemical, IRIS is available to EPA contractors, state and international environmental agencies, other federal agencies, universities and other risk assessors. The risk information on IRIS represents consensus Agency position on the potential adverse human health effects of the chemical on-line. Health information on additional chemicals is constantly added to IRIS as it is reviewed and agreed upon by EPA review groups of expert scientists. Included in the data base are some Superfund Amendments and Reauthorization Act (SARA) Title III right-to-know chemicals.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OHEA/HQ	William Farland	4,557.6	59.6

## Technology Transfer, Regulatory Support and Regional Operations Activities

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OTTRS	Peter Preuss	12,014	

## Modeling, Monitoring Systems and Quality Assurance

### *Manage the Mandatory Quality Assurance Program*

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

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

Quality assurance programs consist of specific activities conducted before, during and after environmental data collection. During the planning of an environmental data collection program, QA activities focus on assuring that the quality of the data needed by data users has been defined by the data user/decision maker, communicated to the technical staff, and that a QC system has been designed to result in the production of the appropriate data quality, and to facilitate its measurement and documentation. During the implementation of a data collection effort, QA activities ensure that the QC system is operating as intended and that problems found by QC are corrected. After environmental data are

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collected, QA activities focus on assessing the quality of the resulting data. Here, one determines whether the quality, quantity, and kind of data obtained are adequate to support data-dependent regulatory decisions or research hypotheses.

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

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

- requiring QA in all Agency-supported environmental data collection activities,
- defining Data Quality Objectives,
- developing quality assurance program and projects plans,
- conducting management and technical audits and reviews,
- implementing corrective actions based on the findings/recommendations of audits,
- establishing achievable data quality limits for methods cited in EPA regulations,
- developing and adopting technical guidelines for assessing data quality, and
- providing for QA training.

In recent years, the Agency's QA activities have focused on identifying the basic elements that are essential to effective quality assurance for environmental data. QAMS has put considerable emphasis on issuing guidance defining these key elements and describing their importance in the efficient and effective expenditure of resources



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assigned to environmental data collection. This guidance development phase has now been completed, and in FY 1991 QAMS will continue with full-scale implementation support and oversight.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OMMSQA/HQ	Nancy Wentworth	1,785.8	53

## Exploratory Research

### *Visiting Scientists Program*

The Visiting Scientists Program has two components: a competitive visiting scientists and engineers program and a summer fellowship program. The objective of the Visiting Scientists and Engineers Program is to attract accomplished visitors into the Agency for 1 to 3 years to assist in strengthening the Agency's science policy and research program. Candidates are sought through annual advertisements in nationally known scientific and engineering publications. They are then subjected to a rigorous peer review from which only the top candidates are recommended for assignment to an EPA laboratory. In FY 1990 five candidates passed peer review.

The Summer Fellows Program is carried out in cooperation with the American Association for the Advancement of Science and sponsors the assignment of post-doctoral and mid-career environmental science and engineering fellows to EPA facilities for the summer months to conduct environmental research projects. In FY 1990, 10 highly qualified fellows were sponsored.

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

## Exploratory Research

### *Small Business Innovation Research (SBIR) Program*

Public Law 97-219 requires EPA to devote 1.25% of its extramural research and development

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OER/HQ	Donald Carey	3,100	0

## *Development, Validation and Standardization of Analytical Methods in Support of Regional Programs*

### **Modeling, Monitoring Systems and Quality Assurance**

This research is targeted at specific areas that have been identified as regional analytical support needs. The intention is to work closely with the regions in order to set priorities within and among these target areas. Based on our current understanding of regional needs, a work plan will be developed and research will be initiated in the following high priority areas: 1) low level methods and reference materials for nutrients, volatile and semi-volatile organics, and metals in all media, 2) digestion techniques for metals, 3) analysis of transition metals in non-aqueous media, 4) solid phase extraction sample preparation techniques for extractable compounds, and 5) validated methods for fish tissue and nutrients in marine systems ecological trends.

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Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OMMSQA/HQ	Jack Puzak	975.0	0
OMMSQA/HQ	Chris Saint		

# Energy

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## Environmental Engineering and Technology Demonstration

### *Develop and Evaluate LIMB Technology*

This area is supporting the evaluation of alternative acid rain control technologies: specifically the development and commercialization of an integrated NO<sub>x</sub>/SO<sub>2</sub> control technology—The Limestone Injection Multistage Burner (LIMB).

LIMB technology can substantially reduce both NO<sub>x</sub> and SO<sub>2</sub> emissions while at the same time reducing the costs for control. A systematic development and demonstration program is underway to bring LIMB technology to the point where industry is able to commercialize it. The program has completed a successful wall-fired boiler demonstration at Ohio Edison's Edgewater Station. SO<sub>2</sub> emissions were reduced by 50-70% dependent on operating mode and NO<sub>x</sub> was reduced below 0.5 lbs. NO<sub>2</sub>/million BTU. The FY 1991 program will include: research to further optimize sorbent performance; analysis to identify potential operability and reliability problems; and construction and installation of LIMB equipment for the EPA/industry cofunded 180 MWe demonstration on a tangentially coal-fired utility boiler.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AEERL/RTP	Mike Maxwell	3,336.6	30
OEETD/HQ	Marshall Dick	193.9	77

## Modeling, Monitoring Systems and Quality Assurance

### *Understanding Atmospheric Processes*

Development will be continued on atmospheric deposition models used for interpreting and forecasting effects. In particular, the state-of-science Regional Acid Deposition Model (RADM) will continue to be field evaluated and documented, then applied to policy and program design questions, monitoring network design and trends analysis, and interprogram effects issues. The RADM model will also be applied to U.S. - Canadian transboundary flux issues, residual

NAPAP assessment questions, and the Clean Air Act implementation.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AREAL/RTP	Jim Vickery	3,515.9	5

## *Establish Deposition Monitoring and Trends*

### **Modeling, Monitoring Systems and Quality Assurance**

This research will focus on obtaining data and analyzing trends for ion levels in wet and dry deposition to form a composite of total deposition on both a national and a sensitive regional scale. Existing networks will be supported and maintained (200 wet sites and 50 dry sites), with siting criteria undergoing statistical development to optimize and enhance both wet and dry research networks. Instrumentation and methods development, quality assurance, and a central data repository - Acid Deposition System (ADS) are integral parts of this program. The high quality data provided will be used to plan and judge the success of the U.S. and Canadian control strategies.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
AREAL/RTP	Jim Vickery	3,615.9	5

# Radiation

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## Modeling, Monitoring Systems and Quality Assurance

### *Off-Site Monitoring Program*

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV	Charles Costa	289.4	100
OMMSQA/HQ	William Keith		

## Environmental Engineering and Technology Demonstration

### *Scientific Support for Radon Program*

This engineering program for Radon Mitigation supports the Agency's Radon Action Program. It is directed at developing and demonstrating cost-effective methods for reducing radon to less than 1 pCi/L in houses, schools, and other structures. The results of these tests, along with analysis of the findings of others, are provided to the States, private sector organizations (such as builders and contractors), and to homeowners. The research will continue to extend the capability of existing radon mitigation to achieve near-ambient radon levels. In addition, new innovative techniques will be developed to cost-effectively reduce low-radon-level houses (responsible for 85% of the risk) to even lower levels. The research focuses on radon mitigation techniques for existing houses, prevention techniques for new construction, and mitigation techniques applicable to school buildings.

# Radiation

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Office or	Laboratory	Contact	Funds (\$k)	In-House
	AEERL/RTP	Michael Osborne	3,457.8	32
	OEETD/HQ	Marshall Dick	192.8	78

# Superfund

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## **Modeling, Monitoring Systems and Quality Assurance**

### *Provide Techniques and Procedures for Site and Situation Assessment*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	William Budde	558.1	50
AREAL/RTP	William Mitchell	375.3	25
EMSL/LV	Michael Hiatt	2,018.7	40
OMMSQA/HQ	Michael Dellarco		

## **Scientific Assessment**

### *Provide Techniques and Procedures for Site and Situation Assessment*

Site-, chemical- and situation-specific exposure and risk assessments are being prepared to assist the Program Office and Regions in evaluating the alternative courses of action and regulatory strategies that might be applied at uncontrolled Superfund sites through development of health and environmental effects assessments for the chemicals most frequently found at candidate sites. The office is also a major participant in the lead demonstration project in several cities.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
ECAO/CIN	Bruce Peirano	548	5.0



# Superfund

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**Environmental  
Engineering  
and  
Technology  
Demonstration**

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

This research program develops and evaluates clean-up technology, demonstrating proto-type equipment such as mobile thermal treatment and mobile soil washing systems. Remedial technology will be assessed and technical reports provided which will include design data and cost information. Engineering expertise will be applied to the assessment of uncontrolled hazardous waste site situations to assist the Office of Emergency and Remedial Response, Regions and others in the development of corrective measure options. In order to provide more effective long-term technical support to the Regional Offices making cleanup decisions, the Superfund Technical Assistance Response Team (START) program has been established. In addition, short-term, quick turn-around technical programs and consultation will be provided to the regional programs and the Office of Waste Programs Enforcement for enforcement support.

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

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

# Superfund

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**Modeling,  
Monitoring  
Systems  
and Quality  
Assurance**

*Provide Quality Assurance—Superfund  
Program Requirements*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	William Budde	1,261.6	15
EMSL/LV	Michael Hiatt	2,428.5	25
OMMSQA/HQ	Michael Dellarco		

**Modeling,  
Monitoring  
Systems  
and Quality  
Assurance**

*Provide Technical Support to  
Enforcement, Program, and Regions*

Site specific monitoring and characterization for all media in support of Superfund investigations is provided to the Agency as part of the Technical Support Program. Monitoring and characterization support activities are provided on an as-requested basis. These include: remote sensing for historical and current site assessment; air, water, ground-water, and soils monitoring for site characterization; and analytical chemistry

# Superfund

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support. Advice and technical assistance on sampling methods, design of sampling plans, and sample analysis is provided. The full range of quality assurance/quality control assistance is offered including design and review of quality assurance plans, provision of quality control materials, and data analysis and interpretation.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/CIN	William Budde	308.0	30
AREAL/RTP	William Mitchell	309.0	25
EMSL/LV	Michael Hiatt	974.1	25
OMMSQA/HQ	Michael Dellarco		

## *Provide Technical Support to Enforcement, Program and Regions*

### **Environmental Processes and Effects**

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

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

# Superfund

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Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RSKERL/ADA	M. Richard Scalf	1,500.4	37.7
ERL/ATH	Rosemarie C. Russo	877.2	36.6
ERL/COR	Bill A. Williams	549.1	13.1
ERL/NARR	Norbert A. Jaworski	348.1	30.7
ERL/DUL	Douglas W. Kuehl	104.6	0.0
ERL/GB	Raymond Wilhour	105.6	65.2

## *Provide Technical Support to Enforcement, Program and Regional Offices*

### **Scientific Assessment**

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

Risk assessments developed by Regional Offices are reviewed for consistency, technical quality, and adherence to Agency risk assessment guidelines. Technical support is provided to the States and Regions through a Technical Support Center for Health and Risk Assessment, for rapid turnaround of risk assessment information and other activities.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OHEA/HQ	Kevin Garrahan		
ECAO/CIN	Pei-Feng Hurst	10,226	61.0

## *Hazardous Substance Health, Risk and Detection*

### **Modeling, Monitoring Systems and Quality Assurance**

Section 311c of the Superfund Amendments and Reauthorization Act authorizes EPA to conduct research "with respect to . . . detection of hazardous substances in the environment." The purpose of this program is to develop and evaluate monitoring techniques and systems which are rapid and inexpensive, fill technical voids,

# Superfund

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integrate monitoring systems into multimedia site assessments, and are as specific, selective and sensitive as possible. Innovative approaches which offer potentially significant cost and time savings to Superfund site investigations are studied. These include: development of improved statistical sampling designs, development of improved techniques for managing and interpreting field data, and development of screening techniques such as immunoassay and chemical sensors.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV	Michael Hiatt	1,853.3	15
OMMSQA/HQ	Michael Dellarco		

## Scientific Assessment

### *Hazardous Substances Health Effects/Risk Assessment and Detection Research*

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

# Superfund

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OHEA/HQ	Michael Callahan	2,169	8.0

## *Hazardous Substances Health Effects/Risk Assessment and Detection Research*

### Health Effects

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

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
HERL/RTP	Robert Dyer	3,779.2	9.9
OHR/HQ	Thomas Miller	3,804.5	

## *Superfund Reportable Quantity Regulatory Efforts*

### Scientific Assessment

Chemical-specific data are being provided on carcinogenicity and chronic effects to support

# Superfund

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Program Office activities necessary to adjust, by regulation, the Reportable Quantities (RQ) for hazardous substances. These include listings in association with Section 3001 of Resource Conservation and Recovery Act (RCRA), consideration of Emergency Planning and Community Right-to-Know Act Section 313 (Toxic Release Inventory) chemicals for listing as CERCLA hazardous substances, support for designation of new substances, and review of old RQ calculations to keep them consistent with new data and changes in risk assessment guidelines.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OHEA/HQ	Alan Ehrlich	728	25.0

## *Innovative/Alternative Technology Research, Development, and Demonstration*

### **Modeling, Monitoring Systems and Quality Assurance**

Section 311b of the Superfund Amendments and Reauthorization Act requires EPA to conduct the Superfund Innovative Technology Evaluation (SITE) Program, which seeks to accelerate the application of promising new technologies to Superfund problems. Examples of technologies being studied and demonstrated include: fiber optics chemical sensors for ground water contamination, immunoassay systems for organic contamination, canisters for air sampling, x-ray fluorescence for rapid metals screening, geophysical equipment for remote sensing of buried waste, and cone penetrometers for rapid and extended depth soil sampling.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EMSL/LV	Michel Hiatt	695.8	15
OMMSQA/HQ	Michael Dellarco		

# Superfund

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## Environmental Processes and Effects

### *Evaluate Technologies to Manage Uncontrolled Waste Sites*

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

To effect cleanup of hazardous chemicals in the environment, edaphic and genetic methods to enhance the biodegradative ability of indigenous and introduced microorganisms are being studied. Principles for application of this information to hazardous waste sites are being developed using in-situ and above-ground reactor technology. The program will identify high priority chemical structures for study, develop gene banks of novel capabilities, and develop approaches for rapid biodegradation. All extramural monies will be expended by the participating laboratories subject to final planning actions.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RSKERL/ADA	James F. McNabb	143.3	100.0
ERL/ATH	Rosemarie C. Russo	68.2	100.0
ERL/GB	Hap Pritchard	68.8	100.0
OEPER/HQ	Will C. LaVeille	1,897.1	0.0

## Exploratory Research

### *Manage Hazardous Substance Research Centers Program*

Authorized by the 1986 amendments to the Superfund Act, the Hazardous Substance Research Centers (HSRC) program supports five university-based research centers across the country. The HSRC approach is unique among federally-sponsored research centers programs. First, the program has a "Think globally, act locally" philosophy. Each center is charged with a global research focus, and a responsibility to act locally and address problems of the two contiguous federal region-pair through technology transfer



# Superfund

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activities. To ensure this, the regional community is represented on the required scientific and technology transfer advisory committees for the center. Other members come from industry, government, and academia. This distinctive technology transfer program element at the HSRCs is required and supported by 10-20% of each HSRC's budget. Both technology transfer and research on the effectiveness of different technology transfer techniques and activities, such as workshops and short courses, are included.

At least 20% of the total center's resources must be provided by university, state, or private sources. This ensures a continuing commitment to the success of the venture by the universities and other clients of each center.

The centers, which consist of multi-university consortia, were selected through a competitive peer review process and established in February 1989. Each center has an eight-year life expectancy and receives \$1.0 million annually from EPA/OER. In addition, each center is building additional federal and industrial support for their research and technology transfer programs. An additional \$1.0 million in grant support from other federal agencies is being provided to the centers this year. An industrial affiliates program is also being established at the centers to facilitate industrial support. This additional support is helping build the reputation of the centers as experts in research and technology transfer for hazardous substance management. The lead institution and research focus of each center include:

*Region-Pair 1-2:* New Jersey Institute of Technology: Incineration

*Region-Pair 3-5:* The University of Michigan: Bioremediation

*Region-Pair 4-6:* North Carolina State University: Waste minimization

*Region-Pair 7-8:* Kansas State University: Soils

*Region-Pair 9-10:* Stanford University: Groundwater

# Superfund

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## Exploratory Research

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
EPA/HQ	Dale Manty	5,000	0

### *Small Business Innovation Research (SBIR) Program—Superfund*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OER/HQ	Donald Carey	692	0

## Exploratory Research

### *Superfund Research Grants*

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

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
OER/HQ	Roger Cortesi	2,400	0

# Superfund

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## Environmental Processes and Effects

### *Field Screening Techniques for Assessment and Evaluation*

This research activity is designed to develop procedures for evaluating the ecological hazards and risks associated with hazardous waste sites and their remedial operations. Ecological endpoints, important to the Superfund program, will be identified and appropriate methods for evaluating the ecological hazards and risks associated with hazardous wastes at Superfund sites will be validated. Available methods will be customized to the extent possible to provide site-specific field assessment methods.

A second purpose is to acquire subsurface process and characterization information that will allow development of a decision-making framework for evaluating the appropriateness and potential efficacy of remediation technologies such as pump-and-treat and various physical/chemical/biological methods. The program will consist of studies on methods for site characterization, immiscible fluid flow and residual saturation, mass transport in heterogeneous media, and accelerated remediation methods.

Office or Laboratory	Contact	Total Funds (\$k)	Percent In-House
RSKERL/ADA	James F. McNabb	1,075.0	0.0
ERL/ATH	Rosemarie C. Russo	82.4	41.5
ERL/NARR	Gerald G. Pesch	384.0	0.0
OEPER/HQ	Will C. LaVeille	250.0	0.0

# Overview

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## *Introduction*

The primary goal of the U.S. Environmental Protection Agency is to mitigate the adverse impacts of pollution on human health and the environment. Toward that end, Agency management must make decisions regarding the development of policy, guidance, standards, regulations, and the appropriate tools for implementing pollution abatement strategies. It is the primary mission of the Office of Research and Development (ORD) to provide high quality, timely scientific and technical information in the service of Agency goals. The Agency's research program is conducted through 12 environmental laboratories across the country, employing some 1900 people, with an annual budget of about \$450 million. The research focuses on areas targetted by the planning process as needing additional emphasis in order to provide the information required for Agency decision making.

## *Research Perspectives*

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

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

# Overview

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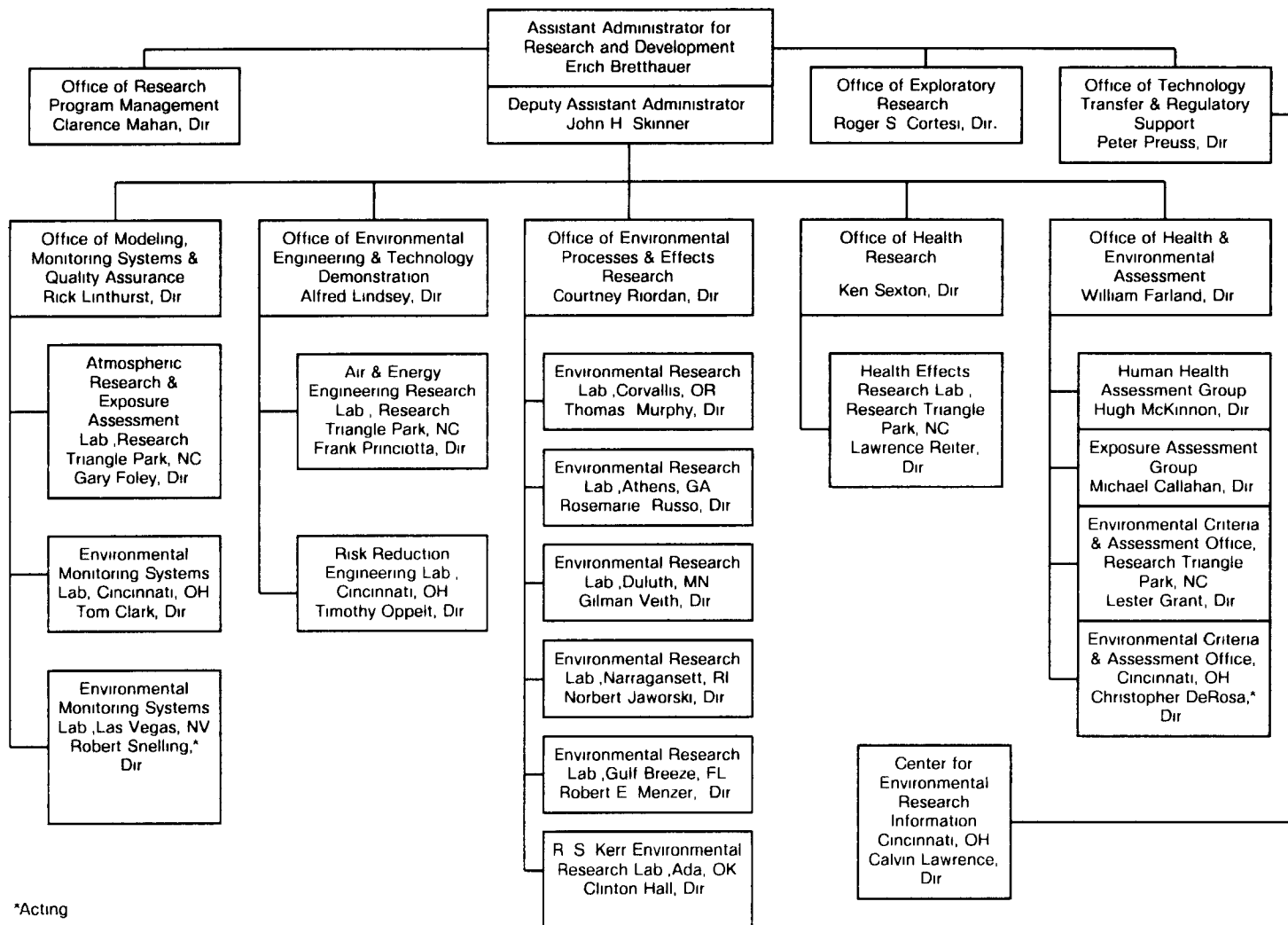
- Risk reduction research—to develop control technologies to treat, destroy, or contain pollutants and methods to reduce or eliminate the sources of pollutants or to prevent exposure to pollutants.

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

- Global climate change (air, water, hazardous waste);
- Environmental Monitoring and Assessment (water, air, energy);
- Total and human exposure assessment (air, water, hazardous waste/superfund, pesticides/toxic substances);
- Ground Water (water, hazardous waste/superfund);
- Pollution Prevention (hazardous waste, pesticides, multimedia);
- Comparative risk for complex mixtures (air, water, hazardous waste/superfund, pesticides/toxic substances); and
- Technology Transfer (all).

## *Conclusions*

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



\*Acting

# ORD Organization

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

## **Assistant Administrator for Research and Development**

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

## **Deputy Assistant Administrator**

John H. Skinner (202) 382-7676  
Headquarters, Washington, DC (RD-672)

## **Senior ORD Official, Cincinnati**

Acting Director, Steven Lutkenhoff CML (513) 569-7951  
Cincinnati, OH 45268 FTS 8-684-7951

Support Services Office CML (513) 569-7966  
Director, Robert N. Carr FTS 8-684-7966

## **Senior ORD Official, Research Triangle Park**

Elizabeth J. Hudson CML (919) 541-0179  
Research Triangle Park, NC 27711 FTS 8-629-0179

## **Office of Technology Transfer and Regulatory Support**

Director, Peter W. Preuss (202) 382-7669  
Headquarters, Washington, DC (H-8105)

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

Technology Transfer Staff  
Director, Mike Moore (202) 382-7671

# ORD Organization

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## Center for Environmental Research Information (CERI)

Director, Calvin Lawrence  
Cincinnati, OH 45268

CML (513) 569-7391  
FTS 8-684-7391

## Regional Operations Staff

Director, David Klauder

(202) 382-7667

Regional Scientist Program Coordinator,  
(Vacant)

(202) 382-7667

## Office of Research Program Management

Director, Clarence E. Mahan  
Deputy Director, W. Randall Shobe  
Headquarters, Washington, DC (RD-674)

(202) 382-7500

Evaluation and Review Staff  
Chief, Thomas L. Hadd

CML (202) 382-7659  
FTS 8-382-7659

Planning Staff  
Chief, Clifford Moore

CML (202) 382-2597  
FTS 8-382-2597

Program and Information Management Staff  
Chief, Linda K. Smith

CML (202) 382-7462  
FTS 8-382-7462

Program Coordination Staff  
Chief, Peter Durant

CML (202) 382-7468  
FTS 8-382-7468

## Office of Exploratory Research

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

(202) 382-5750

Research Grants Staff  
Director, Robert Papetti

(202) 382-7473

Research Centers Program  
Director, Karen Morehouse

(202) 382-5750

Visiting Scientists Program  
Coordinator, Alvin Edwards

(202) 382-7473

Small Business Innovation Research Program  
Director, Donald Carey

(202) 383-7445



# ORD Organization

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## Office of Health Research

Director, Ken Sexton	(202)382-5900
Deputy Director, David Kleffman	
Headquarters, Washington, DC (RD-683)	
Program Operations Staff	
Director, Mary Ellen Radzikowski	(202) 382-5891
Environmental Health Research Staff	
Director, David Kleffman (Acting)	(202) 382-5893
Health Effects Research Laboratory	
Director, Lawrence W. Reiter (MD-51)	CML (919) 541-2281
Deputy Director, Harold Zenick	FTS 8-629-2281

## Office of Modeling, Monitoring Systems and Quality Assurance

Director, Rick A. Linthurst	(202) 382-5767
Deputy Director, H. Matthew Bills	
Acting Associate Director, Jack Puzak	(202) 382-5776
Headquarters, Washington, DC (RD-680)	
Program Operations Staff	
Director, Paul D. Palm	(202) 382-5761
Quality Assurance Management Staff	
Acting Director, Nancy Wentworth	(202) 382-5763
Modeling and Monitoring Systems Staff	
Director, Frederick W. Kutz	(202) 382-5776
Atmospheric Research and Exposure Assessment Laboratory	
Director, Gary J. Foley	CML (919) 541-2106
Acting Deputy Director, William J. Mitchell	FTS 8-629-2106
Research Triangle Park, NC 27711	
Environmental Monitoring Systems Laboratory	
Director, Thomas A. Clark	CML (513) 569-7301
Deputy Director, Gerald D. McKee	FTS 8-684-7301
Cincinnati, OH 45268	

# ORD Organization

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## Environmental Monitoring Systems Laboratory

Acting Director, Robert N. Snelling	CML (702) 798-2525
Acting Deputy Director, Llewellyn R. Williams	FTS 8-545-2525
P.O. Box 93478	
Las Vegas, NV 89193-3478	

## Vint Hill Station

Acting Director, Donald Garofalo	CML (703) 347-6224
P.O. Box 1587, Building 166	FTS 8-557-3110
Warrenton, VA 22186	

## Office of Health and Environmental Assessment

Director, Willilam H. Farland	CML (202) 382-7315
Headquarters, Washington, DC (RD-689)	FTS 8-382-7315

Program Operations Staff	CML (202) 382-7311
Chief, Barry Goldfarb	FTS 8-382-7311
Program Liaison Staff	CML (202) 382-7323
Chief, Jerry Moore	FTS 8-382-7323

Technical Information Staff	CML (202) 382-7345
Chief, Marie Pfaff	FTS 8-382-7345

Human Health Assessment Group	CML (202) 382-7338
Director, Hugh McKinnon	FTS 8-382-7338

Exposure Assessment Group	CML (202) 475-8909
Director, Michael Callahan	FTS 8-475-8909

## 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

Acting Director, Christopher DeRosa	CML (513) 569-7531
Cincinnati, OH 45268	FTS 8-684-7531

# ORD Organization

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## Office of Environmental Engineering and Technology Demonstration

Director, Alfred Lindsey (202) 382-2600  
Deputy Director, Stephen Lingle  
Headquarters, Washington, DC (RD-681)

Program Development Staff  
Director, Greg Ondich (202) 382-5748

Program Management Staff  
Director, Al Galli (202) 382-2583  
Deputy Director, Steve Jackson

### Field Laboratories

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

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

Releases Control Branch  
Chief, Jack Farlow CML (201) 321-6635  
Edison, NJ 08817 FTS 8-340-6635

## Office of Environmental Processes and Effects Research

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

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

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

Marine, Freshwater and Modeling Staff  
Acting Director, Robert R. Swank (202) 382-5791

# ORD Organization

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## Field Laboratories

### Robert S. Kerr Environmental Research Laboratory

Director, Clinton W. Hall  
P.O. Box 1198  
Ada, OK 74820

CML (405) 332-8800  
FTS 8-743-2224

### Environmental Research Laboratory

Director, Rosemarie C. Russo  
Acting Director for Research  
Operations, John E. Rogers  
College Station Road  
Athens, GA 30613

CML (404) 546-3134

FTS 8-250-3134

### Environmental Research Laboratory

Director, Thomas A. Murphy  
Deputy Director, Robert T. Lackey  
200 SW 35th Street  
Corvallis, OR 97333

CML (503) 757-4601  
FTS 8-420-4601

### Environmental Research Laboratory

Director, Gilman D. Veith  
Associate Director for Research,  
Steven F. Hedtke  
6201 Congdon Boulevard  
Duluth, MN 55804

CML (218) 727-6692  
FTS 8-780-5550

Monticello Field Station  
Box 500  
Monticello, MN 55362

CML only  
(612) 295-5145

Large Lakes Research Station  
9311 Groh Road  
Grosse Ile, MI 48138

CML (313) 692-7600  
FTS 8-378-7600

### Environmental Research Laboratory

Director, Norbert A. Jaworski  
Deputy Director, (Vacant)  
South Ferry Road  
Narragansett, RI 02882

CML (401) 782-3001  
FTS 8-838-6001

Hatfield Marine Science Center  
Newport, OR 97365

CML only  
(503) 867-4040

### Environmental Research Laboratory

Director, Robert E. Menzer

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# ORD Organization

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Sabine Island  
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FTS 8-228-9200

# ORD Organizational Descriptions

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## **Office of Technology Transfer and Regulatory Support**

The Office of Technology Transfer and Regulatory Support (OTTRS) is responsible for three broad functions. The first function is to ensure that the Agency's regulations, legislation, and other policy decisions are based on the best scientific and technical information available. OTTRS staff coordinates the input from ORD offices and laboratories to the regulations and participates at all levels of the regulatory process. The second function, technology transfer, implements a program to share the results of ORD's research and development outside the Agency. In coordination with the laboratories and program offices, OTTRS and the Center for Environmental Research Information (CERI) develop technology transfer products. Those products include databases, publications, seminars, and workshops which are available to state and local governments, academia, international organizations, as well as others with an interest in environmental science and technology. The third function, regional operations, is the ORD liaison with EPA's regional offices. Regional operations staff promotes regional interests in the research planning process as well as technology transfer through the Regional Scientist Program and the Regional Superfund Technical Liaison Program.

## **Office of Exploratory Research**

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

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descriptions of these programs are provided elsewhere in this research guide. In addition to the core programs, OER administers other programs which are not supported by research and development funds appropriated to OER but are nonetheless important to the accomplishment of the OER objective. They include:

- A Minority Fellowship Program which awards fellowships to college seniors and graduate students enrolled on a full-time basis at Historically Black Colleges and Universities and majoring in curricula that could be applied to the solution of environmental problems.
- A Minority Summer Intern Program which extends to recipients of fellowships under the Minority Fellowship Program the opportunity for hands-on experience in the area of their academic training by way of a summer internship at an EPA or other environmental facility. (Both the Minority Fellowship Program and the Minority Summer Intern Program are components of the Minority Institutions Assistance Program, which is briefly described elsewhere in this document.)
- The Agency's Senior Environmental Employment Program (SEE) which utilizes the skills and talents of older Americans to meet employment needs of environmental programs.
- The Federal Workforce Training Program which coordinates ORD's participation in workforce training programs used by state and local governments.
- The Resident Research Associateship Program (RRAP) which, through a cooperative with the National Research Council, attracts scientists and engineers to ORD laboratories for one-year assignments to conduct research needed by the Agency. The program sponsors the research of junior, mid-, and senior-level scientists and engineers.

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## Office of Environmental Engineering and Technology Demonstration

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

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

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

- *Drinking Water:* This research program integrates chemistry, engineering, microbiology, and cost to provide effective, reliable, and cost-effective techniques for assuring the delivery of safe drinking water to reduce the risk of chemically and microbiologically induced health effects to the public. Included are laboratory, pilot plant, and field studies on control of lead, radon, synthetic organics, disinfection by-products, viruses, and cysts.
- *Hazardous Wastes:* This program focuses on investigating incineration, land disposal and alternative technologies for treating, detoxifying, and disposing of hazardous wastes.
- *LUST Trust Fund Technical Support:* This program works in close support to the Office of Underground Storage Tanks (OUST) to develop procedures for detecting and preventing leaks from storage tanks and associated piping.



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Under the LUST Trust Fund, technical assistance is provided on site assessment, technology selection, and corrective action to decision officials.

- *Pesticides*: This research program evaluates processes for treating wastes from production, application and disposal of pesticides. The program also evaluates treatment alternatives for disposing cancelled and suspended pesticides, and provides data and guidance on the effectiveness of protective equipment for reducing worker exposure to pesticides.
- *Superfund*: Research is directed at identifying, developing and evaluating technologies to support remediation, removal and enforcement actions. The Superfund Innovative Technology Evaluation (SITE) program facilitates development and conducts demonstrations of innovative technologies as alternatives to containment. The Superfund Technical Assistance Response Team (START) provides engineering and scientific assistance to Regional Offices, Program Offices, and others on the cleanup of hazardous wastes, particularly those associated with Superfund sites.
- *Toxic Chemical Testing and Assessment*: One goal of this research program is to provide test protocols, treatment and control procedures for regulating the manufacture and use of existing toxic chemicals (including asbestos); assessing release and exposure in review of Premanufacturing Notices (PMNs) for new chemicals; and evaluating techniques and devices to contain and destroy genetically engineered organisms are two other goals.
- *Wastewater Treatment (Municipal and Industrial)*: Research efforts are focused on developing cost-effective methods for treating municipal wastewater and sludges, urban runoff, and industrial wastewater discharges from processing and manufacturing operations. The main goal is to provide design and operating guidelines for efficient wastewater management based on the principles of

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pollution prevention and process integration. The research also includes the development of toxicity-based permitting via use of bioassay procedures.

- *Municipal Waste:* This program promotes the integration of municipal solid waste management technologies through research on safe and effective recycling practices, reducing multimedia pollutant releases from municipal land disposal facilities, and research on the utilization and safe disposal of municipal waste combustion residues.
- *Pollution Prevention:* Research is conducted, (1) to assess opportunities for multi-media pollution prevention through source reduction and recycling within operating industrial facilities; (2) to develop and demonstrate innovative pollution prevention technologies for industrial and transportation sector processes; (3) to develop and standardize methodologies for performing consumer product life cycle analyses and for measuring waste reduction.
- *Oilspills:* As a result of EPA's involvement in efforts to clean up the Alaskan oil spill, research is underway to develop and evaluate remediation technologies. The program emphasizes exploiting the natural ability of indigenous microorganisms to degrade oil, with or without nutrient addition.

The major purpose of the *Air and Energy Engineering Research Laboratory* is to develop and assess methods and technologies for preventing, or reducing the effects of air pollutants on human health and welfare, and on the global environment.

- *Acid Rain:* This program focuses on developing innovative controls for acid rain precursors, SO<sub>2</sub> and NO<sub>x</sub>, including the Limestone Injection Multistage Burner; developing models that will identify the best possible control alternatives for various scenarios; and developing inventories of acid rain precursor emissions.

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- *Air Toxics*: Emphasis is placed on developing technologies and pollution prevention approaches to reduce emissions of volatile organic compounds (VOCs); identifying sources of VOCs; developing improved designs that will achieve better control of woodstove emissions; and providing direct technical assistance to state and local agencies through the Control Technology Center (CTC) which has extensive information on existing technologies applicable to a variety of air pollution sources.
- *Hazardous Wastes*: The primary goal of this program is to study the fundamental combustion mechanisms that influence thermal destruction of hazardous wastes. Included are studies of metal aerosols from waste incineration, failure modes in a small pilot-scale rotary kiln, and small pilot-scale studies of fluidized-bed incineration.
- *Indoor Air Quality/Radon*: Research is currently concentrating on (1) developing and demonstrating technologies for reducing the entry of naturally-occurring radon into houses, schools and other public buildings; (2) studying emissions from building materials and consumer products as sources of indoor air pollution; (3) evaluating the effects of "sinks" that adsorb/desorb pollutants in the indoor environment; and (4) evaluating indoor air control options for gases and particles.
- *Municipal Waste Combustion*: Work focuses on evaluating techniques to minimize pollutant formation during combustion, and determining the effectiveness of various devices in controlling air pollution from municipal waste incinerators.
- *Ozone Non-Attainment*: This program supports ORD's overall ozone non-attainment strategy by developing innovative technologies, mitigation strategies, process modifications and improving existing technologies which will prevent, or reduce, the emission of hydrocarbons, nitrogen oxides and VOCs.

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- *Stratospheric Ozone*: In cooperation with industry, AEERL evaluates, identifies, and recommends substitute products and new industrial processes which will replace ozone depleting substances that are now in use. The current emphasis is on alternatives for home and commercial refrigeration systems.
- *Global Climate Change*: This program is evaluating mitigation options for greenhouse gases (carbon dioxide, methane, nitrous oxide) including innovative technological solutions to the problem. Also planned are inventories of emissions that are contributing to global climate change.

## Office of Health Research

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

- Toxicity test method development
- Generation of dose-response data
- Development of methods to use data from toxicity testing and dose-response studies to estimate human morbidity and mortality; including extrapolation from animal data to human effects, from high to low doses, from acute toxicity to long-term effects, and from exposure to dose.

*The Health Effects Research Laboratory* (HERL) in Research Triangle Park, North Carolina, conducts research, both intramurally and extramurally, which is responsive to these goals. Physical, biological and chemical agents are studied; and research is conducted in the scientific disciplines of pulmonary toxicology, genetic toxicology, neurotoxicology, developmental and reproductive toxicology, and epidemiology and biometry. Research to improve the quality of health risk assessment is being conducted through

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the development of pharmacokinetic and biologically based models. These models are being developed to more accurately predict the relationship between environmental concentration, target tissue dose and ultimate health effect.

## **Office of Environmental Processes and Effects Research**

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

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

*The Robert S. Kerr Environmental Research Laboratory* in Ada, Oklahoma, serves as U.S. EPA's center for ground water research, focusing its efforts on studies of the transport and fate of contaminants in the subsurface, development of methodologies for protection and restoration of ground-water quality, and evaluation of the applicability and limitations of using natural soil and subsurface processes for the treatment of hazardous wastes. Subsurface transport and fate information is incorporated into mathematical models for use in predicting the transport and fate of contaminants in the subsurface. Efforts to

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support the immediate needs and activities of EPA's operating programs are focused on the Underground Injection Control Program, the Wellhead Protection Program and the Hazardous Waste and Superfund Programs. RSKERL's Technology Support Program provides decision-makers with a source of information on subsurface fate and transport of contaminants and *in situ* remediation technologies, as well as the associated expert assistance required to effectively use this information.

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

The research identifies and characterizes the natural biological and chemical processes that affect the environmental fate and effects of specific toxic substances, such as pesticides or metals. The results are applied in state-of-the-art mathematical models for assessing and managing environmental pollution problems. Emphasized research areas in FY91 are global climate change, ecological risk assessment, sediment quality evaluation, artificial intelligence-expert systems for predicting chemical reactivity, bioremediation, and wellhead protection.

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

*The Environmental Research Laboratory* in Corvallis, Oregon, conducts research on terrestrial and watershed ecology and assesses the comprehensive ecological impact of inland pollution and other environmental changes caused

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by man. This includes the ecological effects of airborne pollutants, such as acid deposition; the ecological effects of global climate and UV-B changes, the effects of toxic chemicals on terrestrial plants, animals, and ecosystems; the assessment and restoration of contaminated or degraded environments; the characterization and assessment of the vulnerability of ecological systems such as wetlands, to human impacts; and the ecological risks from the terrestrial release of bioengineered organisms and other biological control agents.

*The Environmental Research Laboratory* in Duluth, Minnesota, is primarily responsible for developing water quality criteria and other measures of ecological health for the Nation's freshwaters. The mission of this laboratory is to develop methods for predicting and assessing the effects of pollutants and pollution activities on freshwater resources. Located on Lake Superior, the laboratory specializes in the toxicology of industrial chemicals, pesticides, and other hazardous substances. Primary research programs include developing ecosystem response models, diagnostic methods for watersheds and mass balance ecosystem models for the Great Lakes.

ERL-Duluth continues to conduct its research in surface freshwater systems, both flowing and lakes, including the Great Lakes (Gross Ile, MI) and freshwater wetlands (Monticello, MN). Research programs center on stresses from water criteria pollutants, xenobiotics and biological stressors including climate changes and sediments. Investigations focus on the impact of these stresses through a risk assessment framework including stressor source assessment, classification/characterization, hazard identification and stressor dose-response analysis.

*The Environmental Research Laboratory* at Narragansett, Rhode Island, along with its Pacific Coast laboratory in Newport, Oregon, is the Agency's National Marine Environmental Quality Research and Monitoring Laboratory. The Laboratory's research and monitoring efforts support primarily the EPA Office of Water, Office of Emergency and Remedial Response, and the Office of Air and Radiation. The Laboratory efforts

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respond mainly to legislative requirements of the Clean Water Act, the Marine Protection, Research Sanctuaries Act, Clean Air Act, and the Superfund Reauthorization Act. Major emphasis is placed on providing the scientific base for environmental criteria, waste disposal practices, environmental analysis and impacts, assessments of marine and estuarine risk of regulatory activities by responsible offices.

The principal research and monitoring themes of the Laboratory reflect its major strengths and are critical to accomplish the Laboratory's mission and the Ecological Risk Assessment Program of the Agency. The Laboratory's major themes are: (1) Predictive Biological Test Method Development; (2) Ecological Processes and Significance; (3) Environmental Exposure and Chemistry; and (4) Ecological Indicators and Monitoring.

The Laboratory is responsible for the following research and program areas: (1) marine and estuarine disposal ; (2) water use designation and derivation of criteria for marine and estuarine water and sediment; (3) environmental assessment of ocean disposal and discharges of waste and wastewaters; (4) technical and research support for evaluating remediation options at proposed and designated marine/estuarine Superfund sites; (5) research on the effects of global warming and the depletion of stratospheric ozone on marine systems; and (6) ecological monitoring for Near Coastal Ecosystems (EMAP). Technical assistance, technology transfer, and investigations of an emergency nature, e.g., spills of toxic materials, are also provided to aid EPA offices in evaluating environmental threats posed by toxicants, other pollutants, and physical modifications along our nation's coasts. Technical assistance is also provided to other Federal agencies, states, municipalities, and industry.

*The Environmental Research Laboratory* in Gulf Breeze, Florida, has broad research objectives which include the development of scientific information for (1) formulation of guidelines, standards, and strategies for management of pesticides and toxic chemicals in the near-coastal marine environment, (2) definition of current



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ecological "health" status and measurement and prediction of changes in ecological structure and function over time, (3) description of cause(s) of aberrant conditions or observed changes in ecological status, and (4) application of biological systems to bioremediate toxic and hazardous chemicals in the environment. Research is primarily devoted to chemical compounds and biological products regulated by EPA's Office of Pesticides and Toxic Substances, the Office of Water Programs, and the Office of Solid Waste and Emergency Response.

Research programs specifically addressed by the Laboratory include (1) definition and evaluation of factors and mechanisms that affect biodegradation rates and bioaccumulation potential in food-webs; (2) development of procedures and evaluation protocols for the biological treatment of toxic chemicals and hazardous wastes in the environment; (3) determination of effects of carcinogens, mutagens, and teratogens in aquatic species; (4) development of principles and applications of ecotoxicology, including measurements and predictions of the fate and effects of chemicals and biotechnological products on estuarine organisms, populations, communities, and associated ecological structure and function; (5) development and verification of methods and data that allow extrapolation of effects from laboratory observations to field situations, within and among species, populations, communities, and ecosystems; (6) development of methods to evaluate the environmental risk of toxic chemicals and products of biotechnology to the marine environment; and (7) environmental monitoring and assessment of bays and estuaries of the Gulf of Mexico to define ecological "health" status and to define changes over time and cause(s).

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## **Office of Modeling, Monitoring Systems and Quality Assurance**

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

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

*The Environmental Monitoring Systems Laboratory* in Cincinnati, Ohio, has as its primary mission: (a) conducts research in the development, evaluation, and standardization of chemical and biological methods for environmental assessments; (b) conducts research for detecting, identifying and quantifying microbial pathogens found in environmental media; and (c) provides

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technical assistance to the program office and regions for conducting bioassessments of aquatic systems; (d) provides quality assurance in support of the wastewater, and related solid wastes, Superfund, and toxics program.

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

## **Office of Health and Environmental Assessment**

The Office of Health and Environmental Assessment (OHEA) is responsible for assessing the effects of environmental pollutants in varying exposure situations on human health and ecological systems and determining the degree of risks from these exposures. The risk assessments performed by OHEA are used by the Agency as the scientific basis for regulatory and enforcement decisions. OHEA's responsibilities also include the development of risk assessment guidelines and methodologies, and recommendations for new research efforts that will better support future EPA risk assessment activities and research that will reduce the uncertainties in EPA risk assessment activities.

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

The Office includes four organizational groups:

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

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

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

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

# ORD Office/Laboratory Abbreviations

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

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<b>ERL/COR</b>	Environmental Research Laboratory 200 SW 35th Street Corvallis, OR 97333 CML (503) 757-4601 FTS 8-420-4601
<b>ERL/DUL</b>	Environmental Research Laboratory 6201 Congdon Boulevard Duluth, MN 55804 CML (218) 727-6692 FTS 8-780-5550
<b>ERL/GB</b>	Environmental Research Laboratory Sabine Island Gulf Breeze, FL 32561 CML (904) 934-9200 FTS 8-228-9200
<b>ERL/NARR</b>	Environmental Research Laboratory South Ferry Road Narragansett, RI 02882 CML (401) 782-3000 FTS 8-838-6000
<b>HERL/RTP</b>	Health Effects Research Laboratory Research Triangle Park, NC 27711 CML (919) 541-2281 FTS 8-629-2281
<b>RREL/CIN</b>	Risk Reduction Engineering Laboratory Cincinnati, OH 45268 CML (513) 569-7418 FTS 8-684-7418
<b>AEERL/RTP</b>	Air and Energy Engineering Research Laboratory Research Triangle Park, NC 27711 CML (919) 541-2821 FTS 8-629-2821
<b>OEETD/HQ</b>	Office of Environmental Engineering and Technology Demonstration (RD-681) Washington, DC 20460 (202) 382-2600

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

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