FINAL PERFORMANCE REPORT

Universities Occupational Safety and Health Educational Resource Center

Philip J. Landrigan, MD
Director
Mt. Sinai School of Medicine
New York, NY 10029

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UNIVERSITIES OCCUPATIONAL SAFETY AND HEALTH EDUCATIONAL RESOURCE CENTER

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Abstract

This five year report describes the activities of Universities Occupational Safety and Health Educational Resource Center (UOSHERC), or Region II (New York/New Jersey) Educational Resource Center, from July 1, 1992 through June 30, 1997. During these five years, the constituent programs of the Region II NIOSH ERC have trained a large cadre of occupational safety and health professionals. UOSHERC serves the New York/New Jersey area with a metropolitan population of 18 million people and combined statewide populations of approximately 25 million people.

At present, UOSHERC is a consortium of five institutions offering seven programs in occupational safety and health at five campus locations.

- Mt. Sinai School of Medicine - Center Administration
- Mt. Sinai School of Medicine - Occupational Medicine
- Robert Wood Johnson Medical School - Occupational Medicine
- University of Medicine & Dentistry of New Jersey School of Nursing/Robert Wood Johnson Medical School - Occupational Health Nursing
- New Jersey Institute of Technology - Occupational Safety & Health Engineering
- Hunter College - Industrial Hygiene and Hazardous Substance Training Program
- Robert Wood Johnson Medical School - Continuing Education
- New York University Medical School - Occupational Hygiene

During the 1992-1997 period, New York University sponsored a training program in occupational hygiene as part of UOSHERC. NIOSH has discontinued this link for the future. As a way of documenting the needs in the field, we issued a major report to NIOSH in 1996 entitled Costs of Occupational Injuries and Illnesses in the United States, 1992 (*Archives in Internal Medicine*. 157:1557-1568, 1997). In 1997, we proposed a new program, *Occupational Health Risk Communication*, which was approved by NIOSH but not funded..

Significant findings

This five year report describes the activities of Universities Occupational Safety and Health Educational Resource Center (UOSHERC), or Region II (New York/New Jersey) Educational Resource Center, from July 1, 1992 through June 30, 1997. UOSHERC has been continuously funded by NIOSH to conduct professional training in occupational health and safety since 1978.

At present, UOSHERC is a consortium of five institutions offering seven programs in occupational safety and health at five campus locations, including:

- Mt. Sinai School of Medicine - Center Administration
- Mt. Sinai School of Medicine - Occupational Medicine
- Robert Wood Johnson Medical School - Occupational Medicine
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- Robert Wood Johnson Medical School - Continuing Education

During the 1992-1997 period, New York University sponsored a training program in occupational hygiene as part of UOSHERC. NIOSH has discontinued this link for the future. Also, during this past five year period, occupational health nursing was re-instituted within the ERC at a new institution, the UMDNJ/Robert Wood Johnson Medical School. (Previously, Hunter College had a training program occupational health nursing at in the 1980's). In 1997, as part of our competitive renewal application, a new program in occupational safety and health training, *Occupational Health Risk Communication*, was approved but not funded by NIOSH.

As a means of documenting the needs in the field, we issued a major report to NIOSH in 1996 entitled Costs of Occupational Injuries and Illnesses in the United States, 1992 (*Archives in Internal Medicine.* 157:1557-1568, 1997).

UOSHERC hosts an annual scientific conference, a biannual trainee research exchange day, and an External Advisory Board.

Graduates of UOSHERC continue to make significant impact at local, regional, and national levels in occupational safety and health. UOSHERC has an excellent record on training minorities in occupational safety and health. Most of the constituent UOSHERC programs have between 25% and 35% minority graduates in the past five years.

Report

This five year report describes the activities of Universities Occupational Safety and Health Educational Resource Center (UOSHERC), or Region II (New York/New Jersey) Educational Resource Center, from July 1, 1992 through June 30, 1997. UOSHERC has been continuously funded by NIOSH to conduct professional training in occupational health and safety since 1978. During these five years, the constituent programs of the Region II NIOSH ERC have trained a large cadre of occupational safety and health professionals. UOSHERC serves the New York/New Jersey area with a metropolitan population of 18,000,000 people and combined statewide populations of approximately 25,000,000 people.

At present, UOSHERC is a consortium of five institutions offering seven programs in occupational safety and health at five campus locations. These figures do not include the New York University Occupational Hygiene Training Program, which is no longer funded through the UOSHERC, beginning July 1, 1997. However, in this report, we will include NYU's training program, since they trained PhD level industrial hygienists for the five year period encompassed in this report.

The following institutions are involved with UOSHERC:

- Mt. Sinai School of Medicine - Center Administration
- Mt. Sinai School of Medicine - Occupational Medicine
- Robert Wood Johnson Medical School - Occupational Medicine
- University of Medicine & Dentistry of New Jersey School of Nursing/Robert Wood Johnson Medical School - Occupational Health Nursing
- New Jersey Institute of Technology - Occupational Safety & Health Engineering
- Hunter College - Industrial Hygiene and Hazardous Substance Training Program
- Robert Wood Johnson Medical School - Continuing Education

The record of UOSHERC during the current grant period, 1992-1997, was marked by growth and consolidation. We retained the original components of the ERC, including Mt. Sinai (occupational medicine and center administration) NYU and Hunter (industrial hygiene) and Robert Wood Johnson (continuing education). The NJIT occupational safety engineering training program and the Robert Wood Johnson occupational medicine training program were added to the ERC in the late 1980's. During this past five year period, occupational health nursing was re-instituted within the ERC at a new institution, the UMDNJ. (Previously, Hunter College had a training program in occupational health nursing in the 1980's). UOSHERC currently trains all four core areas of occupational safety and health training, as traditionally defined by NIOSH.

Although well-established, UOSHERC continues to evolve in order to meet the regional and national needs in occupational health and safety. As a way of documenting the needs in the field, we issued a major report to NIOSH in 1996 entitled Costs of Occupational Injuries and Illnesses in the United States, 1992. This has recently been published in a peer-reviewed article in the *Archives in Internal Medicine*. 157:1557-1568, 1997. In 1997, as part of our competitive renewal application, we proposed, to add two new programs in occupational safety and health training. One program, *Occupational Health Risk Communication*, was approved but not funded. The second program, *Labor Studies: Occupational Health and Safety*, was not approved. Thus, we continue to develop new ways of meeting needs in the field, even as the funding environment makes fulfillment of those needs difficult.

Administrative Structure

UOSHERC is administered by a core staff at Mt. Sinai School of Medicine in conjunction with the ERC Management Committee. Phil Landrigan, MD serves as the Center Director, as he has since 1985. Steven Markowitz, MD, serves as Deputy Director of the ERC, having held this position since 1988. Angela Lam continues to be the business manager, and Katherine Gleaton is the administrative assistant in UOSHERC.

The program management committee consists of the program directors from each of the constituent occupational safety and health programs and meets a minimum of twice per year. These individuals include, in addition to Phil Landrigan and Steve Markowitz, Morton Lippmann (NYU), Beverly Cohen (NYU), David Kotelchuck (Hunter), Audrey Gotsch (Robert Wood Johnson Medical School), Michael Gotchfeld (Robert Wood Johnson Medical School), Gail Buckler (UMDNJ School of Nursing/Robert Wood Johnson Medical School), and Howard Gage (NJIT). Dr. Gage has recently been replaced by Dr. One-Jang Jeng as Director of the Occupational Safety Program.

Activities of the program management committee have consisted of self-review of programs, hosting the annual scientific conference, soliciting advice from the ERC External Advisory Committee and hosting a research training exchange day.

In 1992, UOSHERC formed the Regional Occupational Safety and Health Forum, a group of occupational safety and health professionals from labor, academia, industry, and government in New York and in New Jersey. This group was initiated in order to discuss important current problems in the field and to formulate solutions that could achieve a broad consensus among the parties involved in occupational safety and health. Between 1992 and 1994, the Forum held bi-annual meetings attended by 40-60 people at each meeting. The group also authored the document in 1993 entitled Enhancing the Infrastructure to Safeguard the Health of America Workforce. This document was sent to the National Health Care Task Force and is attached as Appendix A. Site visitors from NIOSH hailed the Forum as an innovative means of interacting with the constituencies of the health and safety training programs.

This group was disbanded in 1994 as a result of the disappearance of national discussion about occupational safety and health policy. A more traditional External Advisory Board has been re-constituted and currently meets twice per year.

New Program Developments

In the 1992-1997 period, occupational health nursing was added to UOSHERC as a training program, sponsored by the UMDNJ School of Nursing and Robert Wood Johnson Medical School. Our attempts to add two additional programs in 1997 failed, though the *Occupational Health Risk Communication* program was approved by NIOSH without funding. We will continue to work to achieve funding for this invaluable training program. The NIOSH decided in 1996 that the NYU occupational hygiene training program, though very worthwhile, was not sufficiently integrated into UOSHERC to be included. Hence, NYU will continue to conduct this training separate for UOSHERC. Attempts will be made in the future to ensure their integration within UOSHERC and, hopefully, they will be able to formally re-join the ERC.

Interdisciplinary Interaction

The interaction of trainees and faculty within UOSHERC is extensive and arises from the real need for the individual training programs to provide a comprehensive occupational safety and health education. The interdisciplinary interaction is extensively documented in the UOSHERC competitive renewal grant application to NIOSH for 1997-2002 (pages 82-86). The most specific activities include the annual scientific conference and the research trainee exchange day.

Annual Scientific Conference

The Annual Scientific Conference sponsored by UOSHERC is an ongoing forum for interaction among the ERC trainees. The 1997 conference was entitled "Health and Safety Hazards and Abatement in the Construction Industry. In Appendix B, the list of five conferences held during 1992-1997 period is provided. All ERC trainees attend the scientific conference. To the extent possible, we invite trainees and former trainees as presenters at these scientific conferences.

Trainee Research Exchange Day

For the past five years, we have conducted a biannual research exchange day. At this event, which is rotated among the ERC campuses, trainees from the constituent trainee programs present their research projects. The audience is limited to trainees and selected faculty to encourage discussion and interaction. In 1996, we conducted this meeting via telecommunication with locations in Manhattan and Sterling Forest, NY.

Program Impact

Graduates of UOSHERC have made significant impact at local, regional, and national levels in occupational safety and health. The NYU occupational hygiene program is one of the few training programs for doctoral levels in industrial hygiene/toxicologists in United States and has consistently produced high quality graduates who work in academia, government, and private industry. Hunter College produces practice-oriented industrial hygienists and is a national leader in producing minority graduates in the field. . The occupational health nursing program at UMDNJ and the occupational safety engineering at NJIT are beginning to meet industry's need for such trained safety professionals.

The two occupational medicine programs, at Mt. Sinai Medical Center and at Robert Wood Johnson Medical School, graduate specialty physicians who work mostly in the regional area in a variety of settings. Of note is that the New York State Occupational Health Clinical Network, which consists of 8 clinical centers throughout New York State, is dominated by physicians who graduated from the Mt. Sinai occupational medicine residency training program. Three of the medical directors of these occupational health clinics are Mt. Sinai graduates. Three of the four academic occupational medicine programs in the New York/New Jersey metropolitan area are headed by Mt. Sinai graduates. Three Mt. Sinai graduates are recipients of the NIEHS Academic Award

UOSHERC is proud of its record on training minorities in occupational safety and health. Of the five trainees at NYU in 1997, two are African-American and one is Asian-American. A total of 43% of the 14 occupational hygiene trainees at NYU during the past five years were African American or Asian American. In the occupational health nursing program, 25% of trainees in the last two years are of minority background (African-American or Hispanic). Over one-third of the trainees at Hunter in industrial hygiene are persons of color. In occupational medicine, Mt. Sinai has produced three minority specialty physicians of the 12 graduates during the current 5 year period.

Future Plans

UOSHERC is now working diligently to improve two aspects of the consortium: interdisciplinary interaction and introductions of new program. We are developing new mechanisms for interdisciplinary interaction, including joint courses and joint research. We support the currently approved but unfunded Occupational Health Risk Communication program based in Robert Wood Johnson Medical School and hope that NIOSH is able to find funding for this program in the 1998-1999 trainee period. In addition, we will continue to work with the NYU occupational hygiene training program in the hopes of having it re-join UOSHERC in the next ERC competitive renewal period.

CENTER ADMINISTRATION

MOUNT SINAI MEDICAL CENTER

APPENDIX A

Enhancing the Infrastructure to Safeguard the Health of America's Workforce

ENHANCING THE INFRASTRUCTURE TO SAFEGUARD THE HEALTH OF AMERICA'S WORKFORCE

A Report by the
Occupational Health and Safety Forum of New York and New Jersey
May, 1993

Enhancing the Infrastructure to Safeguard the Health of America's Workforce

This document presents a plan for safeguarding the health of America's workers. This plan was developed by the Occupational Health and Safety Forum of New York and New Jersey, a coalition of health and safety specialists from trade unions, industry, government and academia. A list of this document's authors is provided on page 2. The Forum is organized around the New York-New Jersey Educational Resource Center, a consortium of six universities in the New York metropolitan area whose educational and research training endeavors form the primary means through which the National Institute for Occupational Safety and Health (NIOSH) fulfills its mandate to support professional training in the region.

This document provides a blueprint for improving the health and safety of workers in New York, New Jersey, and across the nation and, thus, for strengthening national productivity. The views in the report are non-partisan. They reflect the consensus opinion of specialists from industry, labor and academia, each of whom has worked for many years in the field of occupational health and safety. This document and its recommendations are not intended to be comprehensive. Important issues about which it may be difficult to find consensus, such as reform of OSHA, the overhaul of workers' compensation and others, are, therefore, not included in this document. Rather, this plan focuses on revitalizing the infrastructure of occupational health through which new approaches to addressing the health of workers might be undertaken. Through implementation of this plan, the region and the nation can expect to reduce its health care costs and increase the well-being of this and future generations of Americans.

For additonal information about the Regional Occupational Health and Safety Forum or to obtain additional copies, please contact Steven Markowitz, M.D. or Philip Landrigan, M.D., Mount Sinai School of Medicine, 1 Gustave L. Levy Place - Box 1057, New York, NY 10029 (212) 241-6173.

Signatories*

Edward Anselm, MD	Empire Blue Cross and Blue Shield
Grace C. Applegate	Grace C. Applegate Associates
Amy Bahruth	CWA Local 1031
Paul Brandt-Rauf, MD, ScD, DrPH	Columbia University
Gail Buckler, RN	Robert Wood Johnson Medical School
Charles Burrus, PhD	NYC Transit Authority
Joseph M. Cannella, MD	Mobil Corporation
Beverly Cohen PhD	New York University Medical Center
Michael Crane, MD	Consolidated Edison
Kathleen Crowley	Presbyterian Hospital, New York City
Rick Engler	Industrial Union Council of New Jersey
George Friedman-Jimenez, MD	New York City Health and Hospitals Corporation
Eric Frumin	Amalgamated Clothing and Textile Workers Union
Bernard Goldstein, MD	Robert Wood Johnson Medical School
Andrew Goodman, MD, MPH	New York City Department of Health
Audrey Gotsch, DrPH	Robert Wood Johnson Medical School
Richard N. Gottfried	Health Committee, New York State Assembly
Sonny Hall	Transport Workers Union, Local 100
Robin Herbert, M.D.	Mount Sinai Medical Center
David Kotelchuck, PhD	Hunter College School of Health Sciences
Philip J. Landrigan, M.D.	Mount Sinai School of Medicine
Stephen Levin, M.D.	Mount Sinai School of Medicine
Morton Lippmann, PhD	New York University Medical Center
Michael Lohman	Communication Workers of America
Matthew London,CIH	New York State Department of Health
Marsha Love	District 1, Communication Workers of America
Steven Markowitz, M.D.	Mount Sinai School of Medicine
Jean McGrane, JD, CIH	New York City Health and Hospitals Corporation
James McGowan	New York State Professional Firefighters Association
Jim Melius, M.D, DrPH	New York State Department of Health
Jacqueline Messite, M.D.	New York Academy of Medicine
David Michaels, PhD, MPH	City University of New York Medical School
Steven Mooser, MPH	Mount Sinai School of Medicine
Deborah Nagin, MPH,	New York State Department of Health
Kathleen O'Leary.	New Jersey Department of Health
Jan D. Pierce	District 1, Communication Workers Union of America
Christopher Placitella, JD	Wilentz, Goldman, and Spitzer
Rebecca Plattus	International Ladies Garment Workers Union
Francis W. Quinless, PhD	University of Medicine & Dentistry School of Nursing
Ruth Rodriguez	Office of the Manhattan Borough President
William Rom, MD	New York University Medical Center
Eric Scherzer	Oil, Chemical & Atomic Workers, District 8 Resource Center
Joel Shufro, PhD	New York Committee for Occupational Safety and Health
Frank Tooze	District 9, International Brotherhood of Painters and Allied Tradesmen
Dominick Tuminaro, JD	Pasternack, Popish & Reiff
Stephen Zoloth, PhD	Hunter College School of Health Sciences

* Identification of the affiliated institution is for identification purposes only and does not imply endorsement of the document by the institution.

I. Introduction

Occupational diseases and injuries encompass a broad range of human illness and disability. Some are common, such as lung cancer among asbestos workers, musculoskeletal injury among workers engaged in repetitive activities, fatalities among construction workers, and chronic bronchitis in workers exposed to dusts. Others are less common, classical diseases that were discovered decades ago but nonetheless still occur. These include cancer of the bladder in dye workers, leukemia in workers exposed to benzene, and mesothelioma in asbestos workers. Still other occupational conditions are not fully characterized, but are important because they involve large numbers of workers. Examples include disorders of the nervous system in workers exposed to solvents, chronic kidney disease in workers exposed to lead, premature senility in workers with chronic exposure to neurotoxicants, heart problems in workers exposed to carbon monoxide, and impairment of reproductive function in men and women exposed to lead and pesticides. Additionally, acute injuries occur among workers in all sectors of the economy and contribute importantly to disability among working age Americans. These occupational illnesses and injuries afflict hundreds of thousands of workers throughout the region and the United States.

Occupational injuries and diseases are highly preventable. Since they arise from conditions created by people, they can be largely prevented through alteration of those conditions. *Primary prevention* of occupational disease and injury, that is, the complete avoidance of damage to health, requires only the elimination or reduction of hazardous exposures. The cornerstones of primary prevention are threefold: pre-market testing of materials to be introduced into the workplace; implementation of appropriate workplace control measures; and effective education of workers and managers. *Secondary prevention*, i.e., early detection of occupational disease and injury in the presymptomatic or early stages when it can still be controlled or cured, is also feasible. It depends on the ability to efficiently and effectively identify and monitor workers at high risk for occupational disease and trauma. Finally, *tertiary prevention*, the prevention of complications and disability from already existing illness and injury, depends on development and wide application of appropriate diagnostic, treatment, and rehabilitation strategies. Prevention on all three levels requires a solid and comprehensive base of information on the health effects of specific occupational exposures and data on where and by whom hazardous substances are used.

Our understanding of the impact of the environment on human health is intimately linked to scientific knowledge of the human toxicity of chemical and physical hazards that are present in the workplace. Hazardous exposures are usually more intense and of longer duration in occupational settings than in the ambient environment. Research in occupational health has, therefore, provided the body of scientific knowledge and the methodologic tools for research that have been essential for understanding and for estimating the impact of environmental contamination on human health. For example, we understand the deleterious effect of radon on the population of the U.S. and its contribution to lung cancer mortality, because radon exposure was carefully studied in miners working directly with naturally occurring sources of radon. In other instances, the toxins degrading the environment emanate directly from activities undertaken in the workplace. Obvious examples include hazardous waste dumpsites and contamination of drinking water supplies by pesticides and solvents. Clearly, the strengthening of occupational health through research, professional training, education, public health surveillance, and clinical services will have a highly beneficial effect on recognizing and preventing human illness due to toxicants in the environment.

Public policies adopted over the past 15 years clearly demonstrate that occupational illnesses and injuries can be prevented. The frequency and severity of lead poisoning among adults in the United States has diminished as a result of a strong lead standard promulgated by OSHA in 1978. When specific chemicals have been shown to cause dramatic illness affecting scores of workers, the reduction or abolition of the use of these agents quickly stops the epidemic. Examples from the last two decades include a terrible neuropathy caused by the pesticide kepone, sterility among male workers exposed to dibromochloropropane, disabling bladder dysfunction caused

by dimethylaminoproprionitrile, lung cancer among young male chemical workers exposed to bischloromethyl ether and, most recently, significant liver inflammation caused by dimethylformamide. In the environmental sphere, the elimination of lead from most gasoline has lowered blood levels both in children and adults and, as an additional benefit, has lowered lead exposure for workers heavily exposed to ambient airborne lead, such as toll booth operators and traffic control personnel.

II. The Costs of Occupational Injuries and Diseases

Disease, death and disability rates are very high among American workers. Each year, 10,000 American workers are killed as a consequence of acute traumatic injury on the job. Each year, an estimated 50,000 to 70,000 American workers die of chronic occupational diseases including cancer, lung disease, kidney failure and neurologic impairment. Each year, an estimated 350,000 American workers are made ill by exposures encountered at work.

The costs of work-related injuries in the United States were recently studied by the Rand Institute for Civil Justice. The aim of the study was to evaluate the current status of compensation for all types of accidental injuries in the United States. This study found that nonfatal acute work-related injuries cost the nation 83 billion dollars in 1989, representing approximately one-half of the estimated costs of all nonfatal accidents. These costs include income loss and medical care costs. Moreover, the $83 billion expended for nonfatal work-related accidents represented nearly 2% of the gross national product in 1989.

The Rand study also demonstrated that much of the medical costs of work-related injuries are borne not by the Workers' Compensation system but by the health insurance sector and by workers themselves. Workers' Compensation pays the hospital and outpatient medical bills for only about 50% of workers injured on the job. Private and public health insurance is the exclusive source of payment for inpatient and outpatient costs for an additional 35% of workers with occupational injuries. Other impairment-related costs such as supplies, special equipment, home modification, and transportation expenses were almost entirely (94%) paid for out-of-pocket by the injured workers. Of all direct annual medical costs of work-related injuries, workers themselves paid 30 cents of every dollar expended to treat or recover from the injury.

Work-related injuries also impose high costs in lost work days with accompanying loss of wages. Work-related injuries cause 60% of all lost work days due to any type of accident and account for two-thirds of all earnings loss due to accidents. Only about one-half of workers who appeared to be eligible for compensation payments from Workers' Compensation reported receiving such compensation. The remaining workers received income from other sources (about 25%) or no income at all (about 25%).

Injuries have additional costs other than income loss and medical costs. Among these are pain, mental anguish and psychological disorders, which are not compensated by Workers' Compensation. Family members suffer as well. Injured workers are unable to perform normal housekeeping activities, which lowers the quality of life and also causes work loss for family members as they miss work to substitute for the injured worker in maintaining the household. Work-related injuries are the single most important cause of diminished ability to contribute to household maintenance.

Diseases caused by toxic exposures in the workplace are also frequent and costly in the United States. A study conducted in New York State in 1987 examined the direct medical costs plus the indirect economic costs of five major categories of occupational disease and found that the annual cost of occupational disease in New York at that time was $600 million. A similar study in New Jersey in 1989 found that the comparable annual cost of occupational disease in that state were $280 million. By extrapolating these data to the entire United States, it may be concluded that the national costs each year of occupational disease exceed $6 billion. Although this estimate makes plain the fact that occupational diseases are a major contributor to health care costs in the United States, the estimate is almost certainly a conservative one which underestimates the full extent of the problem. One shortcoming in the estimate is that it

considered only five categories of occupational disease--chronic lung disease, cancer, heart disease, stroke, and end-stage kidney disease. It did not include skin disease, repetitive motion injury, chronic back disease or other major contributors to the total problem of occupational diseases. Also, the estimate did not include the costs of acute traumatic injury sustained on the job. And finally, the numbers are outdated, because health care costs have risen so rapidly since 1987. Further studies are needed to gain more precise and accurate data.

Clearly, these expenditures contribute substantially to the global health care budget in the United States. Moreover, occupational diseases and injuries are highly preventable. They are not inevitable consequences of aging. These diseases are much more amenable to prevention and thus to cost-savings than are many of the other chronic diseases that afflict Americans.

III. The Importance of Occupational Health Professionals

The occupational health specialties, including occupational health nursing, occupational medicine, industrial hygiene, ergonomics, safety engineering, and occupational health education, are the only professional specialties that are in a position to deal simultaneously with issues of occupational health and worker productivity. Specialists in these disciplines understand the requirements and prerogatives of industry and labor, the paradigm of disease prevention and public health, and issues of health as they arise in the workplace. Specialists in occupational health therefore constitute a unique national resource, straddling the two worlds of work and health.

Unfortunately, however, there are too few such professionals. The most common full-time health professional in the workplace is the nurse. Yet, most of these nurses have no formal training in occupational health. The unmet needs of the specialty of occupational medicine have been studied and can provide further insight into the degree of scarcity of human resources in all of these disciplines. A recent report from the Institute of Medicine (IOM) of the National Academy of Sciences concluded that the deficiencies in trained medical personnel in this field were extreme. The IOM report suggested that a minimum of 3,100 to 5,500 new occupational medicine physicians must be trained in the next decade simply to meet current shortfalls. By contrast, only about 100 new physicians complete training in occupational medicine each year in the United States.

Important shortages also exist in industrial hygiene, ergonomics, occupational health education, safety, toxicology, and epidemiology, but estimates of the exact numbers of trained professionals needed are not available.

IV. Workers Compensation and Health Care Reform

Each year the various state Workers' Compensation systems pay approximately $32 billion for the care of ill and injured workers. All parties involved in these systems - workers, employers, unions and physicians among them - agree that Workers' Compensation programs are imperfect. The costs of these programs have risen sharply in the past decade, yet workers generally complain that indemnity payments are too low. Many physicians refuse to participate due to rigid fee schedules and cumbersome bureaucratic procedures required to obtain approval for treatment. While victims of work-related injuries generally obtain Workers' Compensation, the vast majority of work-related illnesses are not effectively addressed through the Workers' Compensation system. There is a broad consensus that physicians frequently do not recognize the occupational origin of many illnesses, and thereby prevent workers afflicted by occupational diseases from filing claims with Workers' Compensation.

What are the implications of heath care reform for the Workers' Compensation systems? What would be the consequences of merging Workers' Compensation with other forms of medical reimbursement? We believe that some effects would be positive. Access to care for ill or injured workers may become easier if Workers' Compensation systems are merged with the overall health care system. More physicians might participate and the barriers to obtaining care raised by employer challenges to "work-relatedness" lessened. Also, participation in health care plans

might impose the sorely needed disciplines of quality assurance and outcome evaluation on systems of care for workers.

However, there are also important potential liabilities that may result from the merging of these systems. At least in theory, Workers' Compensation systems provide a financial incentive to employers to reduce hazards at the workplace - the more accidents, the higher the premiums - and correctly allocate these costs to the responsible employer. The claims process allows for tracking and recording of worker injury and illness and at least the potential for follow-up workplace evaluation, intervention and prevention of future injury. Without these systems other programs to record and track workplace injury and illness will have to be developed. Other features unique to the Workers' Compensation system would need to be preserved. These include: a) full employer liability for all disability and medical costs associated with occupational illnesses and injuries, b) experience rating of employers to determine premium levels, and c) employee participation in selection of providers. Changing these features of the Workers' Compensation system would undermine current incentives to correct unsafe working conditions and thereby to prevent injury and illness.

Merging the care of workers with occupational injuries and illnesses with the general system of health care will also increase the need for training primary health care providers in the discipline of occupational health. As long as the care of injured and ill workers has been segregated fiscally, it has usually been provided by specialists who have some knowledge of the diagnosis and treatment of work-related problems. Mainstreaming work-related health problems will mean that workers with such problems will be treated by primary care providers. Such providers are not currently knowledgeable about occupational health and, unless trained, will not identify the work-relatedness of many occupational illnesses and injuries. Relevant education about occupational health will need to be undertaken. Even with such education, however, the current emphasis of the health care system on diagnosis and treatment of diseases, not on their causes and prevention, makes us skeptical that a much altered system of health care financing and organization will maintain the current level of recognition of occupational diseases and injuries, much less lead to significant improvement in such recognition.

A final advantage of current Workers' Compensation programs that would need to be protected if any merger occurs is that premiums accumulate in a discrete pool of funds that can be drawn upon to benefit both worker and employer. Small annual assessments on the Workers' Compensation premiums of several states such as New York, Massachusetts, and Michigan facilitate the dedication of specific funding streams for innovative programs such as a statewide system of occupational medicine clinics and a statewide programs in worker training and education. Such programs demonstrate well the ability of the Workers' Compensation system to be used for disease and injury prevention activities.

V. Public Health Surveillance of Occupational Diseases and Injuries

Public health surveillance is defined as by Alexander Langmuir, MD of the Centers for Disease Control as "the ongoing and systematic collection, analysis, interpretation and dissemination of data related to health. This information is used to plan, implement, and evaluate public health interventions." Occupational surveillance programs undertaken by governmental agencies identify instances of illness, injury, or excessive exposure and monitor trends in their occurrences across different industries and occupations, over time, and between geographic areas. The purpose of surveillance is not only to collect and analyze data but also to provide a rational, scientific basis to direct active prevention programs designed to control and eliminate the occurrence of occupational disease and injuries.

Surveillance for occupational diseases, injuries and hazards has become increasingly important in efforts nationwide to prevent mortality and morbidity due to work exposures or conditions. The Public Health Service's Promoting Health/Preventing Disease: Year 2000 Objectives for the Nation lists surveillance as a key component in each priority area within occupational safety and health and notes, "Progress depends greatly on surveillance improvements. Occupational illness and disease surveillance systems are necessary to identify

high risk groups and to assist in developing appropriate prevention strategies." The Year 2000 Objectives for the Nation also contains a recommendation that each state have a plan for the identification, management, and prevention of leading work-related diseases and injuries within the State. These recommendations have been endorsed in principle by the American Public Health Association, the Council of State and Territorial Epidemiologists, and the Association of State and Territorial Health Officers.

Occupational disease and injury surveillance can readily utilize existing sources of general health data, including death certificates, hospital discharge data, cancer and birth defects registry data, and medical examiners reports. Specialized data sources specifically dedicated to work-related disease and disability include Workers' Compensation records, reporting from clinical laboratories (e.g. - heavy metals), poison control centers, and physician reports of occupational disease. For example, the Centers for Disease Control recently reported that 21,241 adults in 18 states had elevated blood lead levels, 90% of whom had excessive exposure to lead at work. An elevated blood lead level has become the most common reported occupational condition and among the top 5 most common reportable conditions or diseases of any type in the United States. Identification of individual cases of disease and injury allows the use of the *sentinel health approach,* whereby cases are followed up at the workplace to identify and to intervene to lower risks for workers subject to the same conditions in the workplace.

Since prevention of occupational diseases requires reduction of deleterious exposures, surveillance can also be directed towards monitoring hazardous exposures in the workplace. Existing data sources useful for this include workplace inspections reports from the Occupational Safety and Health Administration and the Mine Safety and Heath Administration and data from the Environmental Protection Agency on toxic substances inventories collected under the Superfund Amendments and Reauthorization Act -Title III. These data sources have barely been tapped to conduct activities for the purposes of preventing occupational injuries and illnesses.

VI. Recommendations

To improve the health of workers in New York, New Jersey, and throughout the United States, to prevent occupational disease and injury and to increase national productivity, the Forum offers a series of recommendations. These recommendations are non-partisan. They reflect the consensus of members of the Forum and include the views of labor, industry, government, and academia. These recommendations are not intended to serve as a comprehensive plan to enhance occupational safety and health. Vital issues such as OSHA reform, the enhancement of NIOSH, Workers' Compensation reform, and others await further examination by the Regional Occupational Safety and Health Forum. Rather, these recommendations are intended to address the urgently needed revitalization of the infrastructure of occupational health to enhance education, public health practice, services and research in the field.

A. Worker Education.

We recommend that worker education efforts at the federal and state levels be expanded, with special focus on occupations and industries with recognized hazards.

The OSHA New Directions program, established in 1978, was a bold federal initiative which for the first time committed OSHA to supporting workplace health and safety training and education programs. OSHA expenditures of about $25 million per year resulted in the training of hundreds of thousands of workers and managers annually, and laid the basis for preventive approaches to occupational health and safety in workplaces across the U.S., which persist to this day. The program also developed a large group of skilled health and safety professionals with workplace experience who have become a new generation of national leaders in this field.

Following cutbacks in this program during the 1980's, states as diverse as Maine, Michigan and New York adopted their own programs, based on the New Directions model and funded by small levies on Workers' Compensation premiums.

The policy of OSHA and numerous other Federal agencies has increasingly included worker training as an important component of the development of comprehensive standards. The national educational program for hazardous waste and emergency response workers mandated by SARA in 1986, adopted by OSHA (CFR 1910.120) and now administered by NIEHS, is an excellent example of this new approach. It demonstrates the importance of establishing a coordinated infrastructure dedicated to providing targeted training for an industry sector with clear job hazards. Similarly, Congress has established special funds for such training of DOE facility cleanup workers.

1. Additional Federal and state programs to promote worker education should be established. An OSHA program similar in approach to New Directions would be voluntary, relatively inexpensive, encourage the development of labor-management training programs, and enhance the formation of competent health and safety committees in the workplace. Such a program should focus on hazardous jobs and industries based on labor and management interests in initiating such programs. Such a nationally coordinated approach would also help set standards for training programs, encourage the development of regional training consortia, and discourage the proliferation of training programs with inadequate or inappropriate curricula and/or taught by unqualified individuals, as has happened in many state and city abatement programs for asbestos, radon and lead .

2. Worker health and safety training should also be routinely integrated into job training and retraining initiatives currently being considered by the Departments of Labor, at both state and Federal levels. But because such efforts must necessarily focus on training for employment in new technology and other job-growth industries, they cannot substitute for a national program targeted to worker health and safety protection in existing hazardous industries, whatever their job growth potentials.

B. Professional Education

We recommend a broad expansion of training programs to ensure an adequate number of occupational health specialists and to provide a minimum level of competence among related professionals such as primary health care providers, engineers, public health professionals, and others. Mainstreaming Workers' Compensation into the health care system, the current lack of availability of occupational health specialists for the private and public sector, especially for small business, and the increased needs for training workers make the training of specialists and non-specialists in occupational health an urgent need.

1. Enhance Current Training Programs Current federal funding for all professional occupational health training is $11 million per year, through the National Institute for Occupational Safety and Health. Adjusted for inflation, this level of support is less than it was in 1977. The private sector and universities have only limited resources to support this training. A sizable increment in funding for this training, which would still be a modest sum overall, would significantly stabilize the educational programs in the universities and would increase the number of trained personnel in these areas.

2. Career development To further careers in occupational health we recommend that funding be provided to the National Institute for Occupational Safety and Health to underwrite the re-training of appropriate personnel currently working in the military or for private defense contractors to become occupational health safety engineers, nurses and physicians.

3. Scholarships for professionals We recommend that a revolving federal fund be established, similar in design to the National Health Service Corps, which would enable medical students who subsequently undergo occupational medicine training to pay back medical school loans by serving as occupational health physicians in under-served areas.

4. Minority Professional Recruitment. Because of the serious under-representation of minorities among occupational safety and health professionals and the disproportionate impact of occupational illness and injuries on minorities, a specific program should be established to educate and encourage minority youth and college students to seek careers in occupational health and safety. Since similar needs exist in the field of environmental health, consideration should be given to developing a program to be jointly sponsored by the Environmental Protection Agency, the Federal Department of Labor, and NIOSH. Such a program could be undertaken at the state level as well.

5. Curriculum Reform in Professional Schools To assure adequate knowledge among all professionals who design, operate, and monitor workplaces as well as those who care for injured or ill workers, we urge that innovative programs be undertaken to include occupational health training in the curriculum of all nurses, physicians, engineers, and related disciplines. This should occur at the undergraduate, graduate, and post-graduate levels.

C. Integration of Occupational Health into Economic Development

Considerable public discussion in recent years has centered on the development of national industrial policy, whereby the government actively participates in the decision-making process of investment, industrial development, and job growth. That the new or expanded workplaces created by such policy must include considerations of occupational health and safety as essential components of such a policy has not been, but must become an essential part of such a discussion.

The creation of wealth in the form of high-paying, stable jobs depends upon the promotion of health for those who will have such jobs. No matter how skilled, workers who become disabled as a result of illness or injury will no longer be productive workers or adequate income earners.

Small businesses are currently a dynamic part of the economy and are responsible for much of the recent job growth in the economy. Yet, such businesses have the least access to occupational health expertise due to the dearth of available and affordable occupational health services offered by private consultants, trade associations and government agencies. Small businesses are, therefore, vulnerable to failure to protect their workforce and to non-compliance with state and Federal regulations.

We therefore recommend that serious consideration be given to the creation of industrial extension agents at the state and county levels. These agents would have a function in industry similar to that of extension agents in agriculture. They would provide factory owners and workers with helpful advice on matters of occupational safety and in addition to advice on productivity and industrial design. This approach to occupational safety and health will make it an integral part of the overall retooling of American industry at the grass-roots level and will facilitate compliance with government regulation. Such a voluntary system of consultative services must not be construed as replacing the need for vigorous regulation and enforcement in occupational safety and health.

D. Occupational Health Surveillance

The National Institute for Occupational Safety and Health (NIOSH) should significantly expand its occupational health and exposure surveillance activities and support and promote the development of occupational health surveillance programs in all fifty states.

1. NIOSH should receive adequate funding to award and coordinate cooperative agreements with each of the fifty states for the development of occupational health surveillance programs. A minimum of $200,000 should be made available annually to each state department of health or agency designated for these purposes.

2. State health departments or other designated agencies should:

   - Compile and publish annually a report on the incidence, prevalence and distribution of occupational illnesses, injuries and hazards based on epidemiologic analyses of all health and hazard data.

   - Develop the capacity to systematically use surveillance data to target interventions and public health programs.

   - Mandate laboratory reporting of levels of heavy metals in biological specimens and physician reporting of occupational diseases.

   - Collect/code occupation and industry in all data sources, if missing.

   - Maintain computerized registries of all individuals with occupational illness or injury identified from existing data bases and/or from case reports.

3. NIOSH should have adequate staff and resources to:

   a) coordinate and standardize the surveillance activities in the states.

   b) compile, analyze and publish the surveillance data collected by the state departments of health.

   c) provide technical consultation regarding surveillance activities to the state departments of health.

   d) promote the utilization of the surveillance data to design and prioritize occupational health research projects; establish emphasis enforcement activities in OSHA; and identify high risk groups that need access to education and prevention programs.

E. Research in Occupational Health

We recommend that occupational health research efforts be greatly strengthened.

No aspect of occupational health has been so neglected over the past two decades as research. An adequate scientific effort to expand the knowledge base and to develop new research methods in the systematic attempt to understand the nature and impact of occupational hazards has neither been mounted nor sustained in recent years. We still know little about the health effects of most chemical agents used in the workplace. According to a study by the National Research Council published in the mid-1980's, a complete information base was available for virtually none of the chemical agents that are used in large quantities in the United States. Little progress has been made since that time in understanding the the possible health impact of the majority of these chemical substances.

This is hardly surprising given the minimal level of resources that have been devoted to occupational health research in recent years. The total federal research budget that is earmarked for occupational health research by scientists at the nation's universities is administered by NIOSH and totals $6 to $7 million per year. This amounts to five cents per worker each year, or one-tenth of 1 percent of the 1993 NIH research budget. Research supported by NIEHS is often relevant to occupational health concerns, but this agency's budget has been stagnant in real dollars over the past decade. Extra-governmental support for occupational health research is meager and is not directed in a manner that systematically builds the fundamental base of knowledge. Indeed, there is little that even resembles an occupational health research establishment.

Yet, the recognition and ultimate reduction in occupational illness and injury is critically dependent upon a solid scientific basis informed by the results of research using the tools of epidemiology, toxicology, ergonomics, engineering, molecular biology, and other disciplines. Education of professionals and workers alike requires a vital scientific research base to give the teaching meaning and content. Occupational health faculty at medical schools and universities will not thrive and gain access to their schools' curricula unless they are able to perform research with the support of outside funds. Public health surveillance depends upon the results of research endeavors for its targets and methods. Finally, the opportunities for disease and injury prevention, so clearly possible in occupational health, cannot be realized unless research efforts demonstrate the outcomes to be prevented, the doses at which these outcomes occur, and the effectiveness of the methods employed to prevent occupational diseases and injuries.

APPENDIX B

LIST OF ANNUAL ERC SCIENTIFIC CONFRENCES, 1992-1997

UNIVERSITIES OCCUPATIONAL SAFETY AND HEALTH EDUCATIONAL RESOURCE CENTER (UOSHERC)

Annual Scientific Conferences
1992-1997

18th Annual Scientific Meeting **Health and Safety Hazards and Abatement in the Construction Industry** **New York University Medical Center**	**April 17, 1997**
17th Annual Scientific Meeting **Occupational Exposure and Occupational Health Databases** **New York University Medical Center**	**April 18, 1996**
16th Annual Scientific Meeting **Violence in the Workplace** **New York Academy of Medicine**	**March 13, 1995**
15th Annual Scientific Meeting **Asbestos Science & Policy** **Mt. Sinai Medical Center**	**April 29, 1994**
14th Annual Scientific Meeting **Controlling Inhalation Hazards in the Workplace** **Mt. Sinai Medical Center**	**April 29, 1993**
13th Annual Scientific Meeting **Minoriteis and Occupaitonal Health** **Mt. Sinai Medical Center**	**April 23, 1992**

OCCUPATIONAL AND ENVIRONMENTAL MEDICINE RESIDENCY

MOUNT SINAI MEDICAL CENTER

Occupational and Environmental Medicine Residency
Final Report
July 1, 1992 - June 30, 1997

Mount Sinai School of Medicine
New York, New York, 10029

Steven Markowitz, MD
Program Director

NIOSH Grant No. T42/CCT210425-05

October 1, 1997

Abstract

This report summarizes the activities of the occupational and environmental medicine (OEM) residency program at Mt. Sinai School of Medicine from July 1, 1992 through June 30, 1997. During this time period, the full-time two year residency program at Mt. Sinai School of Medicine entered its third decade of educational service. The Mount Sinai OEM Residency Program is currently the only occupational and environmental medicine residency program in New York State.

There were 12 residents who completed the OEM residency program at Mount Sinai from July 1, 1992 through June 30, 1997, including 9 women, 3 men, 1 African American and 2 physicians of Hispanic origin. All residents are currently employed in occupational and environmental medicine in a broad variety of settings.

Steven Markowitz, MD, continued as the residency program director and has filed this position since 1991. In 1995, Jacqueline Moline, MD, MSc, a graduate of the Mt. Sinai Residency Program became Assistant Director of the residency program.

The Occupational Medicine Residency Program underwent its periodic review by the Accreditation Council for Graduate Medical Education in 1996 and received full accreditation for five years. In addition, the residency program underwent its periodic review by NIOSH as part of a competitive renewal in 1996 and was approved for three years of continued funding.

Mount Sinai Medical Center continues to offer a rich clinical research and educational environment for physicians training in occupational medicine.

I. Significant Findings

The Mount Sinai Occupational and Environmental Medicine (OEM) Residency Program is currently the only occupational medicine residency program in New York State, which has 17,000,000 people and is the third largest state in the nation.

There were 12 residents who completed the OEM residency program at Mount Sinai from July 1, 1992 through June 30,1997. The 12 graduates included 9 women and 3 men and 1 African American and 2 physicians of Hispanic origin during the grant period (25% racial and ethnic minority graduates).

All graduating residents are employed in occupational and environmental medicine. There is a broad distribution in terms of settings of employment, including 2 graduates in corporate settings, 3 graduates in academia, 1 in the United States Public Health Service, 3 graduates in hospital-based practices, and 3 are OEM consultants.

Steven Markowitz, MD continued as the residency program director and has filled this position since 1991. In 1995, Jacqueline Moline, MD, MSc, a graduate of the Mt. Sinai Residency Program became Assistant Director of the residency program.

The OEM Residency Program underwent its periodic review by the Accreditation Council for Graduate Medical Education in 1996 and received full accreditation for five years. The OEM residency program also underwent its periodic review by NIOSH as part of a competitive renewal in 1996 and was approve for three years of continued funding.

Mount Sinai Medical Center continues to offer a rich clinical, research and educational environment for physicians training in occupational Medicine.

II. Report

This report summarizes the activities of the occupational and environmental medicine (OEM) residency program at Mt. Sinai School of Medicine from July 1, 1992 through June 30,1997. During this time period, the full-time two year residency program at Mt. Sinai School of Medicine entered its third decade of educational service.

The Mount Sinai OEM Residency Program is currently the only occupational medicine residency program in New York State, which has 17,000,000 people and is the third largest state in the nation.

A. Accomplishments

There were 12 residents who completed the OEM Residency program at Mount Sinai from July 1, 1992 through June 30,1997. The periods of training and names of these residents is provided in Table 1. The average number of graduates per year were 2.4. The total of 12 graduates included 9 women and 3 men. The residency program continues to have a limited degree of racial and ethnic heterogeneity, graduating 1 African American and 2 physicians of Hispanic origin during the time period (25% of graduates.

Table 1 also shows the current employment status of the resident graduates. All residents are employed in occupational and environmental medicine. There is a broad distribution in terms of settings of employment, including 2 graduates in corporate settings, 3 graduates in academia, 1 in the United States Public Health Service, 3 graduates in hospital-based practices, and 3 are OEM consultants.

The Mt. Sinai residency program has had ample high-quality applicants to the program during the 1992-1997 period. No funding positions have gone unfilled due to the lack of qualified applicants.

Three graduates during the 1992-1997 period attended the Mt. Sinai program for only one year, because they entered with the master's of public health degree and needed only one year to complete the training requirements for board-eligibility according to the American Board of Preventive Medicine.

All two year graduates completed the master's in Community Medicine, which included the submission of a master's thesis. The titles of these theses are provided in Table 2.

B. Faculty/Leadership

Steven Markowitz, MD, continued as the residency program director and has filled this position since 1991. In 1995, Jacqueline Moline, MD, MSc, a graduate of the Mt. Sinai Residency Program became Assistant Director of the residency program. She concentrated on expansion of the field corporate field placement program and the didactic part of the practicum year. Katherine Gleaton continues as administrative assistant of the residency program, a position which she has held with great dedication since 1987.

There has been the normal amount of turnover of the faculty in the Department of Community Medicine, which sponsors the Occupational Medicine Residency Program. However, all disciplines that are required to provide the array of courses in the Master's Program has been maintained.

The Irving Selikoff Occupational Health Clinical Center, where the residents receive their clinical training in occupational medicine, has expanded considerably since 1992. It has a central facility at Mt. Sinai and now three satellite facilities in Brooklyn, Westchester, and the Garment Workers (UNITE) Health Center. Although the residents do all their clinical training at the central facility at Mt. Sinai, they have the opportunity to observe at the satellite facilities where workers form different kinds of work settings and different health problems are seen.

C. Program Developments

The Occupational Medicine Residency Program underwent is periodic review by the Accreditation Council for Graduate Medical Education in 1996 and received full accreditation for five years. The next review will be in 2001. In addition, the residency program underwent its periodic review by NIOSH as part of a competitive renewal in 1996 and was approved for continued funding. When the overall ERC was approved for only three years, this period of approved funding for the residency program was established for three years.

The residency training program continues to receive funding from New York State as part of a fellowship program, supported in conjunction with the New York State Clinic Network. Nonetheless, because NIOSH stipends are modest and cover only 57% of the resident's salary, there remains an unfilled gap for each resident. The funding from the New York State Health Department fills only part of this gap. The remainder is filled by miscellaneous funds from a variety of sources.

The Residency Advisory Committee meets twice per year as required by the ACGME. Prominent occupational medicine physicians such as Paul Brandt-Rauf., MD, Michael Crane, MD, and Michael Alderman, MD, serve on this committee.

D. Future Plans

No significant changes in the structure of the residency program are planned in the coming years. The Master's program is well-established. The corporate field placements at various local corporations

function very well. The clinical experience or the resident extensive is well supported by a large clinical faculty. The research environment is rich in faculty resources.

Due to the dwindling of funds from NIOSH, the residency program will need to search for alternative sources of funds to continue to support the residency program.

Table 1

Occupational Medicine Residents
Mount Sinai School of Medicine
1992-1997

Louise Short, MD, MS	1990-1992	Hospital Infections Program Centers for Disease Control and Prevention Atlanta, GA
Sandra Stratford, MD, MSc	1991-1993	Physician, Occupational Medicine IBM Corporation Somers, NY
Marc Wishnuff, MD, MSc	1991-1993	Consultant in Occupational Medicine New York, NY
Susan Etzi, MD, MS	1992-1993	Consultant in Occupational Medicine New York, NY
Jacqueline Moline, MD, MSc	1991-1993	Assistant Professor Division of Environmental & Occupational Medicine Mt. Sinai School of Medicine, New York, NY
Susan Richman, MD, MSc	1992-1994	Instructor Division of Environmental & Occupational Medicine Mt. Sinai School of Medicine, New York, NY
Mary Jo Morgenstern, MD, MSc	1993-1995	Emergency Medicine (Consultant in Toxicology) Columbia Presbyterian Hospital, New York, NY
Jasbir Daley, MD, MSc	1993-1995	Employees' Health Service Montefiore Medical Center, Bronx, NY
Jaime Szeinuk, MD, MSc	1993-1996	Faculty, Division of Environmental & Occupational Medicine, Mt. Sinai School of Medicine, New York, NY
Marta Cabrera, MD. MSc	1991-1996	Medical Director Exxon Co., Santiago, Chile
Geoffrey Gendels, MD, MS	1995-1996	Chief, Division of Occupational Medicine St. Mary of Nazareth, Chicago, Illinois
Marilyn Zwass, MD, MS	1995-1996	Consultant, Los Angeles, California

TABLE 2

Masters Theses
Mt. Sinai OEM Residents, 1992-1997

Resident	Title of Thesis	Year
Louise Short, MD, MS	Clinical Trial of a Needle-less Heparin Lock System at a Large Urban Hospital	1992
Jacqueline Moline, MD, MSc	The Utility of Screening Asbestos-Exposed Workers for Non-Asbestos Related Disease	1993
Sandra Stratford, MD, MSc	Visual Fatigue and Video Display Terminal Use	1993
Mark Wishnuff, MD, MSc	Survey of Occupational Cancer Epidemiology Publications in the General Medical Literature	1993
Marta Cabrera, MD, MSc	Decline in Spirometric Pulmonary Function in Asbestos Workers: A Longitudinal Study	1995
Jasbir Matharu-Daley, MD, MSc	Occupational Vitiligo: A Study of the Oxy-Durez Plant, Niagara Falls	1995
Mary-Jo Morgenstern, MD, MSc	The Physician Shortage in Occupational and Environmental Medicine: A Proposal for Combined Residency Training, Including Financial and Practical Considerations	1995
Susan Richman, MD, MSc	Medical Surveillance for the Transmission of Tuberculosis: The Role of Two-Step Testing in the Prevention of Occupational Medicine	1995
Jamie Szeinuk, MD, MSc	Radiographic Abnormalities in Asbestos-Exposed Workers with Gastrointestinal Carcinoma	1995

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FINAL PERFORMANCE REPORT

HAZARDOUS SUBSTANCE ACADEMIC PROGRAM

Hunter College (CUNY)
School of Health Sciences
425 E. 25th St.
New York, NY 10010

PROJECT TITLE;
NIOSH (Region II) Educational Resource Center

PROJECT DURATION
February 1, 1993 - June 30, 1997

PROGRAM DIRECTOR:
David Kotelchuck, Ph.D., CIH

GRANT NUMBER
T42 CCT 210425

Submitted: September 17, 1997

HAZARDOUS SUBSTANCE

HUNTER COLLEGE, CUNY

Academic Training Program (HSAT)

(a) Faculty Commitment and Breadth

David Kotelchuck, Ph.D., MPH, CIH is Director of the Hunter component of the ERC program, as well as Associate Professor and formerly Director of the graduate Environmental and Occupational Health Sciences (EOHS) Program. He assumed academic program directorship in 1984, and directorship of the Hunter ERC program in 1987. He has also been a member of the Board of Directors of the NJ/NY Hazardous Waste Workers Training Consortium since 1987. Under his supervision in this NIOSH program are the two full-time faculty members in the EOHS Program: Jack Caravanos, Dr.P.H., CIH, CSP, and since February 1, 1997 Director of the graduate EOHS Program and Mark Goldberg, Ph.D., CIH.

All EOHS faculty have been with the Hunter ERC component for at least five years each. All three-faculty members who are members of the Environmental and Occupational Health Sciences Program are certified industrial hygienists. Each is tenured and each teaches a wide range of industrial hygiene and occupational health and safety courses.

The adjunct faculty who have taught specialty courses in the hazardous waste and emergency response field include:

- Christine Proctor, MS, CIH, former Executive Director of the Hunter Hazardous Materials and Emergency Response Training Program
- John Malool, MS, Course Director of the NJ/NY Hazardous Waste Workers Training Consortium
- James Fahey, Ph.D., Prof. of Chemistry at Bronx Community College and former visiting staff member, Oak Ridge Natl. Laboratories
- James Foley, MA, MS, CSP, Senior Fire Protection, Safety and Health Coordinator, New York State Power Authority
- Raul Cardenas, Ph.D., formerly Prof. of Civil and Env. Engineering, Polytechnic Univ. of NY, and Lab Director, Rockland County Sewer District, Orangeburg, NY
- Walter Loss, MS, consultant and former Staff Scientist, Brookhaven National Laboratory, Upton, NY.

(b) Faculty Reputation and Strength

Between 1985 and 1995, full-time Hunter faculty were principal investigators or co-principal investigators in over $6 million of federal, state and local training and education grants, which resulted in the training of workers and professionals in the New York City metropolitan area and in New York State. These included major initiatives in the training of asbestos abatement workers and hazardous waste site and emergency response personnel, as well as comprehensive health and safety and employees.

Dr. David Kotelchuck, Director of the Hunter ERC Program, also directs the Hunter College component of the New Jersey/New York Hazardous Materials Worker Training Program. He is also currently conducting an epidemiological analysis of mortality patterns among a national cohort of service employees, all formerly members of the Service Employees Intl. Union (SEIU), AFL-CIO.

Dr. Jack Caravanos continues his leadership in training about the hazards and controls for occupational asbestos exposure as Curriculum Director for Region II EPA Asbestos Training programs. He teaches a number of other OSH training courses for the Division of Consumer Health Education of the University of Medicine and Dentistry of New Jersey, including a comprehensive review course of industrial hygiene. He is currently completing a research study on the handling of hazardous chemicals and awareness of their hazards in high school labs across NY State.

Finally, Dr. Mark Goldberg, CIH, an experienced industrial hygienist formerly with the New York City Department of Health, is currently developing work protocols for construction workers removing lead paint and performing other tasks on the Williamsburg Bridge in NYC. He also currently holds a joint appointment at Mt. Sinai Medical Center in NYC.

(c) Program Plan

The goals of the proposed program are:

(1) To broadly develop interest in and understanding of the problems of hazard recognition, evaluation and control at hazardous waste sites and during emergency response to chemical spills and fires among most graduates of the Hunter Masters program in occupational and environmental health and safety, as well as other interested professionals and

(2) To graduate annually a smaller group of industrial hygiene professionals with advanced training including field experience in this specialty area.

Below is a summary list of core courses offered during the grant period related to issues of hazardous waste site recognition, evaluation and control and emergency response procedures and protective equipment:

- EOHS 745 Hazardous Waste Management (3cr)
- EOHS 741 Env. & Industrial Hygiene Lab (4cr, required)
- EOHS 770.82 Industrial Hygiene at Hazardous Waste Sites (3cr)
- EOHS 770.81 Environmental Audits and Site Assessment (3cr)
- EOHS 770.86 Fire Safety and Emergency Response (3cr)
- EOHS 770.87 Groundwater Contamination and Hydrogeology (3cr)

Descriptions of the above courses and the faculty assigned to them are as follows:

EOHS 745 Hazardous Waste Management (Prof. Caravanos) - A review of the sources, transportation and control of hazardous chemical wastes. Regulatory requirements, disposal methods and health effects will also be presented. (Note: Separate from course EOHS 770.69 Solid Waste Management, taught by Dr. Raul Cardenas, which deals with municipal solid wastes.)

EOHS 741 Environmental and Industrial Hygiene Lab (Profs. Caravanos and Goldberg) - Physical, chemical and instrumental methods for measuring environmental and occupational contaminants. Course curriculum recently revised by Dr. Caravanos, with lab equipment modernized using funds from NIOSH ERC grants. Two class sessions per semester are devoted to operation, maintenance and real-time use of SCBA and other respirators, fit-testing procedures, and use of standard hazardous waste site field measurement equipment such as photoionizers and combustible gas meters.

EOHS 770.82 Industrial Hygiene at Hazardous Waste Sites (Prof. Malool) -
An introductory course, which will cover all required topics in the 40-hour Hazardous Waste Site Investigators course, but at levels appropriate to our graduate students. This course is required for scholarship recipients and other students specializing in the hazardous waste field, except for those who have already successfully completed a 40-hour course elsewhere.

EOHS 770.81 Environmental Audits and Site Assessment (Prof.Caravanos) -
Discussion of recommended procedures for making an environmental audit of a site, writing up the Environmental Impact Statement, and making an assessment of OSH hazards both at active and inactive hazardous waste sites.

EOHS 770.86 Fire Safety and Emergency Response Procedures (Prof. Malool) -
Review methods for identifying and preventing fires in factories and office buildings, New York fire code requirements, and procedures for dealing with chemical fires and chemical spills.

EOHS 770.87 Groundwater Contamination and Hydrogeology (Prof. Loss) -
Discuss fundamentals of aquifer formation and contamination with emphasis on interpretation of groundwater contamination data for hazardous waste sites. (See outline, Appendix B)

In addition two industrial hygiene courses had content related to hazardous waste operations, namely:

EOHS 770.88 Ind. Processes and Site Visits (Prof. Goldberg) -
Classes visited hazardous waste sites and recycling facilities, and observed emergency response procedures at hospitals and various industrial facilities.

EOHS 762 Noise and Radiation: Measurements and Controls (Profs. Kotelchuck and Fahey) -
Discussed radiation survey and control problems at hazardous waste sites, such as those associated with illegal dumping.

The following table lists the current and proposed courses on hazardous waste and emergency response, plus a few other relevant current courses, in terms of their contribution to the tasks of recognition, evaluation and control of these hazards. (Some courses contribute to more than one of these categories):

Functional Category	Related Hunter Course
Recognition (Identification)	Industrial Hygiene at Hazardous Waste Sites Env. Audits and Site Assessment Env. & Ind. Hyg. Lab (Monitoring Eqpt.) - (Required of all students) Ind. Hygiene lecture course (Required) Env. and Occ. Toxicology (Required)
Evaluation (Assessment)	Industrial Hygiene at Hazardous Waste Sites Hazardous Waste Management Ind. Processes & Site Visits Groundwater Contamination and Hydrogeology Noise and Radiation
Control (Management)	Industrial Hygiene at Hazardous Waste Sites Hazardous Waste Management Fire Safety and Emergency Response Env. & Industrial Hygiene Lab. (Study and use respirators and chemical protective clothing) (Required)

(d) Training Facilities and Resources

The Hunter Environmental and Occupational Health Sciences Program is housed on the Brookdale Health Sciences Campus of Hunter College, located at 25th Street and First Avenue in Manhattan. It shares the Brookdale campus with the six other programs of the School of Health Sciences, including the Community Health Education program (which has an environmental and occupational health concentration), as well as with the Hunter-Bellevue School of Nursing and the Brookdale Geriatric Center.

Facilities at Brookdale include classroom space, the Brookdale Health Sciences library (a branch of the larger Hunter College library), and a well-equipped audiovisual center, as well as computer facilities and laboratory space. Also one building of the Brookdale Center houses a dormitory for 200 students, the only dormitory facility within the City University system. This dormitory permits our industrial hygiene program to recruit students from outside the New York City metropolitan area, and each year several students from central or western New York State, the Middle Atlantic states and/or foreign students enroll in the Hunter ERC program and reside in the dormitory.

The audiovisual center provides slide, overhead and video projectors for use in any Brookdale classroom, as well as classroom space for viewing movies and videos, and a computer center containing approximately 20 IBM and IBM-compatible personal computers. The Health Sciences library has about 20,000 books relating to the health professions, over 200 periodicals and a CD-ROM reader. Also through computer hookups with the main Hunter Library at the 68th Street campus, students have access to a wide variety of databases through the MEDLARS network of the National Library of Medicine.

Students and faculty have access through terminals and dedicated phone lines to the IBM mainframe computer of the City University of New York, one of the most powerful in the Northeast. Also students have access to Apple and other IBM-compatible 486 computers and related printers, including laser printers.

The Industrial Hygiene and Environmental laboratory, located in the School of Health Sciences laboratory facility, provides classroom lab space for Hunter EOHS lab courses and for analysis of field and masters research studies. The laboratory includes a Miran infrared spectrophotometer, a gas chromatography unit with flame ionization detector, an atomic absorption spectrophotometer, low and high volume personal sampling pumps, precision sound level meters, an octave band analyzer, simple spirometers, and a host of other industrial hygiene air sampling and ancillary equipment.

To assist in hands-on training during the hazardous waste site investigators courses conducted at Hunter College, a loading dock area in the basement of Brookdale Campus building has been converted into a mock hazardous waste site, and is used during the site investigation simulation part of the course.

(e) Training Report

The Hunter EOHS program has regularly offered as planned, various courses related to hazardous waste and emergency response since the grant began in the Spring of 1993. In so doing, Hunter has fulfilled its grant goals by offering five specialty courses in hazwaste and emergency response, plus a modified lab course and other elective courses shaped by this focus.

Between the Spring semester of 1993, when the HSAT program was begun, through the Spring 1997 semester, the six core courses in hazardous waste and emergency response operations were offered 28 times (about 3 courses per semester). Below is a table of the courses, how often they were offered, and the number of students taking each:

		Nr. Times Offered	Nr. of Students
EOHS 745	Hazardous Waste Mgmt.	5	76
EOHS 770.81	Env. Audits & Site Asses.	4	72
EOHS 770.82	IH at Hazardous Waste Sites	3	39
EOHS 770.86	Fire Safety & Emer. Response	5	68
EOHS 770.87	Groundwater Contamination	2	32
EOHS 741	Env. & Occ. Laboratory	9	154
	Total	28	441

Also, two related courses with related contents were:

EOHS 770.88	Ind. Processes & Site Visits	3	32
EOHS 762	Noise & Radiation	5	79
	Total	8	111

In January 1997, a 40 hour Hazwoper course was offered at Hunter College by the NJ/NY Haz. Materials Worker Training Program to 22 current or former EOHS students. This program, during the January mid-semester break, was highly successful, and is expected to be offered in future years.

Finally during the period from Spring 1993 through June 1997, eighteen students were awarded internships at a variety of public and private agencies in the New York City metropolitan area. The public agencies have included the US Public Health Service, the US Environmental Protection Agency, New York State Dept. of Environmental Conservation, New York City Dept. of Environmental Protection and the New York City Dept. of Health. Also students have interned with the Environmental Safety Dept. of New York University Medical Center, the Div. of Environmental and Occupational Medicine of Mt. Sinai Medical Center, and several private consulting agencies in this area.

FINAL PERFORMANCE REPORT

INDUSTRIAL HYGIENE PROGRAM

Hunter College (CUNY)
School of Health Sciences
425 E. 25th St.
New York, NY 10010

PROJECT TITLE:
NIOSH (Regon II) Educational Resource Center

PROJECT DURATION:
July 1,1992-June 30, 1997

PROGRAM DIRECTOR:
David Kotelchuck, Ph.D., CIH

GRANT NUMBER:
T42 CCT 210425

Submitted: September, 17, 1997

INDUSTRIAL HYGIENE PROGRAM
HUNTER COLLEGE, CUNY

1. Industrial Hygiene Program Area (Hunter College)

A. Academic Training (Masters Level)

1. Faculty Commitment/Breadth

Full-time faculty participating in the ERC Industrial Hygiene program at Hunter during the past five grant years (7/1/92-6/30/97) were:

Core faculty		
D. Kotelchuck, Ph.D., MPH, CIH	Assoc. Prof.	Pgm. Dir., OSH, Biostatistics
J. Caravanos, DrPH, CIH, CSP	Asst. Prof.	IH Lab, Site Assess., Computer Applications
M. Goldberg, Ph.D., MS, CIH	Asst. Prof.	IH Core, Ventil., Site Visits
Supporting faculty		
S. Zoloth, Ph.D., MPH	Professor	Epidemiology
Adjunct faculty (1995-97)		
J. Fahey, Ph.D., MS Adj. Professor	Noise & Radiation	
J. Jacobson, Ph.D., CIH	Adj. Asst. Prof.	Toxicology
J. Malool, MS	Adj. Lecturer	Fire Safety, Emer. Resp., IH Haz. Waste Sites
S. Geier, MS, CSP, C.Audi.	Adj. Lecturer	Ind. Safety
H. Sabath, MPH, Msc, CPErg.	Adj. Lecturer	Ergonomics
D. Kass, MSPH	Adj. Lecturer	Hlth. Ed. in Wkplace, Env. Justice

This is a distinguished, stable faculty. Three of the four fulltime faculty (Kotelchuck, Caravanos, Zoloth) have been with this ERC component for at least ten years each. Dr. Goldberg joined the full-time faculty during 1990-91. All three faculty members who comprise the Environmental and Occupational Health Sciences Program (Kotelchuck, Caravanos, Goldberg) are certified industrial hygienists. Each is tenured, and teaches a wide range of industrial hygiene and occupational health and safety courses. Dr. Zoloth regularly teaches the graduate epidemiology course. He is a distinguished occupational epidemiologist who conducts research and publishes actively in his specialty field. Currently he is on leave from his faculty post, and is Acting Associate Provost of Hunter College. During his absence, the epidemiology core course is being taught by Marjorie Goldstein, Dr.P.H.

Dr. James Fahey is Professor of Chemistry at Bronx Community College and a graduate of the Hunter EOHS program. He conducted research for many years at Oak Ridge Natl. Lab and is experienced in assessment of radiation levels. Dr. Jane Jacobson got her Ph.D. in toxicology from Johns Hopkins Univ., and now directs the Eastern Environmental Testing Corp., a respected consulting firm in New York. She has a CIH, and has been teaching the basic toxicology course since the Spring 1995 semester. John Malool is a graduate of the Hunter EOHS program, and is now a master teacher and Curriculum Director of the NJ/NY Hazardous Waste Worker Training program at the Univ. of Medicine and Dentistry of New Jersey. He is a former professional firefighter, currently director of the Bergen County (NJ) Hazmat Emergency Response unit, and is a nationally recognized expert in his specialty. Susan Geier is an experienced professional who has her CSP (Certified Safety Professional) and runs a large safety consulting company. Herman Sabath, Msc, MPH is a Certified Professional Ergonomist, has many years of experience as a labor inspector in Israel and an IH consultant in the U.S. He teaches our Ergonomics course. Finally Daniel Kass, Co-Director of the Center for Occupational and

Environmental Health at Hunter College, is a professional health educator, and an experienced occupational health and safety trainer. He teaches the course Health Education in the Workplace in the Community Health Education program, which many EOHS students take, as well as a new course on Environmental Justice.

In addition to the range of professional specialties represented at the Hunter ERC Program, Hunter faculty have also demonstrated a deep commitment to health and safety education through worker and professional education and training.

Since 1985, full-time Hunter faculty have been principal investigators or co-principal investigators in over $4 million of federal, state and local training and education grants, which resulted in the training of thousands of workers and professionals in the New York City metropolitan area and in New York State. These included major initiatives in the training of asbestos abatement workers and hazardous waste site and emergency response personnel, as well as comprehensive health and safety and Right-to-Know training for thousands of state and local public employees.

For example, Dr. David Kotelchuck, Director of the Hunter ERC Program, also directs the Hunter College component of the New Jersey/New York Hazardous Materials Worker Training Program, a consortium of academic, labor and public agencies funded since 1987 by continuing grants from the National Institute for Environmental Health Sciences and EPA. During 1996-97 the Hunter program taught a total of 20 courses to over 500 hazardous waste workers, and related consulting and engineering personnel, as well as to emergency response personnel. Many of these were inspectors and officials of the New York State Dept. of Environmental Conservation. Also Dr. Kotelchuck is part of the consortium, under the direction of Dr. Audrey Gotsch of the Univ. of Medicine and Dentistry of New Jersey, which received in 1993 a grant from the U.S. Dept. of Energy to train hazardous waste and emergency response personnel at DOE sites such as Brookhaven Natl. Laboratory and the Princeton Plasma Physics Laboratory.

Meanwhile Dr. Jack Caravanos continued his leadership in training about the hazards and controls for occupational asbestos exposure. He continues as Curriculum Director for Region II EPA Asbestos Training programs, and teaches a number of other OSH training courses for the Division of Consumer Health Education of the University of Medicine and Dentistry of New Jersey, including courses on school OSH hazards for school business officials in New Jersey and on industrial hygiene instrumentation. Since 1991, Dr. Caravanos has directed a highly successful Comprehensive Industrial Hygiene Review Course for professionals taking the Industrial Hygiene Certification examination, sponsored by the Continuing Education and Outreach Program of the ERC with participation from faculty members of three Region II ERC programs. He has also written a book entitled "Quantitative Industrial Hygiene," published by ACGIH, which is widely used by industrial hygienists for IH review.

Dr. Stephen Zoloth of the Hunter ERC faculty has demonstrated his continued leadership in the field of worker training and education by founding with Dr. Kotelchuck the Center for Occupational and Environmental Health at Hunter College, recognized as a Center by the Board of Trustees of the City University of New York in 1990. The Center currently has 6 full and part-time employees, and is directed by Daniel Kass, M.S.P.H. Recently Dr. Zoloth and Daniel Kass were awarded an unprecedented three-year training grant by the New York State Dept. of Labor to assist labor unions and other organizations in developing their own on-going OSH monitoring and training programs. Since February 1997, Dr. Zoloth has been Acting Associate Provost of Hunter College.

Finally, Dr. Mark Goldberg, C.I.H., an experienced industrial hygienist who most recently was a senior industrial hygienist with the New York City Department of Health, has taught in a number of health and safety training courses at UMDNJ, including courses on lead assessment and removal and on hospital health and safety, as well as the CIH Review courses. In 1991, he was invited by a number of German environmental groups to inspect an asbestos textile factory in South Korea, and recommend modifications. He is currently working with faculty members at the Mt. Sinai School of Medicine to develop protocols to protect bridge repair workers from lead hazards while they conduct major bridge repairs. As part of this project, he is currently working with ironworkers rehabilitating the Williamsburgh and Queensboro Bridges. During this project, Dr. Goldberg has involved numerous Hunter graduate students in this work, and three are now employed full-time on the project.

2. Faculty Reputation/Strength

Over the past five years the Hunter ERC faculty's commitment to and strength in the field of industrial hygiene has grown. Every full-time faculty member in the EOHS Program now has their CIH designation, and Dr. Caravanos is also a Certified Safety Professional (CSP),

Another indictor of faculty strength and reputation is the extent and breadth of their external grant funding. As noted above in this Narrative, the four full-time faculty members involved in the Hunter ERC Program have been principal or co-principal investigators in over $4 million of training and research grants since 1985, not including NIOSH ERC program support. The grants were from a wide variety of federal, state and local groups and agencies, including the National Institute of Environmental Health Sciences, the United Brotherhood of Carpenters and Jointers of America, the International Union of Operating Engineers, the United Paperworkers International Union, the New York State Department of Labor, the New York State Department of Health, the New York City Major's Office of Operations, the NYC Fire Department and a variety of NYC local unions and city agencies. Sub a broad base of support speaks to the reputation and stength of the Hunter Program.

While training grant responsibilities were a major focus of Hunter ERC faculty activities, second only to its graduate education responsibilities, Hunter ERC faculty continued to publish professionally during the past grant period. Dr. Zoloth published important occupational epidemiology studies on asbestos disease among sheetmetal workers and occupational mortality among pulp and paper workers, as well as a chapter in a widely used textbook on occupational health by Levy and Wegman. Dr. Kotelchuck during the same period has published chapters in three books, one on the history of occupational health in the U.S., another on chemical hazards in the workplace, and a third assessing occupational safety and health hazards in the 1990s. Currently Dr. Kotelchuck is conducting a mortality study of a national cohort of service employees who were former members of the Service Employees Intl. Union, AFL-CIO. Dr. Caravanos is currently preparing a second edition of his book Quantitative Industrial Hygiene for the ACGIH. And Dr. Goldberg has recently published to articles on task-based lead exposure among bridge renovation workers, and their related blood lead levels.

The professional reputation of the Hunter ERC is also attested to by their election to leadership in a number of national and regional professional societies. Thus Dr. Kotelchuck completed a three-year term as an elected member of the Governing Council of the American Public Health Association, and is an elected Board member of the New York Committee for Occupational Safety and Health. Dr. Caravanos serves as a member and office of the Air Pollution and Waste Management Committee o the American Society of Civil Engineers. Both have served frequently in recent years as members of NIOSH site visit teams. Also Dr. Goldberg is a member of the Task-Based Exposure Assessment Committee for the national Building and Construction Trades Council, AFL-CIO, and of the NIOSH Construction Industry Technical Advisory Committee.

Finally, the Hunter IH faculty and program has been given votes of confidence in recent years by our professional industrial hygiene colleagues in the New York metropolitan area and by our program graduates. In particular, over the past two years the Metropolitan New York chapter of the American Industrial Hygiene

Association (AHIA) has donated a total of $5,000 to the George Kupchik Scholarship Fund at Hunter to assist our graduate students. Also in 1995, Dr. David Kotelchuck, Hunter IH Program Director, was given the Chapter's annual recognition award, its s0-called Bulllmoose award, for contributions to the profession. The Metro chapter also established a highly successful mentoring program for graduate IH students during this past year, and six Hunter students are receiving professional encouragement and assistance through the program. Then in January 1996, Eric Gertner, a graduate of Hunter's IH Masters program, established our first fully endowed scholarship to support the education of our students in hospital and health care health and safety, a major industry and area of concern in the New York region.

3. Distinctive Core Program Contribution

In 1992 the Hunter EOHS Program was approached by training and education officials of the Brookhaven National Laboratory (BNL) n Upton, Long Island, New York, asking whether Hunter would consider establishing on a one-time basis a Masters degree program in industrial hygiene on the lab site. EOHS faculty decided that this represented a unique opportunity for cooperation between the EOHS program and this major national research facility (employing 4000 professional persons), and agreed to set up such a program identical in curriculum to the existing IH progam at Hunter. The program was jointly approved by BNL officials and by the City University Board of Trustees in the Spring of 1993, and courses began in September 1993. Twenty graduate students registered in the program, several of whom has masters and doctoral degrees in other fields, two of whom were already Certified Industrial Hygienists (without Masters degrees) and four of whom, enrolled by special permission, were full-time OSHA health and safety personnel in the agency's Long Island Area Office. By the Spring semester, 1996, the students had all completed their course requirements and passed the comprehensive examination, and are working on their thesis projects. Two students completed their theses in January 1996, and are now graduated from the Program. By the end of the Summer, all students are expected to have finished their theses, and a graduation ceremony was held in September 1996.

Another important development during 1995-1996 was the creation of the External Advisory Board for the EOHS Program which has met three times during this academic year. It consists of over 20 distinguished graduates of the Program, and has made suggestions about curriculum changes, especially in our Hazardous Waste Management Track, and helped establish an improved job-seeking network for our future graduates. Also in the Spring term of 1995, with faculty encouragement, a student chapter of AIHA was founded and chartered at Hunter College. It has since held a number of functions including a joint meeting with EOHS faculty, guest lecturers and social functions.

Overall, the upcoming period represents one of maturation and change for Hunter's industrial hygiene program, from a period of rapid growth of our student body and expansion of the academic program in terms of new course offerings, to one of essentially steady enrollment and strengthening of the IH curriculum and the professional training of our students.

B. Training Record

Between July 1, 1992 and June 30, 1997, the Industrial Hygiene program of the Hunter College School of Health Sciences graduated 166 persons with Masters degrees (MS). Of these, 51 (31 percent) received scholarship aid from the NIOSH Educational Resource Center grant.

The NIOSH grant has supported and enhanced the education of all graduate students in the Environmental and Occupational Health Sciences Program. Typically, during the last five years, the program has had between 90 and 100 matriculated students annually, most of whom are part-time students and take about 3 years on average to graduate. In recent years about 12 students per year attend full-time, and are eligible for NIOSH ERC support.

Master of Science in Occupational Safety and Health Engineering at New Jersey Institute of Technology

Final Performance Report

Program Director: Howard Gage, Ph.D., P.E.
New Jersey Institute of Technology
Newark, NJ 07102

Grant Number: T42/CCT 210425
Project Period: July 1, 1992 to June 30, 1997

OCCUPATIONAL SAFETY & HEALTH ENGINEERING
NEW JERSEY INSTITUTE OF TECHNOLOGY

ABSTRACT

The Master of Science in Occupational Safety and Health Engineering Program at New Jersey Institute of Technology has been one of the members of the NIOSH New York/New Jersey ERC since 1988. For the period of 1992 to 1997, eighteen students have earned the M.S.O.S.H.E. degree. All graduates have secured professional positions in the field.

The project was directed by Dr. Howard Gage of the Department of Industrial and Manufacturing Engineering during the 1992-1997 period. Several other faculty members, including the Associate Program Director Dr. One-Jang Jeng, participated in the program by teaching courses and advising students in their respective specialties.

The curriculum of the program has been revised several times since 1992. The revisions were essential to reflect the rapid change of occupational safety and health issues, and the vision of faculty members to meet the current and future needs in the fields. A new elective course, covering much of the same material addressed in the forty hour HAZWOPER course has been added. This course, EVSC 585, is entitled: Health and Safety Aspects of Environmental Engineering.

The laboratory facilities dedicated to the M.S.O.S.H.E. Program have been upgraded using computer-interfaced-and-modularized systems for sampling and analyzing occupational hazards. It is hoped that students receiving training through the program will be able to utilize state-of-the-art technologies for identifying, analyzing and controlling safety and health hazards arising in the work place.

Current student enrollment appears to have reached a plateau. Special efforts have already been taken to attract the attention of engineers considering a professional career in our specialty. It is anticipated that these steps will succeed in attracting a larger nucleus of students which will allow us to broaden our current roster of course offerings.

Although this program is primarily engineering oriented, NJIT fully appreciates the fact that it deals with an interdisciplinary field. Therefore, in order to familiarize our students with the contributions made by other safety and health related specialties, attending various training courses and technical seminars held throughout the region has been always strongly encouraged and supported.

It is our commitment to train high quality graduate students who will become the leading safety and health specialists in the field. Therefore continuous funding from NIOSH for supporting students is essential for the operation and future development of the program.

PROGRAM PROGRESS

Uniqueness of the Program

The objective of the graduate Occupational Safety and Health Engineering Program at New Jersey Institute of Technology is to train engineers in the specialty of occupational safety and health. The program has a practical orientation and aims to train students so that upon graduation, they are able to assume both the technical and managerial responsibilities borne by safety professionals.

This program is unique in that it is intended exclusively for practicing engineers. Nearly all of our students have an undergraduate degree in this discipline, but lack substantial knowledge of occupational safety and health. By pursuing graduate work in this field, students are able to combine their knowledge of engineering principles with an awareness of the special kinds of problems and solutions in this field. Engineering solutions through identifying, evaluating, and controlling industrial hazards offer the most effective approach to long term problem solving in occupational safety and health.

Student Status

This program has been one of the members of the NIOSH New York/New Jersey ERC since 1988. For the period of 1992 to 1997, eighteen students have earned the M.S.O.S.H.E. degree. A list of selected theses completed by NIOSH trainee students between 1992 and 1997 is included in Appendix A. All graduates have successfully secured professional positions in the field. In addition to the graduates, there are three more students who have completed the course work and are expected to graduate within the next academic year.

A satisfactory student population has been achieved to assure that all required courses and a choice of electives are offered on a regular schedule. Students, not only from the M.S.O.S.H.E. program, but also in different majors from NJIT, UMDNJ and Rutgers University took occupational safety and health engineering courses offered by the program.

Faculty Involvement

The project was directed by Dr. Howard Gage of the Department of Industrial and Manufacturing Engineering. The Associate Project Director was Dr. One-Jang Jeng who joined the program in the fall of 1995. Several other faculty members also participated in the program by teaching courses and advising students in their respective specialties. These faculty members are Dr. Norman Van Houten, NJIT's Director for Health and Environmental Safety, Professor Reisman of the Electrical Engineering Department, Professor Trattner of the Environmental Sciences Program, and Professors Charles Wilson and Tina Chu of Mechanical Engineering Department.

There are also a number of adjunct faculty members who teach courses in their specialties and who make themselves available to advise students and even serve as thesis advisors when the dissertation covers one of the their areas of concern. Included in this group are: Chester Grelecki, George Olsen, Richard Jacobs, and Horacio Iberra.

Laboratory Facilities Upgrade

The program has three laboratories for conducting research in the following areas: ergonomics, safety, and environmental studies. For the past two years, a research grant has been awarded to Dr. Jeng by NJIT for the development of a computer based data acquisition system for generating task requirement and monitoring worker performance. One of the objectives of the project was to identify ergonomics risk factors quantitatively and provide workers their performance related to ergonomic risk factors, such as force, posture, and repetitiveness. The laboratory was benefited from the project by adding a microcomputer (Pentium 90) equipped with a data acquisition board (PCI-MIO-16E-10, National Instrument) and LabVIEW™ software. The system was successfully linked to both existing equipment, such as a four channel electromyograph/electrocelegram system (Model 7P511J, Grass Medical Instrument) and strength testing system (Lafayette Instrument), and several newly purchased transducers including an accelerometer (Sensotec) and two goniometers (Penny & Giles). Students will receive state-of-the-art training for identifying, analyzing, and controlling health and safety hazards. A second computer system will be needed for more trainees to practice data collection and processing.

The faculty not only have emphasized the importance of upgrading the laboratory hardware and software to meet the current and future needs, but also realized the importance of accessing occupational safety and health information through the internet. The program's internet homepage has been under construction by a NIOSH trainee student. The ultimate goal for the project is to promote the program and to interact with faculty and students from other institutes to participate in this ERC.

Curriculum Revision and New Course Development

Over the past five years, the curriculum has been revised several times. The latest revision resulted from suggestions made in December 1991 by an external NIOSH review panel (see Appendix B).

A new elective course covering much of the same material addressed in the forty hour HAZWOPER course is being added. This course, EVSC 585, is entitled: Health and Safety Aspects of Environmental Engineering. In the past, several of our students had requested such a course, but up until recently it was only available through NJIT's Division of Continuing Education without academic credit. This fact, coupled with its relatively high cost, made it impractical for most of our trainees.

Interdisciplinary Interactions

Although this program is primarily engineering oriented, NJIT fully appreciates that fact that it deals with an interdisciplinary field. Therefore, in order to familiarize our students with the contributions made by other safety and health related specialties, attending at various training courses and technical seminars held throughout the region has been always strongly encouraged and supported. A number of such offerings were given regularly through the Institute's own Division of Continuing Education. Other relevant courses are offered through the outreach activities of the ERC itself in nearby Piscatway, New Jersey. Here students are introduced to the work of occupational health physicians and nurses, industrial hygienists, as well as other scientists active in the field. This interaction allowed our students to gain a better appreciation of the roles of non-engineers working in occupational safety and health. Such awareness is essential for all those who will hold positions of meaningful responsibility in the field, no matter their background.

Future Plan

Current student enrollment appears to have reached a plateau, and additional efforts were made in order to increase participation. Steps already underway include the printing and distribution of new program brochures, as well as increased appearances by NJIT faculty at career days, transfer days and other similar events held at campuses throughout our geographic area. Promotional advertisements will appear in a variety of technical publications and in other media in order to attract the attention of engineers considering a professional career in our specialty. We anticipate that these steps will succeed in attracting a larger nucleus of students which will allow us to broaden our current roster of course offerings.

CONCLUSION

It has been our privilege to serve as a member of the NIOSH New York/New Jersey ERC since 1988. For the period of 1992 to 1997, eighteen students have earned the M.S.O.S.H.E. degree. We realize the need of training engineers to work as occupational safety and health specialists has always been tremendous. Although recently the program has had some difficulties recruiting more full-time engineering students, strategies were investigated to promote the program and the outcome was very promising. It is our commitment to train high quality graduate students who will be the leading safety and health specialists in the field. Therefore continuous funding from NIOSH for supporting students is essential to the operation and future development of the program.

Appendix A. List of selected theses completed by students who received NIOSH Trainee Scholarship between 1992 and 1997.

Name	Thesis Title	Date of Graduation
James Luke	Computerizing Occupational Safety and Health Information	Fall, 1992
Gina Marie Ochs	Laboratory Health and Safety Compliance Guide for Private Colleges and Universities	Spring, 1993
Joseph Michael Schwed	Reducing Health and Safety Risks by Replacing Compressed Air with an Electromechanical System	Spring, 1993
Eilyn Fabregas	Modern Techniques Used to Improve a Hearing Conservation Program in a Power Generating Plant	Spring, 1993
David W. Venezia	IntelAd: Intelligent Computer Workstation Adjustment Software	Fall, 1993
Jose R. Fabregas	The Effects of Different Types of Noise on Human Heart Rate	Spring, 1994
Thomas C. Carle	Prevention of Occupational Exposure of Tuberculosis to Healthcare Workers	Spring, 1994
Kiran A. Mody	Managing Occupational Hazards Confronting Healthcare Workers	Spring, 1994
Diane A. Colson	Hazard Recognition and Regulation: An Asbestos Chronology	Spring, 1995
David B. Mahone	Effects of Ergonomic Worksite Changes on Risks for Cumulative Trauma Disorders of the Upper Body in an Assembly and Press Operation Job	Spring, 1995
Laverne Raquel Ogieste	Safety Guidelines for Occupational Hazards to the Reproductive System	Fall, 1996

Appendix B. Current M.S.O.S.H.E. Curriculum

MASTER OF SCIENCE
IN
OCCUPATIONAL SAFETY AND HEALTH ENGINEERING

The following is the approved curriculum for this graduate studies program:

REQUIRED COURSES (18 Credits)

IE	614	-	Safety Engineering Methods
IE	615	-	Industrial Hygiene and Occupational Health
I E	661	-	Man-Machine Systems
I E	677	-	Applied Statistics and Epidemiology for Hazard Analysis
I E	685	-	System Safety
EM	633	-	Legal Aspects of Health and Safety

ELECTIVE COURSES (12 credits, minimum to 18 credits, maximum from the following list)

BME	669	-	Engineering Physiology
CE	702	-	Health and Safety Aspects of Environmental Engineering
EvSc	603	-	Hazwoper Certification
EvSc	614	-	Quantitative Risk Assessment
EvSc	616	-	Toxicology for Engineers and Scientists
I E	608	-	Product Liability Control
I E	665	-	Applied Industrial Ergonomics
I E	670	-	Industrial Work Physiology
I E	675	-	Safety in Facility and Product Design
I E	725	-	Independent Study
ME	660	-	Noise Control
ME	670	-	Introduction to Biomechanical Engineering

A six credit research oriented thesis (I E 701) is also required but this can be replaced by six credits of additional course work with the approval of the student's advisor.

For acceptance into this program, students must hold a bachelors degree in any branch of engineering from an accredited university with an acceptable grade point average. Those students who lack certain prescribed university prerequisites will have their records evaluated individually, and a list of make-up courses will be prepared by their advisor.

Note: BME = Biomedical engineering
EM = Engineering Management
EVSc = Environmental Science

revised 3-31-97

CONTINUING EDUCATION OUTREACH
ROBERT WOOD JOHNSON SCHOOLOF MEDICINE

UNIVERSITIES OCCUPATIONAL SAFETY AND HEALTH EDUCATIONAL RESOURCE CENTER: CONTINUING EDUCATION AND OUTREACH PROGRAM

FINAL PERFORMANCE REPORT, SEPTEMBER 30, 1997

PROJECT PERIOD: JULY 1, 1992 – JUNE 30, 1997

SUBMITTED BY
UNIVERSITY OF MEDICINE AND DENTRISTRY OF NEW JERSEY-
ROBERT WOOD JOHNSON MEDICAL SCHOOL
675 HOES LANE
PISCATAWAY, NEW JERSEY 08854-5635

PROGRAM DIRECTOR: AUDREY R. GOTSCH, Dr. P.H.

GRANT NUMBER: T42-CCT 210425

UNIVERSITIES OCCUPATIONAL SAFETY AND HEALTH EDUCATIONAL RESOURCE CENTER: CONTINUING EDUCATION AND OUTREACH PROGRAM

FINAL PERFORMANCE CLOSE-OUT REPORT, SEPTEMBER 30, 1997
SUBMITTED BY
UMDNJ-ROBERT WOOD JOHNSON MEDICAL SCHOOL

B. ABSTRACT

The Continuing Education and Outreach Program is based at the Division of Community Health Education, Department of Environmental and Community Medicine, Robert Wood Johnson Medical School, University of Medicine and Dentistry of New Jersey. The primary mission of the Continuing Education and Outreach Program of the UOSHERC consortium is to provide short-term training and continuing education courses designed for occupational physicians, occupational health nurses, industrial hygienists, occupational safety engineers and other occupational safety and health professionals, paraprofessionals and technicians, with emphasis on the New York/New Jersey geographical region and to provide outreach activities that include but are not limited to interaction with other colleges and universities, labor unions, professional societies, educators in grades K-12 as well as vocational schools and community groups. Utilizing advice from the Program's Task Forces and the UOSHERC Advisory Committee, efforts have been made to reach a wider audience in both the private and public sector.

Over the past five years, the program has offered a total of 793 courses in all core disciplines to almost 14,000 attendees. In the past year, 98 courses were offered to a total of 1558 students. The roster of course directors and program faculty reflects a balance of academic faculty and consultants. Identification of new course directors and faculty is ongoing and several are former students.

National and regional needs are identified through the utilization of the Program Task Forces and the UOSHERC Advisory Committee; the conduct of needs assessments nationally through the NIOSH-ERC traveling exhibit; formal, periodic needs assessments conducted through the Continuing Education and Outreach Program and course evaluations.

Evaluation procedures illuminate the changing needs in the workplace. Future programming reflects the information gained from instructor and course evaluations and modification of courses is often implemented as a result these evaluations. The development of new courses and the elimination of courses for which there is no longer a need sometimes follow these evaluations.

There have been many new courses added to the continuing education offerings by the Program over the past five years. Courses for physicians and safety professionals have been given top priority this past year. Regulatory developments in the field of lead abatement training and accreditation have continued to influence lead related courses.

A valuable part of continuing education is the link between the UOSHERC and the corporate community. These linkages have afforded trainees the opportunity to visit nearby facilities, speak with employees and learn how the latest programs are implemented in the workplace.

Opportunities for interdisciplinary activities are found at the Annual UOSHERC Scientific Meeting and the Occupational Medicine Seminar Series, which now offers CME Category 1 credit. These meetings provide an opportunity for students and faculty to gather and hear timely presentations.

The Resource Center at EOHSI has continued to produce teaching materials and information for teachers and school children. Teaching for Healthier Environments, a newsletter for classroom teachers has a circulation of 5000, with another 2000 distributed through meetings and conferences. 219 K-12th grade teachers have been trained and 200 more will be trained through ITV. Two new INFO letters have been published and 3 INFOsheets have been revised. Four hour TB training programs have been provided for 60 health care workers and 20 trainers. Industrial Hygiene sections of 153 Material Safety Data Sheets have been prepared. ToxRAP (Toxicology, Risk Assessment and Air Pollution), a program created and developed at the Resource Center to use hands-on activities to help youngsters master the scientific base for understanding scientific issues has been pilot tested and is now undergoing revisions.

The Continuing Education and Outreach Program, established at the UMDNJ-Robert Wood Johnson Medical School in 1978, has experienced continued growth during the five-year period ending June 30, 1997. Specific, unique contributions made during this reporting period are highlighted in this summary report.

CONTINUING EDUCATION

C. BACKGROUND

Although the Continuing Education and Outreach Program was established in 1978 at the UMDNJ-Robert Wood Johnson Medical School, the Continuing Education and Outreach Program currently functions through the Centers for Education and Training of the Environmental and Occupational Health Sciences Institute (EOHSI), a joint Institute of the UMDNJ-Robert Wood Johnson Medical School and Rutgers, The State University of New Jersey. In addition to the training provided through the NIOSH-ERC, the Centers for Education and Training of EOHSI also includes a NIEHS Hazardous Materials Worker Training Center, an USEPA Mid-Atlantic Asbestos Training Center, and a USEPA Air Pollution Compliance Training Demonstration Center.

Dr. Audrey Gotsch has served as the Program Director since the inception of the Program in 1978. She has continued to provide stable leadership and has recently been awarded the Distinguished Career award by the American Public Health Association.

D. NEEDS ASSESSMENTS

Needs assessment data for the UOSHERC Continuing Education and Outreach Program are drawn from a variety of sources. The NIOSH/ ERC Exhibit travels nationally to professional meetings staffed by the ERC/CEO Program Directors and provides feedback to each ERC. Participation in the NIOSH-ERC exhibit activities at professional meetings, which includes the administration of a needs assessment, has provided national and additional regional training needs assessment to this Center as well as to all ERCs. Additionally, the OHN Task Force has made information available regarding the needs assessment conducted relative to the strategic planning for the future of the NJ State Association of Occupational Health Nurses. Data from the NJOHN needs assessment was used to plan the educational program of the 80th Annual Conference of the Northeast Association of Occupational Health Nurses, October 11-13, 1995, for which planning has taken place during this reporting period. Other valuable methods of needs assessment include the utilization of information noted on course evaluation forms, review of upcoming legislation which includes a training component, advice and counsel of the Center's course directors, program faculty and advisory committees. Data from these sources and the new needs assessment survey have resulted in the development of nine new courses for 1997- 98 and modifications of some existing courses.

E. FACULTY STRENGTH

Faculty participation in the Continuing Education and Outreach Program continues to be strong. Currently there are 24 course directors and approximately 150 program faculty who participate in Program activities such as the development of new curricula, providing lectures for short courses and the Annual Scientific Meeting and identifying new program areas. Responding to a rapidly changing workplace, current and future course development is expected to add professionals with new areas of specialization.

F. TRAINING ACCOMPLISHED

During the five year period from 7/1/92-6/30/97, 973 courses were provided by this Program. In addition, the number of total trainees increased to 15,601. Courses have been presented in Occupational Medicine, Occupational Health Nursing, Industrial Hygiene, Occupational Safety, and in other related program areas. Trainees have included individuals in these disciplines as well as in other related professional and paraprofessional disciplines. Richard Lynch, PhD, RU, taught ergonomics in the Fundamentals of Industrial Hygiene and served as course director and instructor for the Practical Ergonomics course. Dr. Lynch also teaches the "noise analysis" section of the Hearing Conservation course at EOHSI. Jack Caravanos, DrPH, continues to serve as course director and instructor for the Certified Industrial Hygiene Exam Review and Lead Inspector/Risk Assessor courses.

G. INTERDISCIPLINARY INTERACTION

The UOSHERC Annual Scientific Meeting provides an opportunity for interdisciplinary interaction and serves as a forum for the presentation of papers on timely topics. Annual meeting

themes are selected by the UOSHERC Management Committee. The meeting is always co-chaired by the ERC Center Director and a UOSHERC Program Director. The topics for the annual meetings of the UOSHERC during this five-year period were:

1993	Controlling Inhalation Hazards in the Workplace
1994	Asbestos: Science and Policy
1995	Workplace Violence: Preventive and Interventive Strategies
1996	Occupational Health and Safety in the Information Age: Occupational Exposure and Occupational Health Databases
1997	Health and Safety Hazards and Abatement in the Construction Industry

H. FACILITIES

In addition to three classrooms dedicated to the training program at the Institute, a unique facility of the Program is the off-campus 6,000 square foot, custom-designed facility, with classrooms and a hands-on training room conveniently located with staff offices and training support services. Additional available classrooms are located at Hunter College School of Health Sciences in New York City; Northport, New York; Rutgers, The State University of New Jersey in Piscataway and New Brunswick, NJ; and, for annual meetings, the Hatch Auditorium at Mount Sinai School of Medicine and New York University Medical School, New York City.

I. ADVISORY TASK FORCES

In addition to the Advisory Board for UOSHERC, specific advisory task forces were formed in order to provide input to the course planning and development process, establish linkages, and identify courses needed by target groups in the future. In 1997, the *Certified Safety Professional Review* course and in 1998, the *Process Safety Management* courses were both developed in direct response to suggestions from the Occupational Safety Task Force. The Industrial Hygiene Task Force was the at foundation of development of the lead program and the new toxicology courses. With the assistance of the Occupational Medicine Task Force, we have offered the *Occupational Medicine Residency Seminar Series* as a course with CME, Category I credit in 1997. Upon suggestion of the Task Force, *Medical Response to Chemical Emergencies* and *Managing Latex Allergy* will be offered to physicians in 1997-98. The Advisory Task Forces have also provided links to professional organizations, which, in turn, have provided co-sponsorship and marketing for courses and conferences.

J. OUTREACH

Although the UOSHERC faculty outreach is included with each Program report, these activities have been summarized by the Continuing Education and Outreach Program.

EDUCATIONAL DEVELOPMENT

Michael Gochfeld, MD, PhD collaborated with the Department of Medicine, New Jersey

Medical School and UMDNJ former resident Gwen Brachman, MD, (now Assistant Professor) on the design and implementation of an employee health program for health care workers impacting 7500 employees of UMDNJ in Newark. Gail Buckler, MPH, COHN-S, has served on the Occupational Health Nursing Task Force at the EOHSI-Centers for Education and Training and the Advisory Board of the Rutgers College of Nursing. Howard Kipen, MD, served as the Course Director, Indoor Air ALA/ATV Meeting in San Francisco, CA impacting 65 physicians. Dr. Kotelchuck (Hunter College) has been actively involved in the development of educational programs in industrial and occupational hygiene for many years. He has worked with Princeton Plasma Physics Laboratory, Brookhaven National Laboratories, APHA, NIEHS Hazardous Materials Training Center, NIOSH Site Visit Teams, NYCOSH, NJIT, NYU, Dana Farber Cancer Institute, Department of Energy and many others, consulting, developing training courses, manuals and other educational materials. Dr. Beverly Cohen has recently worked with the Newburgh Elementary Schools Program about pilot-testing TOXRap curriculum materials, initiating an industrial hygiene information program and a *Detectives in the Workplace* program. In NYC, Dr. Cohen has consulted with schools about exposure assessment and air quality testing, using curriculum information provided by EOHSI. Dr. Cohen has mentored an intern sponsored by the NY Academy of Sciences and hosted 25 students from NYC High School for the Environment in her laboratory. She has also reviewed "Industrial Hygiene" for the SIGI Plus program of the Educational Testing Service, Princeton, NJ, for students seeking career information to enable them to create a personalized career plan. At UMDNJ, a critical outreach effort has been the ongoing development of an environmental health sciences curriculum, *ToxRAP*, to introduce students to the principles of toxicology and the process of environmental health risk assessment. This series has been completed and pilot tested and is presently being disseminated. In addition, the occupational health and safety curriculum, *Safe Schools*, that has been developed and disseminated to vocational educators in secondary schools has continued and expanded. Tuberculosis Train the Trainer, designed for the healthcare educator was developed by Barry Schlegel, UMDNJ, in response to the increasing number of active tuberculosis cases and the possible exposure to healthcare professionals.

PRESENTATIONS/LECTURES/AWARENESS SEMINARS

Philip Landrigan, MD, Mt. Sinai, continues to serve on the Presidential Advisory Committee on Gulf War Veterans' Illnesses. He presented the opening talks for CM-1, Medical Detective Stories and CM-4, The Nature of Public Health. Dr. Landrigan lectured to Williams College pre-med students on Environmental and Occupational Medicine concerns; Harvard on neurotoxicity; Metropolitan Museum of Art on raising children toxic free; Brooklyn College Eastern NY Occupational Health Clinic on lead poisoning; Cornell Medical School on environmental diseases; West Chester Board of Health on pesticides. Dr. Landrigan lectured to the W. Alton Jones Foundation Board; the US EPA in Puerto Rico; the Heinz Foundation in Boston and the Washington DC-NJCRAC on environmental hazards to children. Grand Rounds presentations by Dr. Landrigan included Boston Children's Hospital and St. Barnabas Hospital. Environmental Causes of Cancer was presented at the Neoplastic Medicine Grand Rounds by Dr. Landrigan. Dr. Landrigan continues to serve on numerous committees including the Gulf War Presidential Committee, NIOSH Board of Science Counselors, NY State Public Health Council-Priorities Committee and the NY State Childhood Lead Advisory Committee and served as

moderator of the "Child Health and Environmental Change" session of the one day conference for physicians, "Human Health and the Environment: Five Years after Rio" co-sponsored by the Department of Community Medicine, Mount Sinai School of Medicine in June, 1997. In May, 1997, Dr. Howard Kipen, UMDNJ lectured on Diagnosis and Management of RADS and gave two postgraduate course talks on Indoor Air and Multiple Chemical Sensitivities to the American Lung Association/American Thoracic Society Conference in San Francisco, CA., impacting 400 physicians. Gail Buckler, UMDNJ, lectures regularly at EOHSI - CET on medical surveillance in the 40 hour Hazardous Waste and Industrial Hygiene courses. Ms. Buckler has lectured at the EPOCH Envi program for primary care physicians. She taught blood borne pathogens and OCC Health Regulations, toxicology and hearing conservation to nursing students at Middlesex County College. Howard Gage, NJIT, lectured students at the Environmental Science Center of NYU, Tuxedo, NY on the Fundamentals of Ergonomics. One-Jang Jeng(NJIT) presented safety lab demonstrations at NJIT to students and faculty from the School of Industrial Management and to visitors from South Africa. Dr. Michael Gochfeld, UMDNJ, organized a session, "Frontiers of Occupational Medicine" at the annual ACOEM meeting, targeting trainees in Occupational Medicine and physicians entering the field from other specialties, impacting 45 physicians and 6 trainees. Ongoing programs at the Resource Center of EOHSI include Safe Schools, Adopt-a-School and the Summer Institute for teachers. The number of teachers that now have our curriculum and have been either pilot tested or trained at the Summer Institute or the Adopt-a-School trainings totals 1,316 teachers from grades K-12. Dr. Morton Lippmann has provided lectures on ozone and particulate matter standards at the Professional Conference on Industrial Hygiene, Nashville, TN (400); members of Congressional Staffs (180) and Winter Toxicology Forum (150), Washington, DC; 5th US-Dutch International Symposium, Noordwijk, The Netherlands (125); Lawrence Berkeley National Laboratory, CA (85); and Annual Scientific Conference of Health Effects Institute, Annapolis, MD. (150). Lectures were given by Dr. Kotelchuck in courses at Hunter College and to groups such as the United Food and Commercial Workers' Union and the Dana Farber Cancer Center. Dr. Mark Goldberg (Mt.Sinai and Hunter College) trained building inspectors; Ironworker JourneyMen and NYC DOT inspectors and contractors in lead. Jack Caravanos, DrPH, CIH, CSP (Hunter, UMDNJ) continues to lecture on lead and asbestos topics to various groups.

CONSULTATIONS

One-Jang Jeng, NJIT, provided consultation for Lucent Technologies, Whippany, NJ, to evaluate workstations and workers' tasks for identifying ergonomics risk factors in the reprographics department and provided consultation to the packaging department of Thomas I. Lipton Company, Flemington, NJ, assessing ergonomics programs. Dr. Jeng provided a workshop for students applying to graduate school, promoting the OSHE Program. Gail Buckler, UMDNJ, serves as consultant to Union Carbide on medical job descriptions. Dr. Gochfeld provided consultations for DuPont Corporation on contamination by lead and mercury in Pompton Lakes; Public Service Electric and Gas on community exposure and occupational health considerations during the remediation of former Manufactured Gas Plants at 8 sites in NJ, impacting hundreds of families around former coal gas plants; Keuhne Chemicals on the consequences of exposure during the loading of tanker trucks with chlorinated compounds; and the City of Hoboken Department of Health on mercury exposure in a condominium affecting 33

families. Dr. Lippmann provides consultation to the EPA Science Advisory Board; Center for Indoor Air Research, Linthicum, MD; Advisory Committee for University of Southern California; World Health Organization; Northeast States Clean Air Foundation, Boston, MA; Chemical Industry Institute of Toxicology, Research Triangle Park, NC; ACGIH, Military Personnel Deployment Toxicology, Ft. Detrick, MD and Ft. Collings, CO and Mt. Sinai Medical School Study of Childhood Asthma Risk Communication. Dr. Beverly Cohen has recently consulted with The Cornwall Hospital on personnel symptoms that may result from indoor air and reviewed manuscripts for AOEH, JAWMA and AS&T. Ongoing consultation is provided by UOSHERC faculty at UMDNJ relative to medical monitoring programs for employees and on subjects such as occupational and reproductive hazards, medical monitoring, health effects of lead, asbestos, musculoskeletal disorders, pesticides, and indoor air quality. Dr. Gotsch chaired site visit reviews for the CEPH accreditation, worked with the Advisory Board of Farm Safety 4 Just Kids and serves as a consultant to the New Jersey State Department of Health through the New Jersey Public Health Council, which she chairs. Carolyn Messina (UMDNJ) has consulted with corporations such as BASF and Ortho-McNeil and the NJ Department of Health and Senior Services Lead Training Department relative to training needs.

OTHER

The faculty and staff of UOSHERC institutions have authored hundreds of publications, provided testimony before the U.S. Senate and OSHA hearings, and chaired committees which have had an impact on the general public. In addition they have developed video clips and press meetings. Audiences reached have included school children, science teachers, vocational educators, newspaper science editors, librarians, labor union members, industry and the general public. Howard Gage, NJIT, is the newsletter editor of Safety and Risk Assessment Division, American Society of Mechanical Engineers and the associate editor of Safety and Risk Assessment, ASME Journal of Manufacturing Science and Engineering. Dr. Gochfeld's work with the U.S. Department of Energy on occupational health risks during ongoing and proposed environmental remediation activities at the Savannah River Site is ongoing and impacts about 8500 remediation workers. Carolyn Messina, Ed. M, and Howard Kipen, MD exhibited at the new Jersey State Association of Occupational Health Nurses in March, 1997, distributing course information to 100 members. L Drs. Lipppmann and Cohen (NYU) have authored eleven publications in 1996. Industrial/Occupational Hygiene faculty continue to provide outreach in these categories. Interaction with government agencies, companies, individuals, labor unions, community groups and other institutions will continue to provide opportunities for such outreach.

K. PUBLICATIONS

Abatemarco, Diane, Cristine Delnevo, Mitchel Rosen, Louise Weidner and Audrey Gotsch. "Medical Surveillance Practices of Blue Collar and White Collar Hazardous Waste Workers". Journal of Occupational Medicine 37(1995): 578-582.

Goldstein, Bernard and Audrey R.Gotsch. "Risk Communication" Clinical.Occupational Environmental Medicine. Ed. Linda Rosenstock. Orlando: W.B. Saunders, Co., 1994. xviii+909p. 68-76.

Gotsch, Audrey R. And Louise Weidner. "Strategies for Evaluating the Effectiveness of Training Programs." Occupational Medicine: State of the Art Reviews. Ed. Michael J. Colligan. Philadelphia: Hanley and Belfus, Inc., 1994. 171-187.

HAZARDOUS SUBSTANCE TRAINING PROGRAM

A. NEEDS ASSESSMENT

A needs assessment for this region was conducted in two phases. Phase I Needs Assessment for hazardous substance training was directed toward 1) identifying the number of individuals requiring training in professional level courses covered under the current program and 2) identifying the number and type of public sector positions for whom program development is required. The latter objective was based on the diversity and volume of activities in this region which may result in unconventional need. While many agencies are just beginning to fully identify their needs, this assessment represents the conservative estimates of all groups, as identified in meeting with agencies' officials and a phone survey. Total training needs were estimated to be 22,120, indicating a development or revision of new materials or revision or modification of extant materials.

Phase II Needs Assessment has been ongoing since 1991. As of 1993, all impact assessments have been conducted by mail, rather than by telephone; response rates showed mailing surveys as a useful and cost-effective method with this population. All public employees who have received stipends for the 40-Hour Site Investigation course through NIOSH were mailed impact surveys six months post course. The survey requests data regarding exposure to hazards since training, circumstances where training prevented illness or injury, the perceived value and reported use of the manual/course materials and the work-site relevance of selected core modules. It also includes seven life-threatening scenarios where trainees will be asked to report whether they could recall with certainty relevant health or safety facts if confronted with the situation. The primary interest lies with trainees who report uncertainty. Responses and trends are reviewed; recommendations for curricula modification are made when appropriate.

B. FACULTY COMMITMENT

The course director, John Malool, MS, as well as the teaching faculty for the hazardous substance training have remained the same since the training was initiated by this Program. All members of the faculty have extensive field experience which is critical for this program. In addition, a wide range of experts are available through the NIEHS supported training center which is also administered by the EOHSI Centers for Education and Training.

The New Jersey/New York Hazardous Materials Worker Training Center held its first annual Trainers' Exchange Workshop on May 28, 1996 at the Centers for Education and Training in Piscataway, New Jersey. This workshop provided an opportunity for trainers to share training issues with each other. Trainers spent the day discussing unique training approaches, demonstrating techniques by facilitating hands on activities and providing suggestions and feedback to one another. Training props and equipment, along with multi medium, served to assist in the interactive workshop. Members of different agencies each took a role leading sessions. Individual sessions included hands-on activities, demonstrations and interactive discussion.

Topics covered throughout the day included: unique training approaches, such as the case study approach, small group activities, hands-on activities and training props; transfer of training to the field, including assuring student knowledge/ skills gain and literacy issues; and using technology in training. The workshop concluded with an evaluation session where the participants commented on the day's activities. Participants indicated that the Trainer's Exchange was a beneficial forum where people could met, discuss and suggest on issues in health and safety training through an interactive environment

The support given to instructors in UMDNJ's training courses includes professional development, through continuing education programs, newsletters and other sources of information. All of the instructors in the program are professionals currently active in the hazardous waste industry. They must keep current with new legislation, equipment and trends in the industry in order to operate effectively at their usual employment site. In addition, several instructors are Certified Industrial Hygienists or Certified Safety Professionals and need to obtain professional development credits to maintain their certification. The "Clearinghouse Newsbrief" is another source of information given to the instructors. The news and information presented allows instructors to see what's current with other training centers and news in the hazardous materials industry.

John Malool has attended and presented at several meetings, as well as prepared lectures for a graduate level course during the past year. Mr. Malool attended the following meetings: 1996 NIOSH ERC Annual Meeting and presented a case study reporting on a Hazardous Materials Emergency Response to an incident in Lodi, NJ and the Virginia State Fire Department Hazardous Materials Conference and presented on Confined Space incidents. He also prepared lectures for and taught in a graduate level course at Hunter College entitled *Industrial Hygiene at Hazardous Waste Sites.* Additionally, he assisted in the development of an attended the pilot program of a NIOSH course on *Chemical Protective Clothing.*

C. PUBLIC EMPLOYEES

The primary initiative for this Program was to provide public employees with training support to attend hazardous substance training courses offered by this Center. Through the Hazardous Substance Training Program supported by NIOSH, 165 stipends have been provided for public employees who have participated in hazardous substance courses offered through the NIEHS Hazardous Materials Worker Training Center. The traineeships included 45 professionals in the 40-Hour Site Investigation course, 120 persons in the 8-Hour Supervisors and 8-Hour Refresher courses. The public employee groups that have received stipend support include: New Jersey Department of Transportation; New York City Department of Health; New Jersey State Departments of Health and Senior Services and Environmental Protection; Municipal Fire Prevention Bureau; County Legislature; County Prosecutor's Office; County and Municipal Health Department; City Government; N.J. Transit; N.J. Department of Human Resources and N.J. Highway Authority.

D. CURRICULA

There have been no significant curricula changes. However, new case studies have been developed for the 8-Hour Annual Refresher Course. UMDNJ uses the case study approach for the Refresher training. In the course, participants read EPA, New Jersey Departments of Environmental Protection and Health, Agency for Toxic Substances and Disease Registry and local newspaper reports and are asked to identify the hazards, select the level of personal protective equipment and prepare the remediation of the site. During appropriate times during the day, slides and videotape of the site are shown to offer more insight for the students. The total number of professionals trained to handle hazardous materials during this five year period is 4483.

E. PROGRAM EVALUATION

The Advisory Board is chaired by Glen Paulson, Ph.D. and includes representation from unions, government, academia and the hazardous waste industry. While many of the current members have served on the Board since the Center was established in 1987, three new members were added during this funding period to reflect the expanded scope of Center activities. In addition, at the May, 1996 Board Meeting, four more nominations to the Board were approved. Following nomination and approval by the Board, all Board members are appointed by the Dean of UMDNJ-Robert Wood Johnson Medical School.

The Board members have been very pleased with the progress that the Center has made. In their role of providing feedback on programs currently being offered, the Board is soliciting members who would like to serve as external reviewers for the curricula that is provided by our Center's members. This review will take place in the coming year.

Evaluation procedures include data collection of trainee characteristics, teaching processes, and to ensure that public sector employees receive training that is appropriate to their positions. In addition, proficiency exams are administered for all initial and refresher trainees; each trainee is contacted by telephone six months following the training program to determine the relevance of the training to their positions and to obtain further recommendations for improved course offerings.

OCCUPATIONAL HEALTH NURSING
UNIVERSITY OF MEDICINE & DENTISTRY OF NEW JERSEY

UNIVERSITIES OCCUPATIONAL SAFETY AND HEALTH EDUCATIONAL RESOURCE CENTER

FINAL PERFORMANCE REPORT, SEPTEMBER, 1977

UNIVERSITY OF MEDICINE AND DENTISTRY OF NEW JERSEY
SCHOOL OF NEW JERSEY, SCHOOL OF NURSING

Program Director: **Gail Buckler, RN, MPH, COHN-S**
University of Medicine and Dentistry of New Jersey
School of Nursing

Grant Number: **T42 CCT 210425**

ABSTRACT

In July, 1992 the University of Medicine and Dentistry of New Jersey-School of Nursing (UMDNJ-SN) received funding from NIOSH to develop a master's level occupational health nursing program. The program was designed to meet the needs for this specialized training in the New York-New Jersey Region which was lacking an occupational health nursing graduate program since the Hunter College Program was discontinued in 1987.

Three options were proposed initially including an Master of Science in Nursing (MSN) - Advanced Nurse Practitioner option; Master of Public Health (MPH) - Occupational Health Nursing Practice; and a dual MSN/MPH degree. The MPH option was approved for two years and the MSN and dual degree options were disapproved. In order to meet the demands for advanced practice nursing education in the region, the UMDNJ-School of Nursing continued to offer the MSN program. More trainees selected the MSN option than the MPH option and upon a second site visit at the end of the initial two years, the MPH option was disapproved and the MSN option was approved. Consequently, efforts were focused on recruiting and training students who were interested in pursuing the MSN degree as well as curriculum development and fostering collaborative intra-institutional relationships. Although this program has become the focal point, efforts continue to recruit students into the MPH program, and at the current time, one student is matriculated in this program.

The UMDNJ-OHN Program remains the **only** graduate program in occupational health nursing in the New York-New Jersey area. The program meets an important need in this region. Given that New Jersey remains the most densely industrialized state, it is apparent that there continues to be a need for appropriately educated occupational nurse practitioners. Graduates of the UMDNJ-MSN-OHN Program are prepared to deliver both primary care and occupational safety and health services. This is particularly important as the health care system moves from acute care to community-oriented care. They are recruited for their clinical competence, focus on preventive services, cost effectiveness, and administrative and management skills in an environment which demands these attributes.

SIGNIFICANT FINDINGS/ ACCOMPLISHMENTS

During the grant period the UMDNJ-SN MSN-OHN Program has made substantial progress in the following areas:

1. Provision of a master's level training program in occupational health nursing to Region II, which was without such a program since 1987.

2. Development of strong leadership and commitment by a prominent leader in the field of occupational health nursing in New Jersey.

3. Fostering interdisciplinary interactions across schools and programs.

4. Establishment of a sound curriculum plan designed to provide a solid academic core, primary care and occupational health and safety services.

5. Affiliations with practicum sites that provide the maximum enhancement of clinical experiences for the students.

6. Response to critical areas of concern to improve the quality of the program.

The above are discussed in detail in the following section.

REPORT AND CONCLUSIONS

Unique Contributions:

The unique contributions of the MSN-OHN Program include: 1) it is the only MSN-OHN Program in Region II; 1) the focus is on advanced practice nursing with a specialty emphasis in occupational health nursing; 3) a strong intra-institutional collaboration between the SN and the Roberto Wood Johnson Medical School (RWJMS); 4) emphasis in the UMDNJ-BSN Program on occupational and environmental health, therefore, increasing the pool of RNs who are knowledgeable in this specialty; 5) acceptance of nurses with non-nursing baccalaureate degrees into the MSN-OHN Program; 6) offering both an OHN emphasis in the MPH and MSN Program; 7) maximum accommodation of part-time evening students in both programs; 8) faculty with cross-school appointments between SN and RWJMS; 9) acceptance of students in the MSN-OHN Program in both the Newark (Northern) and Stratford/Camden (Southern) campuses; and 10) approval of the UMDNJ-SN as an "approved" provider of nursing continuing education through the New Jersey State Nurses Association. The SN has provided CEUs to members of the New Jersey State Association of Occupational Health Nurses for attending educational programs.

Leadership:

The strength of the MSN_OHN Program is the leadership and commitment of Gail Buckler, RN, MPH, COHN-S who serves as student advisor, coordinator for the OHN clinical experiences, and key faculty for the Occupational Health Nurse Practitioner courses. Ms. Buckler has twenty-seven years of experience in the field of occupational health. In 1987 she earned her M.P.H. degree in occupational health from the joint Graduate Program in Public Health offered by UMDNJ and Rutgers University. Her Bachelor of Science in Nursing degree was awarded by Hunter College in 1969. In 1991, she received her certification in advanced knowledge and practice in occupational health nursing from the American Board of Occupational Health Nurses, Inc. and she was recertified in 1996 as a Certified Occupational Health Nurse-Specialist.

Ms. Buckler is a recognized leader in the field of occupational health nursing in New Jersey. She currently holds a leadership position in the New Jersey State Association of Occupational Health Nurses (NJSAOHN) where she serves as President. She has participated on many professional organization committees, including bylaws, governmental affairs, strategic planning, and research. She served on the Institute of Medicine Committee on Enhancing Environmental Health in the Practice of Nursing and is an author of the resultant publication entitled Nursing Health and The Environment: Strengthening the Relationship to Improve the Public's Health, published in 1995.

Ms. Buckler holds academic faculty appointments within SN and RWJMS and teaches in both nursing and medical curricula in the undergraduate, graduate and continuing education levels. She has designed the curriculum for and teaches Environmental and Occupational Health in the three SN RN to BSN programs which are based upon a community focus. In addition, she is the Coordinator of the UMDNJ-Environmental and Occupational Clinical Center in Piscataway, New Jersey and Assistant Director of Occupational Health at that institution.

Interdisciplinary Focus:

The interdisciplinary focus of the OHN-MSN track is enhanced by the enrollment of students in course work both at the New Jersey Graduate Program in Public Health and at New Jersey Institute of Technology where students share classes with occupational physicians, sanitarians, industrial hygienists, and occupational safety specialists. In addition, occupational health nursing has been well integrated into the continuing education component of the ERC. Occupational health nurses participate in course work such as spirometry and occupational hearing conservation at the Universities Occupational Safety and Health Educational Resource Center (UOSHERC) at UMDNJ. The UOSHERC cosponsored an Annual Scientific Meeting in 1996 entitled *Occupational Health and Safety in the Information Age* that was attended by both faculty and students in the Occupational Health Track as well as students in other New York-New Jersey ERC core programs.

Over the past several years, Ms. Buckler has been instrumental in providing leadership to both the MSN-OHN Program and MPH-OHN Program initiatives. The program is very well supported via the total expertise of a diverse team of SN faculty, consisting of practitioners, researchers, and administrators.. The nursing team is complemented by an interdisciplinary team of occupational health physicians, industrial hygienists, psychosocial professionals within RWJMS specifically and the New York-New Jersey ERC in general. Therefore, under Ms. Buckler's administrative leadership, the SN has the total expertise to continue to offer an outstanding program through the combined talents of occupational health nursing and medical faculty, research faculty and advanced practice nursing faculty.

Curriculum:

During the five years of this grant, a sound curriculum plan has been developed to meet the program goals and objectives. The overall goal of the MSN-OHN Program is to provide advanced preparation to registered nurses in health assessment, health management, and occupational health science in order to prepare them for employment as Occupational Health Nurse Practitioners. This goal is achieved via structuring the curriculum around the constructs of knowledge, clinical practice, teaching and learning, leadership and management, planned change, scientific research, and professionalism. The objectives, relative to the scope of practice of these advanced practitioners, are as follows:

Upon completion of the program, the graduates will (1) Assess the health status of worker populations by performing interviews, collecting occupational health histories and physical examinations and by ordering and interpreting diagnostic tests; (2) Identify work hazards/risks and develop interventions aimed at controlling these hazards; (3) Provide preventive and health maintenance services; (4) Interact with the occupational health team members to collaboratively develop occupational health programs; (5) Conduct occupational health research and design prevention programs based on research findings. Interwoven throughout these specific objectives is the incorporation of legal and ethical principles within the scope of advanced practice nursing.

Graduates of the program will earn a Master of Science in Nursing (MSN) Degree. Full time students can complete the program within two years and part time students can complete the requirements for the degree within four years. The graduates will be eligible to take the American Nurses Association or the American Academy of Nurse Practitioners certification exam as an Adult Nurse Practitioner and upon certification can work as a Nurse Practitioner in a number of practice settings such as hospital employee health services, corporations, privately owned occupational health clinics, and academic institutions. Academic credits for relevant occupational safety and health courses can be applied towards the

requirement of the American Board for Occupational Health Nursing (ABOHN) for certification in Occupational Health Nursing.

In May, 1996 the Executive Council of the UMDNJ-SN approved a Curriculum Plan that would become effective in Fall, 1997. This plan included a 12 credits core curriculum, a 22 credit advanced practice (adult primary care and occupational health nursing curriculum) with a 6 credit minor in occupational health. The new plan strove to met the following goals: 1) consistency in our graduate program across tracks and campuses; 2) appropriateness of content for specialty certification credentialing; 3) maximum of 40 credits to enhance marketing and student recruitment; and 4) content aimed at graduate level only. This plan was reconsidered in response to reviewers' concern about the elimination on some of the OHS courses and it was, subsequently, redefined. Table 1. Represents the core requirements, specialty cognate courses, and clinical courses which comprise the current curriculum plan. This plan requires 12 credits of occupational safety and health cognates in addition to the core and advanced practice curricula. The total number of credits is 48.

Clinical Practicum Sites

The specialty practicum experience is a synthesis of the core nursing curriculum, the advanced practice skills and the track-specific courses. Ms. Buckler selects sites to meet the needs of individual students and varies the type of experiences to add breadth to the students' practice base. She has negotiated with corporate medical departments, industrial medical clinics, hospital-based occupational health programs as clinical practicum sites for the OHN students. The students are supervised on site by occupational physicians and nurse practitioners. Ms. Buckler serves as the students' faculty preceptor.

Conclusions:

Upon critical review of the OHN-MSN Program, there are several areas of concern that were identified and have been addressed. The following describes these concerns and the response to each:

1. Lack of doctorally prepared OHN faculty – Ms. Buckler has applied to the New Jersey Graduate Program in Public Health to pursue a doctoral degree (Ph.D.) in Public Health with a specialty in Environmental and Occupational Health.

2. The lack of OHNP faculty – nurse practitioner faculty members employed in occupational health settings are being utilized as site preceptors for the OHN students. These SN faculty members will also present didactic materials during the occupational health nurse practitioner theory course. The pool of OHNPs will increase as the program graduate additional students.

3. Decrease of curriculum requirements – the curriculum has been redesigned to include 1212 credits of OHS cognates (see Table 1).

4. Small number of graduates – to date, two students have graduated from the MSN-OHN Program. Most of the students are pursuing a part time course of study, therefore, the number of graduates has been low. It is anticipated that in 1998 three students will graduate and that additional students will graduate in the ensuing years.

TABLE 1.

UMDNJ-SCHOOL OF NURSING
ADULT HEALTH WITH AN OCCUPATIONAL HEALTH CLINICAL FOCUS
M.S.N. PROGRAM SPECIALTY TRACK
(CURRICULUM PLAN: EFFECTIVE FALL, 1997)

)URSE	*COURSE TITLE*	*CREDITS*	*DIDACTIC*	*CLINICAL*
URS5101	Science and Research	3	3 hrs	0
URS5104	Pathophysiology	3	3 hrs	0
SPD5106	Clinical Skills and Physical Diagnosis I	1	1 hrs	0
URS5107	Primary Care of Adults & Aged I	4	2 hrs	6 hrs
URS5100	Advanced Practice Nursing Role Seminar	0	1 hr	0
EVEL I	TOTAL:	11	10 hrs	6 hrs

)URSE	*COURSE TITLE*	*CREDITS*	*DIDACTIC*	*CLINICAL*
URS5105	Clinical Pharmacology	3	3 hrs	0
SPD5106	Clinical Skills and Physical Diagnosis I	1	1 hrs	0
URS5107	Primary Care of Adults & Aged I	4	2 hrs	6 hrs
IE0615	Prin o f Industrial Hygiene	3	3 hrs	0
IE0614	Safety Methods and Ergonomics	3	3 hrs	0
EVEL II	TOTAL:	14	12 hrs	6 hrs

OURSE	*COURSE TITLE*	*CREDITS*	*DIDACTIC*	*CLINICAL*
HNP5301	Occupational Health APN Theory and Practicum	7	3 hrs	12 hrs
URS5201	Research Design and Application	3	3 hrs	0
ORE5520	Prin of Epidemiology	3	3 hrs	0
ORE5531	Intro to Env. Health	3	3 hrs	0
EVEL III	TOTAL:	16	12 hrs	12 hrs

OURSE	*COURSE TITLE*	*CREDITS*	*DIDACTIC*	*CLINICAL*
URS5401	APN Core Role Theory	3	3 hrs	0
ACNP5402	Adult APN Role Practicum	5	0	15 hrs
EVEL IV	TOTAL:	8	3 hrs	15 hrs

Notes. (1) OHNP Track = 49 credits.
(2) Clinical hours calculated as: 1 academic credit = 3 clinical hours.
(3) SN courses are calculated as 16 weeks each Fall and Spring semester.
(4) OHNP Track: Focus on occupational health.
(5) OHNP Track: Total clinical hours throughout curriculum = 576 hours.

5. Need to include OHN research preparation - the occupational health nurse practitioner theory course has been restructured to include development of a research proposal in accordance with the National Occupational Research Agenda (NORA).

6. Lack of attention to the design, implementation and evaluation of health programs aimed at the aggregate level - this content is currently included in the occupational health nurse practitioner theory course.

7. Interdisciplinary interaction - students in the MSN-OHN Program continue to share academic courses and practicum experiences with trainees within this Educational Resource Center.

All in all, the UMDNJ-SN MSN-OHN Program meets the training and employment needs of the region by providing health care practitioners who are prepared to deliver both primary care and occupational safety and health services. Graduates are prepared to deliver these services in diverse settings.

OCCUPATIONAL MEDICINE
ROBERT WOOD JOHNSON SCHOOL OF MEDICINE

Occupational Medicine Residency
University of Medicine & Dentistry of New Jersey
Robert Wood Johnson Medical School

EOHSI Building
681 Frelinghuysen Road
Piscataway, NJ 08855

Grant #

Director: Michael Gochfeld, MD, PhD
Phone 732-445-2917 FAX 732-445-0130
email: gochfeld@eohsi.rutgers.edu

ABSTRACT

The Occupational Medicine Residency program at UMDNJ-Robert Wood Johnson Medical School is one of the two OM programs in this Educational Resource Center. It is one of four graduate training programs operated through the Environmental and Occupational Health Sciences Institute of New Jersey. This Institute, a partnership of Robert Wood Johnson Medical School and Rutgers University, brings together faculty in occupational medicine, environmental health, exposure assessment, epidemiology, risk communication, and public health policy. New Jersey's Graduate Program in Public Health is operated within EOHSI and provides the academic base for the residency program. Doctoral programs in Toxicology and Exposure Assessment are also offered, providing residents the opportunity to interact with graduate students in these disciplines. Each year two new residents enter the program, with preference being given to those with postgraduate training and experience in primary care. A total of 19 have graduated since the residency began in 1985, with 9 graduates between 1993 and 1997.

SIGNIFICANT EVENTS

During the five year period 1992-1997 several changes enhanced the scope and quality of the residency. The major physical change was the opening of the Environmental and Occupational Health Sciences Institute building which brought together several disciplines (occupational medicine, toxicology, exposure assessment, risk communication, and Epidemiology) under one roof. Moreover, for the first time, the entire occupational medicine division was housed together, and the Clinical Center was relocated to the EOHSI building as well. This greatly facilitate the interaction between the residents and all faculty, since the faculty offices are located wither in the clinic space itself or on the floor immediately above. Toxicologists and industrial hygienists now use the clinic for research projects in which the residents become involved.

During this period Howard Kipen, MD, MPH, assumed directorship of the Division of Occupations Medicine and Sandra Mohr, MD, MPH, was recruited as Assistant Professor and Deputy Director of the Residency.

Major research initiatives in which the residents have had the opportunity to participate include health studies of exposure to the fuel oxidant MTBE (methyl-tertiary butyl ether) under the direction of Dr. Mohr (the co_PI), and the NIOSH-funded study of lead and solvent exposure in construction workers under Dr. Fiedler (The PI).

In 1995 the program took over responsibility for operating the medical department of a nearby Colgate plant, and a resident has been assigned there two half-days per week, under the direction of Iris Udasin, MD.

In 1996 the program took over responsibility for the Employee Health program for Robert Wood Johnson Medical School with Iris Udasin, MD, as the director, responsible for about 2000 employees. Residents participate in the provision of employee health services in this new program.

REPORT

The past decade has seen a substantial change not only in health care in general but in occupational medicine in particular. The shift away from individual corporate medical departments to free standing occupational medicine providers has been swift, and is reflected in the jobs taken by our recent graduates. Nonetheless the image of corporate medical practice remains attractive to some, and several residents maintain a strong preference for this mode of practice.

Applications are received from a large number of U.S. and foreign physicians, some with a clear interest in occupational medicine, and others with a vague notion that preventive medicine may offer attractive employment opportunities. Since we rely on our residents to work independently during their practicum, at industrial sites which require independent decision-making, we preferentially select candidates with training (including some who are board certified) in either internal medicine or family medicine. We have been very fortunate in recruiting highly qualified physicians to our program. Indeed, two of our recent residents who participated in joint training in internal medicine and occupational medicine, were considered the outstanding resident among their internal medicine cohort.

Table 1. Program Graduates since 1993

Name	Graduated	Other Boards	Boards in OM	Current Practice Activities Where	Doing What
James Craner	1993	IM	1994	Nevada:	Private OM Clinic & consultant
Peter Nigro	1994	FP	1995	New Jersey:	Head of hospital OM clinic
Wanda Moody	1994	IM		Connecticut:	industrial medicine clinic
Patrick Joyce	1994	IM*	1996	Washington DC:	OM clinic and consultation, including medical director for FBI
Charles Stimler	1995	IM		New York:	clinician 50% OM/50% IM
Gwen Brachmann	1995	IM	[1997]	New Jersey:	academic OM at UMDNJ
Carol Diamond	1996	--		Pennsylvania:	VP at US Health Care/ disability and utilization research
Victor Politi surgeon)	1996	[IM]*		New York:	Medical director (chief NY Police Department
Elliot Kusnetz	1996	[FP]*	[1997]	New Jersey:	medical director of private OM clinical/consultative service
Art Heinrich	1997	[IM]		New Jersey:	Clinician in private OM clinic

IM=Board certified in internal medicine
FP=Board certified in family practice
[IM]=Board eligible in internal medicine
[1997] Scheduled to take board examination in late 1997
* Denotes joint 4 1/2 year residency training with OM and IM or FP

Table 2. Current Occupational Medicine Residents and their background and aspirations.

Name (graduation year)		Training	Desired career
Dorothy Quail	(98)	BC-Family Medicine	Corporate or hospital OM practice
Rosa Coppalocchia	(98)	BC-Internal Medicine	Corporate OM department
Evamarie Eskin	(99)	2 years of anesthesiology	Academic
Glenn Greene	(99)	PhD (Physics) + 1 year of IM	Academic
Neil Haas	(99)	Combined IM/OM residency	Undecided

EOHSI has a strong emphasis on toxicology and not surprisingly, our residents see a high proportion of cases with actual or suspected toxic exposures that need to be evaluated. Real or suspected exposure to heavy metals, solvents and pesticides make up a substantial part of the cases seen in our clinic. We also provide experience at ergonomics through clinical research projects and in the practicum sites. Our program places a premium on getting the residents out into the workplaces of their patients. Each patient is asked to arrange a visit to their workplace. Many workers are reluctant to let their boss know they have a clinical problem. Nonetheless a significant number of our patients do arrange a site visit for residents and faculty. Residents visit the sites with an OM attending and with a certified industrial hygienist in the company of fellow students in industrial hygiene and occupational nursing. A special inter-university course, taught by a certified industrial hygienist has been developed to supplement these visits, by making weekly visits to selected industrial sites.

RECRUITMENT

Judging by the number of job announcements received each month, there are still not enough trained occupational medicine physicians to fill the need. All residents are recruited long before graduation, some even being subject to seductions during their first year of training. This observation reveals a strong need for increased support of occupational medicine training. Our program with four full-time, board certified faculty physicians and additional full and part-time faculty, would be able to double its enrollment if funding were available for qualified candidates.

RESIDENT PROGRESS AND SUCCESS

During the 12 years the residency has existed, only one candidate has chosen to withdraw from the program. Of our nine most recent graduates, six are board certified in internal or family medicine and two are board eligible. Most residents take their occupational medicine boards as soon as they become eligible (about a year after graduation). Of these nine residents, all but two are in full-time occupational medicine practice. One combines internal and occupational medicine practice, and one is involved in research and surveillance of health care utilization with an emphasis on workers' compensation and disability, for a large HMO. Two of the residents are now full-time academicians. After completing his residency, Dr. Nigro spent two years as the medical director of a large airforce base in New Jersey, before joining the faculty of UMDNJ-RWJMS to head the occupational medicine program at Cooper Hospital on the Camden campus. Dr. Gwen Brachman joined the faculty of UMDNJ-New Jersey Medical School (Newark), as an assistant professor in the Department of Medicine to head the Employee Health Service for the school and its hospital.

STRUCTURE OF THE PROGRAM

The UMDNJ-RWJMS occupational medicine program is accredited for two years: academic and practicum. All incoming residents must have completed their pgy1 clinical year, and most have completed two or three years of primary practice. More than half of our incoming residents are board certified in internal or family medicine before they begin our program.

ACADEMIC YEAR: The first year is devoted mainly to course work for the MPH degree. In their first summer the residents take the required course in Occupational Health which covers the basic principles of occupational medicine, industrial hygiene, and ergonomics. The program is tailored specifically for physicians. During the regular academic year residents typically take four courses (12 credits) each semester. They also have three half-days of clinical assignments and a half day of conferences and journal club.

PRACTICUM YEAR: Our location in central New Jersey is fortunate because of the proximity of major corporations and their corporate medical directors. We have had a long working relationship with a number of corporations which not only accept, but provide stipend support for, our residents. Typically each resident takes at least two rotations ranging from 6-12 weeks each. The minimum requirement is for four months of practicum experience in a corporate setting. Our affiliation agreements currently include Lucent Technologies (formerly Bell Laboratories), Merck Chemical, Exxon Biomedical, Mobil, DuPont, Colgate, and Schering. Two of the corporate preceptors, Drs. Lawrence Shoner and Steven Lerman, are former graduates of our residency. In addition, we have developed rotations with New Jersey Manufacturers insurance company where residents have hands on clinical responsibility for workers' compensation cases and Prudential insurance where residents learn the challenges of evaluating workers for disability. A new rotation has been set up at Cooper Hospital under the direction of our former resident, Peter Nigro, MD, MPH. Here residents will have expanded opportunity to evaluate and treat walk-in injuries.

FACULTY CHANGES AND NEW PROGRAMS

During the five year period 1992-1997 the occupational medicine program benefitted from a number of new programs which enrich the educational and training opportunities for the residents. The opening of the new Environmental and Occupational Health Sciences Institute building brought together the academic and clinical offices, providing us with excellent clinical facilities on the first floor of the building. This has allowed us to expand our clinical services to include walk-ins with minor emergency problems that our residents are now able to evaluate and treat.

In 1992 Sandra Mohr, MD, MPH, was recruited as Assistant Professor and Deputy Director of the Residency. She has developed an active research program around upper extremity musculoskeletal injuries as well as a collaborative research program on MTBE and its possible health effects. Residents have participated in both of these research projects.

In 1994 Howard Kipen, MD, MPH, assumed directorship of the Division of Occupational Medicine. He has aggressively sought new clinical opportunities which have expanded opportunities for our residents.

Major research initiatives in which the residents have had the opportunity to participate include health studies of exposure to the fuel oxidant MTBE (methyl-tertiary butyl ether) under the direction of Dr. Mohr (the co-PI), and the NIOSH-funded study of lead and solvent exposure in construction workers under Dr. Fiedler (the PI).

In 1995 the program took over responsibility for operating the medical department of a nearby Colgate plant, and a resident has been assigned there two half-days per week, under the direction of Dr. Udasin.

In 1996 after several years of negotiations the medical school initiated a comprehensive employee health program with Iris Udasin, MD, as director. The program

provides clinical services on both campuses of the medical school. Residents see patients and have the opportunity to evaluate common sprains and strains and as well as prophylaxis for rare diseases and needlestick injuries. Under Dr. Udasin's tutelage, residents provide periodic surveillance examinations for animal handlers and those who handle hazardous waste.

In 1997 former resident Peter Nigro took a faculty position at the Camden campus of UMDNJ-RWJMS to head the occupational medicine program at Cooper Medical Center (Camden, NJ). We have begun a collaboration with that program, and Evemarie Eskin, MD, a first year resident, spends one day a week at Cooper with Dr. Nigro, evaluating and treating minor emergencies and other occupational health cases.

CURRICULAR CHANGES

In order to accommodate the clinical experience of our residents, the faculty developed a more clinical version of the Principles of Occupational Health course required of all residents and public health students in the occupational health track. Typically 4-6 physicians take this course each summer. A new inter-university course provides residents an increased opportunity to make site visits to industrial sites and other workplaces with other students in the ERC including industrial hygienists, safety, and occupational nursing students.

Richard Lynch MS, PhD, CIH, completed his doctoral studies in ergonomics in the program under Drs. Gochfeld and Mohr. Dr. Lynch has developed an advanced Principles of Industrial Hygiene course for residents and other experienced students. Dr. Lynch is also available to precept students in ergonomics.

FACULTY

Our faculty has grown during this period. Faculty are shown in Table 3. Except for the persons marked with an asterisk, all have their primary appointment in the Occupational Medicine Division. Dr. Lynch is a full-time faculty member at Rutgers University with a half-time committment to occupational the residency and Dr. Hague is a full-time faculty member in the Health Education/Risk Communication with a 20% committment to the residency. Drs. Thorpe and Hanley serve the residency one day a week, participating in case management conferences, precepting residents, and organizing and overseeing the practicum rotations.

Table 3. Faculty of the Occupational Medicine Residency program.

Name	Appointment	Role
Michael Gochfeld, MD, PhD	Clinical Professor	Residency Director
Sandra Mohr, MD, MPH.	Assistant Professor	Deputy Residency Director
Howard M. Kipen, MD, MPH	Associate Professor	Division Director
Iris Udasin, MD	Associate Professor	Director Employee Health
John Thorpe, MD,	Clinical Professor	Practicum Coordinator
Marshall Hanley, MD, MPH	Clinical Professor	Chair of Advisory Committee
Nancy Fiedler, PhD, Services	Associate Professor	Director Psychosocial
Richard Lynch, MS,PhD	Assistant Professor*	Industrial Hygiene/ergonomics
Robert Hague, MS,PhD	Assistant Professor*	Industrial Hygiene
Gail Buckler, MPH, RN	Instructor	Clinic Coordinator
Jeffrey Bowden, MSW	Instructor	EAP Coordinator

Of the six physicians five are certified in occupational medicine and five are certified in internal medicine. Dr. Fiedler and Mr. Bowden are Certified EAP counselors, Ms. Buckler is a certified occupational health nurse,and Drs. Lynch and Hague are certified industrial hygienists.

OCCUPATIONAL MEDICINE RESIDENCY ADVISORY COMMITTEE

The OMRAC chaired by Marshall Hanley meets twice a year to review the program and consider new needs and directions. Members include site preceptors, physician and industrial hygienists from the state health department, former residents, and other academics. The meetings provides the opportunity for residents to report on their experiences and activities and to meet future preceptors.

FUNDING

The residency is privileged to receive two stipends from the ERC. Because of the contractual agreement between UMDNJ and the Committee for Interns and Residents, all residents must receive the union scale salary according to their level of training. Since our incoming residents usually start as PGY-3 (ca $43,000 salary + $11,000 fringe), it is apparent that the NIOSH stipend covers only about half of the costs of the two residents who are supported.

We are required to raise the balance for these residents as well as the stipends for the other residents from other sources including clinical services and consulting. Table 4 shows a sample budget. At present we are fortunate in having one of our residents partially supported by the Occupational Physicians Scholarship Fund (OPSF).

Table 4. Breakdown of financial support for the OM Residency

Status of Resident	% Support by stipend from ERC	from OPSF	Raised from other sources
ERC-Supported Resident	50%		50%
ERC-Supported Resident	50%		50%
non-supported Resident			100%
OPSF-supported resident		50%	50%

FUTURE

Since occupational medicine programs generally receive no support from hospitals, it is incumbent in our programs to be able to raise funds for stipend support from a variety of areas. This is challenging, particularly since we are increasingly faced with patients whose HMO does not pay for outside preventive services. Recruitment too is a challenge. Although we always have high quality candidates in our program, the number of applicants with solid credentials remains low. Our faculty have participated in several programs designed to encourage medical students and physicians to consider careers in preventive medicine and occupational medicine.

Our program is fortunate in having a close working relationship with the Graduate Program in Public Health (GPPH) which is operated out of our Department and is housed in the EOHSI Building. Dr. Gochfeld serves also as track director for Environmental and Occupational Health in the GPPH. This has facilitated strengthening the GPPH course offerings and making it more relevant to the needs of future occupational physicians.

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NEW YORK UNIVERSITY MEDICAL CENTER
550 First Avenue
New York, NY 10016

EDUCATION RESOURCE CENTER: TRAINING AND RESEARCH TRAINING IN OCCUPATIONAL HYGIENE

FINAL PERFORMANCE REPORT
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Program Director: Morton Lippmann, Ph.D.
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ABSTRACT

The purpose of this program, a major component of the NIOSH, Region II ERC, has been to provide professional training at the graduate and post graduate levels in occupational hygiene (OH). Research training is an integral part of the doctoral program and the focus of the postdoctoral program. The training program is accomplished primarily within the NYU Nelson Institute of Environmental Medicine (NYU-NIEM), which is a department of NYU School of Medicine and Post Graduate Medical School. The pre and post doctoral programs in OH were the only such research training programs in the NIOSH Region II ERC, and the only ERC postdoctoral OH research training program in the country.

The M.S. training program in OH began with the initiation of the NIOSH Region II ERC in 1978. Since the inception of the NIOSH research training initiative, in 1987, the OH program has emphasized doctoral and postdoctoral training, seeking candidates with the potential for successful careers as faculty and research scientists in OH. The graduates of the program have secured responsible positions in academia, government and private enterprises. All six of the postdoctoral trainees who were supported by NIOSH currently hold research and/or teaching positions. In addition the program has encouraged other environmental health science graduate students to pursue OH training and subsequently secure positions in the field.

Eleven trainees (including 2 postdoctoral) were funded during the last 5 years. Three completed the M.S. degree and are continuing for the Ph.D. Three completed the Ph.D. program as did 2 others who had been funded in the prior grant period. Four Ph.D.'s have been awarded to other OH students.

The postdoctoral program has been focused on exploratory research that addresses key issues in OH for which current exposure assessment techniques have been limiting factors. Both NIOSH postdoctoral trainees who were supported during the last five years have competed successfully for NIOSH research grants.

During this grant period predoctoral occupational health majors were authors or co-authors of 34 technical papers resulting from work performed at the Institute. Postdoctoral trainees authored 19 papers. During the past 5 years 65 abstracts/ presentation of Occupational Hygiene Trainees resulted from work performed while at the NYU-NIEM.

I. INTRODUCTION

The purpose of this program, a major component of the NIOSH, Region II ERC, has been to provide professional training at the graduate and post graduate levels in occupational hygiene. Research training is an integral part of the doctoral program and the focus of the postdoctoral program.

The doctoral and postdoctoral program is designed to train professionals for academic and research careers in universities, government, and private enterprise organizations. The Ph.D. students receive thorough training in occupational diseases, toxicology and control technology, and a comprehensive appreciation of the background and techniques of the environmental health sciences. They complete a doctoral thesis project which is an original contribution to the advancement of knowledge in the field of occupational hygiene. The M.S. curriculum produces professional practitioners who will occupy responsible occupational health positions in government, unions, trade associations, insurance companies and private industry. The postdoctoral trainees take some graduate courses, as appropriate, to fill gaps in their background but, they spend most of their time in residence in exploratory research which prepares them for independent research careers.

Ph.D. and M.S. oriented trainees with academic background in a basic or engineering science were selected based on: (1) prior academic performance; (2) faculty recommendations; (3) interviews, where feasible; and (4) prior graduate studies and relevant work experience. Postdoctoral trainees are those who plan an academic, government or other research oriented career in occupational hygiene.

The training program was carried out primarily within the NYU Nelson Institute of Environmental Medicine, which is a department of NYU School of Medicine and Post Graduate Medical School. It is located both in Manhattan and at Sterling Forest, 50 miles to the northwest. The Institute has a faculty of 55. Many of the additional supporting staff of 80 hold advanced degrees. The annual operating budget is approximately eleven million dollars. It is one of the nineteen university-based centers supported by NIEHS as a national center for research in environmental health. The Institute has approximately 75,000 square feet of modern, well-equipped laboratory and office space. The graduate courses in environmental health are taught at both Sterling Forest and at NYU's campuses in Manhattan where courses in the basic sciences, applied and basic medical sciences, and mathematics are also available.

II. BACKGROUND AND TRAINING HISTORY

This occupational hygiene (OH) training program has been a component of the NIOSH Region II ERC. Our postdoctoral and Ph.D. trainees continue to fill the need for new investigators and teachers, and for expanding research opportunities in occupational health. NIOSH has set a new National Occupational Research Agenda (NORA) to alleviate the still too high rate of illness and injury among American workers and it is essential to provide appropriately trained research personnel. The program has also provided access to courses in OH to many students who are pursuing degrees in other environmental health fields. Since the inception of the NIOSH supported training program in OH at NYU-Nelson Institute of Environmental Medicine (NYU-NIEM) in 1978, the number of NYU graduates working in OH, or closely related fields, who were not NIOSH supported, is greater than the number of OH trainees (43) who were supported.

The NYU-NIEM has offered graduate and post-graduate training in occupational health and related environmental and occupational health sciences for approximately 50 years. For the past 34 years, it has been a federally-designated, university-based, center for teaching and

research in the environmental health sciences. The NIEM began as a Division of Industrial Medicine, and became an independent department of the School of Medicine in 1954. Aside from occupational and environmental hygiene, it is particularly noted for its research in environmental toxicology, carcinogenesis, radiological health, aerosol physiology, respiratory disease and occupational and environmental epidemiology.

The NIEM educational mission is principally to: 1) train postdoctoral, graduate and medical students for productive careers in research, teaching, and other professional services; and 2) conduct research for the identification, evaluation and control of occupational and environmental health hazards. The NIEM addresses a broad spectrum of problems in occupational and environmental health, ranging from the biomedical and ecological effects of radiation and toxic chemicals to the causative mechanisms of cancer, arteriosclerosis, respiratory disorders and other occupational and environmentally related diseases. The programs incorporate the interaction of multiple disciplines relevant to identification and assessment of occupational and other environmental contamination, human exposures to physical and chemical agents, and to evaluation of the associated risks.

Graduate training in environmental health leading to the Ph.D., is offered in various specialty tracks including: 1) occupational and environmental hygiene, with subspecialties in health physics and air pollution, 2) occupational and environmental toxicology, 3) molecular epidemiology, including biostatistics, 4) environmental radiation, 5) environmental oncology, 6) molecular and cellular toxicology, 7) aquatic toxicology, 8) neurotoxicology, and 9) ergonomics and biomechanics. The goal of each program is to provide competence in a basic science, a general perspective on environmental health problems, and specialized knowledge in a chosen environmental health area. The program for each student is adjusted for his or her specific background and goals.

The M.S. training program in OH began with the initiation of the NIOSH Region II ERC in 1978. Since the inception of the NIOSH research training initiative, in 1987, the OH program has emphasized doctoral and postdoctoral training, seeking candidates with the potential for successful careers as faculty and research scientists in OH. The graduates of the program have secured responsible positions in academia, government and private enterprises. All six of the postdoctoral trainees who were supported by NIOSH currently hold research and/or teaching positions. In addition the program has encouraged other environmental health science graduate students to pursue OH training and subsequently secure positions in the field.

A. Distinctive Contributions of the Program

The pre and post doctoral programs of the NYU-NIEM in OH were the only such research training programs in the NIOSH Region II, and the only ERC postdoctoral OH research training program in the country. Research and research training are integral parts of these programs. Many of our graduates continue to work in academia and government research laboratories utilizing the research training obtained at the NYU-NIEM to the further benefit the workforce.

The postdoctoral program has been focused on exploratory research that addressed key issues in OH for which current exposure assessment techniques have been limiting factors. An example is research conducted in this grant period by NIOSH postdoc, Dr. Wei Li, on ultrafine aerosol measurement. Ultrafine aerosols, i.e., freshly generated particles with diameters below ~ 0.1 μm, are associated with occupational exposures to metal fumes and the products of other high-temperature processes, and research in our laboratory and elsewhere has demonstrated that toxic responses increase, for a given mass concentration, as particle size decreases within this size range. Such responses generally correlate better with number concentration than with mass concentration. The current reference method for number concentration is the

condensation particle counter (CPC), but this instrument cannot provide any evidence of the chemical composition of the ultrafine particles.

Dr. Li's research on ultrafine particles has been focused in two areas. In one, he has adapted the Koutrakis method for the semi-continuous monitoring of the mass concentration of ambient air particles in the accumulation mode (0.1 to 2 μm diam.) that is based on a linear relationship between accumulated particulate mass on a 2 μm polycarbonate pore filter and the change in pressure drop across the filter. Dr. Li has shown that there is also a linear increase in pressure drop across a 0.2 μm polycarbonate pore filter with the accumulated mass of the ultrafine particles in ambient air that has been pre-cleaned of particles > 0.15 μm in diameter. However, in order to achieve a practical design for this new system, with its inherently larger baseline pressure and pressure drops, he has had to develop a new and different sequential sampling system than the one used by Koutrakis for the larger particles. If this linear relationship can be shown to also occur for metal fumes and other industrial ultrafine aerosols, it can provide the basis for sensitive new field measurements of relevant exposures.

Dr. Li also assisted Dr. Beverly Cohen on her research for the development of a personal monitor for the number concentration of strongly acidic ultrafine particles (i.e., sulfuric acid in the size range 0.01 to 0.15 μm). The ultrafine acidic droplets are collected by Brownian diffusion as they pass through a narrow channel that has a thin (0.025 μm) film of iron on one side. Each droplet that deposits on the iron film creates a characteristics depression on the film that can be identified by a scanning probe microscope (with resolving power down to 0.002 μm) that we have used on a lease arrangement. Future research on the characteristic images produced by ultrafine particles from industrial processes can lead to scanning systems that can sort and quantitate ultrafine particles according to chemical composition for samples too small for classical chemical analytical techniques.

The NIOSH NORA addresses the still too high rate of illness and injury among American workers. A few examples of personnel among the graduates of the NYU-OH doctoral and post- doctoral programs who are currently engaged in such research, are: Dr. V. Liu who is conducting an active ergonomics research program at the UCLA; Dr. L. Brosseau who is engaged in respirator research with particular emphasis on bioaerosols; Dr. M. Morandi who is working to improve the reliability of passive organic vapor monitors; and Dr. F. Rosenthal, who is doing research on the influence of lung disease on toxicant dosimetry, as well as on the effects of nonionizing radiation.

The faculty of the NYU OH program encourages the participation of trainees in national programs that advance the goals of OH professionals. Dr. J. Xiong, a post-doctoral trainee in this reporting period, is a member of the AIHA Aerosol Technology Committee. That committee's past chair is Dr. L. Brosseau, also a former postdoctoral trainee. Dr. Brosseau now serves on the ACGIH-Chemical Substance TLV committee and on the Editorial Review Board of the AIHA journal. Dr. Xiong also serves as a reviewer for AIHAJ and for AOEH. Another former trainee, Dr. M. McCawley, is chair of the ACGIH Mining Safety and Health Committee. One of our OH-M.S. students, Ms. Melissa Rooney, who was not supported by NIOSH, was President of the NYCON chapter of the American Industrial Hygiene Association in 1994.

The OH program at NYU has filled a unique part of the critical regional and national needs for highly trained professionals. Some of the graduates who have gone on to serve in government include Dr. M. McCawley, NIOSH, Morgantown; in academia include Dr. L. Brosseau, U. Minn.; Dr. M. Morandi, U. Texas; Dr. V. Liu, UCLA; Dr. Michael Kleinman, University of California at Irvine; and Dr. F. Rosenthal, Purdue; and in private enterprise include Dr. Ralph Malek, Rhone Poulenc; Dr. Tai Chan, General Motors; and Dr. Joshua Gurman, Hoechst Celanese. Two of the trainees who completed their studies in this reporting

period have gone to academia (Drs. F. Crofts, Johns Hopkins and J. Xiong, NYU) and two to industry (Drs. P. Weideman, Merck & Co. and S. Waterman, Exxon Biomedical Sci. Inc.)

The Environmental Hygiene Measurements Laboratory course G48.2037 required of OH majors at NIEM was restructured in 1995 so that students would spend at least 30% of the course effort in appropriate clinic, or research, patient studies with occupational medicine trainees at Mt. Sinai or UMDNJ. In 1985 students participated in the Mt. Sinai study of lead exposure to workers renovating the Manhattan Bridge. The study design, sample and data analysis were supervised by Dr. B. Cohen of NYU, sampling at the work site was supervised by Dr. M. Goldberg of the Hunter faculty. In addition the students observed medical screening interviews, sampling for blood lead levels, and review procedures for the employee health maintenance program. The student participants were very enthusiastic about this program stating that the experience was valuable.

III. CURRENT AND PAST TRAINING RECORD

Eleven trainees (including 2 postdoctoral) were funded during the last 5 years (from 5/92 to the present), 3 completed the M.S. degree and are continuing for the Ph.D. Three completed the Ph.D. program as did 2 others who had been funded in the prior grant period. There is 1 currently full time predoctoral NIOSH trainee. Four Ph.D.'s have been awarded to other OH students, and there are currently 8 additional OH doctoral students of whom 2 were funded in the past.

A total of 29 supported trainees (including 5 postdoctoral) of the OH programs have successfully completed their program and secured positions in OH (24) or gone on to pursue further professional training (5). Many additional students benefited greatly from being an integral part of the OH academic program at the NIEM. An approximately equal number of additional graduates and four postdoctoral appointees of EHS not supported by NIOSH are employed as OHs or in closely allied fields. A table of OH trainees supported by NIOSH is appended (Appendix 1).

During the 1996-1997 academic year a total of 54 graduate students and 7 postdoctoral trainees were affiliated with the NIEM. Training in OH was supported in part by NIOSH.

A very positive feature of the ERC has been to encourage other graduate students at the Institute to pursue occupational hygiene training and subsequently secure positions in the field. An example is the laboratory assistant for the environmental hygiene measurements laboratory course who receives thorough training in the design and conduct of experiments. The laboratory assistant actively participates in setting up the laboratory experiments and assists the individual students. Several of the past laboratory assistants have subsequently secure OH positions. Also shown in Appendix 1 is a table of other OH students who have completed training during the last five years.

A. Master of Science

During the past five years 15 Master of Science degrees have been awarded at NIEM, of which 6 were to OH majors (Appendix 2).

B. Doctoral Degrees

As of May 1997 one hundred eighty nine Ph.D.'s had been awarded through the NIEM, 35 which were awarded in the last five years. Nine of the 35 were to OH majors, 5 of whom were supported, in part, by NIOSH. The names of the doctorates, year of their degrees, their thesis titles and the current position held are appended (Appendix 3). As seen from the

current positions as listed; the graduates of the program at the NIEM have secured responsible positions in academia, government and private enterprise organizations. Approximately 50% of the recent graduates hold teaching or research positions.

C. Postdoctoral Trainees

Since 1989, through our ERC program component, NIOSH has provided support for 1 postdoctoral trainee in OH at NYU. Six postdoctoral trainees have been supported under this program. Three of them currently hold OH faculty positions at leading universities: Drs. Lisa Brosseau (U. of Minnesota), Wen Chen (Victor) Liu (UCLA), and Dr. Judy Xiong (NYU). In addition, Dr. Mitchell Cohen (inhalation toxicology at NYU) and Dr. Bahman Asgharian, a senior scientific staff member at CIIT, continue productive research careers in programs directly related to OH. Drs. Brosseau and Xiong competed successfully for NIOSH research grant support during their training, and Dr. Wei Li, who is just completing his third year of training, has also earned a NIOSH RO3 grant.

Two NIOSH postdoctoral trainees were supported during the last five years, i.e., Drs. Xiong and Li.

Dr. Judy Xiong was appointed as a postdoctoral fellow in November 1991. She received her Ph.D. in Chemical Engineering from the University of Minnesota in December 1991. During her fellowship Dr. Xiong obtained a NIOSH funded research grant to develop a sampler for volatile aerosols. She completed her training on 11/25/94 and joined the NYU faculty as a Research Assistant Professor of Environmental Medicine. She passed the core examination of American Board of Industrial Hygiene (ABIH) and was certified as an Industrial Hygienist In Training (IHIT) on July 22, 1994. She also served as a member of the American Industrial Hygiene Association (AIHA) Aerosol Technology Committee. Dr. Xiong is currently the safety officer of the NIEM Health and Safety Committee and chairperson of the Industrial Hygiene Subcommittee.

Dr. Wei Li was appointed as a postdoctoral fellow on 11/01/94. He received his Ph.D. in Chemistry from Clarkson University in July 1993. From August 1993 to September 1994, he was a postdoctoral fellow at Glaxo Inc. During the past year, Dr. Li has participated in the following research programs: 1) Use of iodine vapor to measure the airway deposition of unattached Po-218; 2) Study of the effect of flow pattern and particle charge on the deposition of ultrafine particles in lung airways; and 3) Development of a film detector for ambient acid aerosols. Dr. Li also assisted with the maintenance of the equipment for the measurement of concentration of ambient toxicants. Dr. Li audited the following courses to enhance his background in industrial hygiene: 1) Environmental Hygiene Measurement; 2) Environmental Contamination.

D. Student Publications Record

During this 5 year grant period predoctoral occupational health majors were authors or co-author of 34 technical papers resulting from work performed at the Institute. Postdoctoral trainees authored 19 papers. Some of the latter were based on prior work but completed while at NYU. The lists of publications are appended (Appendix 4).

E. Student Participation in Scientific Programs

The extensive participation of the faculty in national and international occupational health associations provides strong encouragement for trainees to develop a broad perspective and interest in many areas of OH. They are encouraged to attend and to actively participate in national conferences. Since the initiation of this training program many of the NYU OH

trainees have presented the results of their research to colleagues at the American Industrial Hygiene Conference (AIHC). Such participation provides substantial encouragement to trainees to actively participate in needed research. It also expands their understanding and interest in a wide range of current industrial hygiene problems. Scientific presentations by OH majors are presented in Appendix 5. Presentations at AIHC and other national meetings made by postdoctoral trainees are also listed.

APPENDIX 1

Trainee Rosters

A. All NIOSH-Supported Trainees

Predoctoral

Name	Appointment Period	Current Status
Mr. D. Johnson	9/1/78 - 1/31/79	Coordinator, Safety & Indust. Hyg., Celanese Res. Co., Summit, NJ
Ms. L. McFadden	9/1/78 - 8/31/79	M.S., 1981, Indust. Hyg., General Motors*
Mr. R. Mersky	1/26/79 - 6/30/80	M.S., 1981, Indust. Hyg., Geomet Consult.*
LCDR. J. Formisano	1/26/79 - 9/1/81	M.S., 1981, Head, Occupational Hyg. Dept., U.S. Navy, Sigonella, Sicily (currently on full-time leave at NYU (3 yrs-for Ph.D. studies))
Ms. C. Martinelli	9/1/79 - 1/31/81	M.S., 1981, Indust. Hyg., Hoffmann-LaRoche, Nutley, NJ
Mr. J. Dietrich	9/1/79 - 1/31/81	M.S., 1981, Indust. Hyg., Bristol-Myer Squibb Co., New Brunswick, NJ, CIH, CSP
Ms. T. Bernstein-Wolff	9/1/80 - 5/31/81	*
Dr. Mark Maiello	9/1/80 - 5/31/81	Ph.D., 1986, Indust. Hyg., Lederle Labs, Pearl River, NY
Dr. John Concato	6/18/80 - 8/31/81	M.S., 1981, M.D., 1985 in Med., NYU, Clin. Asst. Prof. Yale School of Med. & V.A. Hospital, New Haven
Mr. V. Illuzzi	9/1/80 - 8/31/82	M.S., 1984*
Mr. J. Bohne	9/1/80 - 8/31/82	M.S., 1981, Commander, Bioenvironmental Engineering Flight, USAF
Mr. S. Turner	9/1/80 - 8/31/82	M.S., 1983, CIH, Safety Engineer, ACUSON, Mountain View, CA
Mr. A. Chapkovsky	9/1/81 - 8/30/82	*
Mr. J. Olcott	9/1/82 - 2/28/83	M.S., 1984, Envirogenics, Inc., Mercerville, CIH
Mr. K. Barbee	12/1/81 - 6/30/83	M.S., 1984, Occupational Hygienist, Motorola, Inc., Austin, TX, CIH
Ms. K. Decker	2/1/82 - 6/30/83	M.S., 1985, USDOE/EML
Mr. M. Avdenko	9/1/81 - 8/31/83	M.S., 1983*
Dr. R. Positano	9/1/81 - 8/31/83	M.S., 1984, DDM 1988, Asst. to the Pres., NY College of Podiatric Medicine
Dr. M. Morandi	10/1/83 - 1/31/85	M.S., 1981, Ph.D., 1985, Assoc. Prof. School of Public Health, U. Texas, Houston, CIH
Dr. K. Wales	9/1/83 - 6/30/85	Ph.D., 1986, Epidemiol., Mobil Oil Co., Princeton, NJ; Consult., Metropol. Life Ins.
Dr. A. Fellman	9/1/84 - 8/31/85 12/1/87 - 2/1/89	Ph.D., 1989, Health Physicist, Malcolm Pirnie, Inc., Cranbury, NJ
Mr. M. Ostapczuk	9/1/84 - 5/31/86	M.S., 1986, Indust. Hyg., Barr Laboratories, Pomona, NY, CIH, CSP
Mr. J. Bean	2/1/85 - 4/30/91	*
Dr. R. Blumenthal	6/16/86 - 8/18/87	M.D., 1992, Albany Medical College, Private Practice
Dr. D. Neun	9/1/88 - 1/31/90	M.S., 1990, Ph.D., 1992, Product Safety Toxicol., Dow Corning, Midland, MI
Mr. P. Jaques	9/1/88 - present	M.S., 1991, Ph.D. Student
Dr. S. Katsifis	3/13/89 - 3/13/90	Ph.D., 1993, Faculty, St. Johns School of Pharmacy

Cpt. R. Wright	9/1/89 - 8/31/91	M.S., 1991, Indust. Hyg., U.S. Army, U.S.A. CHPPM, APG, MD
Dr. S. Merlino-Waterman	1/15/90 - 6/30/94	M.S., 1992, Ph.D., 1995, Toxicologist, Exxon Biomed. Sci., Inc., E. Millstone, NJ
Dr. F. Crofts	7/1/91 12/31/94	Ph.D., 1995, Post-Doc, Johns Hopkins Univ. Med. Ctr., Baltimore, MD
Dr. P. Weideman	7/1/92 - 10/31/94	Ph.D., 1995, Industrial Hygiene, Dupont-Merck Co., DE
Ms. J. Azare	9/1/94-6/31/95	Ph.D. Student
Mr. Y. Hazi	9/1/94-present	M.S., 1996 - Ph.D. Student
Ms. C. Gwynn	7/1/95-present	M.S., 1995 - Ph.D. Student
Mr. S. Thomas	9/1/95-present	Ph.D. Student
Ms. C.Y. Wu	7/1/95-present	M.S., 1993, Part-time Ph.D. Student, Minnesota Pollution Control Agency, Air Quality Div., St. Paul, MN
Ms. P. Zolotarevsky	9/1/96-present	Ph.D. student

Postdoctoral

Name	Appointment Period	Current Status
Dr. M. Cohen	7/1/88 - 6/30/90	Res. Asst. Prof., NYU Medical Center
Dr. B. Asgharian	6/1/89 - 11/30/90	Senior Research Scientist, CIIT, RTP, NC
Dr. L. Brosseau	6/1/89 - 12/31/90	Asst. Prof., Indust. Hyg., U. of MN, CIH
Dr. W.C.V. Liu	4/8/91 - 6/30/91	Adj. Asst. Prof., Indust. Hyg., UCLA, Berkeley, CIH
Dr. J. Xiong	11/15/91 - 11/25/94	Res. Asst. Prof., NYU Medical Center, IHIT
Dr. W. Li	11/1/94-present	Postdoctoral Fellow

B. Other QH Students Who Have Completed Degrees in the Past Five Years

Name	Degree Awarded	Current Status
	Ph.D.	
Dr. R. Malek	1993	Manager Corporate Indust. Hyg. Rhone-Poulenc, Princeton, NJ, CIH
Dr. T. Rahon	1994	Pres. CoPhysics Corp., Monroe, NY, CHP
Dr. Z. Hiz	1995	*
Dr. M. Heikkinen	1997	Associate Research Scientist, NYU Medical Center
	M.S.	
Ms. C.Y. Wu	1993	Minnesota Pollution Control Agency, Air Quality Div., St. Paul, MN
Mr. J. Antkowiak	1996	Project Supervisor, Radiological Services Dept., Teledyne Isotopes, Westwood, NJ
Mr. P. Decker	1996	Pharmaceuticals Div., CIBA-GEIGY Corp., Suffern, NY

* Current position not verified.

APPENDIX 2

Masters Degrees Obtained at the Institute of Environmental Medicine 1992-Present with Thesis Title and Current Employment*

†**Waterman, Stacey Jean**, May 1992, "The Suitability of Passive Diffusion Monitors for Environmental Monitoring," Toxicologist, Exxon Biomed Sciences, Inc. Mettlers Road, CN 2350, East Millstone, NJ 08875-2350.

***Hur, Tau**, October 1992, "Organ Response of Metallothionein and Hemeoxygenase Due to Endotoxin Inhalation."

McGovern, Timothy J., February 1993, "The Analysis of Particle Number Concentration and Hygroscopic Growth Rate of Acid Aerosols Used in Toxicologic Studies," Toxicology Consultant, ICS Kaiser, Fairfax, VA.

***Oliviera, Roseanna**, February 1993, "Anaerobic of Toxic Hexavalent Chromium in Enrichment Cultures."

†**Wu, Chun Yi**, October 1993, "Hygroscopic Properties of combustion Generated Particles," Minnesota Pollution Control Agency, Air Quality Division, 520 Lafayette Rd., St. Paul, MN 55155-4194.

†**Antkowiak, Joel**, May 1996, "Radiation Synovectomy in the Treatment of Rheumatoid Arthritis," Project Supervisor, Radiological Services Department, Teledyne Isotopes, 50 Van Buren Ave., P.O. Box 1235, Westwood, NJ 07675-1235.

†**Decker, Paul**, May 1996, "Occupational Exposure to Heavy Metals from Pressure Treated Wood Dust," Sr. Safety & Environmental Education Specialist, Technical Education & Training Services, Pharmaceuticals Division, Ciba-Geigy Corp., Old Mill Rd., P.O. Box 100, Suffern, NY 10901.

Su, Lin, May 1996 (qualifying exam in lieu of thesis), Assistant Research Scientist, NYU, Tuxedo, NY.

Voitkun, Victoria A., May 1996 (qualifying exam in lieu of thesis), Ph.D. student, EHS/Sackler Program, NYU, Tuxedo, NY.

McManus, Thomas, September 1996, "Effects of Ozone on the Distribution of Hexavalent Chromium in Rat Lung and Pulmonary Immune Cells," Zeiss Optical Systems, Inc., Digital Imaging, One Zeiss Dr., Thornwood, NY 10594.

***Su, Shaun C.**, September 1996, "Implanted Knee and Hip Prostheses: Review of Carcinogenic Effects."

†**Gwynn, Charon**, May 1995 (qualifying exam in lieu of thesis), Ph.D. student, EHS Program, NYU, Tuxedo, NY.

†**Hazi, Yair**, May 1996 (qualifying exam in lieu of thesis), Ph.D. student, EHS Program, NYU, Tuxedo, NY.

•†**Thomas, Sean**, September 1997, "The Metal Content of Size Fractionated Urban and Rural Particulate Matter," Industrial Hygienist, Albert Einstein College of Medicine, Department of Environmental Health and Safety, Bronx, NY.

•†**Rooney, Melissa**, September 1997, "Comparison of a Vapor-Particle Sampler for the Simultaneous Measurement of Vapor and Particles to Organic Vapor Diffusion Monitors and Charcoal Tube and Pre-filtered Charcoal Tube Samplers" (not currently employed).

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* Unable to verify current employment.
† Occupational Hygiene major.
• Degrees awarded after 6/30/97.

APPENDIX 3

Doctoral Degrees Obtained at the Institute of Environmental Medicine 1992-Present with Thesis Title and Current Employment*

†**David Neun**, May 1992, Environmental Health Sciences
"Differential Effects of In Vivo and In Vitro Benzene Exposure on Hematopoietic Stem Cells from Two Strains of Mice"
Product Safety Toxicologist, Dow Corning Corp., 2200 W. Salzburg, Midland, MI 48686-0994

O'Connor, Owen, October 1992, Environmental Health Sciences
"Bacterial Metabolism of Aromatic Compounds and a Complex Hazardous Waste Under Anaerobic Conditions"*

Day, Gina L., February 1993, Environmental Health Sciences
"Tobacco, Alcohol, and Other Factors in Relation to Second Primary Cancers Following Oral and Pharyngeal Cancer: A Nested Case-Control Study"
Nat'l Cancer Inst., 6130 Exec. Blvd., Exec. Plaza North, Rm. 415 Bethesda, MD 20892

Corti, Miriam, February 1993, Environmental Health Sciences
"The Erythropoetic Effects of *In Vitro* Exposure to Benzene and Ethenol Including the Mechanisms of Action of Benzene Metabolites and Ethanol on Erythroid Precursors"
Post-Doc - Tulane University, New Orleans, LA

Felber, Mary, May 1993, Sackler, Environmental Oncology
"Molecular Analysis of Progression in Rat Skin Tumors Induced by High and Low Let Radiation"
Post-Doctoral-Fellow, Rockefeller University, Behavioral-Neurobiology Dept., NY, NY

Grevatt, Peter, May 1993, Sackler, Environmental Oncology
"The Role of O2-Ethyldeoxythmidine in Mutagenesis and Cytotoxicity by Ethylating Agents"
Sci. Advisor, Risk Assessment, US Env. Protect. Agency, Region 2, 26 Federal Plaza, NY, NY

†**Katsifis, Spiros**, September 1993, Environmental Health Sciences
"Metal Interaction with Physical and Chemical Agents in the Induction of SCE's in Cultured Human Lymphocytes"*

Su, Wei Yi, September 1993, Environmental Health Sciences
"Effects of Ozone and Acid Aerosol Exposures on Surfactant Associated Protein A in the Lung"
EPA, HERL, Research Triangle Park, NC 27711

†**Malek, Ralph**, September 1993, Environmental Health Sciences
"Estimates of Inhalation Exposure to Styrene in the Reinforced Plastic Industry: Controlling factors and Predictive Model"
Manager, Corp. Industrial Hygiene, Phone-Powlenc, Princeton, NJ

Jin, Yi, September 1993, Environmental Health Sciences
"Tumor Suppressor Gene Alterations in Rat Skin Cancer Induced by High and Low LET Radiation"
Post-Doc, Institute of Cancer Research, Columbia University, NY NY 10032

Duffy, Jeffrey, December 1993, Environmental Health Sciences
"The Response of Glial Fibrillary Acidic Protein (GFAP) and GFAPmRNA in the Central Nervous System as an Index of Neurotoxicant Exposure"
Post-Doc, University of Miami, FL

Chin, Yue E., September 1994, Sackler, Environmental Oncology
"Mechanistic Studies of Effects of Nickel (Ni2+) on DNA Replication"
Dept. of Pathology, Yale Medical School, 310 Cedar Street, New Haven, CT 06510

†**Rahon, Theodore**, September 1994, Environmental Health Science
"Design of a Gamma Radiation Detection and Imaging system for long Range and Remote Applications"

President, CoPhysics Corporation, Monroe, NY 10950

Fleisher, Jay, September 1994, Environmental Health Science
"Intervention Follow-up Studies Designed to Identify the Health Effects of Bathing in Marine Waters Contaminated with Domestic Sewage"
Asst. Prof., Department of Preventative Medicine, State Univ. of NY Health Science at Bklyn

Nesta, Douglas P., September 1994, Environmental Health Sciences
"Identification and Characterization of a Variant Collagen α3 (VI) From Rooster Arteriosclerotic Plaques"
Medical Research Division, American Cyanamid Co., Pearl River, NY 10965

Wang, Zaolin, September 1994, Environmental Health Sciences
"Molecular Mechanisms of Arsenite Resistance in Chinese Hamster V79 Cells"
Post-Doc., Los Alamos National Laboratory, Life Sciences Division, Los Alamos, NM 87545

Lin, Xinhua, January 1995, Environmental Health Sciences
"Studies of Nickel Induced Neoplastic Transformaton in Cultured Human Osteoblasts"
Dept. of Medicine, Memorial Sloan-Kettering Cancer Center, 1275 York Ave., NY, NY 10021

Hubbard, Frank, January 1995, Sackler, Environmental Oncology
"The Role of H-ras in the Malignant Conversion of Rat Tracheal Epithelial Cells"
Fox Chase Cancer Center, Philadelphia, PA 19111

†**Crofts, Frances,** January 1995, Sackler, Environmental Oncology
"CYP1A1 Polymorphisms and Genetic Susceptiblity to Lung Cancer: The Role of Genotype, Phenotype, and Ethnicity"
Post-Doc, Dept. of Env. Hlth Sci., Div. of Tox. Sci. John's Hopkins Univ. Med. Ctr., Baltimore, MD 21205

Ashkenazi-Kimmel, Tracy, May 1995, Environmental Health Sciences
"Interactive Effects of Exposure to Sulfuric Acid Aerosol and Ozone on Morphology of the Rat Lung: Importance of Aerosol Droplet Size"
Toxicologist, Warner-Lambert Company, 201 Tabor Road, Morris Plains, NJ 07950

†**Waterman, Stacey,** May 1995, Environmental Health Sciences
"Immune Mechanisms in Lead Induced Neurotoxicity"
Exxon Biomed Sciences, Inc. Mettlers Road, CN 2350, East Millstone, NJ 08875-2350

Lee, Yong Woo, May 1995, Sackler, Environmental Oncology
"Molecular Mechanisms of 6-Thioguanine Resistance Induced by Carcinogenic Nickel Compounds in the Transgenic G12 Chinese Hampster Cells: A Relevance to the Role of Epigenetic Mechanisms in Nickel Carcinogenesis"
Post-Doc, New York University Medical Center, Department of Environmental Medicine, NY

†**Hiz, Zekiye,** May 1995, Environmental Health Sciences
"A 2-Stage Model with Repair for Radiation Carcinogenesis"*

†**Weideman, Patricia,** September 1995, Environmental Health Sciences
"Comparison of the Pulmonary Inflammatory Response of Lactating and Postlactating Rats to Acute Ozone Exposure and Evaluation of the Influence of Inhaled Dose"
Dupont-Merck Co., DE

Donahue, Jean M., January 1996, Sackler, Environmental Oncology
"Studies on the Biological Significance of Ethylating Agent-Induced N3-Ethyldeoxythymidine"
Assistant Professor, Barnard College

Grunwald, Cheryl Malka, May 1996, Environmental Health Sciences
"Effects of Exogenous and Endogenous Factors on Hepatic CYP1A mRNA Expression in Atlantic Tomcod"
Seeking employment

Gong, Zhaolong, September 1996, Environmental Health Sciences
"DMSA (Succimer) Reduces the Neurotoxicity of Lead"
Laboratory of Neurotoxicology, Building 10, Room 3D40, National Institute of Mental Health, National Institutes of Health, Bethesda, MD 20892-1262

McGovern, Timothy J., September 1996, Environmental Health Sciences
"Pharmacological Mechanisms in the Pulmonary Toxicity of Sulfuric Acid Aerosol and Ozone"
Toxicology Consultant, ICS Kaiser, Fairfax, VA

Condon, Mark S., January 1997, Environmental Health Sciences
"Saromal-Epithelial Interactions in Prostate Carcinogenesis"
Instructor of Biology, Dutchess Community College, Department of Biological Sciences, 53 Pendell Road, Poughkeepsie, NY

Hosselet, Stephen C., January 1997, Environmental Health Sciences
"Ionizing Radiation-Induced Transformation of Rat Skin Keratinocytes Transfected with the *c-myc* Oncogene"
Principal Scientist, Hoffmann-LaRoche, Inc., 340 Kingsland St., Nutley, NJ 07110

Matheson, Joanna M., January 1997, Environmental Health Sciences
"Immune Mechanisms in Metal-Induced Nephrotoxicity"
Staff Fellow, NIOSH, CDC, 1095 Willowdale Road, Morgantown, W VA 26505

†**Heikkinen, Maire**, January 1997, Environmental Health Sciences
"A Portable, Integrating Diffusion Battery for the Measurement of Radon Progeny Particle Size Distribution in Indoor Air"
Associate Research Scientist, Nelson Institute of Environmental Medicine, NYU Medical Center, Tuxedo, NY 10987

Barr, Ann, January 1997, Environmental Health Sciences (Biomechanics and Ergonomics)
"Effect of Electronic Mouse Design on Patterns of Motor Coordination of the Forearm and Wrist and on User Skill"
Assistant Professor, Physical Therapy Dept., College of Allied Health Professions, Temple Univ., 30307 N. Broad St., Philadelphia, PA 19140

Sheikhzadeh, Ali, January 1997, Environmental Health Sciences (Biomechanics and Ergonomics)
"The effect of pure and complex loading on the recruitment patterns of ten selected trunk muscles"
Coordinator of the Muscle Lab., Occupational and Industrial Orthopedic Center, Hospital for Joint Diseases, 63 Downing St., New York, NY 10014

Ballesteros, Anita, January 1997, Sackler, Environmental Oncology
"Expression of the Retinoblastoma Gene in Rat: A Study of Four Rat Strains"*

Total 189 (total 1992-present: 35)

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* Unable to verify current employment
† Occupational Hygiene major

APPENDIX 4

Publications of Occupational Hygiene Trainees During the Last 5 Years which Resulted from Work Performed while at the Institute of Environmental Medicine.

(The name of the Occupational Hygiene student is underlined.)

Predoctoral Trainees

Chen, L.C., Wu, C.Y., Qu, Q.S., and Schlesinger, R.B. Number concentration and mass concentration as determinants of biological response to inhaled irritant particles. Inhal. Toxicol. 7:577-588, 1995.

Chen, L.C., Huang, X., Wu, C.Y., Zalma, R., Pezerat, H., and Qu, Q.S. The role of ferroussulfate in coal dust induced lung injury. Appl. Occup. Environ. Hyg. 11(7):973-979, 1966.

Christie, N.T. and Katsifis, S.P. Nickel carcinogenesis. In: Biological Effects of Heavy Metals, Vol. II (E.C. Foulkes, ed.), CRC Press, Inc., Boca Raton, FL, Chapter 4, pp. 95-128.

Christie, N.T. and Katsifis, S.P. Nickel carcinogenesis. In: Mechanisms of Metal Carcinogenesis (E.C. Foulkes, ed.), CRC Press, Inc., Boca Raton, FL, Chapter IX (In press).

Cohen, N., Laurer, G.R., Pomroy, C., Morse, R.S., Hickman, D.P., Estrada, J.S. and Neton, J.W. Long-term retention of lead-210 in man. A unique case of internal contamination. Health Phys. 62:553-555, 1992.

Colome, S.D., Kado, N.Y., Jaques, P.A. and Kleinman, M. Indoor-outdoor air pollution relations: Particulate matter less than 10 μm in aerodynamic diameter (PM10) in homes of asthmatics. Atmos. Environ. 26A(12):2173-2178, 1992.

Cosma, G., Crofts, F., Currie, D., Toniolo, P. and Garte, S.J. The relationship between genotype and function of the human CYP1A1 gene. J. Toxicol. Environ. Health 40(2):315-322, 1993.

Cosma, G., Crofts, F., Currie, D., Wirgin, I., Toniolo, P. and Garte, S.J. Racial differences in restriction fragment length polymorphisms and messenger RNA inducibility of the human CYP1A1 gene. Cancer Epidemiol., Biomarkers, Prev. 2:53-57, 1993.

Crofts, F., Cosma, G.N., Currie, D., Taioli, E., Toniolo, P. and Garte, S.J. A novel CYP1A1 gene polymorphism in African-Americans. Carcinogenesis 14(9):1729-1731, 1993.

Crofts, F., Taioli, E., Cosma, G.N., Currie, D., Toniolo, P., and Garte, S.J. Functional significance of different human CYP1A1 genotypes. Carcinogenesis 12:2961-2963, 1994.

Fellman, A., Ralston, L. Hickman, D., Ayres, L. and Cohen, N. Polonium metabolism in adult female baboons. Radiat. Res. 137:238-250, 1994.

Garte, S.J., Trachman, J., Crofts, F., Toniolo, P., Buxbaum, J., Bayo, S., and Taioli, E. Distribution of composite CYP1A1 genotypes in Africans, African-Americans and Caucasians. Human Hered. 46:121-127, 1996..

Gordon, T., Weideman, P.A., and Gunnison, A.F. Increased pulmonary response to inhaled endotoxin in lactating rats. Am. Rev. Respir. Dis. 147:1100-1104, 1993.

Gunnison, A.F., Weideman, P.A., and Sobo, M. Enhanced inflammatory response to acute ozone exposure in rats during pregnancy and lactation. Fundam. Appl. Toxicol. 19:607-612, 1992.

Gunnison, A.F., Weideman, P.A., Sobo, M., Koenig, K.L., and Chen, L.C. Age-dependence of responses to acute ozone exposure in rats. Fundam. Appl. Toxicol. 18:360-369, 1992.

Ito, K., Thurston, G.D., Hayes, C. and Lippmann, M. Associations of London, England daily mortality with particulate matter, sulfur dioxide, and acidic aerosol pollution. Arch. Environ. Health 48:213-220, 1993.

Ito, K., Kinney, P., and Thurston, G.D. Variations in PM10 concentrations within two metropolitan areas and their implications to health effects analyses. Inhal. Toxicol. 7:735-745, 1994.

Ito, K. and Thurston, G. Daily PM10/mortality associations: An investigation of at-risk subpopulations. J. Expos. Anal. Environ. Epidemiol. 6:79-96, 1996.

Jaques, P.A., Thurston, G.D., Kinney, P.L. and Gorczynski Jr., J.E. Precision of an ambient sequential acid aerosol sampling system. Appl. Occup. Environ. Hyg. 8(4):313-316, 1993.

Kado, N.Y., Colome, S.D., Kleinman, M.T., Hsieh, D.P.H., and Jaques, P.A. Indoor-outdoor concentration and correlations of PM10-assocated mutagenic activity in nonsmokers and asthmatics homes. Environ. Sci. Technol. 28(6):1073-1078, 1994.

Kinney, P.L., Ito, K., and Thurston, G.D. A sensitivity analysis of mortality/PM10 associations in Los Angeles. Inhal. Toxicol. 7:59-69, 1994.

Lippmann, M., and Ito, K. Separating the effects of temperature and season on daily mortality from those of air pollution in London: 1965-72. Inhal. Toxicol. 7:85-97, 1995.

Neun, D.J., Penn, A. and Snyder, C.A. Evidence for strain-specific differences in benzene toxicity as a function of host target cell susceptibility. Arch. Toxicol. 66:11-17, 1992.

Taioli, E., Crofts, F., Demopoulos, R., Trachman, J., Toniolo, P., and Garte, S.J. A specific African-American polymorphism is associated with adenocarcinoma of the lung. Cancer Res. 55:472-473, 1995.

Taioli, E., Crofts, F., Trachman, J., Bayo, S., Bradlow, L., Toniolo, P. and Garte, S.J. Racial differences in CYP1A1 genotype and function. Tox. Lett. 77:357-362, 1995.

Taioli, E., Crofts, F., Trachman, J., Demopoulos, R., Ford, J., and Garte, S.J. Enhanced risk of lung and prostate adenocarcinoma in African-American smokers carrying a novel CYP1A1 gene polymorphism. Poly. Arom. Comp. (in press).

Thurston, G.D., Gorczynski, J.E., Jaques, P., Currie, J. and He, D. An automated sequential sampling system for particulate acid aerosols: Description, characterization, and field sampling results. J. Exp. Anal. Environ. Epidemiol. 2:415-428, 1992.

Thurston, G.D., Ito, K., Kinney, P.L. and Lippmann, M. A multi-year study of air pollution and respiratory hospital admissions in three New York State metropolitan areas: Results for 1988 and 1989 summers. J. Exp. Anal. Environ. Epidemiol. 2:429-450, 1992.

Thurston, G.D., Gorczynski, J.E., Currie, J.H., He, D., Ito, K., Lippmann, M., Waldman, J., and Lioy, P. The nature and origins of acid aerosol pollution measured in Metropolitan Toronto, Ontario. Environ. Res. 65:254-270, 1994.

Thurston, G.D., Ito, K., Lippmann, M. and Bates, D.V. Respiratory hospital admissions and summertime haze air pollution in Toronto, Ontario: Consideration of the role of acid aerosols. Environ. Res. 65:271-290, 1994.

Waterman, S.J., El-Fawal, H.A.N., and C.A. Snyder. Lead alters the immunogenicity of two neural proteins. A potential mechanism for the progression of lead-induced neurotoxicity. Environ. Health Perspect. (in press).

Weideman, P.A. and Schlesinger, R.B. The effect in vitro exposure to ozone on eicosanoid metabolism and phagocytic activity of human and rabbit neutrophils. Inhal. Toxicol. 6:43-55, 1994.

Weideman, P.A., Chen, L.C., and Gunnison, A.F. Enhanced pulmonary inflammatory response to ozone during lactation in rats: Evaluation of the influence of inhaled dose. Inhal. Toxicol. 8:495-519, 1996.

Whyatt, R.M., Garte, S.J., Cosma, G., Bell, D.A., Jedrychowski, W., Wahrendorf, J., Randall, M.C., Cooper, T.B., Ottman, R., Tang, D., Tsai, W.Y., Dickey, C.P., Manchester, D.K., Crofts, F., and Perera, F.P. CYP1A1 messenger RNA levels in placental tissue as a biomarker of environmental exposure. Can. Epi. Biomar. Prev. 4:147-154, 1995.

Postdoctoral Trainees*

Asgharian, B., Fang, C.P. and Cohen, B.S. Generation of submicron mass/volume-monodisperse aerosols with a nebulizer-impactor-electrostatic classifier system. Aerosol Sci. Technol. 16:96-104, 1992.

Brosseau, L.M., Fang, C.P., Snyder, C. and Cohen, B.S. Particle size distribution of automobile paint sprays. Appl. Occup. Environ. Hyg. 7:607-612, 1992.

Chin, Y.E., Snow, E.T., Cohen, M.D., and Christie, N.T. The effect of divalent nickel (Ni^{2+}) on *in vitro* DNA replication with DNA polymerase a. Cancer Res. 54:2337-2341, 1994.

Cohen, B.S., Brosseau, L.M., Fang, C.P., Bowers, A. and Snyder, C. Measurement of air concentrations of volatile aerosols in paint spray applications. Appl. Occup. Environ. Hyg. 7:514-521, 1992.

Cohen, B.S., Xiong, J.Q. and Li, W. The influence of charge on the deposition behavior of particles with emphasis on singly charged nanometer sized particles. In: Aerosol Inhalation: Recent Research Frontiers (Marijnissen and Gradon, eds.), Kluwer Academic Publishers, MA, pp. 153-164, 1996.

Cohen, B.S., Xiong, J.Q., Asgharian, B., and Ayres, L. Deposition of inhaled charged ultrafine particles in a simple tracheal model. J. Aerosol Sci. 26:1149-1160, 1995.

Cohen, M.D., Klein, C.B. and Costa, M. Forward mutations and DNA-protein crosslinks induced by ammonium metavanadate in cultured mammalian cells. Mutat. Res. 269:141-148, 1992.

Cohen, M. and Costa, M. Chromium compounds. In: Environmental and Occupational Medicine (W. Rom, ed.), Little Brown and Co., Boston, MA, pp. 799-806, 1992.

Cohen, M.D., Parsons, E., Schlesinger, R.B., and Zelikoff, J.T. Immunotoxicity of *in vitro* vanadium exposure: Effects on interleukin-1, tumor necrosis factor, and prostaglandin E_2 production by WEHI-3 macrophages. Int. J. Immunopharmacol. 15(3):437-446, 1993.

Cohen, M.D., Kargacin, B., Klein, C.B., and Costa, M. Mechanisms of chromium carcinogenicity and toxicity. CRC Crit. Rev. Toxicol. 23(3):255-281, 1993.

Cohen, M.D., Yang, Z., and Zelikoff, J.T. Immunotoxicity of particulate lead: *In vitro* exposure alters pulmonary macrophage tumor necrosis factor-release and activity. J. Toxicol. Environ. Health 42:377-392, 1994.

Gordon, T., Galdanes, K. and Brosseau, L. Comparison of sampling media for endotoxin contaminated aerosols. Appl. Occup. Environ. Hyg. 7:472-477, 1992.

Li, W. and Hopke, P.K. Hygroscopicity of consumer spray product aerosol particles. J. Aerosol Sci. 25: 1341-1351, 1994.

Xiong, J.Q. and Carr, R.W. The kinetics of the reaction $CF_2ClO_2NO_2$<--> $CF_2ClO_2 + NO_2$. The 12th International Symposium on Gas Kinetics, University of Reading, Reading, England, July 1992.

Xiong, J.Q. and Carr, R.W., Jr. The thermal decomposition of $CF_2ClO_2NO_2$. J. Phys. Chem. 98: 9811-9822, 1994.

Xiong, J.Q., and Cohen, B.S. Benzene: Sampling and analysis of ambient and indoor air. In: Advances in Occupational Medicine and Rehabilitation, Vol. 1, No.1, January-March 1995 (M. Imbriani, S. Ghittori, and E. Capodaglio, eds.), Fondazione Clinica del Lavoro Edizioni, Pavia, Italy.

Xiong, J.Q., Fang, C.P., and Cohen, B.S. A portable volatile/particle sampler (submitted to Am. Ind. Hyg. Assoc. J.).

Zelikoff, J.T., Sisco, M.P., Yang, Z., Cohen, M.D., and Schlesinger, R.B. Immunotoxicity of sulfuric acid aerosol: Effects on pulmonary macrophage effector and functional activities critical for maintaining host resistance against infectious diseases. Toxicology 92:269-286, 1994.

Zelikoff, J.T. and Cohen, M.D. Immunotoxicology of inorganic metal compounds. In: Immunotoxicology (R. Smialowicz and M. Holsapple, eds.), CRC Press, Inc., Boca Raton, FL, pp. 189-228, 1995.

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* Includes papers that were based on prior work but prepared and published while in residence at NYU.

APPENDIX 5

Abstracts/Presentations of Occupational Hygiene Trainees
During the Last 5 Years which Resulted from Work Performed while at the
Institute of Environmental Medicine.

(The name of the Occupational Hygiene student is underlined.)

Predoctoral Trainees

*Azare, J. Apoptosis and efflux pump in human lymphocytes. Presented at the Universities Occupational Safety and Health Education Resource Center Research Trainee Day, Tuxedo, NY, April 8, 1996.

*Azare, J., Cohen, D., and Flescher, E. Non-steroidable anti-inflammatory drugs (NSAID) protect human T lymphoma cells against apoptosis induced by anti-cancer drugs. Proc. of the Am. Assoc. for Cancer Res. 38, March 1997.

Claudio, L., Waterman, S., and El-Fawal, H.A.N. Evaluation of genetic susceptibility to lead intoxication using auto-antibody titers to nervious system proteins. The Toxicol. A102:19, 1995.

Cosma, G., Crofts, F., Currie, D., Toniolo, P. and Garte, S.J. Human lymphocyte CYP1A1 gene expression and DNA polymorphisms. Abstract, Platform Presentation, AACR meeting, 1992.

Cosma, G., Crofts, F., Currie, D., Toniolo, P. and Garte, S.J. Genetic polymorphisms and mRNA inducibility of the human CYP1A1 gene. American Association of Cancer Research satellite meeting: Molecular and biochemical methods in cancer epidemiology and prevention. September 23-26, 1993.

Cosma, G., Crofts, F., Currie, D., Toniolo, P. and Garte S.J. Relationship between genotype and function of the human CYP1A1 gene. Society of Toxicology annual meeting, February, 1993.

Crofts, F. Human CYP1A1 gene: A marker of exposure and susceptibility to polycyclic aromatic hydrocarbons. 4th International Conference on Anticarcinogenesis and Radiation Protection, 1993.

Crofts, F. Human cytochrome P4501A1 (CP1A1) gene expression as a marker of exposure of polyaromatic hydrocarbons (PaHs). Presented at the Research Exchange Day of the NY/NJ ERC, NJIT, May 1994.

Crofts, F., Taioli, E., Currie, D., Cosma, G., Toniolo, P. and Garte, S.J. A novel CYP1A1 gene polymorphism in African Americans and lung cancer risk. American Association of Cancer Research annual meeting, April 10-13, 1994.

Flescher, E., Azare, J., Jaspers, I., and Cohen, D. Non-Steriodial anti-inflammatory drugs enhance the expression and function of P-Glycoprotein in a human T lymphocyte cell line: Molt-4. Presented at the AACR Conference, Washington, DC, April 24, 1996. Proceedings of the American Association for Cancer Research, Vol. 37, March 1996.

*Flescher, E., Salnikow, K., Azare, J., Tripoli, H., and Cohen, D. Inhibitors of A P-glycoprotein function induce apoptosis in transformed T lymphocytes. FASEB J. 10:A1071, 1996.

Garte, S., Taioli, E., Crofts, F., Currie, D., Cosma, G. and Toniolo, P. A novel polymorphism in the CYP1A1 gene specific to African-Americans. American Association of Cancer Research satellite meeting: Interactions of Cancer Susceptibility Genes and Environmental Carcinogens, November 9-13, 1993.

*Gwynn, R.C., Burnett, R.T. , Thurston, G.D. Acidic particulate matter air pollution and daily mortality and morbidity in the Buffalo, NY region. Presented at the 1996 Annual Meeting of the American Thoracic Society.

Gwynn, R.C. A time series analysis of daily hospital admissions and mortality. Presented at the Universities Occupational Safety and Health Education Resource Center Research Trainee Day, Tuxedo, NY, April 8, 1996.

Gwynn, R.C. and Thurston, G.D. A cross-sectional analysis of the effects of PM10 on 1990 U.S. mortality. Presented at the 1994 Annual Meeting of the International Society of Exposure Analysis/ International Society of Environmental Epidemiology.

Gwynn, R.C., Burnett, R.T. , Thurston, G.D. A Time Series Analysis of Acidic PM and Dasily Mortality and Morbidity in the Buffalo, NY Region. Presented at the 2nd Colloquium on Particulate Air Pollution, May 1, 1996.

*Thurston, G.D. and Gwynn, R.C. Ozone and asthma mortality/hospital admissions in New York City. Am. J. Respir. Crit. Care Med. 155(4):A426, 1997.

Hazi, Yair. The effects of electrostatic charge on the deposition of submicron particles in a dog lung during breathing. Presented at the Universities Occupational Safety and Health Education Resource Center Research Trainee Day, Tuxedo, NY, April 8, 1996.

Heikkinen, M.S.A. and Harley, N.H. A new integrating radon decay product particle size spectrometer. Presented at the 6th International Conference of Indoor Air Quality and Climate, Helsinki, Finland, July 4-8, 1993.

Heikkinen, M.S.A. and Harley, N.H. A new calculation method for the radon progeny concentrations in air. Presented at the 38th Annual Meeting of the Health Physics Society, Atlanta, GA, July 11-15, 1993.

Heikkinen, M.S.A. Instrumentation for measurement of the size distribution of the radon daughters. Seminar Series: Seminar on Current Environmental and Occupational Health Issues. Seminar given at the Brookdale Campus, Hunter College, NY, April 10, 1995.

Ito, K., Lippmann, M., and Kinney, P.L. A cross-sectional analysis of respiratory health in relation to long-term ozone exposure. Am. Rev. Respir. Dis. 147:A633, 1993.

Ito, K., Lippmann, M., and Kinney, P.L. A cross-sectional analysis of pulmonary function in relation to long-term exposures to particulate matter. Am. Rev. Respir. Dis. 149:A842, 1994.

Ito, K. and Thurston, G.D. An investigation of sensitive subpopulation in short-term associations of particulate matter and mortality. Am. J. Respir. Crit. Care Med. 151:A358, 1995.

Jaques, P.A., Thurston, G.D., Kinney, P.L., and Lippmann, M. The effects of ambient ozone exposure on the dispersion of an inhaled NaCl aerosol bolus in exercising adults. Presented as a poster at the ISEA, NC, September 18-21, 1994.

Jaques, P.A., Thurston, G.D., Kinney, P.L., and Lippmann, M. The effects of ambient ozone exposure on the dispersion of an inhaled aerosol bolus in exercising adults. Presented as a poster at the ATS International Conference, Boston, MA, May, 1994.

Spivak, S.D., Schlesinger, R.B., Weideman, T. and Mossman, B.T. Ozone induces catalase message in rat lung fibroblasts, at common, ambient concentrations, *in vitro*. Am. Rev. Respir. Dis. 143(4):A491, 1992.

Spivak, S.D., Schlesinger, R.B., Weideman, T. and Mossman, B.T. Ozone induces increased gene expression of catalase and glutathione peroxidase in rodent tracheal epithelial cells ***in vitro***. Presented at the Fourth International Conference on Environmental Lung Disease, 1992.

Taioli, E., Crofts, F., Currie, D., Cosma, G., Toniolo, P. and Garte, S.J. A novel CYP1A1 gene polymorphism as a marker of genetic susceptibility of tobacco in African-Americans. American Society of Preventive Oncology annual meeting, March 6-9, 1994.

Thurston, G.D., Kinney, P.L., Ito, K., and Lippmann, M. Daily respiratory hospital admission and summer haze air pollution in several New York metropolitan areas. Am. Rev. Respir. Dis. 145:A429, 1992.

Thurston, G.D., Ito, K., Lippmann, M., and Bates, D.V. Summertime haze air pollution and asthma hospital admission in Toronto, Ontario. Am. Rev. Respir. Dis. 147:A634, 1993.

Thurston, G.D., Gwynn R.C., and Ito, K. Variations in air pollution-mortality associations across 8 major U.S. cities. Resp. and Crit. Care Med. 4:A358, 1995.

Waterman, S. and Cohen, B.S. The suitability of passive diffusion monitors for environmental monitoring. AIHCE, Boston, MA, June 3, 1992.

Waterman, S., El-Fawal, H.A.N. and Snyder, C.A. A possible mechanism in Pb-induced neurotoxicity: Enhancement of the antigenicity of nervous system proteins. Poster presentation at Mid-Atlantic Society of Toxicology (MASOT) meeting, May 1994.

Waterman, S., El-Fawal, H.A.N., and Snyder, C.A. A possible mechanism in Pb-induced neurotoxicity: Enhancement of the antigenicity of nervous system proteins. Presented at the New York/New Jersey Educational Resource Center Meeting, NJIT, May 1994.

Waterman, S., Snyder, C.A., and El-Fawal, H.A.N. Lead treatment of myelin basic protein (MBP) enhances the antigenicity of MBP in CBA/J mice. The Toxicol. A119: 291, 1994.

Waterman, S., Snyder, C.A. and El-Fawal, H.A.N. Lead enhances the antigenicity of basic protein in CBA/J mice. Poster presentation at the SOT meeting, March 1994.

Waterman, S., El-Fawal, H.A.N., and Snyder, C.A. Nervous system damage precedes immune system involvement in male mice exposed to lead. The Toxicol. A54:10, 1995.

Weideman, P.A., Sobo, M. and Gunnison, A.F. Effect of age on ozone-induced pulmonary cytotoxicity and arachidonic acid metabolism. The Toxicol. 12:229, 1992.

Weideman, P.A. Comparison of the pulmonary response of lactating and postlactating rats to acute ozone exposure and evaluation of the influence of dose. Presented at the Research Exchange Day of the New York/New Jersey Educational Resource Center Meeting, NJIT, May 1994.

Weideman, P.A., Nadziejko, C. and Gunnison, A.F. Inflammatory responses following O_3 exposure: A comparison of Sprague-Dawley rats from different facilities of a single breeder. The Toxicol. 14:89, 1994.

Weideman, P.A., Nadziejko, C., and Gunnison, A.F. Sensitivity of lactating rats to the effects of acute ozone exposure. Am. J. Respir. Crit. Care Med. 151: A497, 1995.

Weideman, P.A., Nadziejko, C., Chen, L.C., and Gunnison, A.F. Inflammatory and morphological responses of lactating and postlactating rats following ozone exposure: A comparison of concentration and inhaled dose. The Toxicol. 15: 93, 1995.

Wu, C.Y. and Twaroski, C.J. Health-based review of the national emission standards for hazardous air pollutants for source categories: Perchloroethylene dry cleaning facilities. To be presented at the 89th Annual Meeting of the Air and Waste Management Association, Nashville, TN, June 24, 1996.

Postdoctoral Trainees

Brosseau, L.M. and Cohen, B.S. Measurement of air concentrations of volatile aerosols in paint spray applications. AIHCE, Boston, MA, June 3, 1992.

Cohen, B.S., Xiong, J.Q. and Ayres, L. Deposition of inhaled charged ultrafine particles in a simple tracheal model. Poster presentation at the 11th AAAR Annual Meeting, October 12-16, 1992, San Francisco.

Cohen, B.S., Xiong, J.Q., Fang, C.P., and Ayres, L. Deposition of inhaled charged ultrafine particles. Platform Presentation at the 4th International Aerosol Conference, Los Angeles, CA, August 29-September 2, 1994.

Cohen, B.S., Xiong, J.Q., Fang, C.P., and Ayres, L. Deposition of charged, charge neutralized and zero-charge ultrafine particles. Abstract, 14th AAAR Annual Meeting, Pittsburgh, PA, October 9-13, 1995.

Cohen, B.S., Xiong, J.Q., and Li, W. Use of iodine vapor to measure the airway deposition of unattached Po-218. Proceedings of the AAAR Annual Meeting 1995, Pittsburgh, PA, October 9-13, 1995, p. 150.

Cohen, B.S. and Li, W. Electric charge on ambient ultrafine particles. 2nd Colloquium on Particulate Air Pollution and Health, May 1-3, 1996, Park City, Utah, p. 16.5.

*Cohen, B.S., Xiong, J.W., and Li, W. The relative role of electrical charge and convective flow in enhanced airway deposition of nanometer sized particles. Abstracts, 15th AAAR Annual Meeting, Orlando, FL, October 14-18, 1996.

Cohen, M.D., Schlesinger, R.B., and Zelikoff, J.T. Vanadium-induced alterations in macrophage responses to biological response modifiers *in vitro*. The Toxicol. 13(1):422, A1665, 1993.

Cohen, M.D., McManus, T.P., Z. Yang, Q. Qu, Zelikoff, J.T., and Schlesinger, R.B. Vanadium alters macrophage interferon-γ interactions and -inducible responses. The Toxicol. 15(1):257, A1375, 1995.

Li, W. The deposition of ultrafine particles (~1 nm) in tracheobronchial cast. Occupational Safety and Health Education Resource Center Research Trainee Day, Tuxedo, NY, April 8, 1996.

*Li, W., Xiong, J.Q. and Cohen, B.S. Regional deposition of unattached radon progeny (Polonium-218) in tracheobronchial region. AIHCE 96, Washington D.C., p. 49.

McManus, T., Cohen, M.D., Zelikoff, J.T., and Schlesinger, R.B. Ozone-induced alterations in macrophage interactions with interferon-γ. The Toxicol. 13(1):421, A1663, 1993.

McManus, T., Zelikoff, J.T., Schlesinger, R.B., and Cohen, M.D. Immunotoxic effects in the rat lung from vanadium inhalation. 34th Annual Meeting of the Society of Toxicology, Baltimore, 1995. The Toxicol. 15(1):257, Abstract # 1374, 1995.

Xiong, J.Q., Fang, C.P., and Cohen, B.S. A volatile aerosol sampler. Abstract, 12th AAAR Annual Meeting, Oak Brook, IL, October 11-15, 1993.

Xiong, J.Q. A volatile aerosol sampler. Presented at the Research Exchange Day of the New York/New Jersey Educational Resource Center Meeting, NJIT, May 1994.

Xiong, J.Q., Fang, C.P., and Cohen, B.S. A personal vapor/particle sampler for measuring phase distribution of chemicals in the workplace, Platform Presentation at AIHCE, Kansas City, MO, May 20-26, 1995.

*Xiong, J.Q., Zhong, M., Fang, C.P., Chen, L.C., and Lippmann, M. Influence of organic films on reactivity and hygroscopicity of sulfuric acid aerosol. Abstracts, 1997 SOT Annual Meeting, Cincinnati, OH, March 1997.

Zelikoff, J.T., Cohen, M.D., Sisco, M.P., and Schlesinger, R.B. Inhalation of sulfuric acid depresses the bactericidal activity of rabbit pulmonmary macrophages. Am. Rev. Respir. Dis. 145(4):A276, 1992.

Zelikoff, J.T., Cohen, M.D., Sisco, M.P., and Schlesinger, R.B. Inhaled sulfuric acid compromises pulmonary defense mechanisms important for resistance against infectious agents. 7th Annual Symposium of the Foundation for Immunotoxicology, Virginia Beach, 1992.

Zelikoff, J.T., Cohen, M.D., Sisco, M.P., and Schlesinger, R.B. Contribution of sulfuric acid to respiratory infections. Am. Rev. Respir. Dis. 147(4):A384, 1993.

Zelikoff, J.T., Baker, K., Cohen, M.D., and Chen, L.C. Woodsmoke emissions: Effects on pulmonary immune defense. The Toxicol. 15(1):256, A1373, 1995.

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* Presented during the 1996-1997 academic year by trainees who have been supported by NIOSH.

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DEPARTMENT OF HEALTH & HUMAN SERVICES

Memorandum

Date March 11, 1998

From Principal Engineer, OECSP

Subject Final Performance Report for entry into NIOSHTIC/NTIS for NIOSH Training Grant No. T42 CCT 210425

To William Bennett, IRB, EID (C-28)

The enclosed report has been received from the Center Director to document work performed during the specified grant project period. The following information applies to the designated Education and Research Center (ERC):

1. Title: Universities Occupational Safety and Health Educational Resource Center

   Center Director: Philip J. Landrigan, M.D.
   Mt. Sinai School of Medicine
   New York, NY 10029

   Grant No.: T42 CCT 210425

   Project Period: 7/1/92 - 6/30/97

Please place the report in DIDS and I also recommend it for entry into NIOSHTIC and submission to NTIS.

Thanks for your assistance.

John Talty

John T. Talty, P.E., DEE

cc: T. Meinhardt/B. Kuchinski

Enclosure

closeout.msm