

FY-1992 EPA Research Program Guide

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Notice

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

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Introduction

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

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

How to Use the Program Guide

The following descriptions of the research program of the Office of Research and Development (ORD) 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, whom 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 "ORD Organization Descriptions" 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) 260-5750**

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

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

Hazardous Air Pollutant Regulatory Activities

Environmental Engineering and Technology Demonstration

The 1990 Clean Air Act Amendments (CAAA) require EPA to establish emission standards for source categories of the 189 air toxics listed under Title III of the 1990 CAAA. These emission standards must be based on Maximum Achievable Control Technology (MACT) or Generally Available Control Technology (GACT) for some area sources. In order to support this revamped air toxics regulatory approach, ORD is conducting research on innovative air toxic control approaches which will be applicable to source categories, including area sources, which emit one or more of the 189 air toxics. The focus of the innovative control work is on development of the corona destruction process which at the bench and small pilot scale has shown great promise as a cost effective technique for controlling low concentration streams of several air toxics. ORD/Office of Environmental Engineering and Technology Demonstration (OEETD) is working cooperatively with industry and the military to demonstrate the performance of the corona reactor at large pilot scale, possibly 1000 cfm. This larger scale demo is supported by fundamental in-house corona destruction research. Techniques to prevent air toxic emissions are also under investigation as part of the Administrator's 2% Pollution Prevention Set-Aside Program. Source reduction approaches for air toxic emissions from auto body refinishing and wood furniture coating operations (both of these operations emit several of the 189 air toxics) are being demonstrated. These demonstrations are expected to facilitate market acceptance of these new environmentally benign coating approaches. Wood stoves (a major non-point source of air toxics) research is improving the existing EPA certification test and testing an ORD-developed secondary combustion wood stove to assess its performance in the field. ORD is also attempting to improve the performance of existing in-use air toxics control technologies for point and area sources by determining the extent to which these technologies are operating below design specifications and developing enhanced operation and maintenance approaches to prevent and control the resulting excess emissions. The initial emphasis of the control effectiveness program is on control devices and techniques used in the coatings

Air

industry. Technical assistance to state and local agencies is expanding to address the expected increase in requests for technical information due to the 1990 CAAA. This assistance is provided through the Control Technology Center (CTC) which is jointly funded by ORD and OAQPS to provide technical information on air toxic control technologies via the CTC HOTLINE and to conduct engineering evaluations which provide data on emissions and control options for sources where this information is not readily available. Finally, methods to improve emissions estimates are being developed for specific air toxic source categories. This emissions methodology research supports development of the national area source strategy mandated under section 112(K) of the 1990 CAAA and the Great Lakes study.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AEERL/RTP	Wade Ponder	3,992.9	40
OEETD/HQ	Marshall Dick	250.0	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 exposure to ambient levels of 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 generated. HAPs will be selected for study in order to support the requirements of Title III of the 1990 Clean Air Act Amendments and to meet 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. 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	3,588.9	72

Hazardous Air Pollutant Regulatory Activities

Modeling, Monitoring Systems and Quality Assurance

The need for technology to monitor non-criteria contaminants at the regional, state, and local levels continues. Broad-based stationary source screening methods, generic methods and specific methods for hazardous pollutants with emphasis on source emission monitoring in support of Maximum Achievable Control Technology (MACT) regulation development as specified in the 1990 CAAA are ongoing. 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 Projects (IACP), will continue to study the origins and chemical composition of individual species

Air

of toxics, mutagenic or carcinogenic pollutants which are present in ambient air.

Laboratory studies are underway to determine atmospheric reaction rates and transformation products of HAPs. These studies will describe the formation, removal, and fate of air toxics in complex atmospheric mixtures found in urban air. As part of the IACP, the program is conducting an ambient air monitoring study in an urban location to quantify the sources of carcinogens in ambient air. In addition, the program will develop methods for characterizing area-wide source emissions of toxics.

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	5,619	49
	Larry Cupitt		
OMMSQA/HQ	Dwight Hlustick		

Hazardous Air Pollutant (HAP) Regulatory Activities

Scientific Assessment

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 FY92, major emphasis will be placed on implementation of programs that are responsive to new requirements of the CAAA. Health assessment activities will focus on the list of 189 air-toxics in the CAAA and OAR information needs relative to their decisions on negligible risk, residual risk, designation of lesser quantity cut-offs, ranking of hazard for modifications, and source category designation. Cancer unit risks will be developed for those listed air toxics

that have not already been evaluated. Chronic inhalation reference concentrations (RfC) will be developed for non-cancer effects. As a methodology for acute RfCs becomes available from the research program, acute RfCs will be developed. Draft RfCs are submitted to the EPA-wide RfD/RfC Work Group, co-chaired by OHEA. After verification or determination that the data base is inadequate for an RfC, the appropriate information is entered onto the Integrated Risk Information System (IRIS.) Those listed chemicals having data bases inadequate to meet the criteria for RfC development will be identified. OHEA provides 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 not processed in FY-91.

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. This 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 basis for uncertainty assumptions in the chronic RfC method so that, ultimately, some key assumptions can be replaced with actual values, (2) developing an acute RfC 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 consultant to OAR on air toxics health issues by providing expert review on listing/delisting decisions.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
ECAO/RTP	Lester Grant	4106.3	48

Air

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 are being developed to apportion the potential cancer risk from alternative engine and fuel types. The work includes 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 and mutagenic activity of methanol exposure. Work continues on the evaluation of the impact of atmospheric transformation on the carcinogenic potential of mobile source emissions.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
HERL/RTP OHR/HQ	Ila Cote Susan Perlin	408.3	34

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 both 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 develop-

ment 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, elevation, speed, and fuels, including evaporative hydrocarbon emissions from refueling, running losses, and long term standing. 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.

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Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AREAL/RTP	Ken Knapp Dale Pahl Frank Black	3,010	38
OMMSQA/HQ	Dwight Hlustick		

Mobile Sources

Scientific 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 and ecosystem effects and greenhouse gas emissions related to production, storage, and use 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 strategy will be reviewed by the Scientific Advisory Board and by the public before the final document is 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 co-ordination of the program within and outside EPA. This will entail the development of major health and ecosystem assessments of the alternative fuels and conventional fuels. These documents will be subjected to expert scientific review at workshops, as well as public and Scientific 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 interpretative reports of findings from the ORD research program. This assessment program began in FY-91 with the initiation of a methanol assessment and the

completion of a Million Metric Tons (MMT) assessment. In FY92 the emphasis will be on: (1) completing an assessment of the health effects of diesel emissions, including the development of a cancer unit risk and (2) initiating a reevaluation of the cancer unit risks of benzene and 1,3-butadiene.

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 FY92, at 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	273.4	54

National Ambient Air Quality Standards (NAAQS)

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

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 as well as studies of the formation, characterization and control of acid aerosols and visibility.

Ambient methods development focuses on measuring particulate matter in support of anticipated changes to the NAAQS as well as the development of improved methodologies for acid aerosol and visibility measurements.

Modeling, Monitoring Systems and Quality Assurance

Air

The visibility research program is addressing the analysis of visibility monitoring including intensive studies such as the Mojave Study to determine the source of aerosol components, its contribution to visibility reduction, and its seasonal variation. This program includes continuing support to and coordination with other agencies concerning visibility characterization and source attribution research; the initiation of a visibility trends network to track the effects of controls required by the CAAA of 1990; and the modification of simple photochemical models to include important constituent parameters that affect visibility reduction.

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

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AREAL/RTP	William Wilson	2,268	20
EMSL/LV	Marc Pitchford	234	29
OMMSQA/HQ	Dwight Hlustick		

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 NAAQS pollutants (primarily O₃, NO₂, CO₂, sulfur oxides, particulates and acid aerosols) using both human and animal studies; (2) to develop 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 particulates, alone and in combination with ozone, NO₂, and SO₂.

Research will be done to improve the models used to extrapolate from 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 these data will be used to develop extrapolation models to predict human pulmonary responses, (functional and morphological) to gases and particulates.

Animal, human clinical and epidemiology studies will provide data to determine the extent to which the primary air pollutants cause or exacerbate the development of non-carcinogenic diseases. 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 O₃, NO₂, and acid aerosols.

The health effects data from this research program are incorporated into EPA criteria documents which are used to set and revise NAAQS.

Office or Laboratory		Total Percent	
		Contact Funds(\$K)	In-House
HERL/RTP	Ila Cote	12,601.7	32
OHR/HQ	Susan Perlin		

National Ambient Air Quality Standards (NAAQS)

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

Environmental Processes and Effects

Air

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	2,394.2	40
OEPR/HQ	Paul Ringold	0	0

National Ambient Air Quality Standards (NAAQS)

Scientific Assessment

The main objective of the NAAQS scientific assessment program is to review and revise criteria documents for sulfur oxides, particulate matter, nitrogen oxides, ozone and other photochemical oxidants, carbon monoxide, and lead. Air Quality Criteria Documents (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 (CASAC) 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 FY92, final editing and printing will be completed for the revised Carbon Monoxide AQCD reviewed in draft form by CASAC in May 1991. Also, public comments will be received and analyzed with regard to the First External Review Draft of a revised Nitrogen Oxides AQCD, followed by CASAC review of that draft AQCD. Work will also be initiated in FY92 on the develop-

ment plan for the Congressionally mandated periodic review of criteria for particulate matter and sulfur oxides and database assembly/update efforts will continue for acid aerosols, lead, and ozone. Lastly, expert consultation and technology transfer concerning criteria air pollutant issues will continue to be provided in FY92 to support NAAQS development/revision by EPA's Office of Air and Radiation, to assist EPA Regions and States in dealing with local/regional air pollution problems, and to support EPA international activities on subjects related to the criteria air pollutants.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
ECAO/RTP	Lester Grant	1,874.9	57

New Source Performance Standards and State Implementation Plans

Modeling, Monitoring Systems and Quality Assurance

This program provides scientific support on atmospheric science and monitoring methodologies for New Source Performance Standards (NSPSs) and State Implementation Programs (SIPs) to assure attainment and maintenance of NAAQS. As designated by the 1990 CAAA, a major study of ozone formation in the Southeast (Southern Oxidant Study) was initiated with Atlanta, GA, being the focus of much of the program although other southern areas are involved. This study will define factors which influence ozone non-attainment including the role of biogenic emissions using the Regional Oxidant Model (ROM) to determine the impact of Volatile Organic Compounds (VOCs) and NO_x emissions on ozone control strategies. Data from the 1988 Acid Deposition study is being used to evaluate the Regional Particulate Model. Additional work includes the air dispersion modeling experiments and testing and model development to modify existing regulatory models (complex terrain), to support PM₁₀ regulatory activities and to upgrade regional and urban particulate models. This program also provides meteorological guidance and support to ORD laboratories and other Agency offices as well as research and development of ambient and source emission methods for criteria pollutants including their precursors.

Ongoing work includes PM10 methods evaluations including acid aerosol methods development.

To allow States to more easily evaluate SIP revisions, a program will be initiated to incorporate or nest the Urban Airshed Model (UAM) into the Regional Oxidant Model (ROM), including the standardization of the chemistry and transport modules. The Agency will initiate a program to incorporate major components of the ROM, the Regional Acid Deposition Model (RADM), and the Regional Particulate Model (RPM) into a new model, MODELS3, which will include upgrades using the latest advances in science and technology in atmospheric physics, chemistry, and computing.

The Agency will modify or develop new source monitoring methods for VOCs including continuous monitoring. In addition, the Agency will increase its quality assurance efforts with respect to the National Performance Audit Program (NPAP) which addresses the State and Local Monitoring Network (SLAMS). In addition, the NPAP system will include SIP sites.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AREAL/RTP	John Clements Jack Shreffler Francis Schiermeier	11,973	49
EMSL/LV OMMSQA/HQ	James McElroy Dwight Hlustick	872	49

New Source Performance Standards and State Implementation Plans

Research is underway to improve emission estimation methodologies for criteria pollutants and their precursors and to evaluate and demonstrate technologies and prevention approaches which reduce emissions of VOCs, sulfur oxides (SO_x), nitrogen oxides (NO_x), and particulate matter (PM) from major point and area sources including utility boilers, industrial facilities, and consumer products. The emissions methodologies research is designed to assist states develop the comprehensive accurate emissions inventories which, based on the 1990 CAAA, must be submitted with SIPs and must be updated periodically.

Environmental Engineering and Technology Demonstration

Research to improve VOC emissions estimates for area sources including solvents usage, off-highway vehicles, and gasoline marketing operations is being developed. Increased emphasis is being placed on validating these new area source methodologies. Once validated, the new methods will be used by OAQPS to provide guidance to state and local authorities responsible for preparing ozone and PM10 SIP inventories. The control/prevention research is focused on innovative control approaches for VOC area sources and SO_x/NO_x controls for industrial facilities. ORD is assisting OAQPS meet the CAAA mandate to establish criteria for regulating VOC emissions from consumer and commercial products. Evaluating and demonstrating approaches to reduce VOCs emitted from non-process related solvent usage is the initial priority. SO_x emission reduction research is focused on supporting a pilot scale evaluation of the ADVACATE process at TVA's 10 Mwe Shawnee plant. In-house research to optimize the ADVACATE process, particularly sorbent reactivity, is also being conducted to support the TVA pilot scale demonstration. The NO_x control program is evaluating, developing, and demonstrating advanced combustion modification and flue gas treatment technologies including reburning, selective catalytic reduction, and non-selective catalytic reduction. There is a renewed interest in advanced NO_x controls due to its impact on ozone non-attainment and its contribution to visibility impairment, forest damage and its direct health effects.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AEERL/RTP	Jim Abbott Everett Plyler	2,433.5	59
OEETD/HQ	Marshall Dick	280.0	90

Indoor Air Pollution Activities

Scientific Assessment

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

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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 FY92 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; and continue comprehensive assessment of biocontaminants found in indoor air.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
ECAO/RTP	Michael Berry	479.1	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 studies with human volunteers and laboratory animals will be maintained to better understand "sick building syndrome." The approach to study the effects of indoor air is broad. Work will continue on the evaluation of the dosimetry and effects of environmental tobacco smoke (ETS) in humans. Genetic bioassay studies of organics from indoor air sources will be used to make comparisons of the potential cancer risks from various sources. Human clinical studies of VOCs will continue to be conducted in chambers to determine effects related to

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the "sick building syndrome." Work will be conducted to characterize people with multiple chemical sensitivities. This work will be critical to understanding the physiological basis for multiple chemical sensitivity. Work will start on exposing rodents to emissions from consumer products, such as carpets.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
HERL/RTP OHR/HQ	Ila Cote Susan Perlin	431.1	13

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 quantify 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 parameters that influence indoor air quality. The research is focusing on applying the building diagnostic and measurement methods development over the past few years on applications to studies of large buildings. The results of these studies will be used in developing guidance on the most effective design and operation of large buildings to minimize human exposure to indoor air pollutants. Studies developing and refining personal and area exposure monitors are underway in order to provide the best possible measurements of specific pollutants. Finally, the Agency will initiate a program

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to measure biocontamination of buildings through the development of bioaerosol monitoring techniques.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AREAL/RTP	Ross Highsmith	1,389	12
EMSL/CIN	Alfred Dufour	611	27
OMMSQA/HQ	Dwight Hlustick		

Indoor Air

Environmental Engineering and Technology Demonstration

Title IV of the Superfund Amendments and Reauthorization Act (SARA) of 1986 requires the EPA to establish a research program which includes R&D to characterize and identify sources of indoor contaminants and to control these emissions through technologies or other mitigation measures. Both of these R&D areas will be addressed under ORD's indoor air research program. The source characterization research program will evaluate emissions from a variety of indoor sources and will collect data on compounds emitted, emission rates of these compounds, emission rate decay, and the interaction of source emissions with indoor surfaces (i.e., sinks). Increased emphasis will be placed on characterizing biocontaminant sources. Characterization research includes: conducting chamber studies to determine biocontaminant growth on indoor surfaces; human exposure studies involving "real" sources; large chamber test studies to develop methods and emissions data for activity sources; and multiple experiments involving sink materials and decaying sources. Indoor air mitigation research will focus on evaluating and demonstrating alternative IAQ approaches including source management, ventilation strategies, and air cleaning devices for a variety of indoor pollutants with increased emphasis on biocontaminants. Specific mitigation research includes: development of methods for evaluating the effectiveness of air cleaners to control biological pollutants; initiation of work on evaluating air cleaners for large commercial spaces; full scale material conditioning and "bake-out" studies including evaluation of sink adsorption/desorption behavior; and evaluations of the effects of indoor temperature, humidity, and dust level on biological pollutants.

Environmental Processes and Effects

Laboratory	Contact	Total Funds(\$K)	Percent In-House
AEERL/RTP	W. Gene Tucker	3,000.0	25
OEETD/HQ	Marshall Dick		

Global Change Research and Stratospheric Ozone Research

Concentrations of trace gases that may lead to climate change are rapidly increasing in the atmosphere, and model projections based on current trends suggest an increase in global average temperature during the next 40 to 60 years. Human activities have increased the levels of emissions dramatically during the last century and current activities are producing emissions of carbon dioxide, methane, chlorofluorocarbons, and other gases in increasing quantities. The biosphere produces emissions of most of these same gases and also serves as a sink for atmospheric carbon. Unfortunately, the global carbon balance is not "closed" such that global sources and sinks, and their rates of change, are known. Rather, atmospheric concentrations are measured, emissions are estimated, and the future net rate of increase is inferred from projections of current trends.

The EPA's mission is to protect human health and the environment. The impacts of global change represent a significant threat to that mission. The EPA's objectives on global change (including both global climate and stratospheric ozone) are twofold. First, the primary EPA objective is to protect and maintain the Nation's environmental resources for present and future generations. Second, to fulfill this objective, a need exists to measure, evaluate, and predict the ecological, environmental, and human-health consequences of global change.

Thus, the EPA's Office of Research and Development (ORD) has developed an effective research strategy to fill major gaps in our national information needs, to focus on uncertainties identified within the U.S. Global Change Research Program (USGCRP), and to complement the many active research efforts on climate change internationally.

The EPA/ORD plays critical scientific roles with the USGCRP in developing predictive understanding of

global change. Equally important, the EPA/ORD research provides the scientific base for the EPA program offices to develop global change response strategies. Although the EPA/ORD effort is only two percent of the total U.S. program, research funding has been growing at the same rate as overall U.S. global change funding.

The current emphases of the EPA Global Change Research Program (GCRP) are on reducing emissions of carbon, increasing capture and storage of carbon by terrestrial systems, understanding the processes and interactions of climate change, quantifying the effects of climate change in the terrestrial system, and predicting the impacts of future change. Future initiatives are expected to broaden our ability to assess (1) emissions of radiatively important trace gases, (2) regional-scale impacts, (3) ecological effects, and (4) carbon sequestration techniques—all of which will increase our ability to develop effective management strategies and policy decisions.

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 on the atmospheric and biospheric transport and fate of the proposed chlorofluorocarbon substitutes. 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. Support for the Vienna Convention for the Protection of the Ozone Layer and the renegotiated Montreal Protocol will continue, in cooperation with other nations.

Although the EPA research effort represents only two percent of the Federal program budget, the Agency's effort is an integral part of U.S. research on global change. The Office of Research and Development is responding to the need for critical input in making sound regulatory and policy decisions, and specifically, credible scientific data so that we can predict future change better, define effects more accurately, and evaluate societal response options more accurately. The EPA is committed to ensuring that

U.S. policy fosters environmental protection, as well as sustainable utilization of its natural resources. It is recognized that human-induced climate change is likely; however, the current predictions are uncertain, the potential effects are poorly defined, and the solutions are not readily available or apparent.

The EPA GCRP began several years ago with the recognition that there are intimate links between human-induced changes in emissions of radiatively important trace gases, changes in atmospheric chemistry, changes in climate, and impacts of the resultant climatic and chemical environment on human society. Thus, the GCRP initiated research to link these four areas, not only to ensure strong links between the specialized research areas, but also so that current research within these areas would be of the type needed both by other scientists and by policy makers.

The interaction of policy concerns and scientific research embodied in the EPA GCRP requires that the research products provide a scientific foundation for policy development and analysis. Accomplishing this depends not only on the quality of the research performed in the GCRP, but on the ability of the researchers to interpret their own results and the results of other programs in light of environmental policy.

The EPA GCRP focuses on those scientific issues that are the most relevant to policy formation, while striving to maintain the proper balance of responsiveness to changes in policy directions and the scientific flexibility to respond to new scientific questions as they arise.

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Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
OEPER/HQS	Robert C. Worrest	26,000	25
	Paul Ringold		
	Lowell Smith		
	Dennis Trout		
AREAL	Sharon LeDuc		
	Joe Sickles		
AEERL	Jim Abbott		
ERL/ATH	Lee Mulkey		
	Lee Wolfe		
ERL/COR	Peter Beedlow		
ERL/DUL	John Eaton		
ERL/NARR	Hal Walker		
	Henry Lee II		

Global Climate Change

Environmental Engineering and Technology Demonstration

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 research includes development of global and regional emission factors, activities, and functions for anthropogenic and biogenic sources of radiatively important trace gases. The OEETD will support ORD's research on evaluating the enhancement of the terrestrial biosphere as a CO₂ sink; emphasis will be on assessing biomass utilization options.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AEERL/RTP	Dick Stern	4,720	10
OEETD/HQ	Marshall Dick	0	0

Clean Air Act Amendments

Modeling, Monitoring Systems and Quality Assurance

With respect to the Attainment of Air Quality Standards, research includes ozone epidemiology studies, studies on regional visibility and haze, ozone ecosystem effects studies, and additional health criteria assessments. Additional support for SIPS and new

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source standards include the development of improved emission inventory methods, improvements in the ROM as well as additional applications initiation of the development of a more advanced model incorporating previous models (MODELS3), additional ambient and source monitoring methods development for O₃ and its precursors and other pollutants, and engineering efforts to develop and evaluate techniques for the control of VOCs and NO_x. Air toxics studies include additional risk studies for air toxics in support of CAAA as well as studies and measurement methods for area-wide and point source determinations, and Great Waters toxic deposition studies. Mobile source studies are concentrating on risks from alternate fuels including atmospheric transformation studies as well as human exposure studies to formaldehyde and other compounds. The acid deposition program includes demonstrations of NO_x control approaches, updating emission inventory methodologies, aquatic effects monitoring in sensitive regions, forest effects monitoring in select high elevation areas, and visibility monitoring in nonclass I areas including eastern United States.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
OMMSQA/HQ	D. Hlustick	19,652.1	10
AREAL/RTP	J. Clements		
EMSL/LV	J. McElroy		
OEPR/COR	T. Murphy		
HERL/RTP	Ila Cote		
ECAO/RTP	Les Grant		
ECAO/CINN	C. Sonich-Mullin		
OHEA/HAG	C. Ris		
OHEA/EAG	M. Callahan		
AEERL/RTP	F. Princiotta		

Health Effects Institute

Health Effects

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

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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 OHR/HQ	Ila Cote	3,000.0	0

Deposition Monitoring and Understanding Atmospheric Processes

Modeling, Monitoring Systems and Quality Assurance

The current research program includes: (1) The continued development of improved methods for estimating area and point source emissions. This includes the development of improved data collection procedures at the sources, States and EPA as well as improved data quality assurance procedures; (2) The maintenance of emission projection models specific to major source categories. These models are used to analyze emission management strategies; (3) Completion of the joint U.S./Canadian evaluation of the RADM along with the Canadian ADOM model; (4) Use of RADM to: optimize CAAA program implementation through forecasting the effects of emissions trading, coal moratoriums, and related interstate issues; extrapolating site-specific deposition monitoring data for baseline trends determinations; supporting interprogram effects of instituting controls on VOCs and oxidants along with acid deposition; (5) Merging

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of RADM and ROM modeling capabilities, enhancement of nitrogen chemistry components, building a comprehensive modeling system to study urban and regional oxidant, nitrogen, and air toxic issues; and (6) Downscaling the RADM model to desk top versions for use by Regional and State offices as well as other sources.

The existing monitoring system for wet and dry deposition will be expanded and upgraded as specified by the 1990 CAAA to meet spacial and temporal trend detection needs. New monitoring will also be initiated to determine visibility trends in the eastern half of the U.S. Finally, a long term program to study the effects of wet and dry deposition on stone and metals will be initiated.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AREAL/RTP	Jim Vickery	6,160	9
OMMSQA/HQ	Dwight Hlustick		

Energy

The goal of the Multimedia Energy research and development program is to provide EPA Program and Regional Offices, Federal, State, and local governments, and industry with the scientific information to guide the development and utilization of energy resources in an environmentally acceptable manner. The major objective is to support implementation of the acid rain provisions contained in Title IV of the 1990 CAAA including demonstrating innovative technologies (Limestone Injection Multistage Burner, LIMB) to reduce acid rain precursors (NO_x and SO_x).

Equipment installation for the Yorktown LIMB demonstration will be completed with the unit available to begin testing in January 1992. During the rest of the fiscal year, optimization and performance testing of the system will be conducted. In addition, laboratory development work on improved sorbents, reactivation of sorbents and other general support to the LIMB processes will be conducted.

Environmental Engineering and Technology Demonstration

Air

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AEERL/RTP	Mike Maxwell	3,318.6	30
OEETD/HQ	Marshall Dick	200	77

Drinking Water

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 and ozone 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 disinfectant use and waterborne infectious disease will be conducted.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
HERL/RTP OHR/HQ	Jack Fowle Rebecca Calderon	4,776.7	33

Health Effects of Drinking Water Contaminants

Scientific Assessment

Development of national drinking water 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 assessments prepared under this program take the form of both criteria documents and health advisories. These documents are comprehensive reviews of the health effects associated with exposure to contaminants in drinking water. They specifically evaluate the relevant scientific data describing the physical and chemical properties, the pharmacokinetics, the toxicity and carcinogenicity in animals and humans, and the mechanisms of toxicity. The health assessments are prepared for various chemicals as requested by EPA's Office of Science and Technology (OST). This risk assessment process enables OST to establish a Maximum Contaminant Level Goal (MCLG), representing a

Drinking Water

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	Linda R. Papa	902.8	71.2

Ground Water Research

Modeling, Monitoring Systems and Quality Assurance

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	Robert Snelling	508.6	37
OMMSQA/HQ	Bill Stelz		

Ground Water

Environmental Processes and Effects

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

Drinking Water

as multiphase transport and solvent composition effects on sorption.

Field evaluation of techniques for determining the mechanical integrity and adequacy of construction of injection wells will occur.

Methods will be developed for delineating well-head protection areas, incorporating multiple sources of pollution into wellhead protection models, and for performing risk assessments in wellhead protection areas.

A new program entitled Midwest Agrichemical Surface/Subsurface Transport and Effects Research (MASTER) will be implemented. This is a cooperative effort with USDA and USGS. The research will evaluate how agricultural management practices affect our ecological resources with a goal towards optimizing the ecological health of agricultural watersheds.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
RSKERL/ADA	James McNabb	3,326.9	38
OEPER/HQ	Barbara Levinson	1,348.7	25
ERL/ATH	Lee Mulkey	654.3	12
ERL/COR	Robert Lackey	343.5	5
ERL/DUL	Nelson Thomas	343.8	6
EMSL/LV	Joe D'Lugosz	575.0	0

Drinking Water Technology

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 by-products and their precursors, inorganic contaminants, maintaining water quality in the distribution system, and developing supporting cost data.

Major treatment occurrence issues include:

Environmental Engineering and Technology Demonstration

Drinking Water

- Assessing formation mechanisms and conditions for disinfection by-products.
- Evaluating control techniques for the by-products.
- 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 Don Tang	2,017.7	63

Drinking Water Technology

Modeling, Monitoring Systems and Quality Assurance

This program conducts research to develop and standardize the technically and economically feasible analytical methods needed to monitor chemical and microbiological contaminants in drinking water. To ensure that data of known quality are obtained, chemical and biological quality control and reference materials are made available, and semiannual laboratory performance evaluations of Agency, state, municipal, and utility laboratories are conducted. Analytical methods are evaluated through single- and multilaboratory methods validation studies. In support of the monitoring laboratory certification program, formal training courses are conducted, and each of the ten regional laboratories is evaluated through an on-site visit at least once every three years.

Drinking Water

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
EMSL/CIN	Thomas Clark	2,788.6	62
EMSL/LV	Robert Snelling	259.9	51
OMMSQA/HQ	Bill Stelz		

Water Quality

Modeling, Monitoring Systems and Quality Assurance

Water Quality Based Approach/Permitting

The monitoring research program develops and standardizes methods to identify and measure chemical and biological pollutants and to determine the biological integrity of ecosystems. To ensure that data of known and acceptable quality are acquired, quality assurance support is provided in the form of quality control and reference materials, biological sampling guidelines, method performance criteria, and semiannual laboratory performance audits. Research seeks to improve the sensitivity of chemical methods for measuring toxic chemicals in water and sediment. Biological methods are developed to screen ambient waters and sediments for chronic and acute toxicological effects of pollutants. Research is conducted to develop procedures that use bioindicators of exposure to environmental contaminants rather than identifying and measuring specific substances as contaminants.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
EMSL/CIN	Gerald McKee	2,352.0	78
OMMSQA/HQ	Bill Stelz		

Scientific Assessment

Water Quality Based Approach/Permitting

EPA's overall research program with regard to water 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 determining risk of adverse human health effects from exposure to mixtures of toxic chemicals, and will evaluate site-specific health hazards as required by the States and EPA. As a part of this effort, EPA develops the specific risk assessments which are used as benchmark guidance to the States.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ECAO/CIN	Linda R. Papa	283.6	79.8

Water Quality

Environmental Processes and Effects

Water Quality Based Approach/Permitting

A water quality-based approach to pollution control provides for correction of ambient water quality problems that remain after mandated pollution control technology (e.g., secondary treatment, effluent guidelines) is in place. This requires the ability to translate water quality standards into specific effluent conditions and discharge limitations for municipalities and industries. Research will be undertaken to provide the necessary information and scientific tools, including: water quality criteria development/modification; sediment quality 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 to support the Agency's "No-Net-Loss" of wetlands policy.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/ATH	Robert Swank	1,076.1	67
ERL/COR	Tom Murphy	2,308.2	20
ERL/DUL	Nelson Thomas	4,219.8	57
ERL/NARR	Norbert Jaworski	2,153.8	57
ERL/GB	Raymond Wilhour	170.1	0
OEPER/HQ	Chieh Wu	977.4	78

Modeling, Monitoring Systems and Quality Assurance

Industrial Wastewater Treatment Technology

Research supports the Agency in implementation of technology-based effluent limitation regulations and modification of enforcement activities as required by water quality-based permit adjustments. Methods are developed and standardized to provide technically and economically feasible methods to determine regulated organic and inorganic contaminants and to ensure that biological limits are not exceeded. In support of the National Pollution Discharge Elimination System (NPDES) program, performance characteristics (accuracy, precision, and detection limits) of available methods for high priority industrial wastewater pollutants are determined through single and

Water Quality

multilaboratory evaluations: when necessary, method deficiencies are corrected or new methods development research is initiated. The research program supports NPDES quality assurance by designing and providing a source of calibration, quality control, and reference materials required for both chemical and biological methods. Through the annual Discharge Monitoring Report Quality Assurance (DMRQA) study, performance evaluation studies are conducted to ensure that acceptable data are acquired by some 7,000 major NPDES permittees.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
EMSL/CIN	Gerald McKee	793.1	73
OMMSQA/HQ	Bill Stelz		

Environmental Engineering and Technology Demonstration

Wastewater Treatment Technology

The wastewater technology research program provides the technical information and engineering assistance needed to develop and implement the regulations and guidance for disposal of sludge and control of pollution from municipal treatment plants to bring plants into compliance with state discharge permits. This program also provides the research in industrial wastewater characterization and control technology needed to support the National Pollutant Discharge Elimination System. The program focuses on stormwater and combined sewer overflow, especially on toxic aspect, and best conventional technology and best available technology limitations in industrial wastewaters. Design, cost and performance information for sludge stabilization, pathogen reduction, and dewatering processes will be proved to support sludge regulation implementation and refinement. Emphasis is also on supporting the new wastewater treatment technologies development and infrastructure protection, particularly with regard to small communities.

Water Quality

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
RREL/CIN OEETD/HQ	Subhas Sikdar Don Tang	1,398.7	40

Wastewater Treatment Technology

Scientific Assessment

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, disposal, and surface impoundment.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ECAO/CIN	Linda R. Papa	405.6	34.7

Wastewater Treatment Technology

Environmental Processes and Effects

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	153.3	100
ERL/COR	Richard Olson	85.4	0
ERL/DUL	William Sanville	90.4	0
OEPPER/HQ	Chieh Wu		

Water Quality

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 of this information 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. Research will also be conducted on the impact of introduced, non-indigenous species on in-situ ecosystems water quality. 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.

Water Quality

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/NARR	Norbert Jaworski	3,271.8	83
ERL/GB	Rod Parish	101.4	100
ERL/DUL	Gilman Veith	4,380.1	10
OEPER/HQ	Steve Cordle	40.8	0

Marine, Estuaries, and Lakes

Modeling, Monitoring Systems and Quality Assurance

The aim of this program is to develop, evaluate, and validate standardized chemical, biological and microbiological methods for the determination of contaminants and biological integrity in marine, estuarine and other salt water matrices. The near-coastal areas of the U.S. are economically some of our richest and most sensitive ecosystems.

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. Ongoing 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 materials for use as quality control and performance evaluation samples.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
EMSL/CIN	Thomas Clark	573.8	68
OMMSQA/HQ	Bill Stelz		

Hazardous Waste

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 the Office of Solid Waste and Emergency Response (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.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
RREL/CIN	R. Hill S. Sikdar H. Freeman	2,644	20
OEETD/HQ	B. Krishnan	215	50

Alternate Technologies

Environmental Processes and Effects

New emphasis is being placed on research for developing bioremediation technologies specifically applicable to Resource Conservation and Recovery Act (RCRA) hazardous wastes. This major program will complement ongoing studies being conducted for Superfund sites but will emphasize biological treatment of known industrial chemicals rather than of complex mixtures. Studies here will be directed at improving the base of scientific knowledge as it applies to optimizing the application of *in-situ* bioremediation. Improvements in the contact between the microorganisms and the chemicals to be degraded, and in the delivery to the subsurface of nutrients and environmen-

Hazardous Waste

tal amendments, such as oxygen, will assure maximum viability and efficacy. 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	John T. Wilson	12.2	100.0
ERL/ATH	Rosemarie Russo	14.1	100.0
ERL/GB	Hap Pritchard	20.8	100.0
OEPER/HQ	Will C. LaVeille	1,211.6	0.0

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 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	873	33
AEERL/RTP	R. Hall	300	100
OEETD/HQ	B. Krishnan	50	100

Hazardous Waste

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	748.7	42

Land Disposal

Environmental Engineering and Technology Demonstration

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

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

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
RREL/CIN OEETD/HQ	R. Landreth B. Krishnan	797 50	31 100

Hazardous Waste

Environmental Engineering and Technology Demonstration

Pollution Prevention

The Pollution Prevention Research Program (PPRP) 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 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	H. Freeman	2,400	0
OEETD/HQ	B. Krishnan	300	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 engi-

Hazardous Waste

neering and control technology 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	643.9	49

Municipal Solid Waste

Scientific Assessment

A user-friendly computer programmed programmer's guide will be developed for the methodology for assessing health risks associated with indirect exposure to combustor emissions. The method will also be used in several test cases. Available information on potential hazards from various waste management options will be surveyed and compiled for use in developing a methodology for comparative risk assessment.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ECAO/CIN	Lynn Papa Cindy Sonich-Mullin	658	30.1

Municipal Solid Waste

Environmental Engineering and Technology Demonstration

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. 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

Hazardous Waste

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	2,600	35
AEERL/RTP	R. Hall	980	35
OEETD/HQ	B. Krishnan	735	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 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 being conducted. 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 character-

Hazardous Waste

ized 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	483.9	11
OMMSQA/HQ	Ken Sala		

Environmental Processes and Effects

Waste Characterization

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

ERL/Duluth is developing procedures and data to evaluate waste characteristics and closure criteria for impacts on aquatic habitats and 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.

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

Hazardous Waste

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	580.5	94.0
RSKERL/ADA	James F. McNabb	3,011.0	41.2
ERL/ATH	Rosemarie Russo	2,195.7	29.0
ERL/COR	Anne Fairbrother	316.6	67.2
OEPER/HQ	Will C. LaVeille	443.9	85.8

Waste Characterization

Scientific Assessment

Chemical-specific health and environmental effects documents are being prepared to support RCRA 3001 listing decisions. Support is also being provided to the Office of Solid Waste (OSW) in the form of reference dose documentation. Assessment methods are being refined, such as microcomputer-assisted risk assessment tools.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ECAO/CIN	Bruce Peirano	1,743	54.2

Quality Assurance

Modeling, Monitoring Systems and 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

Hazardous Waste

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 OSW. 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	300.0	100

Releases

Modeling, Monitoring Systems and Quality Assurance

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 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.

Hazardous Waste

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

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

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	85.7	100

Releases

Environmental Engineering and Technology Demonstration

Underground storage tank (UST) research is evaluating prevention, detection, and corrective action technologies to identify cost-effective, reliable techniques and equipment for USTs. Early work is producing state-of-the-art documents for each type of

Hazardous Waste

technology. The primary focus of ongoing work is corrective action technologies and the targeting of high potential technologies for improved performance. Best engineering practices for leak prevention, the detection of leaks, corrective action, and site cleanup will be documented.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
RREL/CIN	J. Farlow	967	50
OEETD/HQ	R. Nalesnik	50	100

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 developed to detect trace metals in groundwater, ambient, 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 monox-

Hazardous Waste

ide 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		

Development of Techniques and Procedures to Prevent and Contain Oil Spills

Environmental Processes and Effects

This new activity reflects the concerns raised by the recent major oil spills for means to evaluate the various mitigation techniques and their potential environmental consequences. Studies will be conducted to provide the scientific data needed by regional staff to choose the most cost-effective and environmentally sound option for dealing with a spill. These options will include technologies for removing oil, as well as methodologies for determining the effectiveness of the removal process.

Other studies will develop restoration procedures for oil-damaged marine, estuarine, freshwater, and terrestrial ecosystems. Research will be conducted on beach and shoreline remediation using chemical and biological methods. Included will be process development, field evaluations, and protocol development, which will enable assessment of the ecological impacts of spills and of remediation alternatives.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
ERL/ATH	Rosemarie Russo	136.2	16
ERL/GB	Hap Pritchard	146.3	21

Hazardous Waste

Environmental Processes and Effects

Develop Data to Support Treatment, Storage, Disposal Regulations

Direct technical support for site-specific issues will be provided on an *ad hoc* basis to regional office staff involved in RCRA corrective action activities. The need is estimated to be equal to or larger than that related to Superfund site cleanups. Based on the successful Superfund assistance program now in place, the effort will utilize the laboratory-based Technical Support Centers (TSCs). Thus, TSC staffs at RSKERL-Ada (ground water) and at ERL-Athens (exposure modeling and ecorisk assessment) will become available to the regional RCRA Corrective Action programs. Extramural resources will be utilized to contract on-site personnel to assist the TSC and its laboratory in responding to the needs of RCRA staff. The TSCs will also participate in an effort to transfer technical information to the Corrective Action community through a variety of means (e.g., documents, seminars, videos).

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
RSKERL/ADA	John E. Matthews	273.4	22.4
ERL/ATH	Rosemarie Russo	145.0	48.8

Scientific Assessment

Technology Transfer

A pilot Technical Support Center in Health and Risk Assessment will be initiated for the RCRA Corrective Action Program.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
ECAO/CIN	Bruce Peirano	117	5.1

Hazardous Waste

Environmental Engineering and Technology Demonstration

Oil Spills Research

ORD is focusing its oil spills research program in the following four areas:

- Bioremediation
- Dispersant Research
- Mechanical Cleanup of Inland Spills
- Debris Disposal

In the bioremediation area, research will be continued to develop protocols which can be used to evaluate the efficacy and toxicity of bioremediation agents under various spill scenarios. Once developed, these protocols will be verified at spills of opportunity or at research spills. Information on the products tested will be made available to spill coordinators to allow quick decisions to be made on the use of these materials at the time of a spill. Research will also continue to develop similar information on dispersants. In addition, future research may be conducted to determine the relative risk of dispersing the oil throughout the water column vis-a-vis allowing it to remain on the surface and eventually ending up on beaches, marshes, etc. Limited research is being conducted to develop containment and cleanup equipment for use on fast-flowing inland rivers and streams. ORD will undertake research to evaluate alternative disposal options for the debris which is normally generated during cleanup operations following a major oil spill.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
RREL/CIN	A. Venosa	1,335	80
ERL/GB	F. K. Pritchard	550	50
ERL/ATH	J. Rogers	448	70
HERL/RTP	L. Claxton	80	50
OEETD/HQ	K. Jakobson	50	90

Toxic Substances

Environmental Processes and Effects

Biotechnology

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

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

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

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

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/GB	Robert Menzer	1,695.2	13
ERL/COR	Thomas Murphy	1,644.1	16

Toxic Substances

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) and techniques for quantification;
- availability and effectiveness of containment controls or destruction techniques and appropriate validation methods; and
- sources and quantification of 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 (pollution prevention) 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 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

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	John Burckle	138.7	15
OEETD/HQ	Marshall Dick	25.0	75

Biotechnology/Microbial and Biochemical Pest Control Agents

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 GEMs release.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
EMSL/LV	Stephen Hern	286.8	25
OMMSQA/HQ	Laurie Schuda		

Modeling, Monitoring Systems and Quality Assurance

Toxic Substances

Biotechnology/Microbial and Biochemical Pest Control Agents

Health Effects

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

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
HERL/RTP	Elaine Grose	33	
OHR/HQ	David Kleffman	469.1	

Ecology: Ecotoxicity and Risk Assessment

Environmental Processes and Effects

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

The ecotoxicology studies include the movement, transformation and ultimate disposition of toxic substances in all environmental media as a critical component of risk assessment. How plants and animals or ecosystems 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

Toxic Substances

used in regulatory decision making and as a guide to formulating regulatory criteria and standards.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/ATH	Rosemarie Russo	813.0	49
ERL/COR	Thomas Murphy	87.7	100
ERL/DUL	Gilman Veith	463.8	28
ERL/GB	Robert Menzer	100.0	0
ERL/NARR	Norbert Jaworski	37.2	33

Ecology: Transport/Fate/Field Validation

Environmental Processes and Effects

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

Toxic Substances

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/ATH	Rosemarie Russo	893.7	100
ERL/GB	Robert Menzer	678.9	100
ERL/COR	Thomas Murphy	852.2	100

Exposure Monitoring

Modeling, Monitoring Systems and Quality Assurance

Research for exposure monitoring is dedicated to development, testing, and standardizing monitoring methods to estimate total human exposure and population exposures. Human activity patterns are studied to improve estimates of exposure. 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	1,294.9	45
AREAL/RTP	Dale Pahl	580.1	20
OMMSQA/HQ	Laurie Schuda	249.2	

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	4,067.3	37
OHR/HQ	David Kleffman		

Toxic Substances

Modeling, Monitoring Systems and Quality Assurance

Health: Markers, Dosimetry, and Extrapolation

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.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
EMSL/LV	Stephen Hern	332.0	30
OMMSQA/HQ	Laurie Schuda	39.7	

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	Elaine Grose	1,461.0	23
OHR/HQ	David Kleffman		

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

Toxic Substances

bases on plant uptake, fate of organic chemicals, toxicity to fish and reactivity of chemicals (e.g., photolytic, electrophilic, nucleophilic). Integrated into this research is data on transport and transformation of both organic and inorganic substances in freshwater and multimedia environments and application of SAR to predict effects of new chemicals on biota. The latter includes determination of and predictions on toxic mechanisms and microbial transformation and metabolism. Expert systems are being applied to the SAR approach. Computer based predictive programs are in use in regulatory evaluations.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/ATH	Rosemarie Russo	375.9	100
ERL/DUL	Gilman Veith	576.2	58

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 the Toxic Substances Control Act (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	777.7	56
OHR/HQ	David Kleffman		

Emergency Planning and Community Right to Know

Scientific Assessment

In support of the 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

Toxic Substances

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

Emergency Planning and Community Right to Know

Modeling, Monitoring Systems and Quality Assurance

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

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
EMSL/CIN	John Winter	323.8	20
OMMSQA/HQ	Laurie Schuda	44.6	

Emergency Planning and Community Right to Know

Environmental Engineering and Technology Demonstration

In support of SARA Title III, Section 313, research, in cooperation with industrial trade associations, is being conducted that will improve the accuracy of release estimations for the Toxic Release Inventory (TRI) reporting. Current work is concentrating on the difficult-to-estimate releases from welding processes and electroplating and surface finishing industries.

Laboratory	Contact	Total Funds (\$K)	Percent In-House
RREL/CIN	Roger Wilmoth	174	10
OEETD/HQ	Marshall Dick		

Toxic Substances

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, PMN review, and test guidelines and test rules development).

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
OHEA/HQ	Hugh McKinnon	178.2	100.0

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 standardization procedures and guidelines for program office field studies.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
EMSL/CIN	John Winter	345.1	20
EMSL/LV	Stephen Hern	273.6	35
OMMSQA/HQ	Laurie Schuda	86.6	

Engineering

Environmental Engineering and Technology Demonstration

This program supports the Office of Toxic Substances (OTS) in its implementation of the TSCA, Asbestos Hazard Emergency Response Act (AHERA), and Title III of SARA. The program focuses on the development of predictive capabilities to be used in assessing release and exposure levels for the review of PMNs for new chemicals, and the techniques and

Toxic Substances

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 operations area has focused on drying and filtration equipment, with attention to the mechanistic relationships to toxic particulates and their control. 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.

As the program matures, increased interaction is available in "pollution prevention" contexts, where data from Toxic Release Inventory (TRI) estimates can be integrated with control strategies to reduce pollutant generation and worker exposure.

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. Current efforts are stressing evaluations of maintenance practices for vinyl asbestos tile floors.

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

Toxic Substances

broader area of controlling all harmful respirable and durable fibers.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
RREL/CIN	Roger Wilmoth	1,375.0	25
OEETD/HQ	Marshall Dick	108	75

Test Method Development

Modeling, Monitoring Systems and Quality Assurance

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	30.0	

Test Method Development

Environmental Processes and Effects

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.

Toxic Substances

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/DUL	Gilman Veith	164.8	100
ERL/GB	Robert Menzer	214.2	100
OEPR/HQ	Steve Cordle	583.5	66

Test Method Development

Health Effects

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

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
HERL/RTP	Elaine Grose	1842.6	53
OHR/HQ	David Kleffman		

Asbestos

Modeling, Monitoring Systems and Quality Assurance

Research is being conducted to develop and evaluate monitoring procedures to determine human and environmental exposure to asbestos, refractory ceramic fibers (RCFs), and other asbestos substitute fibers in selected microenvironments.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AREAL/RTP	Dale Pahl	507.3	10
OMMSQA/HQ	Laurie Schuda	80.7	

Pesticides

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 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	543.4	46
ERL/DUL	Gilman Veith	358.9	28
ERL/GB	Robert Menzer	1,170.6	53

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*. Research will also focus on the effects of genetically engineered pesticides on mammalian organisms.

Pesticides

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.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
HERL/RTP OHR/HQ	Elaine Grose David Kleffman	578.8	50

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	198.6	100

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

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 supports the management of the operation of the Pesticide Repository which supplies pesticide compounds and metabolites. Federal and State laboratories use these samples as standard reference for internal quality control. Research is conducted to develop procedures to ensure quality control in environmental monitoring studies and analysis of samples for pesticide residues. Efforts will

Pesticides

be continued in FY92 to assess the merits of privatizing the Pesticide Repository.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
EMSL/CIN	John Winter	287.5	0
OMMSQA/HQ	Laurie Schuda	27.2	

Ecology: Ecotoxicity and Risk Assessment

Environmental Processes and Effects

To register or re-register pesticides it is necessary to develop a focused risk assessment process for integrating hazard and exposure assessments 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.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/ATH	Rosemarie Russo	394.7	0
ERL/COR	Thomas Murphy	766.7	9
ERL/DUL	Gilman Veith	429.0	29
ERL/GB	Robert Menzer	360.0	0
ERL/NARR	Norbert Jaworski	45.0	0

Pesticides

Environmental Processes and Effects

Ecology: Transport/Fate/Field Validation

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

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/ATH	Rosemarie Russo	694.4	55
ERL/COR	Thomas Murphy	589.6	32
ERL/DUL	Gilman Veith	496.7	62
ERL/GB	Robert Menzer	1,007.2	81
OEPER/HQ	Steve Cordle	582.4	66

Pesticides

Environmental Engineering and Technology Demonstration

Engineering

This program, which supports the Office of Pesticide Programs (OPP), previously consisted of two major areas: protective clothing and disposal technology. The protective clothing research is concluding and 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 has been 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. OEETD's intent in this area is to provide technology to minimize both worker exposure and pesticide/herbicide disposal to the environment by enhancing handling, transfer, rinsing, and treatment protocols to reduce accidental loss of the chemical.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
RREL/CIN	Glenn Shaul	265.9	60
OEETD/HQ	Marshall Dick	10.0	75

Modeling, Monitoring Systems and Quality Assurance

Exposure Monitoring

A coordinated research program is underway to develop and evaluate methods to determine the residues, fate and transport of pesticides in the residential environment, and the potential levels of human exposure associated with their use. A primary focus is validating methods for assessing exposure of infants and small children to household pesticides, including lawn care pesticides, both inside residences (via track-in to carpets and other indoor surfaces) and in yards and gardens. Factors to be investigated include the

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transfer of chemicals from surfaces to skin, bioavailability of chemicals, and human activity patterns.

Research is also being conducted to develop and conduct field validations of cost-effective and rapid pesticide-specific immunochemical methods such as immunoassays, and immunoaffinity Personal Exposure Monitoring (PEM) devices for measuring pesticide residues.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AREAL/RTP	Dale Pahl	622.6	5
EMSL/LV	Stephen Hern	592.4	15
OMMSQA/HQ	Laurie Schuda	148.7	

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	842.1	66
OHR/HQ	David Kleffman		

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

Pesticides

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 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, provide sensitive, rapid and inexpensive evaluation techniques, and provide testing protocols that may be recommended to industry for testing their products to comply with FIFRA requirements.

Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/GB	Robert Menzer	359.4	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	Elaine Grose	2,895.0	46
OHR/HQ	David Kleffman		

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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 aged 2 months and over will be randomly selected from households, interviewed and invited to participate in medical examinations at mobile examination centers. Approximately 30,000 individuals will undergo the medical examination, which includes a physical examination and diagnostic and biochemical testing. The sample is a statistically representative sample of Americans with oversampling of the very young, the elderly, Blacks and Hispanics.

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

Research and public health goals include the following: (1) estimating the prevalence of disease and risk factors, (2) estimating the incidence of certain diseases, (3) estimating the prevalence of functional impairment, (4) providing population reference distributions of health characteristics including growth and development, (5) monitoring secular changes in diseases and risk factors, and (6) identifying new risk factors for disease and reasons for secular trends in health. EPA and other Federal agencies have collaborated with NCHS in previous NHANES studies and in NHANES-III.

EPA has participated in the planning of NHANES-III and has funded two specific research areas; neurotoxic disorders and pulmonary function.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
HERL/RTP OHR/HQ	Susan Perlin	565	12

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

Health Effects

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

Office or Laboratory	Contact	Total Funds (\$K)	Present In-House
HERL/RTP	John Vandenberg	6320.6	5
OHR/HQ	Tom Miller		

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

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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. Areas in which research proposals will be requested in FY 1992 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 Universities (HBCU) and members of the Hispanic Association of Colleges and Universities (HACU) 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	22,741	0

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 will begin operations in FY

Exploratory Research

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1992. Seven of the eight original centers will be terminated in FY 1992 while the remaining one at Louisiana State University will be terminated in FY 1993. The eight original centers are:

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	4,498	0

Pollution Prevention

Environmental Engineering and Technology Demonstration

The core research program for pollution prevention focuses on development of information sources, educational development and training; integration of pollution prevention into permit writing and enforcement settlements; development of pollution prevention strategies for small and medium scale community

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planning; development of pollution prevention implementation strategies for the industrial and municipal sectors; and on identifying opportunities for pollution prevention in the agriculture sector. Comparative risk assessments are being conducted on several consumer products from design through disposal.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
OEETD/HQ	G. Ondich	1,200	0
RREL/CIN	H. Freeman	700	0
AEERL/RTP	E. Shaver	1,400	0
OPPE/HQ	D. Allen	294	0

Environmental Engineering and Technology Demonstration

Socioeconomic Research

The socioeconomic research program is being implemented to augment the traditional command and control approach to environmental problems. Rather than depending on regulatory programs, the socioeconomic approach utilizes information and communication methods. For many of the recently identified environmental problems (radon, global climate change, non-point sources, etc.), a socioeconomic approach to a solution is much more likely to succeed than a regulatory approach. In some cases, a regulatory approach is just not feasible. Socioeconomic research under this program will be conducted in the following broad areas: risk communication, incentives and disincentives, technical information dissemination, commercialization and utilization, and education and training.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
OPPE/HQ	D. Allen	542	0

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Modeling, Monitoring Systems and Quality Assurance

and

Health Effects

Total Human Exposure

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

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

Initially, this program will stress five major areas: (1) measurement methods development for personal monitoring and microenvironmental characterization, (2) chemical characterization of representative microenvironments (air, food, soil, water), (3) documentation of human activity patterns, (4) development and validation of predictive exposure models, and (5) direct measurement of exposure to validate models. In addition, work will be initiated to develop and implement a pilot monitoring project leading to a nationwide status and trends program.

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Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AREAL/RTP	Gerald Akland	2,485.4	24.0
EMSL/LV	Gareth Pearson	1,018.1	14.0
EMSL/CIN	Al Dufour/ Maurice Berry	431.2	2.3
OMMSQA/HQ	Chris Saint	316.8	21.5
OHR/HQ	Tom Miller	2,000.0	0

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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 and children's respiratory health across a wide gradient of particulate, acid, and sulfur oxide exposures in several Chinese cities. Research is also continuing 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	180.0	0
ERL/ADA	Bert Bledsoe	20.0	0
ERL/ATH	Rosemarie Russo	90.0	0
ERL/DUL	Nelson Thomas	25.0	0
HERL/RTP	Robert Chapman	196.7	0
OEPER/HQ	Chieh Wu	6.8	0
ERL/NARR	Norbert Jaworski	25.1	0

Health Effects

Harvard Study

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	David Kleffman	250	0

Risk Assessment Forum

Consistent Risk Assessment

Risk Assessment Forum—The 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 assess-

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ment guidance. The Forum undertakes projects designed to resolve difficult issues raised (and incompletely resolved) during guideline development. Activities include sponsorship of workshops, colloquia, and other meetings to discuss controversial risk assessment issues.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
AA/ORD Forum	Dorothy Patton	701.8	80.4

Lead Abatement

Scientific Assessment

Lead continues to be one of the most serious public health problems in the U.S. In response to this problem, the Agency will: 1) take regulatory actions to set/revise lead standards to adequately protect public health, 2) carry out effective enforcement/abatement activities to reduce exposure from lead-based paint, soil, water, air, and other relevant media, and 3) identify ways to reduce commercial uses of lead and disposal of lead-contaminated wastes. Multi-media research will be conducted to support regulatory, enforcement, and abatement efforts across all EPA program offices. Research will be conducted in: direct abatement support, exposure analysis/measurement, health implications, and technology transfer.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ECAO/RTP	Lester Grant	2,405.2	7.5

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 program is working closely with the regions to set priorities within and among these specific areas. Based on comprehensive review of regional needs, a work plan has been developed and has initiated research in

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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.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
OMMSQA/HQ	Jack Puzak Chris Saint	597.1	0
AREAL/RTP	Robert Lee	345.0	0
EMSL/CIN	William Budde	296.0	0
EMSL/LV	Llewellyn Williams	245.0	0

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 is conducted in cooperation with EPA's Environmental Monitoring and Assessment 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 and second years of field research from the prototype region will seek correlations among indicators that could identify possible causes of poor condition and will report the condition 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

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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	2,750.0	0
OMMSQA/HQ	Chris Saint		

Ecological Status and Trends

Modeling, Monitoring Systems and Quality Assurance

and

Environmental Processes and Effects

The Environmental Monitoring and Assessment Program (EMAP) is collecting, analyzing, and integrating environmental monitoring data from seven ecosystem types found in the U.S.: Near-coastal environments, forests, wetlands, surface waters, agroecosystems, arid lands, and the Great Lakes.

This information will allow EPA to better assess the status and extent of current environmental problems, by providing associations between human-induced stress and ecological condition. EMAP is also establishing baseline conditions against which future change can be measured, and assessing the degree to which regulatory programs protect the nation's ecological resources. EMAP is focusing 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 limited resources where they will be most beneficial.

Scientifically, EMAP will: (1) identify, characterize, classify, and quantify the ecological resources at risk, (2) provide a probability-based statistical sampling frame which provides unbiased estimates of environmental conditions on a regional basis, (3) identify, evaluate, and develop indicators of 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.

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Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
EMSL/CIN	Bob Graves	554.3	29.8
ERL/COR	Hal Kibby	6130.2	6.7
ERL/DUL	Steve Hedtke	888.3	9.3
ERL/GB	Kevin Sommers	3571.6	2.3
EMSL/LV	Bruce Jones	9,245.6	6.3
ERL/NARR	John Paul	1,068.2	15.5
OEPER/HQ	Courtney Riordon	388.2	0
OMMSQA/HQ	Rick Kutz	5,371.1	13.9
AREAL/RTP	Jim Vickery	3,248.1	7.6

Visiting Scientists Program

Exploratory Research

The Visiting Scientists Program has two components: The Resident Research Associateships Program (RRAP) which is carried out in cooperation with the National Research Council (NRC) and the Summer Fellows Program (SFP) which is conducted in cooperation with the American Association for the Advancement of Science (AAAS). The objective of the RRAP is to attract researchers into EPA's research laboratories to assist in strengthening the Agency's science policy and 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.

The Summer Fellows Program is carried out in cooperation with the American Association for the Advancement of Science and sponsors the assignment of mid-career environmental science and engineering fellows to EPA facilities for the summer months to conduct environmental research projects. In FY 1991, 10 highly qualified fellows were sponsored.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
OER/HQ	Roger Cortesi	184.2	0

Multimedia

Exploratory Research

Small Business Innovation Research (SBIR) Program

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

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
OER/HQ	Donald Carey	2,500	0

Environmental Processes and Effects

Arctic Studies

EPA's Arctic research program will focus research on the nature, extent, and effects of exposure of Arctic ecosystems on a regional scale to atmospheric contaminants. This effort will include analyses of the atmospheric pathways for long-distance transport and deposition, biogeochemical pathways at representative depositional sites, and intermediate and ultimate sinks for these contaminants. Effects research on representative species of major ecosystems will be undertaken to establish what risks there might be to species, including humans. Landscape and regional ecosystem sensitivity studies will follow the species risk studies. These studies will culminate in an assessment of risk in terms of character, magnitude, and timing of changes, to Arctic biological systems from atmospherically deposited contaminants. The program will implement a statistically balanced, spatial sampling

Multimedia

design, based on the strategies of the EPA Environmental Monitoring and Assessment Program (EMAP), for the circumarctic region. The resultant data and observational network will lead to conclusions about the nature and extent of Arctic pollution, and subsequently will be used to develop, define parameters, and test assessment models for mitigation and management design strategies.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ERL/COR	Dixon H. Landers	908.7	0
OEPER/HQ	Robert C. Worrest	51.7	0
	Paul Ringold		

Manage the Mandatory Quality Assurance Program

Modeling, Monitoring Systems and Quality Assurance

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

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

Quality assurance programs consist of specific activities conducted before, during and after environmental data collection. During the planning of an environmental data collection program, QA activities focus on assuring that the quality of the data needed by data users has been defined, and that a QC system has been designed for measuring the quality of the data being collected. During the implementation of a

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data collection effort, QA activities ensure that the QC system is operating and that problems found by QC are corrected. After environmental data are collected, QA activities focus on assessing the quality of the data obtained. Here, one determines whether the data obtained are adequate to support data-dependent regulatory decisions or research hypotheses.

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

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

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

In recent years, the Agency's QA activities have focused on identifying the basic elements that are essential to effective quality assurance for environmental data. QAMS has put considerable emphasis on issuing guidance defining these key elements and describing their importance in the efficient and effective expenditure of resources assigned to environmental data collection. This guidance development phase has now been completed, and in FY 1992 QAMS will continue with full-scale implementation support and oversight.

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Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
OMMSQA/HQ	Nancy Wentworth	1,681.3	51

Radiation

Modeling, Monitoring Systems and Quality Assurance

Off-Site Monitoring Program

The off-site radiation safety program is designed to monitor levels and trends of radioactivity in the environment surrounding nuclear weapons testing areas to verify testing conducted in compliance with existing radiation protection standards. In the event of any accidental release of radioactive contaminants, EMSL/LV has the responsibility to take action to protect the health and safety of the public. While the primary monitoring efforts are conducted in the off-site areas surrounding the Department of Energy's Nevada Test Site, former test sites in Alaska, Colorado, Mississippi, and New Mexico are monitored on a routine basis.

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	178	100
OMMSQA/HQ	Dwight Hlustick		

Environmental Engineering and Technology Demonstration

Scientific Support for Radon Program

The goals of the radon mitigation research program are to evaluate, develop, and demonstrate innovative approaches to reduce indoor radon levels and to understand the fundamental physical mechanisms that influence indoor radon levels. The research results are used to assist the Office of Radiation Programs (ORP) implementation of the Agency's radon program and to provide data on the latest radon mitigation approaches to regional and state officials and the general public.

Processes influencing radon entry are being studied to provide the scientific basis for developing new or improved (effective and economical) radon reduction methods. ORD is using the data on radon entry described above and other information to develop

Radiation

and demonstrate techniques which will cost effectively reduce indoor radon levels in new and existing homes, schools and other structures to outdoor ambient air levels (<1 pCi/L). This research supports the Agency's mandate under the Indoor Radon Abatement Act (IRAA) to reduce indoor radon levels to levels comparable to those outdoors. Specific research includes: bench and pilot scale testing to simulate the relative importance of aggregate and surrounding soil on the radon entry process; demonstrations to define the ability of Active Soil Depressurization (ASD) systems to consistently achieve levels < 1 pCi/L in homes, schools, and other structures; determining the durability and failure rate of currently applied mitigation systems; evaluating innovative mitigation system designs; demonstrating ASD and HVAC control systems as radon mitigation options for schools; and understanding the most significant factors that influence radon mitigation costs. Technology transfer products including updated technical manuals and brochures are being produced for selected audiences.

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
AEERL/RTP	Michael Osborne	2,773	32
OEETD/HQ	Marshall Dick	200	78

Electric and Magnetic Field Research (EMF)

The Electromagnetic Field (EMF) research program is focusing on major issues identified in the Agency's research strategy. Studies designed to verify the suggested association between EMF exposure and cancer are underway. The specific focus of these studies is to determine a plausible biological mechanism and conditions under which EMF promote or induce cancer. In addition, efforts are being designed to develop better exposure data and models to more accurately determine actual human exposures.

Environmental Engineering and Technology Demonstration

Radiation

Office or Laboratory	Contact	Total Funds(\$K)	Percent In-House
HERL/RTP OHR/HQ	Joe Elder Dave Kleffman	935.1	7

Superfund

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 volatile 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	555.2	41
AREAL/RTP	William Mitchell	364.0	13
EMSL/LV	Michael Hiatt	1,608.2	8
OMMSQA/HQ	Michael Dellarco	0	0

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

Environmental Engineering and Technology Demonstration

This research program develops and evaluates clean-up technology, demonstrating prototype 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

Superfund

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	27,150	10
OEETD/HQ	R. Nalesnik		

Provide Quality Assurance—Superfund Program Requirements

Modeling, Monitoring Systems and Quality Assurance

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 compliment the performance evaluations. Based on method performance data, existing analytical protocols are reviewed and improved. A quick re-

Superfund

sponse 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	962.8	17
EMSL/LV	Michael Hiatt	2,277.2	35
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.

Office or Laboratory	Total Contact	Percent Funds (\$K)	In-House
RSKERL/ADA	John Matthews	1,430.4	49.4
ERL/ATH	Rosemarie Russo	835.9	48.4
ERL/COR	Clarence Callahan	457.5	19.2
ERL/NARR	Norbert Jaworski	320.3	41.6
ERL/DUL	Nelson Thomas	47.7	0.0
ERL/GB	Raymond Wilhour	115.1	75.2

Superfund

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 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	406.9	33
AREAL/RTP	William Mitchell	560.6	39
EMSL/LV	Michael Hiatt	1553.8	44
OMMSQA/HQ	Michael Dellarco		

Provide Technical Support to Enforcement, Program, and Regional Offices

Scientific Assessment

Risk assessment support is being provided to support enforcement, program, and regional office needs for both the remedial planning and cost recovery efforts. Major efforts include review assessments submitted by regions; provision of risk assessment information, often on a quick turnaround, through a Technical Support Center for Health and Risk Assessment; development of guidance materials; and offering training courses.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
OHEA/HQ	Kevin Garrahan		
ECAO/CIN	Pei-Feng Hurst	997	71.3

Superfund

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 noncancer endpoints such as reproductive effects. Predictive techniques that can reduce the uncertainties in risk assessment caused by data limitations will be developed and site-specific data will be generated in response to requests from the Office of Emergency and Remedial Response, the Office of Waste Programs Enforcement and EPA Regional Offices.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
HERL/RTP OHR/HQ	Robert Dyer Thomas Miller	3,462	12

Hazardous Substances Health Effects/Risk Assessment and Detection Research

Scientific Assessment

The scientific assessment research program is developing data and procedures for filling in knowledge and information gaps that exist in the Superfund public health evaluation process. Specific areas of research include improved evaluation techniques for non-cancer health effects, research programs in pharmacokinetic modeling, understanding of biomarkers, understanding of complex mixtures, and

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development of improved exposure assessment methodology, especially as it relates to complex exposures.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
OHEA/HQ	Michael Callahan	1,972	8.6

Health Effects Assessments

Scientific Assessment

Health and environmental effects documents are being prepared for the chemicals most frequently found at candidate sites to assist OERR, the Enforcement office and the Regions in evaluating alternative cleanup decisions at uncontrolled waste sites.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
ECAO/CIN	Bruce Peirano	540	55.0

Superfund Reportable Quantity Regulatory Efforts

Scientific Assessment

Chemical-specific data are being provided on carcinogenicity and chronic effects to support establishment or adjustment of Reportable Quantities (RQs) for CERCLA Hazardous Substances. These include chemical-specific information for listing of hazardous wastes as CERCLA Hazardous Substances in association with Section 3001 of RCRA, consideration of other lists of chemicals to be CERCLA Hazardous Substances, designations of new substances, and updates to previous RQ calculations.

Office or Laboratory	Contact	Total Funds (\$K)	Percent In-House
OHEA/HQ	Bruce Peirano	728	24.5

Superfund

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 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.

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 McNabb	832.6	0
ERL/ATH	Rosemarie Russo	80.3	53.5
ERL/NARR	William G. Nelson	297.4	0
ERL/COR	Anne Fairbrother	200.0	0
ERL/DUL	Philip M. Cook	115.5	33.8

Field Screening Techniques for Assessment and Evaluation

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

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program is to develop and evaluate monitoring techniques and systems which are rapid and inexpensive, fill technical voids, 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	1,871.5	11
OMMSQA/HQ	Michael Dellarco		

Modeling, Monitoring Systems and Quality Assurance

Monitoring Technology, Development, and Demonstration

Section 311b of the Superfund Amendments and Reauthorization Act requires EPA to conduct the Superfund Innovative Technology Evaluation (SITE) program, which seeks to accelerate the application of promising new technologies to Superfund problems. Examples of technologies being studied and demonstrated include fiber optic 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	Michael Hiatt	689.4	16
OMMSQA/HQ	Michael Dellarco		

Superfund

Exploratory Research

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 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. At least 20% of the total center's resources must be provided by university, state, or private sources. In addition, each center is building additional federal and industrial support for their research and technology transfer programs. 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

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

Small Business Innovation Research (SBIR) Program—Superfund

Exploratory Research

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

Superfund

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

Superfund Research Grants

Exploratory Research

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	1,649.1	0

Evaluate Technologies to Manage Uncontrolled Waste Sites

Environmental Processes and Effects

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

To effect cleanup of hazardous chemicals in the environment, 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

Superfund

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	John T. Wilson	642.2	27.9
ERL/ATH	Rosemarie Russo	586.4	14.7
ERL/GB	Hap Pritchard	845.3	10.3

Overview

Introduction

The primary goal of the U.S. Environmental Protection Agency is to mitigate the adverse impacts of pollution on human health and the environment. Toward that end, Agency management must make decisions regarding the development of policy, guidance, standards, regulations, and the appropriate tools for implementing pollution abatement strategies. It is the primary mission of the Office of Research and Development (ORD) to provide high quality, timely scientific and technical information in the service of Agency goals. The Agency's research program is conducted through 12 environmental laboratories across the country, employing some 1900 people, with an annual budget of about \$490 million. The research focuses on areas targeted 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 ecological resources
- 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 and to develop indicators by which the status and trends of ecosystems can be identified
- Risk assessment research—to develop methods to integrate information on pollutant sources, fate and transport, exposure, and health and ecological effects in order to assess the overall risk posed by a pollutant or a group of pollutants
- Risk reduction research—to develop methods and technologies to reduce or eliminate the sources of pollutants or to prevent exposure to pollutants; to develop control technologies to treat, destroy, or contain pollutants

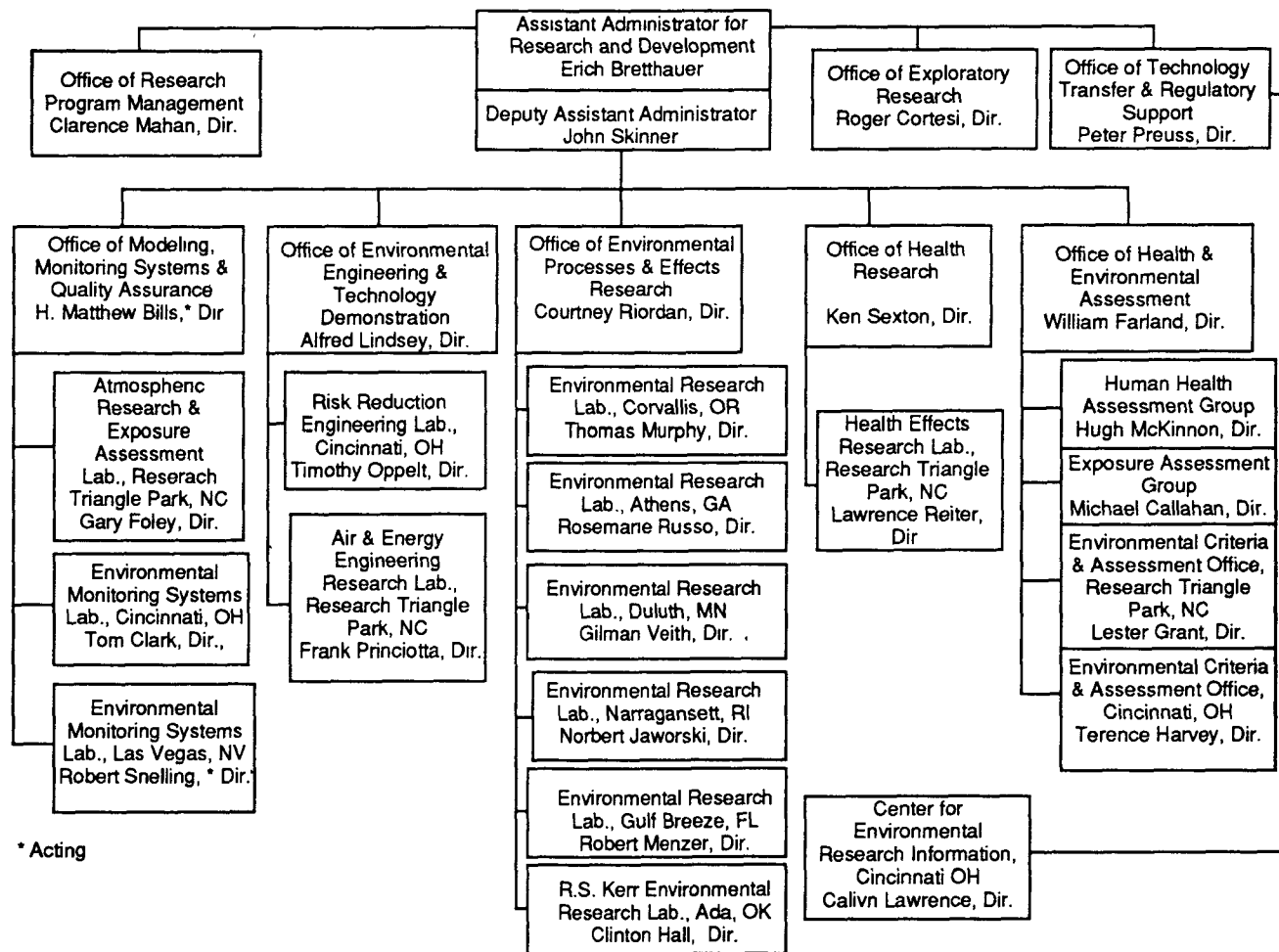
In addition to functional areas, several cross-media problems also categorize the total ORD program. Those cross-media problems receiving special emphasis at present and for the foreseeable future and the Agency programs most concerned are:

Overview

- 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. Increasingly, ORD plans new expanded research based on issues that pose the greatest risk to human health and the environment. 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.



ORD Organization

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

Assistant Administrator for Research and Development-

Erich Bretthauer (202) 260-7676
Headquarters, Washington, DC (RD-672)

Deputy Assistant Administrator

John H. Skinner (202) 260-7676
Headquarters, Washington, DC (RD-672)

Senior ORD Official, Cincinnati

Senior Official, Calvin O. Lawrence CML (513) 569-7951
Cincinnati, OH 45268 FTS 8-684-7951

Office of Senior ORD Official, Cincinnati

Director, Andrew Avel CML (513) 569-7951
Cincinnati, OH 45268 FTS 8-684-7951

Senior ORD Official, Research Triangle Park

Senior Official, Gary Foley CML (919) 541-2613
Research Triangle Park, NC 27711 FTS 8-629-2613

Office of Senior ORD Official, Research Triangle Park

Director, John J. Neal 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) 260-7669
Headquarters, Washington, DC (H-8105)
Deputy Director, Jay Benforado (202) 260-7669

Regulatory Support Staff
Director, Jay Benforado (202) 260-7669

Technology Transfer Staff
Director, Mike Moore (202) 260-7671

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

ORD Organization

Regional Operations Staff	
Director, David Klauder	(202) 260-7667
Regional Scientist Program Coordinator, Ron Landy	(202) 260-7667
Superfund Technical Liaison Program Coordinator Jerry R. Garman	(202) 260-7667

Office of Research Program Management

Director, Clarence E. Mahan	(202) 260-7500
Deputy Director, (Vacant)	
Headquarters, Washington, DC (RD-674)	

Evaluation and Review Staff	CML (202) 260-7659
Chief, Thomas L. Hadd	FTS 8-260-7659

Planning Staff	CML (202) 260-2597
Chief, Peter Durant	FTS 8-260-2597

Program and Information Management Staff	CML (202) 260-7462
Chief, Linda K. Smith	FTS 8-260-7462

Program Coordination Staff	CML (202) 260-7468
Chief, Joanne Rodman	FTS 8-260-7468

Information System Staff	CML (202) 260-7471
Chief, Clifford Moore	FTS 8-260-7471

Office of Environmental Engineering and Technology Demonstration

Director, Alfred Lindsey	(202) 260-2600
Deputy Director, Stephen Lingle	
Headquarters, Washington, DC (RD-681)	

Program Development Staff	
Director, Greg Ondich	(202) 260-5748

Program Management Staff	
Director, Al Galli	(202) 260-2583
Deputy Director, Steve Jackson	

ORD Organization

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) 260-5950
Deputy Director, Michael W. Slimak
Headquarters, Washington, DC (RD-682)

Program Operations Staff
Director, Patricia M. Neuschatz (202) 260-5962

Terrestrial and Ground Water Effects Staff
Director, Jackie Durham (202) 260-8930

Marine, Freshwater and Modeling Staff
Director, (Vacant) (202) 260-5791

Field Laboratories

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

Environmental Research Laboratory
Director, Rosemarie C. Russo CML (404) 546-3500
Director for Research Operations, FTS 8-250-3500
Robert R. Swank
College Station Road
Athens, GA 30613

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ORD Organizational Descriptions

Office of Technology Transfer and Regulatory Support

The Office of Technology Transfer and Regulatory Support (OTTRS) is responsible for 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 Research Program Management

The Office of Research Program Management (ORPM) is a principal staff office to the Assistant Administrator. In this role, ORPM provides executive leadership and guidance on matters of budgeting, accountability, program planning, analysis, review, integration and coordination, resource management, organizational and manpower management, environmental compliance, policy development and analysis, and administrative development and management services. ORPM is responsible for the overall budget execution and financial management of all ORD resources. ORPM is also responsible for assuring that the budget requests to the Agency, OMB, and Congress respond to the regulatory and programmatic needs of EPA, while at the same time anticipating future environmental research necessary to address emerging issues. ORPM also has national responsibility for human resource management (HRM) programs within ORD, with the ORD Comprehensive Human

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Resource Management Plan providing the basis for these programs.

Office of Environmental Engineering and Technology Demonstration

The Office of Environmental Engineering and Technology Demonstration (OEETD) 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

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Underground Storage Tanks (OUST) to develop procedures for detecting and preventing leaks from storage tanks and associated piping. 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

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provide design and operating guidelines for efficient wastewater management based on the principles of 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, SO₂ and NO_x, 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 Environmental Processes and Effects Research

The Office of Environmental Processes and Effects Research (OEPER) 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 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 (RSKERL) 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-

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water quality, and evaluation of the applicability and limitations of using natural soil and subsurface processes for the treatment of hazardous wastes. Subsurface transport and fate information is incorporated into mathematical models for use in predicting the transport and fate of contaminants in the subsurface. Efforts to support the immediate needs and activities of EPA's operating programs are focused on the Underground Injection Control Program, the Wellhead Protection Program and the Hazardous Waste and Superfund Programs. RSKERL's Technology Support Program provides decision-makers with a source of information on subsurface fate and transport of contaminants and *in situ* remediation technologies, as well as the associated expert assistance required to effectively use this information.

The Environmental Research Laboratory in Athens, Georgia, conducts and manages fundamental and applied research, and provides technical assistance/technology transfer, required by the Agency to predict the transformation, speciation, and transport of pollutants across and within the air-water-soil-media. This research is the foundation for the development of risk-based methodologies (1) to assess the potential ecological and human exposures and risks associated with conventional and toxic pollutants in the water-sediment of aquatic/marine ecosystems and in soil ecosystems, (2) to quantify the interactions of soil ecosystems with and responses to global climate change, and (3) to design and evaluate strategies for soil-related remediation/risk reduction techniques, such as nonpoint source control and contaminated soil cleanup.

This research identifies and characterizes the natural biological and chemical processes that determine the environmental fate and effects of specific toxic substances, such as pesticides or metals. The results are applied in state-of-the-art computer models for assessing and managing environmental pollution problems. Emphasized research areas in FY92 are radiatively important trace (greenhouse) gas emissions from temperate and tropical terrestrial/soil systems in response to global climate change, ecological risk assessment, sediment quality evaluation, artificial intelligence-expert systems for predicting chemical

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reactivity, bioremediation, hazardous waste site evaluation, 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 assessment related to remedial actions at Superfund sites, for corrective actions at RCRA facilities and for ecological exposure and risk assessment support for pesticides, toxics, and general water quality management.

The Environmental Research Laboratory in Corvallis, Oregon, conducts research on terrestrial and watershed ecology and assesses the comprehensive ecological impact of inland pollution and other environmental changes caused by man. This includes the ecological effects of airborne pollutants, such as acid deposition; the ecological effects of global climate 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. Studies of exotic species, integration of research data into EMAP, and non-point pollution also will be of high priority.

ERL-Duluth continues to conduct its research in surface freshwater systems, both flowing and lakes,

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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 a National Marine Water Quality Research Laboratory which has been given expanded roles in sediment quality and monitoring. 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 respond mainly to legislative requirements of the Clean Water Act, the Marine Protection Act, 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

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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 related to the near-coastal marine environment 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 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,

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(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), and (8) development and evaluation of procedures and chemical and biological products for remediating spilled oil at sea or in coastal environments.

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 descriptions of these programs are provided elsewhere in this research guide. In addition to the core programs, OER administers other programs which are 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.)

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- 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 Experimental Program to Stimulate Competent Research (EPSCoR) which attempts to stimulate better research and researchers in those states that have traditionally lacked a strong university-based research effort and have, therefore, been relatively unsuccessful at garnering federal research support.

Office of Health and Environmental Assessment

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

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

The Office includes four organizational groups:

The Human Health Assessment Group provides state-of-the-art methodology, guidance, and procedures on the health risks associated with suspected cancer-causing agents and the risks associated with chemicals that are suspected of causing detrimental reproductive effects, including mutagenic, teratogenic, and other adverse reproductive outcomes and reduced fertility;

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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.

Office of Health Research

The Office of Health Research (OHR) 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

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responsive to these goals. Physical, biological and chemical agents are studied; and research is conducted in the scientific disciplines of pulmonary toxicology, genetic toxicology, neurotoxicology, developmental and reproductive toxicology, and epidemiology and biometry. Research to improve the quality of health risk assessment is being conducted through the development of pharmacokinetic and biologically based models. These models are being developed to more accurately predict the relationship between environmental concentration, target tissue dose and ultimate health effect.

Office of 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 develops programs related to: (a) monitoring of pollutants in the environment, (b) developing sampling strategies and techniques for monitoring hazardous waste leaches 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

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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) conducting research in the development, evaluation, and standardization of chemical and biological methods for environmental assessments, (b) conducting research for detecting, identifying and quantifying microbial pathogens found in environmental media, (c) providing technical assistance to the program office and regions for conducting bioassessments of aquatic systems, (d) providing 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.

ORD Office/Laboratory

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OHEA/HQ	Office of Health and Environmental Assessment (RD-689) Washington, DC 20460 (202) 260-7315
OHR/HQ	Office of Health Research (RD-683) Washington, DC 20460 (202) 260-5900
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