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**FINAL PROGRESS REPORT  
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## II. ABSTRACT

### The Occupational Safety and Health Education and Research Center University of Cincinnati

The University of Cincinnati's training program in occupational and environmental health was initiated in 1947 as an outgrowth of its research activities. The research program in occupational health at the University of Cincinnati was initiated in 1924, and the initial Kettering Laboratory was built in 1930 to house and develop a University-based unit to which occupational health problems could be brought for study. The growth of the research program and subsequent initiation of an occupational health training program was a response to an urgent need, particularly since WWII, to identify, understand and control hazards of the workplace resulting from processes, materials and products which have adverse effects on human health and the ecosystem.

The Occupational Safety and Health Education and Research Center at the University of Cincinnati provides multidisciplinary programs for academic and research training in the major fields of Occupational Safety and Health and related disciplines. These disciplines include: Occupational Medicine, Occupational Health Nursing, Industrial Hygiene, Occupational Safety and Continuing Education/Outreach. A Hazardous Substance Academic Training program was created within the Industrial Hygiene program in 1993. While the major thrust of each core program is at the graduate education level, each of the core programs contribute to a well-developed continuing education effort and individually and collectively promotes outreach activity. In both the Occupational Medicine and Nursing programs there are well-defined curricula for undergraduate medical and nursing students. The details regarding the development, productivity, current and future plans for each core program are described in the body of this application. All core educational units provide curricula not only for their own students but contribute significantly to the teaching and research experiences of students in other programs. This interdisciplinary aspect of the ERC as well as interdisciplinary workshops, field and research experiences is the keystone of productive occupational and environmental health education and research.

The four academic core units have established a required interactive Occupational Health, Hygiene and Safety Workshop for all of its students to foster interdisciplinary interaction among the students in year-long projects that they undertake. A number of seminars in the Department's Environmental Health Seminar series are devoted to topics of particular interest to ERC students.

This University-based Occupational and Environmental Health Center involves the large Medical Center complex which consists of the Colleges of Medicine, Nursing and Health, and Pharmacy, three component University hospitals - The General Division, the C.R. Holmes Division and the Children's Hospital Medical Center; and the Colleges of Engineering, Law and the McMicken College of Arts and Sciences. In addition, in the Cincinnati area there are national health and environmental agencies concerned with occupational and environmental hazards. There is also a large industrial complex with resources such as industrial, medical and safety programs as well as potential hazards, which are materials for training. Two NIEHS-supported hazardous waste worker training centers, based in Cincinnati, one in the Department of Environmental Health, also contribute to the ERC mission. These training centers as well as a NIEHS-supported Superfund Basic Research Center also located in the Department of Environmental Health, provide additional opportunities for student development.

### III. SIGNIFICANT FINDINGS

The primary measure of the productivity of the University of Cincinnati Education and Research Training Center is the quality and accomplishments of the graduates of the training programs, and our Continuing Education and Outreach activities. This report highlights a number of these accomplishments such as presentations and manuscripts on student research and positions that they move into upon graduation.

#### A. INDUSTRIAL HYGIENE

The Industrial Hygiene program is directed from the Department of Environmental Health in the College of Medicine. The program has three objectives. The first is to train professionals to the M.S. degree level to have the skills, scientific knowledge and state-of-the-art expertise to anticipate, identify, evaluate, implement and recommend measures to control health hazards and causes of discomfort in occupational environments. The second objective is to train research scientists to the Ph.D. level to contribute fundamental research in effective methods of anticipating, measuring, evaluating and controlling exposures to hazardous physical and chemical stressors in the workplace. The third objective is to reach out into the community, locally, nationally, and internationally, to offer opportunities to industrial hygiene field professionals and others for gaining knowledge in industrial hygiene or advance their understanding in specific industrial hygiene areas. The I.H. program, therefore, provides courses to train industrial hygiene professionals who need a broad-based understanding of industrial hygiene practice, and it provides courses for industrial hygiene practitioners and others who wish to gain in-depth knowledge in a specific industrial hygiene or focussed research area of specialization.

The Industrial Hygiene program continues a strong graduate training program with about 25 full-time, 13 M.S. and 12 Ph.D. students, enrolled each year. In the past academic year, 12 M.S. degrees and 1 Ph.D. degree were awarded. The program continues to emphasize practical as well as academic training with internships, field surveys, and consultations which are done on a multi-disciplinary basis. Both academic and research training tracks are offered in this program. The Industrial Hygiene M.S. program was one of the initial ones that received accreditation from ABET. Nine areas of emphasis are available within the program including aerosol science, biological monitoring, ergonomics/biomechanics and the hazardous academic training option which is supported through the Hazardous Substances Academic Training program and is affiliated with related worker training efforts. A member of this program's faculty, Dr. Carol Rice, directs the nationally-recognized NIEHS Midwest Consortium for Hazardous Waste Worker Training Program and is affiliated with two other related training centers operated by the International Chemical Workers Union and the UBC Health and Safety Fund. Dr. Clark is Center Director for the EPA-supported Great Lakes Regional Lead Training Center.

Dr. Carol Rice, CIH was made Deputy Director of the Industrial Hygiene Training Program in 1996. A survey of alumni revealed that the practical classes such as field trips and laboratory classes (Air Sampling & Analysis I and II and Industrial Hygiene Laboratory) were among the most highly valued parts of their academic programs. A dual program in Occupational Safety and Ergonomics has been developed with the Safety Engineering program. Courses for the Environmental Health track for this program are presented in Attachment B in Industrial Hygiene and for Engineering in Appendix A in

Occupational Safety. Two new courses have been developed by Dr. Rice: Worker Training and Occupational Histories (with Drs. Doug Linz (Occupational Medicine), Glenn Talaska and Susan Pinney (Epidemiology). The course on worker training which has been offered as a tutorial, is now offered as a formal course. In subsequent years it will be expanded to fit the needs of other ERC students as well as those elsewhere in the University with responsibility for worker training. The outlines of these courses are presented in Attachment E.

The excellent library facilities of the Medical Center and University provide the students with access to a variety of up-to-date electronic literature search mechanisms and industrial hygiene software systems. Software additions to and increased use of the Howard E. Ayer Environmental and Industrial Hygiene Computer Laboratory continue to be made. Among the new software titles are: Crystal Ball Version 3.0, ARCView, PRE-SCORE and Smart Risk.

Sergey Grinshpun, Ph.D., who has functioned in an expanded capacity in the program during recent years, was made a member of the tenure track faculty in 1997. Facilities for student research have been expanded and enhanced recently as many faculty laboratories moved to the newly completed wing of the Kettering complex.

## B. OCCUPATIONAL HEALTH NURSING

Dr. Sue Davis has been Director of the Occupational Health Nursing (OHN) program since 1994 when Dr. Linda Shortridge accepted a research position at the University of Oregon Health Sciences Center. With changing leadership, the OHN faculty directed team efforts toward increasing internal visibility within the College and University, as well as maintaining external visibility within the community. To guide these efforts, an OHN advisory Committee of practicing OHNs was established.

Outcomes of leadership efforts include increased integration of occupational health nursing and environmental health content in graduate and undergraduate community health courses, and a strengthening of interdisciplinary interaction and research for both students and faculty across occupational health and safety disciplines. Volunteer faculty were expanded to 9, increasing the pool of practicing OHNs available to provide support for programmatic efforts. In addition to the community support, the program has experienced significant administrative support from the College Dean, Dr. Andrea Lindell and from the Department Head, Dr. Janice Dyehouse.

During the 1994-95 academic year Occupational Health Nursing courses were reviewed and evaluated by faculty, students and practicing occupational health nurses. This review formed the basis for revision of the occupational health nursing program during a College-wide revision of baccalaureate, master's and doctoral curricula. College -wide curricular revision began in the Summer quarter of 1995 and courses for the new curriculum were developed during the 1996 - 97 academic year. Implementation of revised curricula began Autumn Quarter, 1997. The revised OHN master's program consists of core courses taken by all masters students, and additional core courses taken in one of two tracks. The Client Systems track is designed for nurse practitioners and acute care advance practice nurses and consists of three additional core courses: physiology, pharmacology and advanced health assessment. The second track, Health Care Systems, is designed for students focusing on health systems administration (Occupational Health Nursing, Community Health Nursing, and Nursing Service Administration) and consists of four courses in health systems administration. These courses are coordinated and taught by faculty from each of the systems majors to ensure application of concepts to

specific specialty practice.

The OHN program consists of a total of 67 graduate credit hours: including 19 masters core credits, 12 nursing systems administration core credits, and 34 occupational health nursing and occupational health and safety credits .

Total OHN program credits increased from 60 to 67 credit hours. The previous program could be completed in four quarters with 14 to 17 credits taken per quarter. The revised curriculum increases the program to five quarters with 12 to 16 credits per quarter. The program is scheduled for consecutive quarters, including the summer quarter.

### C. OCCUPATIONAL MEDICINE

In 1947, the Department of Environmental Health of the University of Cincinnati (UC) College of Medicine created an Occupational Medicine Residency Training Program. The mission of the residency program was and is to graduate physicians who will assume leadership positions in academic, private, corporate and governmental occupational health programs. The residency program has received NIOSH-ERC training program support since the inception of the ERC program, is fully accredited by the Accreditation Council for Graduate Medical Education, and satisfies the training requirements for board certification in Occupational Medicine by the American Board of Preventive Medicine and the American Osteopathic Board of Preventive Medicine. There have been about 200 graduates. Several times that number of students, residents and practicing physicians have been trained as a part of the undergraduate medical curriculum, rotations for visiting physicians, and continuing education programs including the Occupational Medicine Training Course (formerly the Mini-Residency Program in Occupational medicine for Physicians).

The residency training program, provides a unique approach to occupational medicine training in its curricular configuration, the breadth of experience offered and its depth of faculty support. Unlike traditional programs which require one year of didactic training culminating in a Master of Public Health (M.P.H.), followed by one year of clinical work, the U.C. program affords the opportunity for integration of academic and clinical experiences through the two years. Three training tracks, clinical, research and business, offer career-specific training options to the residents. The program leads to a Master of Science degree, following completion of a required thesis project.

When judged by: the *quantity* of graduates; the *quality* of the program as assessed by professional accomplishments and opinions of its graduates; and evidence of developing *self-sufficiency*, the UC OEM Residency Training Program has made major strides during the past 5 years. The total number of graduates completing their training, in part because of funding available through the ERC Training Grant, is 23 spanning the most recent five year training period. Thus, from the standpoint of *quantity* the UC program is one of the most productive nationally.

Perhaps the best *quality* measure of a training program is the professional accomplishments of its graduates. A survey of residency program graduates during the 1990-91 to 1994-95 academic years was recently conducted with a 91% participation rate. All graduates are employed in full-time occupational and environmental medicine practices. All but one graduate in the past 10 years successfully passed the board certifying examination in Occupational Medicine through the American Board of Preventive Medicine. Graduates continue to assume leadership positions in the field. In this survey graduates were asked to rate the perceived helpfulness of the primary training program

components to their practices on a scale of 1 (not at all helpful) to 5 (extremely helpful). Mean ratings were 4.1 for academic course work, 4.2 for clinical preceptorship, 4.1 for Industrial preceptorship, and 3.3 for research experience. Comments on the research requirements reflected some uncertainty about the value of the experience when judged against the time and effort required. Program administration was rated at 4.2 for academic advisor and 4.6 for program director.

The final measure of program strength is *self-sufficiency*. Residency stipends have been increased by nearly 50% and are at the national mean (Range \$28,000 to \$30,000 per year). In addition, residents receive tuition remissions, family health benefits, and \$500/year to support educational expenses and cost of travel to professional meetings. Administrative and financial support through the Department of Environmental Health, the College of Medicine and the University Hospital continue.

New funding sources have been identified for the residency program, which simultaneously allows more residents to be trained and provides a certain amount of fiscal resiliency, should federal graduate medical education funding wane. For example the Procter and Gamble Company will be funding up to two practicum year fellowships and NIOSH has provided support for a combined NIOSH-HHE/UC Occupational Medicine Residency Training Program described in more detail later in this document

#### D. OCCUPATIONAL SAFETY

The five year period between 7-1-92 and 6-30-97 was very productive for the ERC Occupational Safety Program. During the past two years, the program began a transition from a single occupational safety focus to occupational safety/ergonomics. Additional courses in safety and ergonomics were available as electives for the students. In addition a new core course was developed: Occupational Safety Engineering (20-267-520). A plan to revise the core for the safety/ergonomics program was completed in 1996-1997 for implementation in 1997-1998. The new courses were Industrial Environment : Engineering Evaluation and Control (20-267-653) and Interface Design (20-267-655). Evaluation of the core and elective courses will continue through 1997-1998 and beyond to produce a balanced curriculum for safety, ergonomics, and research methodology for MS and Ph.D. level students.

During the five year period, 10 Ph.D. and 60 MS degrees were awarded. All 10 Ph.D. and 46 of the MS degrees were Industrial Engineering majors with safety specialization. The other MS majors included 12 ME, 1 Chemical Eng., and 1 Civil Eng. (reference Appendix C). The University has provided full tuition waivers for all NIOSH supported trainees.

In addition to the NIOSH support, funding for students has been obtained from several industrial organizations. These included Hudson Speciality Foods, James River Corporation, The Kroger Company, Fluor Daniel Corporation, General Electric Aircraft Engines, Crocker Fells Co., and Ergo Accommodations, Inc. In addition, the Institute of Advanced Manufacturing Sciences (IAMS) has assisted interdisciplinary industrial plant visits, and provided facilities for meetings and research.

Outreach and continuing education efforts have been active during the five year period. Examples of outreach include providing assistance to other universities, e.g., University of South Florida; consulting about safety with industrial firms; presenting seminars and short courses in safety

engineering and ergonomics.

The occupational safety program is made possible through a wide range of University courses and faculty, and the NIOSH funding support of the Cincinnati ERC. The majority of courses are taught by faculty from the colleges of Medicine and Engineering through the departments of Environmental Health (EH), and Mechanical, Industrial and Nuclear Engineering (MINE). The major goal of the occupational safety training and research program is to provide graduate engineers with specialized courses and experiences that will enable them to become practicing safety professionals or researchers in the field.

The program offers graduate study leading to the M.S. and Ph.D. degrees in Industrial Engineering, Mechanical Engineering or Nuclear Engineering with a specialization in Safety for both full-time or part-time students. The majority of the students are enrolled in Industrial Engineering.

#### E. HAZARDOUS SUBSTANCE ACADEMIC TRAINING

The Hazardous Substances Academic Training (HSAT) program at the University of Cincinnati is an emphasis area within the Environmental and Industrial Hygiene program. Students selecting the HSAT area have two additional required courses and also attend a 40-hour health and safety class for hazardous waste site workers. Several other industrial hygiene courses have been strengthened in hazardous substance content and additional courses have been developed. The program therefore impacts all students taking industrial hygiene core courses, whether taking courses as part of their Environmental and Industrial Hygiene major or as electives. The HSAT program offers additional training in Biological Monitoring and Risk Assessment for those students pursuing the HSAT program as an area of concentration or who select these courses for other reasons. Although the HSAT program is officially a part of the M.S. degree program, these courses are also taken by the students pursuing the Ph.D. degree in Environmental and Industrial Hygiene, and by students in other programs in the Department of Environmental Health, e.g.,: epidemiology, and elsewhere in the University of Cincinnati, particularly in Civil and Environmental Engineering and Mechanical, Industrial and Nuclear Engineering.

The existing required industrial hygiene course in Hazardous Waste Management has been strengthened through HSAT funding by the addition of a field trip to Northern Ohio to view active hazardous waste operations (a double-lined secure landfill for chemical wastes and an emergency response and remediation operation center) and by incorporation into the class of computer software such as those for the modeling of chemical releases into the air and ground-water and for risk assessment. A special laboratory exercise has been developed for a core industrial hygiene course where students make use of a chemical monitoring data set developed to simulate an actual industrial chemical release incident. Students attend hazardous waste worker training programs and related courses offered through the EPA-supported Haliburton-NUS training center located in Cincinnati or through one of the local programs in the NIEHS-supported hazardous waste worker training centers with which the Department of Environmental Health is involved such as the Midwest Consortium for Hazardous Waste Worker Training and the ICWUC Center for Worker Health and Safety Education. A formal course in worker training was approved by the University during 1996-97.

The HSAT plan consists of an enhancement of the hazardous substances content of existing required courses in the Environmental & Industrial Hygiene program (Hazardous Waste Management and Air Sampling and Analysis I and II), requiring two additional courses for students selecting the

HSAT option and encouraging all students, particularly those in the HSAT option, to attend forty-hour hazardous waste courses that are available at several locations in Cincinnati and the surrounding area. The two additional required courses are Human Biological Monitoring and Biomarkers and Applied Risk Assessment for Industrial Hygienists; the latter was developed especially for this program. In addition, formal courses in Effective Methods for Worker Health and Safety Training and Methods to Obtain Complete Occupational Histories have been developed and are available to students. Trainees are invited to participate in sessions at the Annual Trainer meeting sponsored by the Midwest Consortium for Hazardous Waste Worker Training.

## F. CENTER ADMINISTRATION

Since its inception the Cincinnati Education and Research Center (ERC) has provided education, consultation, community service and research to workers, employees and citizens drawn from a catchment area including much of the Midwestern United States. The ERC at the University of Cincinnati, true to the Center concept, has a full complement of Core Programs. This Center provides interdisciplinary programs for academic and research training in the major fields of Occupational Safety and Health and related disciplines and Continuing Education/Outreach. These disciplines include: Occupational Medicine, Occupational Health Nursing, Industrial Hygiene, Occupational Safety and Ergonomics and a Hazardous Substance Academic Training program within Industrial Hygiene. All core educational units provide curricula not only for their own graduate students but contribute significantly to the teaching and research experiences of students in all programs. This interdisciplinary aspect of the ERC is the keystone of productive occupational and environmental health education, research and service. The interdisciplinary interactions are summarized for the ERC in a central location of this application in the Center Administration narrative.

The administrative functions of the University of Cincinnati Educational Resource Center are carried out through the Center Director, Deputy Director, and the individual Program Directors. Dr. Scott Clark was named Center Director in 1994 following the retirement as Department Director of Dr. Roy E. Albert who had been Director of the Educational Resource Center since his arrival in 1985 to become Director of the Department of Environmental Health. Dr. Scott Clark, Industrial Hygiene Program Director since 1988, was the Deputy Director of the ERC under Dr. Albert for four years. The ERC Director, with the help of the Deputy Director, maintains continuous communication with the individual programs.

A new Director of the Department of Environmental Health was appointed, Marshall Anderson, Ph.D., effective in late June 1996. Dr. Anderson was previously a member of the Cancer Center of the University of Colorado Health Sciences Center and Director of Research at the Cancer Research Institute of St. Mary's Hospital in Colorado. Prior to moving to Colorado he was the Chief of the Laboratory of Molecular Toxicology at the National Institute of Environmental Health Sciences.

An External Advisory Committee has been established for the Center composed of individuals selected because of their specific knowledge of particular academic core(s), their interdisciplinary experience or because they represent a broader constituency, such as organized labor. The individual core programs also have frequent interactions with members of the Committee.

Dual programs in Occupational Safety and Ergonomics has been developed which involves both the Department of Environmental Health and the Department of Mechanical, Industrial and Nuclear Engineering. Students are able to enter a program through either Department depending on their background and interests. Courses are taken from both Departments. One of the industrial hygiene stipends for the year 1996-97 was used for a student with these interests who applied through the Department of Environmental Health. Thus far two students have completed this program, taking courses from programs of both Departments!

Two new courses were recently developed "Effective Methods for Worker Health and Safety Training" (2 gr. cr.) and "Methods to Obtain Complete Occupational Histories". The latter course will be offered jointly by faculty of two of the ERC programs: Dr. Doug Linz (Occupational Medicine), Drs. Carol Rice and Glenn Talaska (Industrial Hygiene) and by Dr. Susan Pinney (Epidemiology). These courses are described in more detail in the Industrial Hygiene Program section.

The Hazardous Substance Academic Training program was initiated in early 1993 near the start of the five-year period covered in this report and its development occurred during this reporting period.

The Occupational Health Nursing Program has developed a Research Training Component. This is in recognition of the need to prepare nurses at the doctoral level to advance the knowledge base in occupational health nursing. In particular, this program will focus on research in disorders of reproduction, youth in the workplace and musculoskeletal/traumatic injury. Dr. Douglas Linz of the Occupational Medicine program and Dr. Ash Genaidy from Industrial Engineering, work closely with Dr. Sue Davis on this research training program. The first student to graduate from the Ph.D. program, Karen Martin, received her degree in June 1994.

### Interdisciplinary Interaction

Interdisciplinary interaction is enhanced by the ERC components being in close proximity to each other and by the Center being based in a comprehensive Department of Environmental Health which also contains faculty in other disciplines involved in occupational safety and health such as biostatistics, epidemiology and toxicology and by the close interaction among the faculty.

The students in the four core academic programs are involved in interdisciplinary interactions on several levels through classroom, research and field experiences:

- the interdisciplinary workshop series,
- research projects involving interdisciplinary interactions among faculty, students and staff,
- academic courses with students from other occupational safety and health disciplines,
- clinic and field projects and worker training activities.

## Interdisciplinary Workshop

All students in the core academic programs participate in the three-quarter Occupational Health, Hygiene and Safety Workshop which is offered for one graduate credit each quarter. The goal of this workshop is to enhance the ability of the trainees to work effectively in small interdisciplinary groups. This is accomplished through a series of seminars by interdisciplinary teams of occupational safety and health professionals, from local industries, through small group discussions and through projects that the teams select and work on throughout the year. The teams are composed of at least one trainee from each of the four core disciplines wherever possible; a faculty member from one of the cores serves as advisor. During the Spring Quarter final reports are presented by the teams with each participant being involved in the presentation.

Research projects involving interdisciplinary interactions include the following which are described in more detail in Section IV.6:

Refractory ceramic fibers study: Study of health effects of current and former workers at US plants focussing on respiratory system (morbidity and mortality) and exposure assessments.

Chem Lawn Study Cross-sectional health study of current residential pesticide applicators.

NIOSH-supported Study of Ergonomics of Task Performances on Slippery Surfaces This study, conducted in the collaboration with the Greater Cincinnati Occupational Health Center.

Cumulative Trauma Disorders in Carpenters. This five-year NIOSH-supported study (Lemasters-Occ Med-PI) has had three M.S. theses projects in Industrial Hygiene completed.

Longitudinal Prospective Pulmonary Study of Paper Products Workers. This five-year industry-funded study involves an occupational medicine resident and a multi-disciplinary faculty.

US Air Force-supported Study of Personnel Exposed to Low Levels of Jet Fuel Two Industrial Hygiene M.S. students completed their research with interdisciplinary committees.

Classroom and field activities also provide important opportunities for student interaction.

The new course on Methods to Obtain Complete Occupational Histories will facilitate involvement of ERC and other students in activities of the Center for Occupational Health. Using the previous Special Topics mechanism several Industrial Hygiene students gained experience in occupational history-taking. This course is recommended as an elective for occupational health nursing students.

The Midwest Consortium for Hazardous Waste Worker Training and the ICWU Center for Chemical Worker Health and Safety Education both provide students with opportunities to interact with other occupational health and safety disciplines in the operation and evaluation of worker training activities. Examples of such activities are pretraining physicals provided by occupational medicine residents, observation of training delivery using participatory techniques and assistance with delivery of training. A number of students have also been involved in field projects with NIOSH staff and at the Greater Cincinnati Occupational health Center (GCOHC).

## Special Interdisciplinary Research Initiative

Special student research initiative funds made available to ERCs by NIOSH were used to fund three interdisciplinary research projects during the last year of this reporting period and to enhance the projects in the Occupational Health, Hygiene and Safety Workshop. A requirement for the research project was that at least three occupational safety and health-related disciplines be involved. The projects funded were a study of the take-home pesticides in migrant farm workers and their families in Northern Ohio, occupational health problems in a local shirt manufacturing facility and problems associated with exposure to laboratory oils in agricultural areas. Completion of those projects occurred after the current reporting period and results will be presented in later reports.

## G. CONTINUING EDUCATION

The Office of Continuing Education, Department of Environmental Health, University of Cincinnati College of Medicine continues the tradition begun in 1949 of offering short courses in environmental and occupational health and safety. Established in 1983, the Office of Continuing Education assumed the coordination of the administrative and marketing functions of the program, allowing faculty to concentrate their efforts on course development. Through this cooperative effort the Office of Continuing Education has built a national reputation for offering excellence in environmental/occupational health and safety short courses. Continuing education courses presented through this program are multi-faceted, ranging from one-day seminars on selected topics to four-week intensive training programs. These courses reflect the reputation, strength, and diversity of the ERC faculty.

The Office of Continuing Education offers courses in all four ERC core areas: occupational medicine, occupational health nursing, environmental/industrial hygiene, and occupational safety. The program is interdisciplinary, utilizing faculty from the College of Medicine, the College of Nursing and Health, the College of Engineering (both from the Clifton campus and Section Road facility), the University College Department of Math and Applied Sciences, and the College of Education. The role of the Continuing Education Office includes the development of new short courses, the coordination of interdepartmental continuing education programming, marketing, administration, and program evaluation. The Director of the Office of Continuing Education is Judy L. Jarrell, M.A., Ed.D., Field Service Associate Professor. The Cincinnati ERC/CE Office also handles the responsibility of the ERC/CE conference booth, which is displayed at four to five national conferences each year.

All ERC continuing education courses are developed with the expertise of course directors. Course directors are responsible for the technical content of their short courses and serve as principal instructors. The majority of course directors are members of University faculty. When appropriate, however, experts outside the University are utilized.

A formal ERC/CE Advisory Committee, formed in the Spring of 1996, works with the CE Director in strategic planning for marketing/advertising, course and instructor evaluations, new course development, and innovative directions for the program. Committee meetings are usually held in the form of conference calls. The following persons serve on this committee:

Glenn Markle, PhD, College of Education

Kay Hayes, MPH, former ERC/CE Director  
Robert A. Herrick, PE, DEE, CIH, consultant  
Richard Fulwiler, ScD, CIH, consultant  
Douglas Linz, M.D., M.S., occupational physician  
Judith Pflaumer, R.N., OHN, occupational health nurse

The development of new courses is also evidence of faculty commitment. For example, the following are some of the new courses which were developed and offered in the last five academic years:

- √ Create Opportunities for Success (for OHNs)
- √ Lead Inspection Training
- √ Fundamentals of Environmental H&S Compliance
- √ New Horizons in Safety Program Management
- √ Fundamentals of Occupational S&H Compliance
- √ OSHA Lockout/Tagout & Electrical Work Practice Standards
- √ Compliance Guidelines for ADA
- √ Occupational & Environmental Toxicology for Physicians
- √ Science for the Non-Scientist
- √ Asbestos Air Monitoring Technician
- √ Water Quality & Hazardous Materials Management
- √ Environmental Risk Assessments
- √ Use of Real-Time Instruments to Solve Industrial Hygiene and Ergonomic Problems
- √ Dealing With Workplace Politics (Nursing)
- √ OSHA Regulations (Nursing)
- √ Health Policy Topics (Nursing)
- √ Lead Inspector Refresher
- √ Lead Supervisor Refresher
- √ Lead Risk Assessor Refresher
- √ Using the Internet to Access Health & Safety Resources
- √ Human Performance Improvement: A Practical & Expanded Ergonomic Approach

In addition to developing new courses for the Cincinnati ERC, Drs. Scott Clark and Judy Jarrell, with the help of William Menrath of the Environmental Health Department, continue to work on the revision of the U.S.EPA-approved Lead Abatement Training for Supervisors and Contractors course curriculum. The grant for this work was expanded to include the development of the U.S.EPA-approved Lead Abatement Project Designer course, expected to be completed by Spring, 1998. Drs. Clark and Jarrell, and specialists William Menrath and John Pesce are working on the development of the course.

## IV. INDIVIDUAL PROGRAM REPORTS

### 1. INDUSTRIAL HYGIENE

#### A. BACKGROUND

The Environmental & Industrial Hygiene program has been directed since 1988 by Scott Clark, Ph.D., P.E., CIH. The previous director, Professor Klaus Willeke, Ph.D., CIH, remains very active in the training program. The program was established in 1952 by the late Professor Emeritus Jacob Cholak and has been a component of the Education and Research Center (ERC) since the creation of the ERCs in 1977. Both M.S. and Ph.D. degrees are awarded. The program core faculty consists of eight full-time faculty and two active part-time emeriti faculty and area practitioners who serve as Volunteer and Adjunct faculty. Four members of the full-time faculty and one of the part-time emeriti faculty are certified by the American Board of Industrial Hygiene. Other faculty from the University teach required courses in areas such as epidemiology, biostatistics, health physics and toxicology. The M.S. program in Environmental & Industrial Hygiene was among the first three to become accredited in 1989 by the American Academy of Industrial Hygiene through ABET. The M.S. program requires two academic years for completion and includes elective courses in a number of focus areas such as airborne particles and microorganisms, biological monitoring, biomechanics and ergonomics and hazardous substances. For the Hazardous Substance Academic Training (HSAT) option two of these elective courses have been changed to "required" (Risk Assessment and Human Biological Monitoring). The M.S. program requires a thesis which usually results in at least one publication and one presentation at a national meeting. The Ph.D. program typically takes about four years for completion and requires a minimum of 18 credits of formal courses beyond those required for the M.S. degree. Numerous presentations at the annual American Industrial Hygiene Conference and Exposition are made by M.S. and Ph.D. students on their research results (Attachment A).

#### B. ACADEMIC TRAINING

##### a. Goals and Objectives

The mission of the Industrial Hygiene program at the University of Cincinnati is to provide comprehensive industrial hygiene training for candidates enabling them to assume leadership roles in occupational health programs in government, labor, the private sector and in education. The Ph.D. program primarily prepares candidates for careers in the academic and research positions. All students, M.S. and Ph.D., receive training in research methods and in the interpretation of research results. Accomplishing this mission begins with the student selection process and continues throughout the three phases of the training program: classroom courses, field training and research. There is a strong emphasis on field practice in the program beginning in the first quarter of the first year during which students observe industrial operations and meet local practitioners in industrial hygiene, safety, occupational medicine and occupational health nursing. The environmental and industrial hygiene science and practice courses during the first year of the program are designed to enable the student to design and conduct industrial hygiene surveys, interpret analytical and observational results and write clear reports. A series of industrial hygiene surveys in workplaces throughout the Greater Cincinnati area are conducted as part of the capstone course, Industrial

Hygiene and Safety Laboratory, (26-904-775) at the end of the first year. A Worker Training course, previously offered as a Special Topics class, was developed into a regular academic course and was offered as a regular course for the first time during the 1996-97 year.

b. Structure of the Program

The M.S. program is very comprehensive in scope with core courses in the diverse aspects of environmental and industrial hygiene science and practice as shown in Attachment B. During the first year students are involved primarily in required course work. Students who have adequate prior training in the subject area of specific required classes are given permission to waive these classes and substitute other courses in their place. In addition to the required courses students are encouraged to register for a number of the important, broadening elective classes. A thesis is required and most students are involved in a presentation at the AIHCE.

Ph.D. students, with the aid of their advisor and other committee members who comprise the Academic Advisory Committee, select additional courses beyond those required for the M.S. degree that are consistent with their research and other interests. Once the Qualifying Examination is passed, usually at the end of their second year, a Dissertation Committee is established.

Opportunities exist to perform rotations in occupational health clinics and to gain worker training experience through one of the hazardous waste worker training centers in the area. Lead abatement and hazardous waste worker training activities in the Department enable our students to become acquainted with these important areas and to gain an appreciation of some of the principles and issues involved through the new Worker Training class. Occupational Safety and Health Seminar presenters as part of the Department-wide Environmental Health Seminar are listed in Attachment C.

During the first year in residence the Program Director or Deputy Director serves as Advisor to each of the new students to promote uniform advice regarding course procedures and to facilitate the student becoming acquainted with several of the faculty before selecting a research advisor. While students are completing the required course work, they must discuss research interests with each member of the core faculty. This facilitates the selection of thesis topics which are of interest to the student and which take advantage of faculty strengths. Research allows the students to focus the skills they have learned and to obtain an appreciation for the development of occupational and environmental health exposure recommendations/standards, and analytical methods. In many cases, research is undertaken which requires integration of several disciplines (e.g., hygiene and medicine). The research process is necessarily futuristic and encourages students to envision what industrial hygiene will become, setting the tone for a career of continued growth and maturation. The large and diversified research program carried out by program faculty provides the students with a wide range of areas from which they may choose their thesis topic. Many students participate in our internship program which is coordinated by Dr. Glenn Talaska.

The unique character of the University of Cincinnati Industrial Hygiene program is most clearly seen in the variety of occupational health research projects and related expertise available both within the activities of the training program faculty, other University faculty and researchers in the immediate area (i.e., NIOSH Taft and Hamilton Laboratories, USEPA Breidenbach Laboratory, USEPA and

NIEHS-supported hazardous waste worker and EPA-supported lead abatement training centers, diverse industries). Students may choose to conduct research as part of an ongoing project headed by one of the program's experienced and widely-recognized faculty. Students are also encouraged to develop their own projects under the supervision of faculty. Participation by faculty in departmental programs outside the ERC is also strongly recommended, such as interaction with biostatistics, epidemiology, toxicology and risk assessment. Student research also serves an important link between this program and health professionals at the nearby NIOSH and EPA facilities. The development of areas of research which take advantage of the proximity of these institutes is encouraged. Full-time students frequently participate in NIOSH projects, NIOSH and EPA scientists regularly serve on research committees, and some NIOSH and EPA employees are members of the University Volunteer and Adjunct faculties. Faculty also provide input to NIOSH programs through their areas of expertise; for example, Dr. Glenn Talaska regularly provides advice to NIOSH investigators in the area of biomarkers. A list of recent student research committees (Attachment D) illustrates both the utilization of NIOSH and EPA resources as well as those from other programs in the Department and elsewhere in the University.

### c. Recent Changes in Program

Dr. Carol Rice, CIH was made Deputy Director of the Industrial Hygiene Training Program in 1996. This recognition will facilitate the implementation of plans to further integrate the courses in the curriculum and to propose revisions if necessary. A survey of alumni who visited our booth at the AIHCE revealed that the practical classes such as field trips and laboratory classes (Air Sampling & Analysis I and II and Industrial Hygiene Laboratory) were among the most highly valued parts of their academic programs. We are therefore continuing efforts to improve these experiences. More problem solving will also be introduced into the classes; for example, students will be given practice in identifying resources and contacts for identifying hazards associated with various types of industrial processes. A joint program in Occupational Safety and Ergonomics has been developed with the Safety Engineering program. Courses for the Environmental Health track for this program was presented in Attachment B. Two new courses have been developed by Dr. Rice: Worker Training and Occupational Histories (with Drs. Doug Linz (Occupational Medicine), Glenn Talaska and Susan Pinney (Epidemiology)). The course on worker training which has been offered as a tutorial will be offered the first time as a formal course. In subsequent years it will be expanded to fit the needs of other ERC students as well as those elsewhere in the University with responsibility for worker training. The outlines of these courses are presented in Attachment E.

The excellent library facilities of the Medical Center and University provide the students with access to a variety of up-to-date electronic literature search mechanisms and industrial hygiene software systems. Software additions to and increased use of the Howard E. Ayer Environmental and Industrial Hygiene Computer Laboratory continue to be made. Among the new software titles are: Crystal Ball Version 3.0, ARCView, PRE-SCORE and Smart Risk.

Sergey Grinshpun, Ph.D., functioned in an expanded capacity in the program during recent years. In addition to participation in some of the regular courses, he also is a faculty advisor for one of the Workshop groups in the Interdisciplinary Occupational Health, Hygiene and Safety Workshop. We were able to have him made a member of the tenure track faculty in 1997.

Facilities for student research have been expanded and enhanced recently as many faculty laboratories are now located in the newly-completed Environmental Health wing which adjoins the existing Kettering Laboratory complex: Bioaerosol Research (Willeke and Grinshpun), Aerosol Science Measurement and Technology (Willeke and Grinshpun), Respiratory Protection (Willeke), Biological Monitoring (Talaska), Exposure Assessment (Rice) and Environmental Analytical Chemistry (Tabor). During early 1996 the teaching laboratories of the program, and the Howard Ayer Industrial Hygiene Student Computer Laboratory moved to the Kehoe wing of the Kettering complex. This wing has undergone a major upgrade in its ventilation system during the past year and one half. Laboratory fixtures in these laboratories was replaced in the early 1990s. Approximately 2000 square feet is available. We anticipate that space for first year and advanced students will also be available. New space for the Program Director's office also became available in the same wing of the Kehoe Hall.

#### d. Recruitment and Admissions

The core full-time faculty (Bhattacharya, Clark, Grinshpun, Jayasimhulu, Rice, Tabor, Talaska and Willeke) meet as a committee of the whole to review applications and select candidates for admission to the program. Applicants are sought who have strong backgrounds in chemistry, biology, physics or mathematics through calculus. For M.S. candidates, strengths in at least three of these areas are required; for Ph.D. applicants, competence in all four is expected. The Graduate Record Examination is usually required for all applicants and the TOEFL is required for international students. The University also has an Oral English Proficiency Test that is required. The median GRE scores for successful applicants is about 1800.

A combination of methods are used to recruit applicants, including mailing of brochures, Petersen's Guide entries, campus visits, and booths/exhibits at professional meetings and brief descriptions of the program at Continuing Education courses. Referrals from individuals familiar with the strengths of our program (alumni and employers) continue to be a major source of applicants. The strong reputation the Department has earned as a result of the contributions and leadership of the alumni is a critical element in the recruitment process. A Department-wide home page was created which includes application information. In recent years the program participated in a College of Medicine outreach program which brought representatives of many undergraduate science and engineering programs in Ohio and adjacent states to the University of Cincinnati Medical Center campus. An updated recruitment brochure was prepared for distribution at our booth at the 1996 AIHCE.

Although there is variation from year to year, full-time enrollment (M.S. and Ph.D.) Has been about 25 in recent years. The entering class in 1994-95 was the largest in many years. This was due to the combination of a larger number of applicants being well-qualified and thus offered admission and a higher percentage of those offered admission who accepted, 70%. During the previous 4 years only between 48 and 62% of these offered admission accepted our offer. The class which entered in September 1995 consisted of a total of eight students: 7 M.S. and 1 Ph.D. The entering class for the 1996-97 year is expected to be about 12.

#### e. Student Status Report

Nine students graduated during the September 1991 to August 1992 period, 6 with a M.S. and 3

with a Ph.D. Eleven students graduated during the September 1992 to August 1993 period, 9 with a M.S. and 2 with a Ph.D. Thirteen students graduated during the September 1993 to August 1994 period, 11 with a M.S. and 2 with a Ph.D. Eleven students graduated during the September 1994 to August 1995 period, 8 with a M.S. and 3 with a Ph.D. Ten students graduated during the September 1995 to August 1996 period, 8 with a M.S. and 2 with a Ph.D. A summary of these trainees is presented in Appendix A. A list of M.S. and Ph.D. Theses are presented in Appendix A and B. The majority of the presentations from our industrial hygiene program at the annual American Industrial Hygiene Conference and Exposition involved our students as presenters of their research (previously presented in Attachment A).

#### f. Faculty Commitment and Breadth

The core program faculty members are full-time University professors involved in externally-supported research, community service and the teaching mission of the ERC. The overall course offerings are a mix of individual faculty and team teaching responsibilities. Selected examples for each faculty member are given below and summarized in Table A.

- Professor Emeritus Howard E. Ayer, CIH continues to make major contributions to the program through teaching the course in Safety Management and by providing important lectures in several other courses. He collaborates on several research projects.
- Dr. Scott Clark, CIH serves as Director of the Industrial Hygiene and HSAT Program. Dr. Clark has helped to integrate lead abatement practices and issues into several courses in the curricula. He is responsible for two required classes and participates in others. His current research includes national evaluation of the effectiveness of lead exposure reduction intervention programs.
- During the 1994-95 academic year Dr. Carol Rice, CIH Deputy Director of the Industrial Hygiene and Hazardous Substance Academic Training program, was on sabbatical leave at the Occupational Studies Section, National Cancer Institute, in Bethesda, MD where she developed collaborative relationships for continuing occupational cancer studies in several industries. She has expertise in a number of areas including beryllium exposures, dusty trades, refractory ceramic fibers and coal dust. The reconstruction of exposure histories is one of her research areas. During 1995-96 she resumed responsibility for one required class and major contributions to two others. In addition she played a key role in the development of two new courses.
- Dr. Amit Bhattacharya has co-authored a recent book on "Occupational Ergonomics: Theory and Applications" with Dr. James McGlothlin of NIOSH. Dr. Bhattacharya is responsible for two required classes. He was promoted to full professor in 1995. He is a Certified Professional Ergonomist (CPE).
- Dr. Sergey Grinshpun has become increasingly involved in the teaching program assisting Dr. Willeke in his classes, participating in the interdisciplinary workshop, providing selective lectures and laboratory classes for Air Sampling & Analysis course, and in advising students. His research area is bioaerosol exposure monitoring in indoor and outdoor environments.

- Dr. Koka Jayasimhulu provides instruction in GC/MS analyses. He was promoted to Field Service Professor in 1996.
- Dr. Tiina Reponen, has been a visiting scientist since 1995. Dr. Reponen has expertise in microbiology and indoor research including studies of fungal spores, bacteria, dust, radon and formaldehyde. She has experience in teaching at the University of Kuopio in ventilation, environmental microbiology, air chemistry laboratory exercise and physical occupational and environmental hygiene. With the retirement of Field Service Emeritus Professor Jozef Svetlik recently, Dr. Reponen's skills have been particularly useful in assisting with the set-up and coordination of laboratory exercises in the Air Sampling and Analysis courses.
- Jozef Svetlik, Field Service Assistant Professor Emeritus, is responsible for Industrial Hygiene & Safety Practice and has major responsibilities in Air Sampling & Analysis I & II and other courses with laboratory components.
- Dr. Wilson Tabor is responsible for one required class, and an important elective in Quality Control/Quality Assistance. His research involved the relationships of hazardous substances and xenobiotics in the environment and human exposures.
- Dr. Glenn Talaska, CIH serves as advisor to M.S. and Ph.D. students has primary responsibility for two required classes and is an active teacher in three others. He was granted tenure in 1995. His areas of expertise include the development of biological monitoring exposure methods.
- Dr. Klaus Willeke, CIH teaches two required classes, advises a number of Ph.D. and M.S. students. His book "Aerosol Measurement" was recently re-printed due to continued high demand. He is involved in a number of research areas including the development of methods to evaluate respiration performance needs and has received numerous awards for his research..
- Many other faculty in the Department make distinguished contributions to our training program in industrial hygiene even though they are not listed in this application as part of the industrial hygiene faculty. For example, Dr. Eula Bingham, Head of the Division of Policy, Education and Risk Assessment, offers an excellent course **Public Policy and Environmental Health**, which is frequently taken by industrial hygiene students.

g. Faculty Reputation and Strength:

The faculty is regularly recognized nationally and internationally for contributions to the field through special awards, invitations to serve on peer review and other panels, etc. Some recent examples are listed below.

- Professor Emeritus Howard E. Ayer received the AIHA **Distinguished Service Award** which recognizes "distinguished service in the advancement of industrial hygiene and unique technical contributions to the aims and goals of the American Industrial Hygiene Association".

- Dr. Scott Clark participated in the delivery of a Chemical Risk Assessment course in Rio de Janeiro to safety engineers and occupational health personnel of the national petroleum company - Petrobras in 1995 workers from a variety of locations throughout the country attended and in a Pediatric Environmental Health Conference in Sosnieniec, Poland in 1996. He has been invited to assist in the development of industrial hygiene graduate education programs in India and Poland and is coordinating the University of Cincinnati Environmental and Industrial Hygiene support for these developing efforts. He serves on the Educational Advisory Board for the new publication International Journal of Agriculture and Environmental Medicine.
- Dr. Carol Rice has been appointed to a six-year term on the Occupational Health Advisory Board of the UAW/GM National Joint Committee on Health and Safety which oversees the joint research agenda and to the Advisory Boards of the Y-12 Beryllium Worker Health Surveillance Project, Oak Ridge, TN and the Health Effects of Lead Project, Johns Hopkins University, Baltimore, MD. She was also a member of the Mine Safety and Health Administrator's Dust Advisory Committee.
- Dr. Amit Bhattacharya recently completed service on the Occupational Safety and Health Study section and has developed a joint Occupational Safety and Ergonomics graduate education program with the University of Cincinnati Department of Mechanical, Industrial and Nuclear Engineering. Two students (1 M.S. and 1 Ph.D.) have already completed this program. (See Attachment B for details of this program.)
- Dr. Sergey Grinshpun, who initially came to the program as a visiting scientist in Dr. Willeke's laboratory, has been made a full-time research professor and we are attempting to create a tenure track position for him. He has given invited lectures presenting his research results at national institutes of occupational health - in Denmark, Sweden and Finland and in many other countries.
- Dr. Koka Jayasimhulu operates the GC/MS University of Cincinnati Facility which is housed in the Department of Environmental Health. He actively publishes with a number of investigators from throughout the University.
- Jozef Svetlik is highly regarded in the local industrial hygiene community and by alumni world wide for his practical advice on industrial hygiene training and field activities.
- Dr. Wilson Tabor has lectured extensively in Mexico and China and has developed long-term research collaborations in each of these countries. For a number of years he has served as Scientific Advisor and Member of the WHO International Visiting Scientist Program.
- Dr. Glenn Talaska has become established as a prominent investigator in the biological monitoring area. He has been active in organizing round tables and technical sessions in this area at annual AIChE meetings. Dr. Talaska was recently invited to present research results in Sweden and Korea where he has developed long-term research collaboration.
- Dr. Klaus Willeke's research laboratory has had a total of over 20 visiting scientists and post-docs from a number of countries in Europe and Asia. It is regarded as one of the pre-eminent facilities of its kind in the world and has expanded in recent years to include biological aerosols.

- Dr. Eula Bingham was awarded the *first Alice Hamilton Award* at the 1995 AIHCE. This new award honors “an outstanding woman who has definitive, lasting achievements in the field of occupational and environmental hygiene”.

Table A contains a summary area of special competence and program responsibilities for core, supporting and adjunct faculty.

Table A  
Program Faculty - Areas of Specific Competence and Responsibilities

<u>Name</u> <u>Core Faculty (Full-Time)/</u>	<u>Program Responsibilities</u>
<u>Specific Areas of Competence</u>	
Amit Bhattacharya, PhD, CPE Biomechanics-Ergonomics	Responsible for (1) Principles of Ergonomics, (2) Biomechanical & Physiol. Aspects of Muscular Activities and Co-responsible for (3) Physical Aspects of the Environment
Scott Clark, PhD, PE, CIH Exposure Assessment	Program Director. Responsible for (1) Hazardous Waste Management and (2) Occupational Health, Hygiene & Safety Workshop. Assists with (3) Industrial Hygiene Practice
Sergey Grinshpun, PhD Aerosol Science	Assists with (1) Occupational Health, Hygiene & Safety Workshop, (2) Industrial Ventilation, (3) Aerosol Measurement and (4) Air Sampling & Analysis
Koka Jayasimhulu, PhD Bio-Analytical Chemistry	Responsible for (1) Instrumental Methods of Analysis and Assists with (2) Air Sampling & Analysis
Carol Rice, PhD, CIH Exposure Assessment	Deputy Director. Responsible for (1) Industrial Hygiene Lab and (2) Worker Training, co-responsible for (3) Physical Aspects of the Environment and (4) Occupational History Methods and assists with (5) Industrial Hygiene Practice and (6) Air Sampling & Analysis.
Wilson Tabor, PhD Environmental Analytical Chemistry	Responsible for (1) Air Sampling & Analysis II and (2) QA/GC in Environmental Toxicology & Chemistry, Assists with (3) Air Sampling & Analysis I
Glenn Talaska, PhD, CIH Biological Monitoring	Responsible for (1) Environmental Hygiene & Safety Technology and (2) Human Biological Monitoring with Biological Markers. Assists with (3) Industrial Hygiene Practice and (4) Air Sampling & Analysis I & II. Coordinator of Internships

Klaus Willeke, PhD, CIH  
Aerosol Science                      Responsible for (1) Industrial Ventilation and (2) Aerosol Measurement

Core Faculty (Part-Time Emeritus)

Howard Ayer, MS, CSP, CIH  
Industrial Hygiene Practice                      Responsible for (1) Safety Management, assists with (2) Environmental Hygiene & Safety Technology, (3) Air Sampling & Analysis

Jozef Svetlik, BS  
Industrial Hygiene Practice                      Responsible for (1) Industrial Hygiene Practice. Assists with (2) Air Sampling & Analysis and (3) Industrial Hygiene Lab

Supporting Faculty

Stuart Baxter, PhD  
Toxicology                      Responsible for (1) Introductory Physiology, (2) Environmental Health Seminar and (3) Environmental Toxicology.

Eula Bingham, PhD  
Occupational Health & Safety                      Responsible for Public Policy in Environmental Health

Ralph Buncher, ScD  
Biostatistics & Epidemiology                      Introduction to Epidemiology                      Responsible for (1) Introduction to Biostatistics and (2) Introduction to Epidemiology

Grace Lemasters, Ph.D.  
Epidemiology                      Responsible for Design & Management of Field Studies

Henry Spitz, PhD  
Radiation Health                      Responsible for Health Physics

Paul Succop, PhD  
Biostatistics                      Responsible for Experimental Design

Adjunct Program Faculty

Richard Fulwiler, ScD, CIH                      Responsible for Introduction to Occupational Health  
Occupational Health & Safety

h. Distinctive Core Program Contributions:

The industrial hygiene program at the University of Cincinnati contributes to the overall teaching research and service missions of the University and the overall community utilizes its industrial hygiene training, research and service resources. Some of the highlights in each area are cited below:

Contributions to Academic Training Programs

- Major textbooks by two of our faculty are being widely used in the industrial hygiene academic community Occupational Ergonomics, Theory and Applications (Bhattacharya and McGlothlin (NIOSH)) and Aerosol Measurement: Principles, Techniques and Applications (Willeke and Baron (NIOSH)).
- The first worker training course for occupational safety and health students that we know of has been developed and is currently being offered.
- A NIOSH-supported work history grant provides academic rigor for the newly-developed worker history course.
- The Occupational Health, Hygiene and Safety Workshop is considered to be a model for enhancing interdisciplinary training of occupational safety and health students.
- The Great Lakes Regional Lead Training Centers, based in the Department of Environmental Health, is a leader in the lead training field and provides exceptional opportunities for student participation.
- A primer on Industrial Hygiene Report Writing has been developed and shared with other industrial hygiene programs.
- State-of-the art facilities for training and research (quantitative respirator testing, bioaerosol sampling methodology development, aerosol sampling efficiency, carcinogen biomonitoring, biomechanics/ergonomics, including balance platform, human motions analysis, slip/fall simulation facility, shoe tribology, five portable lead-in-paint XRF analyzers, advanced analytical chemistry labs (GC/MS, ICP/AES, Kevex XRF, Zeeman AA) afford unusual opportunities for M.S. and Ph.D. students to pursue outstanding thesis projects.
- The carcinogen biomonitoring expertise results in this being the only industrial hygiene program with graduate level and continuing education courses in this area;
- All four academic components of the Cincinnati ERC are located within walking distance of each other in three Colleges with a tradition of close working relationships which facilitates interaction among students and faculty;

Contributions to Research Knowledge (Graduate student research was an important component for each of these contributions)

- A major long-term interdisciplinary study of workers in the refractory ceramic fibers (RCF) industry being conducted within two of the ERC components (Occupational Medicine and Industrial Hygiene), and with participation of the Department's Epidemiology and Biostatistics group has shown a statistically significant exposure-response relationship for RCF and pleural plaques; as part of a study to evaluate exposures in the refractory ceramic fiber industry, the types of past engineering controls which impacted airborne concentration were identified; these observations may be useful to others in predicting exposure levels prior to implementation of engineering controls.

- Program faculty were selected by the Department of Housing and Urban Development to become the National Coordination Center for the long-term evaluation of lead abatement carried out in over 1000 housing units at 14 sites around the country, from Boston (MA) to Alameda County (CA).
- Research in a large foundry provides further documentation that the current U.S. standard for worker exposure to silica is inadequate and that triethylamine exposure below the current guideline is related to ocular effects.
- An analysis of beryllium exposure data by a M.S. student which indicated substantial excursions in exposure, even among persons with average exposure intensity below the current standard was used in a successful application through NIOSH to conduct follow-up research among beryllium workers to determine if maximum exposure intensity is predictive of chronic beryllium disease.
- Research by a recent Ph.D. student Rubens Mazon (Vargas, Sao Paulo, Brazil) produced a health risk based model for ranking hazardous sites which incorporated economic components especially designed for use in developing countries.
- A new air sampler developed by Drs. Willeke and Grinshpun and a recent Ph.D. student is useful under a wider variety of air velocity conditions and provides a more uniform distribution on the filter.
- Results from lead exposure studies are providing key information for the development of health-based settled dust lead standards by the USEPA and HUD.
- Results from reports of critical incidents in workplaces shows the need for team building and training in written standard operating procedures.
- Over 200 publications have been contributed by the faculty and students during the reporting period (Attachment F).

#### Contributions to Service to the Community

- Many state and local health and housing agency staff as well as private practitioners from the region have been trained by the U.S. Environmental Protection Agency-supported Great Lakes Regional Lead Training Center.
- The Midwest Consortium for Hazardous Worker Training, the International Chemical Workers Union Center for Health and Safety Education, the UBC Health and Safety Fund (three of the worker training centers established by NIEHS through SARA), and one of the Consortium components (Greater Cincinnati Occupational Health Center) are nationally-recognized worker training centers.
- Drs. Amit Bhattacharya and Eula Bingham are on the Advisory Board for the Center to Protect Worker Rights (CPWR) which reviews grants submitted to the CPWR for construction research.

### i. Program Evaluation

Each quarter students evaluate the courses. The results are compiled and discussed at faculty meetings to decide on changes that are warranted. During the 1995-96 year a group of second year industrial hygiene students evaluated the five most recent years' activities of the Occupational Safety and Health Workshop. Among their recommendations that were adopted by the faculty are:

- change the number of credits per quarter to two to more adequately reflect the time required to complete the interdisciplinary projects.
- require the class only for second year industrial hygiene students since they will be better prepared to participate in interdisciplinary occupational safety and health activities at that time (currently this workshop is required for two years by industrial hygiene students but only for one year for other disciplines).
- include most of the didactic topics in the fall quarter.
- eliminate the role of "facilitators" (currently preformed by second year industrial hygiene students because most groups developed their own leadership during the Fall Quarter and thus very little role was then needed for a facilitator.

A recurrent problem noted by students in the field trip class (Industrial Hygiene & Safety Practice) was the difficulty in hearing comments by tour leaders, particularly in noisy environments. A mobile system with specially-equipped headsets for trip participants that are connected to a microphone system for tour leaders in being considered.

## **C. RESEARCH TRAINING**

### a. Objectives and Goals

The objectives of the research training program are to provide training to all M.S. and Ph.D. students in the many areas of research including statistical and epidemiologic aspects, sampling and analysis methods, comprehensive survey methods and research approaches. Ph.D. students receive additional training in such areas as experimental design and hypothesis development.

### b. Program Plan/Leadership

Research by students is under the direction of Thesis and Dissertation Research Committees, appointed by the Departmental Degrees Committee from persons suggested by the Advisor in consultation with the student. These committees are individually constituted for each student from University faculty and other disciplines needed for the particular research. Student research topics are presented during an on-going series of seminars, at special presentations and at national conferences. Frequently investigators from various disciplines from NIOSH and other organizations serve as key members of the student research committee (Previously presented in Attachment D).

The Research Committee for M.S. theses and Ph.D. dissertations provides the primary leadership

for the research program for individual student. The composition of these research committees for current students were previously presented in Attachment D. Two elective courses devoted to the development and conduct of research are Experimental Design (Dr. Paul Succop - Biostatistics) and Design and Management of Field Studies (Dr. Grace Lemasters - Epidemiology). The first course includes detailed statistical design and data analysis experience using actual data sets and the second includes scientific research proposal development. Many industrial hygiene students who have enrolled in these classes during the past five years follows:

c. Faculty Recognition/Breadth

(See Academic Training, Section B.1.e and f: Faculty Commitment and Breadth and Faculty Reputation and Strength and B.1.g: Distinctive Core Contributions, especially Contributions to Research Knowledge)

Major new initiatives in research included:

1. Initiated pilot research study dealing with the issue of "older workers" returning to work after retirement and ergonomic aspects of their jobs and injury mechanism.
2. Completed a NIOSH sponsored six-year study dealing with CTD and ergonomic evaluation of carpenters at construction sites.
3. Initiated series of NIOSH sponsored research studies dealing with effect of workplace ergonomic risk factors which cause loss of postural stability among industrial workers (construction workers, grocery workers, roofers) during task performance.
4. Initiated series of NIEHS sponsored research studies dealing with effect of environmental lead and the effect of chelation therapy on functional abilities of children.
5. Initiated series of research studies dealing with effect of industrial chemicals (such as jet fuel, solvents, pesticide etc.) on the neuromuscular performance of industrial workers.
6. Initiated a NIH sponsored (Dental Research Institute) collaborative research study with Columbia University, NY to investigate neurobehavioral effect of mercury based dental amalgam.
7. Evaluation of exposure during non-routine or short-term tasks.
8. Influence of short-term exposures on disease risk.

We also expanded outreach activities:

1. Helped initiated the first MS program in industrial hygiene in India.
2. Western Kentucky University undergraduates and faculty joined the University of Cincinnati

faculty and students for an informal "mixer" as part of the annual Western Kentucky University trip to Cincinnati to visit the NIOSH facilities.

3. University of Cincinnati faculty initiated an annual reception to recognize local professionals who contribute to the Environmental and Industrial Hygiene teaching and research programs.

d. Program Evaluation

The research program is evaluated through the research committee process, faculty meetings, external peer review of proposals and manuscripts and comments at professional meeting presentations. In addition, the State of Ohio Board of Regents recently initiated an extensive evaluation of all doctoral programs at its state universities. Our industrial hygiene program was reviewed along with the Department of Environmental Health Ph.D. programs in toxicology and epidemiology & biostatistics. The Board of Regents evaluated these programs using a Biological Sciences Review Panel composed of seven faculty from universities outside Ohio. The University of Cincinnati College of Medicine made use of a three-member outside review panel to perform its internal evaluation (Drs. Morton Lippmann, Gary Carlson and Howard Rockette). Following are excerpts from the final report of the Ohio Board of Regents on the Ph.D. program within the Department of Environmental Health.

"PROGRAM DESCRIPTION AND CRITIQUE: Overall, the graduate program in Environmental Health ranks among the top five programs in the nation. The faculty has outstanding strength in all three areas of academic emphasis (environmental and industrial hygiene/occupational safety and ergonomics, environmental toxicology, and epidemiology and biostatistics)...the completion rate is high and essentially all of the graduates find immediate employment in appropriate positions.

The research program is excellent with sources of support ranging from industry to government to foundations. There are excellent ties with EPA and NIOSH offices and laboratories located in Cincinnati. This has been a source of strength. It appears that the departmental leadership has, appropriately, exploited linkages with the agencies--to the benefit of both. The amount of support generated by departmental faculty is unusually high and has been leveraged effectively. The state of Ohio has an excellent bargain in the presence of the department.

The external reviewers were generally laudatory but pointed out that the restriction of Graduate Student Assistantships (GA) support to first year students and the cap on the total number of matriculants placed undue burdens on a program that clearly seems to meet the needs of the State of Ohio and the profession in terms of producing marketable graduates.

Overall the three programs appear to meet the expectations of the Board of Regents and, in fact, would appear to be doing so in exceptional fashion.

**RECOMMENDATION:** The Review Panel has no serious concerns about the Ph.D. program in Environmental Health at UC. We recommend that the program continue to be supported."

e. Special Contributions (Also see "Distinctive Core Program Contribution" under Academic Training)

Many of the "distinctive contributions" mentioned in the Academic Training section apply as well

to Research Training. Special contributions include widely-acclaimed research textbooks by Drs. Bhattacharya and Willeke. Scientific panel membership by individual faculty (see faculty reputation and strength), best scientific paper awards and research patents. During the past year one of the M.S. students (C. Blasio) was awarded a special EPA Fellowship, one of only about 20 nationwide, for his research on radioactive residues from former oil extraction facilities in Kentucky. A June 1996 graduate, Dr. Shiow-Yi Chiou has been awarded a National Research Council Fellowship. Many current students (M.S. and Ph.D.) received AIHAF Fellowships during the reporting period.

f. Program Support From Other Sources

Student tuition support and several assistantships are provided by the University of Cincinnati. Faculty in the Environmental and Industrial Hygiene Program are directly responsible (as Principal Investigator) for over \$5,000,000 in research grants and contracts and also play major roles in other grants and contracts. (See Sources of Support for individual faculty for details). The Department of Environmental Health ranks first among all departments throughout the University of Cincinnati in external funding received with an annual budget of over \$12,000,000.

The Eastman Kodak Company has provided financial support for the program for each of the years of the reporting period.

1. Current and Past Training Records

a. Number of Current Trainees

There are usually 8-14 full-time Ph.D. students enrolled in the program. During recent years the proportion of Ph.D./M.S. students has sometimes exceeded 50%.

b. Graduates

Graduates of the doctoral program during the past five years and their current places of employment are indicated in Appendix C. Publications involving students are shown with those of the program faculty in Attachment F List of Publications and are designated by an asterisk.

1993 AMERICAN INDUSTRIAL HYGIENE CONFERENCE PRESENTATIONS FROM  
 KETTERING LABORATORY, DEPARTMENT OF ENVIRONMENTAL HEALTH,  
 UNIVERSITY OF CINCINNATI

NEW ORLEANS, LA

<u>Title</u>	<u>Authors</u>	<u>Date/ Time</u>	<u>Session # Paper #</u>
AN INVESTIGATION OF THE POTENTIAL FOR WORKERS AT A LEAD MINE TO CARRY HOME LEAD DUST	W.E. Menrath R.L. Bornschein C.S. Clark	Monday 5/17/93 4:00	4/38
ERGONOMIC RISK FACTORS ASSOCIATED WITH CARPENTRY TASKS	L. Greathouse G. Lemasters A. Bhattacharya	Monday 5/17/93 3:20	7/48
DERMAL ABSORPTION OF CARCINOGENS IN USED GASOLINE ENGINE OILS:	G. Talaska M. Schamer T. Collins J. Cudnik* R. Reilman	Monday 5/17/93 4:20	11/91
ELECTRON MICROSCOPY STUDY OF REFRACTORY CERAMIC FIBERS	P.A. Mackinnon* C. Rice J. Lockey G. Lemasters P. Gartside	Monday 5/17/93 1:00-3:00	1/386**
ATTIC DUST, A SOURCE OF LEAD EXPOSURE FOR WORKERS AND OCCUPANTS	W.G. Menrath C.S. Clark R.L. Bornschein	Tuesday 5/18/93 1:20	22/187
URBAN BACK YARDS AND SUPERFUND SITES-A DISPARITY IN POLICY	W.G. Menrath	Tuesday 5/18/93 2:00	22/189
WORKER EXPOSURES DURING LEAD-BASED PAINT ABATEMENT	S.W. Rucker* C.S. Clark	Tuesday 5/18/93 2:20	22/190
EFFECT OF ROOF INCLINATION ON POSTURAL STABILITY AND PERCEIVED SENSE OF FALL	R. Emerich A. Bhattacharya P.A. Succop A. Bagchee*	Tuesday 5/18/93 1:00-3:00	3/475**
MEASUREMENT AND SIGNIFICANCE OF POSTURAL INSTABILITY AT ELEVATED SURFACES	A. Bagchee* A. Bhattacharya	Wednesday 5/19/93 8:20	25/207
AN ASSESSMENT OF LEAD EXPOSURES IN THREE RADIATOR REPAIR SHOPS	G.M. Piacitelli* C.H. Rice	Wednesday 5/19/93 9:00-12:00	4/508**

\*Student

\*\*Poster Session

**1994 AMERICAN INDUSTRIAL HYGIENE CONFERENCE PRESENTATIONS FROM  
KETTERING LABORATORY, DEPARTMENT OF ENVIRONMENTAL HEALTH,  
UNIVERSITY OF CINCINNATI**

**ANAHEIM, CA**

<u>Title</u>	<u>Authors</u>	<u>Date/ Time</u>	<u>Session # Paper #</u>
EVALUATIONS OF TRAINING PROGRAM EFFECTIVENESS "TRAINING EVALUATION APPROACHES/METHODS"	J.L. Jarrell	Monday 5/23/94 9:30-11:30	2 ROUNDTABLE
EFFECT OF WORKERS' SHOE WEAR PATTERNS ON COEFFICIENT OF FRICTION AND SUBJECTIVE ASSESSMENT OF SLIPPERINESS	S. Chiou* A. Bhattacharya P. A. Succop	Monday 5/23/94 2:20	5/38
A TEST-RETEST RELIABILITY STUDY OF A WORK-RELATED MUSCULOSKELETAL DISORDER QUESTIONNAIRE	A. Booth-Jones* A. Bhattacharya G. Lemasters P. A. Succop M.R. Atterbury H. Applegate R. Stinson	Monday 5/23/94 2:40	5/39
PREVALENCE OF WORK-RELATED MUSCULOSKELETAL DISEASE IN CARPENTERS	G.K. Lemasters A. Bhattacharya C. Forrester M.R. Atterbury C. Forrester H. Pierson H. Applegate Y. Li R. Stinson	Monday 5/23/94 4:00	6/43
COMPARISON OF SELF-REPORTED HAND/ WRIST WORK-RELATED MUSCULOSKELETAL DISORDERS IN CARPENTERS TO PHYSICAL EXAMINATION FINDINGS	M.R. Atterbury H. Pierson H. Applegate Y. Li R. Stinson G. Lemasters	Monday 5/23/94 4:20	6/44
EVALUATION OF AN ERGONOMIC DOSIMETER AT CONSTRUCTION SITES	J.M. Warren* H. Applegate R. Stinson G. Lemasters A. Bhattacharya	Monday 5/23/94 4:40	6/45
EFFECT OF ENVIRONMENTAL LEAD EXPOSURE ON FUNCTIONAL GAIT IMPAIRMENT	A. Bagachee* A. Bhattacharya	Tuesday 5/24/94 8:00	2/372**
BIOLOGICAL MONITORING AND THE OSHA CADMIUM STANDARD: SCIENTIFIC BASIS AND PRACTICAL APPLICATIONS	G. Talaska ARRANGER & CHAIR	Tuesday 5/24/94 1:00-4:00	12 ROUNDTABLE

LEAD AND PUBLIC HEALTH POLICY "EXPOSURE TO LEAD FROM SOIL— REQUIREMENTS AND COSTS FOR ABATEMENT	S. Clark	Tuesday 5/24/94 1:00-4:00	15 ROUNDTABLE
A COMPARISON OF EXPOSURES TO REFRACTORY CERAMIC FIBERS OVER MULTIPLE SHIFTS	G.S. Hall* P.S. Gartside G.K. Lemasters J.E. Lockey C.H. Rice	Tuesday 5/24/94 1:00	3/415**
ENVIRONMENTAL CHARACTERIZATION OF EXPOSURES DURING ASPHALT ROAD PAVING	J.N. Zey C. Ellison G.M. Piacitelli D.D. Zaebst G. Smith M. Petersen G. Talaska	Tuesday 5/24/94 1:00	3/417
EFFECTS OF RESPIRATORY HELMET AND POSTURAL FATIGUE ON UPRIGHT BALANCE	C. Pippenger* K. Dietrich R. McKay A. Bhattacharya	Tuesday 5/24/94 1:00	3/427
FORCE TRANSMISSIBILITY DURING HIGH AND LOW IMPACT AEROBICS DANCING	A. Bagchee* L. Greathouse*	Tuesday 5/24/94 1:00	3/428
DISSOLVING NORTH AMERICAN BORDERS: THE PROPOSED REGIONALIZATION OF INDUSTRIAL HYGIENE PROGRAMS IN SISTER CHEMICAL FACILITIES IN MEXICO AND THE UNITED STATES	R. Echavarria* C.J. Hauger J.M. Stone	Tuesday 5/24/94 3:20	14/96
BIOLOGICAL MONITORING/DERMAL ABSORPTION I	G. Talaska ARRANGER & CHAIR	Wednesday 5/25/94 1:00 P.M.	23 ROUNDTABLE
SHOULD INDUSTRIAL HYGIENISTS BE CERTIFIED AS TRAINERS? "EFFECTIVE TRAINING: BEING A CONTENT EXPERT IS NOT ENOUGH"	J. Jarrell	Wednesday 5/25/94 9:00	18 ROUNDTABLE
LABORATORY AND FIELD EVALUATION OF THREE DIFFERENT BIOAEROSOL SAMPLING METHODS: IMPACTION ONTO A GLASS OR AGAR SLIDE VS. IMPINGEMENT INTO A LIQUID	S.J. Terzieva S. Das* J. Donnelly S.A. Grinshpun A. Juozaitis S. Stewart* K. Willeke	Wednesday 5/25/94 3:00	26/212
REVIEW OF OCCUPATIONAL HEALTH AND SAFETY ISSUES: A GLOBAL PERSPECTIVE	R. Echavarria* ARRANGER Rubens Mazon* SPEAKER	Wednesday 5/25/94 1:00-5:00	24 ROUNDTABLE

DEVELOPMENT OF PREDICTION METHODS  
FOR DETERMINING SOLVENT EXPOSURES  
USING A NONSPECIFIC SENSOR

P.A. Jensen\*  
A.J. Rachoy  
C.S. Clark

Wednesday 4/433\*\*  
5/25/94  
1:00

HEALTH CARE MASK PENETRATION BY  
MICROORGANISMS SIMILAR IN SHAPE  
TO TUBERCULOSIS BACTERIA

Y. Qian\*  
J. Donnelly  
S.A. Grinshpun  
A. Juozaitis  
K. Willeke

Thursday 33/265  
5/26/94  
1:00

BIOLOGICAL MONITORING/DERMAL  
EXPOSURE II

G. Talaska  
ARRANGER &  
CHAIR

Thursday 36  
5/26/94  
1:00

\*Student (or student at time of research)

\*\*Poster Session

**1995 AMERICAN INDUSTRIAL HYGIENE CONFERENCE PRESENTATIONS FROM  
KETTERING LABORATORY, DEPARTMENT OF ENVIRONMENTAL HEALTH,  
UNIVERSITY OF CINCINNATI**

**KANSAS CITY, MO  
MAY 22-26, 1995**

<u>Title</u>	<u>Authors</u>	<u>Date/ Time</u>	<u>Session #/ Paper #</u>
EVALUATION OF WORKERS' PERCEIVED SENSE OF LOSS OF BALANCE USING A SHORT QUESTIONNAIRE-TYPE SCALE	S. Chiou* A. Bhattacharya P.A. Succop	Monday 5/22/95 10:00-1:00	1/299**
EFFECT OF VARIOUS ENVIRONMENTAL RISK FACTORS ON THE STOCHASTIC PROCESS ASPECT OF WORKERS' POSTURAL STABILITY CONTROL	C. Lai* A. Bhattacharya S. Chiou	Monday 5/22/95 10:00-1:00	1/300**
HUMIDITY, TEMPERATURE, AND SEASON EFFECTS ON COWL DEPOSITION FOR SAMPLING IN THE REFRACTORY CERAMIC INDUSTRY	G.S. Hall* P.S. Gartside G.K. Lemasters J.E. Lockey C.H. Rice	Monday 5/22/95 10:00-1:00	1/303**
SELECTION OF PESTICIDES FOR INCLUSION IN QUESTIONNAIRE FOR AA BRAIN CANCER CASE CONTROL STUDY	W.T. Sanderson G.M. Calvert K. Davis-King D.D. Zaebst G. Talaska	Monday 5/22/95 3:20	8/244
ELF EXPOSURE ASSESSMENT OF HEALTH CARE WORKERS	G. Enescu* C. Rice C.E. Moss	Monday 5/22/95 2:00	9/55
THE USE OF THE ERGONOMIC DOSIMETER ON CONSTRUCTION JOBS	A. Bhattacharya	Tuesday 5/23/95 9:00-Noon	FORUM 2
COLLECTION AND SURVIVAL OF MICROORGANISMS IN BIOAEROSOL SAMPLERS	S.A. Grinshpun J. Donnelly X. Lin* S. Stewart* S. Terzieva V. Ulevicus K. Willeke	Wednesday 5/24/95 10:00	17/122
BIOLOGICAL MONITORING AND DERMAL EXPOSURE	G. Talaska Arranger & Chair	Wednesday 5/24/95 1:00-5:00	20

<u>Title</u>	<u>Authors</u>	<u>Date/ Time</u>	<u>Session #/ Paper #</u>
BENZIDINE WORKERS HAVE ELEVATED LEVELS OF BENZIDINE DNA ADDUCTS IN EXFOLIATED UROTHELIAL CELLS	G. Talaska R.B. Hayes N. Rothman V.K. Bhatnagar R. Kashyap S.K. Kashyap D.J. Parikh M.A. Butler P.A. Schulte M. Schamer	Wednesday 5/24/95 2:00	20/146
DYNAMIC EVALUATION OF THE MICROBIAL PENETRATION CHARACTERISTICS OF HEALTH CARE RESPIRATORS	K. Willeke J. Donnelly S.A. Grinshpun Y. Qian* V. Ulevicus	Thursday 5/25/95 9:20	23/170
EXPOSURE GROUPING: WHERE DO WE NEED TO GO?	G.S. Hall*	Thursday 5/25/95 1:00-3:00	27 ROUNDTABLE MONITOR
BIOLOGICAL MONITORING FOR CHEMICAL CARCINOGENS IN THE WORKPLACE	G. Talaska Arranger & Chair	Friday 5/26/95 8:00-Noon	29 ROUNDTABLE
CARCINOGEN-DNA ADDUCTS	G. Talaska	Friday 5/26/95 8:00-Noon	29 ROUNDTABLE
FOCUS GROUPS: AN AID FOR ERGONOMIC ASSESSMENT OF CARPENTRY TASKS	J.M. Warren* A. Bhattacharya H. Applegate R. Stinson G.K. Lemasters	Friday 5/26/95 9:20	32/264
PHYSIOLOGICAL WORKLOAD ASSESSMENT OF CARPENTRY	J.M. Warren* H. Applegate R. Stinson G.K. Lemasters A. Bhattacharya	Friday 5/26/95 9:40	32/265

\*Student (or student at time of research)

\*\*Poster Session

**1996 AMERICAN INDUSTRIAL HYGIENE CONFERENCE PRESENTATIONS FROM  
KETTERING LABORATORY, DEPARTMENT OF ENVIRONMENTAL HEALTH,  
UNIVERSITY OF CINCINNATI**

**WASHINGTON, D.C.  
MAY 18-24 1996**

<u>Title</u>	<u>Authors</u>	<u>Date/ Time</u>	<u>Session #/ Paper #</u>
LUNG TOXICOLOGY AND LUNG DISEASES	R. McKay	Sunday 5/19/96 1:00-5:00	611 PROFESSIONAL DEVELOPMENT COURSE
RE-AEROSOLIZATION OF MICROORGANISMS FROM THE FILTER MEDIA OF HEALTH CARE RESPIRATORS	Y. Qian* J. Donnelly V. Ulevicius K. Willeke S. Grinshpun	Monday 5/20/96 10:00	101/1
FIELD TESTING OF NEW MULTI-DIRECTIONAL SAMPLING INLET FOR AIRBORNE PARTICULATES: SIMULTANEOUS MEASUREMENT OF TOTAL DUST, FUNGAL SPORES AND LEAD	B. Haučk* G. Mainelis* T. Reponen A. Reponen V.A. Aizenberg* P. Luby R.L. Bornschein S.A. Grinshpun K. Willeke	Monday 5/20/96 11:20	103/17
ANALYSIS OF CRITICAL INCIDENTS OCCURRING DURING HAZARDOUS MATERIAL WORK	B. Hauck* C. Rice E. Bingham S. Graumlich	Monday 5/20/96 10:00-3:00	301/376**
CHARACTERIZATION OF PHYSIOLOGICAL WORKLOAD USING NEW RATING SYSTEM OF CARPENTRY TASKS	K. Bostic* Y. Li G. Lemasters A. Bhattacharya	Tuesday 5/21/96 10:00-3:00	302/404**
EVALUATION OF WORKERS' POSTURAL STABILITY ON SLIPPERY SURFACES DURING TASK PERFORMANCE	S. Chiou* A. Bhattacharya P. Succop	Tuesday 5/21/96 10:00-3:00	302/407**
OBJECTIVE AND SUBJECTIVE ASSESSMENT OF FLOOR SLIPPERINESS WITH WORN-OUT WORKER SHOES	C. Lai* A. Bhattacharya S. Chiou*	Tuesday 5/21/96 10:00-3:00	302/408
POSTURAL STABILITY AS A MEASURE OF NEUROLOGIC DISORDER IN WORKERS WITH HISTORY OF EXPOSURE TO SOLVENTS	R. Bagchee* A. Bhattacharya D. Linz	Tuesday 5/21/96 10:00-3:00	302/409

<u>Title</u>	<u>Authors</u>	<u>Date/ Time</u>	<u>Session #/ Paper #</u>
SPECTRAL ANALYSIS OF POSTURAL SWAY IN CHILDREN WITH CHRONIC LEAD EXPOSURE	A. Bagchee* A. Bhattacharya P. Succop	Tuesday 5/21/96 4:20	116/152
ERGONOMICS IN CONSTRUCTION	A. Bhattacharya Session Chair	Wednesday 5/22/96 10:00-Noon	120
ETHICS OF BIOMONITORING	G. Talaska Monitor	Wednesday 5/22/96 1:00-4:00	227 ROUNDTABLE
EMERGING SCIENCE ON THE RELATIONSHIP OF LEAD EXPOSURE TO LEAD ABSORPTION	R. Bornschein	Thursday 5/23/96 9:00-Noon	235 ROUNDTABLE
SYNTHESIS OF 2-THIOTHIAZOLIDINE-4-CARBOXYLIC ACID AND ITS CHROMATOGRAPHY IN RAT AND HUMAN URINE	C. Cox*	Thursday 5/23/96 10:00	131/270
AN EVALUATION OF THE EFFECTS OF HAND CLEANSERS ON DERMAL CARCINOGEN ABSORPTION FROM USED GASOLINE ENGINE OILS WITH RESPECT TO THE EXPOSURE-CLEANING INTERVAL	K.D. Carwardine* R. Drexelius* G. Talaska M. Jaeger K. LaDow	Thursday 5/23/96 10:00-2:00	GRADUATE STUDENT POSTER SESSION
AN EVALUATION OF THE RELATIONSHIP BETWEEN BLOOD LEAD AND ENVIRONMENTAL LEAD IN THE HUD LEAD HAZARD REDUCTION GRANT PROGRAM IN PRIVATE HOUSING	M.J. Chen* C.S. Clark P.A. Succop W.G. Menrath	Thursday 5/23/96 10:00-2:00	GRADUATE STUDENT POSTER SESSION
DETECTION AND IDENTIFICATION OF DNA-ADDUCTS BY <sup>32</sup> P-POSTLABELING IN THE EXFOLIATED UROTHELIAL CELLS OF MECHANICS EXPOSED TO USED ENGINE OIL	R. McCartney* M. Jaeger X. Zhou G. Talaska	Thursday 5/23/96 10:00-2:00	GRADUATE STUDENT POSTER SESSION
AN EVALUATION OF THE EFFECTS OF BARRIER CREAM APPLICATION ON THE FORMATION OF DNA ADDUCTS IN THE SKIN AND LUNG TISSUE OF MICE DERMALLY EXPOSED TO USED GASOLINE ENGINE OIL	R.J. Drexelius* G. Talaska K. Carwardine* M. Jaeger	Thursday 5/23/96 10:00-2:00	GRADUATE STUDENT POSTER SESSION
EFFECT OF CHRONIC LOW LEVEL EXPOSURE TO JET FUEL ON POSTURAL BALANCE OF U.S. AIR FORCE PERSONNEL	L.B. Smith* E.S. Puhala* A. Bhattacharya G. Lemasters M. Medvedovic Col. John Joyce	Thursday 5/23/96 10:00-2:00	GRADUATE STUDENT POSTER SESSION

<u>Title</u>	<u>Authors</u>	<u>Date/ Time</u>	<u>Session #/ Paper #</u>
A FIELD METHOD FOR NEAR-REAL TIME ANALYSIS OF PERCHLOROETHYLENE IN END-EXHALED BREATH	N.D. Sweet* G.E. Burroughs L.M. Ewers G. Talaska	Thursday 5/23/96 11:00	131/273
COMMUNITY AND WORKER PROTECTION IN ROUNDTABLE: LEAD-BASED PAINT SCIENCE AND POLICY CONVERGING	C.S. Clark	Thursday 5/23/96 1:00-3:00	243 ROUNDTABLE
EFFECTS OF COLLECTION FLUID EVAPORATION AND PARTICLE RE-AEROSOLIZATION ON THE COLLECTION EFFICIENCY OF LIQUID IMPINGERS	X. Lin* J. Donnelly C. Huang* V. Ulevicius S.A. Grinshpun K. Willeke	Friday 5/24/96 8:00	136/311
CHARACTERISTICS OF EXPOSURE TO FUNGAL SPORES IN INDOOR AIR	T. Reponen S. Grinshpun A. Reppnen V. Ulevicius K. Willeke	Friday 5/24/96 8:20	136/312
EVALUATION OF RELATIONSHIPS WITHIN AND BETWEEN WORKER GROUP EXPOSED TO FIBERS	R. Goodman* C. Rice J. Lockey P. Succop G. Lemasters	Friday 5/24/95 9:40	137/324

\*Student (or student at time of research)

\*\*Poster Session

**1997 AMERICAN INDUSTRIAL HYGIENE CONFERENCE PRESENTATIONS FROM  
KETTERING LABORATORY, DEPARTMENT OF ENVIRONMENTAL HEALTH,  
UNIVERSITY OF CINCINNATI  
(In order of presentation)**

**DALLAS, TEXAS  
MAY 17-23, 1997**

<u>Title</u>	<u>Authors</u>	<u>Date/ Time</u>	<u>Session #/ Paper #</u>
<b>USE OF VISUAL CUES IN REDUCING THE RISK OF FALL DURING WORK AT ELEVATED AND/OR INCLINED SURFACES</b>	<b>A. Bagchee A. Bhattacharya P. Succop M. Medvedovic</b>	<b>Monday 5/19/97 10:00-3:00</b>	<b>301/312**</b>
<b>RELIABILITY AND VALIDITY OF AN ON-SITE POSTURE ANALYSIS SYSTEM</b>	<b>C. Forrester R. Stinson Y. Li A. Bhattacharya G. Lemasters</b>	<b>Monday 5/19/97 10:00-3:00</b>	<b>301/313**</b>
<b>FILTER QUALITIES OF FILTERING FACEPIECES: WHAT DO THE NEW FILTER TEST REQUIREMENTS DRIVE?</b>	<b>C. Chen S. Huang* G. Chiu C. Lai* Y. Hunag</b>	<b>Monday 5/19/97 4:20 :</b>	<b>108/61</b>
<b>TIME-WEIGHTED POSTURE INTENSITY EXPOSURE ASSESSMENT OF CARPENTRY TASKS AT CONSTRUCTION SITES</b>	<b>A. Bhattacharya G. Lemasters Y. Li M. Dimov R. Stinson</b>	<b>Monday 5/19/97 3:40</b>	<b>109/69</b>
<b>CARPENTERS' PERCEIVED EXERTION AND BODY DISCOMFORT SYMPTOMS ASSOCIATED WITH THEIR TASKS: AN ON-SITE EVALUATION</b>	<b>M. Dimov H. Applegate R. Stinson A. Bhattacharya Y. Li G. Lemasters L. Greathouse*</b>	<b>Monday 5/19/97 4:00</b>	<b>109/70</b>
<b>PRESENTATION SKILLS &amp; TRANSFER OF LEARNING TECHNIQUES</b>	<b>J. Jarrell</b>	<b>Tuesday 5/20/97 9:15 - 11:45</b>	<b>213 ROUNDTABLE</b>

<u>Title</u>	<u>Authors</u>	<u>Date/ Time</u>	<u>Session #/ Paper #</u>
A SIMPLIFIED APPROACH TO TESTING PERSONAL INHALABLE AEROSOL SAMPLERS	O. Witschger S. Grinshpun K. Willeke V. Aizenberg* P. Baron J. Smith	Tuesday 5/20/97 9:35	113/94
A METHODOLOGY TO IDENTIFY HIGH-RISK EXPOSURES AMONG CONSTRUCTION WORKERS	C. Rice E. Bingham S. Pinney N. Sweet* V. McDougall W. Cameron	Tuesday 5/20/97 10:00-3:00	302/329**
USE OF GEOGRAPHIC INFORMATION SYSTEM FOR DETERMINATION OF EXPOSURE DUE TO ENVIRONMENTAL LEAD	R. Bagchee* C.S. Clark 10:00-3:00	Tuesday 5/20/97 10:00-3:00	302/348**
SILICOSIS IN WORKERS	C. Rice	Tuesday 5/20/97 1:00-4:00	214 ROUNDTABLE
BIOMONITORING IN AGRICULTURE	G. Talaska Monitor	Wednesday 5/21/97 1:00-4:00	230 ROUNDTABLE
WIND TUNNEL VISUALIZATION OF FLOW AROUND A BUTTON PERSONAL AEROSOL SAMPLER	V. Aizenberg* S.A. Grinshpun K. Willeke	Thursday 5/22/97 10:00-2:30	304**
AN EVALUATION OF THE EFFECTS OF ABRASIVE HAND CLEANERS ON THE EPIDERMAL LAYER WITH RESPECT TO DERMAL CARCINOGEN ABSORPTION FROM USED GASOLINE ENGINE OILS	D.D. Burks* G. Talaska M.M. Jaeger H.V. Dowty K. LaDow	Thursday 5/22/97 10:00-2:30	304**
PULMONARY DEPOSITION MODELING IN A STUDY OF WORKERS WHO MANUFACTURE REFRACTORY CERAMIC FIBERS	T.J. Lentz* C.H. Rice P.A. Succop J.E. Lockey G.K. Lemasters J. Dement	Thursday 5/22/97 10:00-2:30	304**

<u>Title</u>	<u>Authors</u>	<u>Date/ Time</u>	<u>Session #/ Paper #</u>
PHYSICAL AND MICROBIOLOGICAL CHARACTERISTICS OF ALL-GLASS IMPINGERS	X. Lin* K. Willeke S.A. Grinshpun	Thursday 5/22/97 10:00-2:30	304**
COLLECTION OF AIRBORNE MICRO-ORGANISMS: INVESTIGATION OF DIFFERENT METHODS	G. Mainelis* K. Willeke S.A. Grinshpun V. Ulevicius	Thursday 5/22/97 10:00-2:30	304**
EVALUATION OF A PORTABLE X-RAY FLUORESCENCE INSTRUMENT FOR USE IN THE ANALYSIS OF AIR SAMPLES FOR LEAD	J.C. Morley* S. Clark J. Deddens K. Ashley	Thursday 5/22/97 10:00-2:30	304**
THE ROLE OF BIODEGRADATION PATHWAYS IN HUMAN EXPOSURE AND ENVIRONMENTAL FATE OF AZO DYES	J. Ortega* R. Hutchinson D. Meyer* M.W. Tabor	Thursday 5/22/97 10:00-2:30	304**
ENVIRONMENTAL FATE OF AZO DYES: ROLE OF ABIOTIC DEGRADATION	X.-X. Zavan* R. Hutchinson H. Shertzer M.W. Tabor	Thursday 5/22/97 10:00-2:30	304**

\*Student (or student at time of research)

\*\*Poster Session

**GRADUATE EDUCATION PROGRAMS**

**IN**

**ENVIRONMENTAL HYGIENE SCIENCE AND ENGINEERING**

**DEPARTMENT OF ENVIRONMENTAL HEALTH  
UNIVERSITY OF CINCINNATI  
P.O. BOX 670056  
CINCINNATI, OH 45267-0056**

**MASTER OF SCIENCE DEGREE PROGRAMS**

**IN**

**ENVIRONMENTAL AND INDUSTRIAL HYGIENE\* (pages 3-11)**

**OCCUPATIONAL SAFETY AND ERGONOMICS (pages 12-16)**

**\*THE M.S. PROGRAM IN ENVIRONMENTAL AND INDUSTRIAL HYGIENE IS ACCREDITED BY THE AMERICAN ACADEMY OF INDUSTRIAL HYGIENE THROUGH THE RELATED ACCREDITATION COMMISSION/ACCREDITATION BOARD FOR ENGINEERING AND TECHNOLOGY, INC.**

**NOTE: THE REQUIRED COURSES FOR THE M.S. DEGREE ARE ALSO PART OF THE BASIC COURSE WORK REQUIREMENTS FOR THE PH.D. DEGREE. GUIDELINES FOR THE PH.D. DEGREE ARE GIVEN IN A SEPARATE DOCUMENT.**

TELEPHONE DIRECTORY  
**ENVIRONMENTAL HYGIENE SCIENCE AND ENGINEERING**

**Programs in**

**Environmental and Industrial Hygiene  
Occupational Safety and Ergonomics**

*Department of Environmental Health  
University of Cincinnati  
P.O. Box 670056  
Cincinnati, Ohio 45267-0056*

**Office:** 110 Kettering Laboratory, Tele: (513) 558-1747

**Program Director:** Scott Clark, Ph.D., P.E., CIH Tele: (513) 558-1749 (E-mail: c.scott.clark@uc.edu)  
**Deputy Program Director:** Carol Rice, Ph.D., CIH, Tele: (513) 558-1751 (E-mail: alerdlr@ucbeh.san.uc.edu)  
**Occupational Safety & Ergonomics**  
**Program Director:** Amit Bhattacharya, Ph.D., Tele: (513) 558-0503 (E-mail: bhattaat@uc.edu)  
**Division Secretary:** Jane Malloy (110 Kettering)\* Tele: (513) 558-1747; FAX: (513) 558-4397  
**Computer Laboratory:**

**Faculty and Staff:**

Ayer, CIH, Howard (107 KL)	558-0500	Tabor, Dr. Wilson (146 KL)	558-0515
Bhattacharya, CPE, Dr. Amit (107 KL)	558-0503	Talaska, CIH, Dr. Glenn (162 KL)	558-0519
Clark, CIH, Dr. Scott (222 KL)	558-1749	(E-mail: glenn.talaska@uc.edu)	
Grinshpun, Dr. Sergey (107 KL)	558-0504	Willeke, CIH, Dr. Klaus (107 KL)	
(E-mail: sergey.grinshpun@uc.edu)		(E-mail: klaus.willeke@uc.edu)	FAX: 558-2263
Jayasimhulu, Dr. Koka (G44C HPB)	558-0517		
Rice, CIH, Dr. Carol (316 Wherry)	558-1751		
FAX:	558-1722		

**\*Room Numbers**

KL - Kettering Lab  
HPB - Health Professions Building

**Research and Service Laboratories:**

Bioaerosol Research Laboratory	558-0315
Respiratory Protection Research Laboratory	558-1212
Biomechanics and Ergonomics	558-0509
Environmental Analytical Chemistry	558-0514
Environmental and Industrial Hygiene	558-1747
Analytical Chemistry & Biological Monitoring	558-0515
Hazardous Waste Worker Training	558-0528

**For admissions information, forms, contact:**

Graduate Studies Office  
Room 328 Kettering Lab

Department of Environmental Health  
Tel: (513) 558-5704

## Faculty Profile

### ENVIRONMENTAL HYGIENE SCIENCE AND ENGINEERING

#### Programs in

### ENVIRONMENTAL AND INDUSTRIAL HYGIENE OCCUPATIONAL SAFETY AND ERGONOMICS

*Department of Environmental Health, University of Cincinnati  
P.O. Box 670056, Cincinnati, Ohio 45267-0056*

Each of the core faculty members has broad-based experience in environmental hygiene practice and is a specialist in one or more areas of environmental and industrial hygiene, air quality or occupational safety research. Each core faculty is qualified to teach at the practitioner advanced scientific levels. The core faculty is assisted at both levels by colleagues in the Department and the University as well as by Volunteer faculty members and lecturers from industry and governmental institutes in the Cincinnati area. A brief description of each of the core faculty's and support staff's areas of specialization is given below:

#### Core Faculty and Support Staff

Professor Emeritus **Howard E. Ayer, CIH, C.S.P.**, has experience in industrial hygiene laboratory and field research, practice and training. His laboratory and field studies have included aerosols (oil mist, silica dust and asbestos), radiation (uranium mine radon studies), noise (airport and industrial) and ventilation.

Professor **Amit Bhattacharya, Ph.D., CPE**, was trained in the field of mechanical engineering with specialization in biomedical engineering and stress physiology. His research efforts are in biomechanics, ergonomics and stress physiology.

Professor **Scott Clark, Ph.D., P.E., CIH**, has a background in environmental health engineering and has been focussing his efforts on exposure pathways and intervention evaluation for environmental lead and on health effects studies and exposure assessments of workers in the waste processing industries. He is also involved in health risk assessment and lead abatement training.

Associate Professor **Sergey Grinshpun, Ph.D.** was trained as a physicist with focus on aerosol physics and mechanics. He is involved in research on aerosol sampling and analysis applied to biological and physical aspects of aerosols. He is also engaged in the laboratory and field studies on the behavior and transport of leaded particulates in indoor environments.

Field Service Associate Professor **Koka Jayasimhulu, Ph.D.** was trained as a chemical engineer, biochemist and analytical chemist, specializes in the identification of metabolites and the quantitation of organic compounds by mass spectrometry and consults with graduate students and faculty on various aspects of mass spectrometry and collaborates in their research efforts.

**Tiina Reponen, Ph.D.**, is engaged in laboratory and field studies in aerobiology involving airborne microbes, fungi and pollen.

Associate Professor **Carol Rice, Ph.D., CIH**, specializes in the assessment of current industrial exposures and the evaluation of working-lifetime exposures. She has a special interest in historical methods of sampling and analysis which are useful in reconstructing past human exposures to evaluate exposure response relationship; Director, Midwest Consortium for Hazardous Waste Worker Training

Associate Professor **M. Wilson Tabor, Ph.D.**, has a background in biological chemistry, toxicology and analytical chemistry. His research efforts include trace analysis of environmental pollutants, biodegradation of hazardous wastes, and biotransformation of xenobiotics to develop methods for markers and indices of human exposure to hazardous substances.

Associate Professor **Glenn Talaska, Ph.D., CIH**, has a background in industrial hygiene, genetic toxicology, and carcinogenesis. His research is related to biological monitoring, chemical carcinogens and includes DNA adduct analysis, cytogenetics and chemical analysis.

**Klaus Willeke, Ph.D., CIH, has a background in engineering and applied physics and has contributed primarily in the field of physical and biological aspects of aerosol science and technology. His research efforts include fundamental work on aerosol sampling and measurement techniques, deposition of aerosols in the human respiratory system, real time measurement of industrial Professor and environmental aerosols, and new methods of respiratory protection techniques in industry and health care environments.**

#### **Part-Time/Adjunct and Volunteer Faculty**

**Paul Baron, Ph.D., National Institute for Occupational Safety and Health (NIOSH), Edward Burroughs, M.S., CIH (NIOSH), Laurence Doemeny, Ph.D. (NIOSH), Richard Fulwiler, Ph.D. (Technology Leadership Associates), James McGlothlin, Ph.D. (NIOSH), Eugene Moss, Ph.D. (NIOSH), Judd Posner, Ph.D. (NIOSH), Rodney Simmons, Ph.D. (Board of Certified Safety Professionals), Thurman Wenzl, Ph.D. (NIOSH)**

#### **UC Department of Environmental Health Faculty Interacting with Program Faculty and Students**

**Roy E. Albert, M.D., Marshall Anderson, Ph.D., Stuart Baxter, Ph.D., Eula Bingham, Ph.D., Robert Bornschein, Ph.D., Ralph Buncher, Sc.D., Kim Dietrich, Ph.D., Kathleen Dixon, Ph.D., Peter Gartside, Ph.D., Judy Jarrell, Ed.D., George Leikauf, Ph.D., Grace Lemasters, Ph.D., Douglas Linz, M.D., James Lockey, M.D., John Loper, Ph.D., Roy McKay, Ph.D., Ann Middaugh, M.D., Marian Miller, Ph.D., Daniel Nebert, M.D., Jon Reid, Ph.D., Howard Shertzer, Ph.D., Rakesh Shukla, Ph.D., Raymond Suskind, M.D., David Warshawsky, Ph.D., Jonathan Wiest, Ph.D.**

#### **Other UC Department Faculty Teaching Required or Recommended Courses**

**Chemical and Nuclear Engineering: David Greenberg, Ph.D., Sotiris Pratsinis, Ph.D.**

**Civil and Environmental Engineering: David Altman, J.D., Pratim Biswas, Ph.D., Timothy Keener, Ph.D., Riley Kinman, Ph.D., James Morand, Ph.D., Janet Rickebaugh, M.S., Pasquale Scarpino, Ph.D. (Joint Appointment in Environmental Health)**

**Mathematics and Applied Science: Mary Fox, M.S.**

**Mechanical, Industrial and Nuclear Engineering: Roy Eckart, Ph.D., Ash Genaidy, Ph.D., Urmila Ghia, Ph.D., Ronald Huston, Ph.D., Anil Mital, Ph.D., Richard Shell, Ph.D., Henry Spitz, Ph.D., James Thorpe, Ph.D.**

**Radiology: James Kereiakas, Ph.D.**

**Otolaryngology: Robert Keith, Ph.D.**

## PROGRAM DESCRIPTIONS AND ADMISSION REQUIREMENTS

### Environmental and Industrial Hygiene

The M.S. program in Environmental and Industrial Hygiene is accredited by the American Academy of Industrial Hygiene through the Accreditation Board for Engineering and Technology, Inc. (ABET). The Environmental and Industrial Program is a component of the University of Cincinnati Educational Resources Center (ERC) supported by the National Institute for Occupational Safety and Health (NIOSH). Financial support for qualifying students is available from the ERC. In addition, students may apply for a Department of Energy Industrial Hygiene Fellowship or special fellowships from the University of Cincinnati for tuition.

This program seeks to prepare individuals with the skills, scientific knowledge and state-of-the art expertise to anticipate, identify, evaluate, and control health hazards and causes of discomfort in the workplace and other environments. Successful candidates will be better prepared to develop solutions to occupational and environmental exposures (e.g., air contamination, noise, radiation, chemical).

### Occupational Safety and Ergonomics

This interdisciplinary program is offered in collaboration with the Department of Environmental Health in the College of Medicine and the Department of Mechanical, Industrial and Nuclear Engineering in the College of Engineering. The curriculum is designed to provide dual emphasis on the health and engineering aspects of ergonomics and safety. This program will prepare the students to meet the current and future ergonomic/safety concerns of the workforce.

### Admissions Requirement

Candidates for master's degrees in Environmental and Industrial Hygiene and in Occupational Safety and Ergonomics must hold a baccalaureate degree based on a minimum of 120 semester hours or the equivalent that shall include 60 or more, and preferably 68 or more, semester-hour credits in undergraduate- or graduate-level courses in science, mathematics, engineering, and technology, with at least 15 of those at the upper (junior, senior, or graduate) level and a minimum of 21 semester-hour credits, or the equivalent in communications, humanities, and social sciences. Applicants to these programs must have taken at least three of the following one year college courses, with above average grades: chemistry, biology, physics and calculus. Doctoral candidates in these programs must have had one-year courses in all of these areas. The Graduate Record Examination is also required as is, for International students, a minimum score of 580 or the TOEFL examination.

**ENVIRONMENTAL AND INDUSTRIAL HYGIENE PROGRAM  
FOR**

**MASTER OF SCIENCE DEGREE\***

(Accredited by American Academy of Industrial Hygiene Through The  
Related Accreditation Commission,  
Accreditation Board for Engineering and Technology, Inc.)  
Required Courses for  
Comprehensive Practice

Quarter	Course	Number	Credits
Autumn Year 1	Environmental Health Seminar	26-904-701	1
	Environmental Hygiene & Safety Technology I	26-904-707	3
	Air Sampling and Analysis I	26-904-741	3
	Introduction to Occupational Health	26-904-781	1
	Introduction to Physiology*	26-904-785	3
	Introduction to Biostatistics	26-904-787	4
	Special Topics in Industrial Hygiene	26-905-981	<u>2</u>
			17
Winter Year 1	Environmental Health Seminar	26-904-702	1
	Air Sampling and Analysis II	26-904-742	3
	Industrial Ventilation	26-904-779	3
	Survey of Environmental Toxicology	26-904-782	3
	Physical Aspects of the Environment	26-904-790	3
	Industrial Hygiene and Safety Practice	26-904-905	<u>3</u>
Spring Year 1	Environmental Health Seminar	26-904-703	1
	Aerosol Measurement	26-904-743	2
	Industrial Hygiene and Safety Laboratory	26-904-775	3
	Introduction to Epidemiology	26-904-776	3
	Principles of Ergonomics	26-904-792	3
	Basic Industrial Safety	26-904-873	2
	Elective		
Summer	Environmental and Industrial Hygiene Internship <sup>b</sup>		
Autumn Year 2	Environmental Health Seminar	26-904-701	1
	Teaching Practicum in Environmental Health <sup>c</sup>	26-904-725	1 (min)
	Occupational Health, Hygiene and Safety Workshop	26-904-819	1
	Hazardous Waste Management	26-904-834	2
	Health Physics	20-252-640	3
	Occupational Safety and Health Team	29-566-815	1
	Masters Thesis Research	26-904-791	Var
	Electives		
Winter Year 2	Environmental Health Seminar	26-904-702	1
	Occupational Health, Hygiene and Safety Workshop	26-904-820	1
	Applied Risk Assessment <sup>d</sup>	26-905-878	2
	Masters Thesis Research	26-904-791	Var
	Ethics in Research	26-950-730	1
	Team Building in Occupational Safety and Health Setting	29-566-816	1
	Electives		

\*NOT OFFERED IN 1997

Quarter	Course	Number	Credits
Spring	Environmental Health Seminar	26-904-703	1
Year 2	Occupational Health, Hygiene and Safety Workshop	26-904-821	1
	Human Biological Monitoring & Biological Markers <sup>d</sup>	26-904-843	3
	Risk Assessment <sup>e</sup>	26-904-987	4
	Masters Thesis Research	26-904-791	Var
	Electives		

- a) Industrial Hygiene and Safety Practice is offered Autumn and Winter quarters. This course is comprised of a total of 10-12 field trips during the Autumn and Winter quarters. MS. students are required to attend all and to submit reports for 5. For attendance of 5 field trips and for two reports, they will receive 2 credits for 26-905-981 (Special Topics in Industrial Hygiene, Autumn). For attendance in 5 more trips and for acceptance of 3 additional reports they will receive 3 credits for 26-904-905 (Industrial Hygiene and Safety Practice, Winter). There is thus a total of 5 credits for 5 reports and for participation in all the scheduled field trips.
- b) The student is expected to take all courses listed above (59 credits for basic programs, 66 for Hazardous Substances option). Any required course may be waived with the permission of the instructor and advisor when the student has already had the equivalent course content. Another course with equivalent credit hours must then be selected. Upon joining the M.S. program, the student is assigned an academic advisor. As the student's research interests develop, a different advisor can be chosen, and a Thesis Committee is appointed.
- c) Student may elect to initiate thesis research during this quarter.
- d) May be taken any quarter Year 2.
- e) Required only for Hazardous Substances Academic Training option in Environmental and Industrial Hygiene.
- f) Only one of these courses is required.

**ELECTIVE ADDITIONAL COURSES SUGGESTED FOR STUDENT CHOOSING AN AREA OF CONCENTRATION**

**AIRBORNE PARTICLES AND MICROORGANISMS**

<u>Quarter</u>	<u>Course</u>	<u>Number</u>	<u>Credits</u>
Autumn	Advanced Topics in Environmental Microbiology	20-257-649	3
Autumn	Aerosol Science and Engineering	20-257-719	3
Winter	Biological and Microbiological Principles of Environmental Systems	20-257-646	4
Winter	Environmental Biology and Microbiology Laboratory	20-257-650	1
Winter	Particulate Processes	20-257-675	3
Winter	Laminar Viscous Fluid Flow	20-263-828	3
Spring	Design of Particulate Control Systems	20-257-672	3

**BIOLOGICAL MONITORING**

Spring	Biological Effects of Air Pollutants	26-904-771	2
Spring	Human Biological Monitoring & Biological Markers	26-904-843	3
Spring	Kinetics for the Health Sciences	26-904-878	3
Spring	Genetic Epidemiology	26-904-971	3

**ENGINEERING CONTROL**

Autumn	Process Synthesis	20-254-670	3
Winter	Diffusion & Mass Transfer in Environmental Systems	20-257-673	3
Spring	Design of Particulate Control Systems	20-257-672	3
Spring	Design of Gaseous Pollution Control Systems	20-257-674	3

**ENVIRONMENTAL CHEMISTRY**

Autumn	Chemical Principles of Environmental Systems	20-257-647	4
Autumn	Instrumental Methods of Analysis of Pollutants I	26-904-901	3
Winter	Instrumental Methods of Analysis of Pollutants II	26-904-902	3
Winter	Introduction to Air Pollution and Its Control	20-257-661	2
Spring	Instrumental Methods of Analysis of Pollutants III	26-904-903	3
Spring	Advanced Topics in Environmental Water Chemistry	20-257-652	3
Summer	Quality Control and Quality Assurance in Environmental Toxicology & Chemistry	26-904-749	3

**MANAGEMENT/POLICY/RISK ASSESSMENT**

Autumn	Organizational Behavior	22-415-323	3
Winter	Public Policy and Environmental Health	26-904-750	2
Winter	Energy & Environment	26-904-772	1
Spring	Basic Principles of Environmental Law	20-257-657	3
Spring	Management of Professionals	20-265-640	3
Spring	Environmental Quality Management	26-904-835	2
Spring	Risk Assessment	26-904-987	4-5
Winter	Applied Risk Assessment	26-905-878	2

**HAZARDOUS WASTES AND MATERIALS**

Winter	Instrumental Methods of Analysis II	26-904-902	3
Winter	Meteorological Dispersion Modeling	20-257-668	3
Winter	Environmental Issues in Geotechnical Engineering	20-257-632	3
Winter	Effective Methods of Worker Health and Safety Training	26-904-846	2
Spring	Hazardous Waste Disposal	20-257-721	3
Spring	Basic Principles of Environmental Law	20-257-657	3
Summer	Quality Control and Quality Assurance in Environmental Toxicology & Chemistry	26-904-749	3
Winter	Applied Risk Assessment	26-905-878	2

<u>Quarter</u>	<u>Course</u>	<u>Number</u>	<u>Credits</u>
<b><u>OCCUPATIONAL ERGONOMICS/BIOMECHANICS</u></b>			
Autumn	Biomechanical & Physiological Aspects of Muscular Activities	26-904-744	3
Autumn	Stress Reduction	18-223-601	3
Autumn	Industrial Work Physiology	20-267-750	3
Winter	Ergonomics in Design	20-267-751	3
Winter	Anthropometry & Occupational Biomechanics*	20-267-752	3
Spring	Human Factors in Product Design	20-267-651	3
Spring	Interface Design	20-267-655	3
Any Quarter	Ergonomic Internship (Special Topics)	26-905-881	1-3
<b><u>OCCUPATIONAL SAFETY</u></b>			
Autumn	Occupational Safety Engineering	20-267-520	3
Autumn	System Safety I*	20-265-621	3
Winter	System Safety II*	20-265-622	3
Winter	Product Liability	20-267-779	3
<b><u>WATER QUALITY</u></b>			
Autumn	Chemical Principles of Environmental Systems	20-257-647	4
Spring	Environmental Quality Management	26-904-835	2
Spring	Advanced Topics in Environmental Water Chemistry	20-257-652	3
Summer	Quality Control and Quality Assurance in Environmental Toxicology & Chemistry	26-904-749	3

**\*EVENING CLASSES**

**NOTE:** Each Area of Concentration reflects the active research interest of at least one faculty member teaching in this Program.

Please consult the University of Cincinnati "Courses of Instruction Bulletin" for a more extensive listing of available courses. Other relevant courses may be taken instead of the ones listed above. Please see your advisor to work out a program suitable for your interests.

Graduate Education Programs in Environmental Hygiene Science and Engineering

Department of Environmental Health, University of Cincinnati  
P.O. Box 67-0056, Cincinnati, OH 45267-0056

**ENVIRONMENTAL AND INDUSTRIAL HYGIENE PROGRAM  
FOR  
MASTER OF SCIENCE DEGREE**

(Accredited by Related Accreditation Commission,  
Accreditation Board for Engineering and Technology, Inc.)

**ADDITIONAL ELECTIVE COURSES**

**NOTE:** In addition to the elective courses listed under Areas of Concentration on the previous pages, the following courses may be of interest.

<u>Quarter</u>	<u>Course</u>	<u>Number</u>	<u>Credits</u>
Autumn	Introduction to Environmental Health	26-904-745	3
	Physical Principles of Environmental Systems	20-257-653	4
	Aerosol Science and Engineering	20-254-671	3
	Introduction to Biomechanics	20-263-685	3
	Physiology of Exercise	18-223-610	3
	Methods to Obtain Complete Occupational Histories	26-904-845	2
Winter	Use of a Computer in Medical Science	26-904-778	2
	Regression Analysis	26-904-788	4
	Biological and Microbiological Principles of Environmental Systems	20-257-646	4
	Air Resources Management	20-257-664	3
	Tissue Biomechanics	20-263-686	3
Spring Year 1	Experimental Design	26-904-789	4
	Physical/Chemical Processes for Water Quality Control	20-257-654	3
	Biological Processes for Water Quality Control	20-257-655	3
	Human Body Dynamics	20-263-687	3
	Design and Management of Field Studies in Epidemiology	26-904-975	4
	Special Topics - Industrial Processes (p)	26-905-984	2
	Survey of Public Health	26-904-746	3

(p) permission of instructor

\* may be taken any quarter.

Graduate Education Programs in Environmental Hygiene Science and Engineering

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P.O. Box 670056, Cincinnati, OH 45267-0056

**ENVIRONMENTAL AND INDUSTRIAL HYGIENE PROGRAM  
FOR**

**MASTER OF SCIENCE DEGREE**

(Accredited by Related Accreditation Commission,  
Accreditation Board for Engineering and Technology, Inc.)

**ADDITIONAL NOTES**

- o "Industrial Hygiene and Safety Practice" is offered Autumn and Winter quarters. This course is comprised of a total of 10 field trips during the Autumn and Winter quarter. M.S. students are required to attend all and to submit reports for 5. For attendance of 5 field trips, they will receive 2 credits for 26-905-981 (Special Topics in Industrial Hygiene, Autumn), for attendance in 5 more trips and for acceptance of 5 reports they will receive 3 credits for 26-904-905 (Industrial Hygiene and Safety Practice, Winter).
- o Teaching Practicum. There is a requirement of a minimum of one credit of teaching practicum for M.S. students in the second year of study. The teaching practicum requirement applies to all full and part-time graduate students irrespective of source of funding. Conduct of one laboratory experiment in the Air Sampling and Analysis sequence carries one graduate credit, to experiments carry two graduate credits, for example. In conducting experiments, the student is responsible for all attendant duties such as setup, laboratory teaching, cleanup, report reviewing and grading. Practicum assignments in other courses are also available. Each single credit hour is approximately equal to thirty hours of experience.
- o An acceptable Master's thesis demonstrating critical judgment is required. Upon acceptance of a "Statement of Intent", the thesis is performed under the guidance of an appointed committee. While working on the thesis, the student may sign up for thesis credits, up to 15 credit hours per quarter.
- o Students with financial support are required to maintain satisfactory progress towards a degree. This generally requires at least 15 credit hours each quarter. The standard tuition fee allows up to 19 credit hours per quarter.
- o Graduate students wishing to pursue a Ph.D. degree in the Environmental and Industrial Hygiene Program may, with permission and upon acceptance into the program, proceed without a M.S. degree.
- o All requirements must be completed no later than 7 years from entry into the degree program.
- o Also consult "Guidelines for the Degree of Master of Science", "Policy for External Thesis Work", and other information provided by the Graduate Studies Office of the Department of Environmental Health.
- o For further information, please contact:

Graduate Studies Office  
Telephone: (513) 558-5704

or

Environmental Hygiene Science & Engineering Office  
Telephone: (513) 558-1747

Department of Environmental Health, University of Cincinnati Medical Center  
Mail Location 056, Cincinnati, OH 45267-0056

THESE GUIDELINES ARE EFFECTIVE AS OF SEPTEMBER 1998. CONTACT THE GRADUATE STUDIES OFFICE OF THE DEPARTMENT TO INSURE THAT THESE ARE THE MOST UP-TO-DATE GUIDELINES.

***FACULTY PROFILES***

As this program is a collaborative program between the Department of Environmental Health and the Department of Mechanical, Industrial & Nuclear Engineering, several core faculty members from both the departments are involved in the teaching and/or advising of students. The names of these faculty members are listed below:

1. Amit Bhattacharya, Ph.D., CPE (Certified Professional Ergonomist)  
Coordinator of the program for the students in the Department of Environmental Health  
**Primary Research Areas:** Ergonomics, Biomechanics, Traumatic Injuries, Effect of Environmental Chemicals on Postural Balance
2. Ash Genaidy, Ph.D., CPE (Certified Professional Ergonomist)  
Coordinator of the program for the students in the Department of Mechanical, Industrial & Nuclear Engineering  
**Primary Research Areas:** Ergonomics, Occupational Biomechanics
3. Richard Shell, Ph.D., PE  
Director, Safety Engineering Program and Industrial Engineering, Department of Mechanical, Industrial & Nuclear Engineering
4. Thomas Waters, Ph.D.  
Volunteer Assistant Professor  
NIOSH, Cincinnati  
**Primary Research Areas:** Ergonomics, Occupational Biomechanics
5. Vern Putz-Anderson, Ph.D.  
Volunteer Associate Professor  
NIOSH, Cincinnati  
**Primary Research Area:** Ergonomics
6. Ronald Huston, Ph.D.  
Professor  
Department of Mechanics  
**Primary Research Area:** Biomechanics

## OCCUPATIONAL SAFETY & ERGONOMICS PROGRAM (NEW PROGRAM SINCE 1994)

### *DESCRIPTION OF PROGRAM*

At the University of Cincinnati, the graduate (M.S. and Ph.D.) study of ergonomics and safety is accomplished as a special emphasis area within the Department of Environmental Health (DEH) and the Mechanical, Industrial and Nuclear Engineering Department (MINED). This curriculum will be given as a special program under the existing National Institute for Occupational Safety and Health sponsored Education Resource Center activities located within the DEH and the MINED. Since the fields of ergonomics and safety are interdisciplinary in nature, students with various training and education need to be trained to address both engineering and health aspects. Thus, the Occupational Safety and Ergonomic Program (OSEP) at the University of Cincinnati has been designed to accommodate both students with engineering degrees and those majoring in medical sciences, biology, chemistry, physics, psychology and management. In general, a student with an undergraduate engineering degree will apply for admission into the OSEP through the MINED while others with majors in medical sciences, biology, chemistry, physics, psychology and management will apply through the DEH. There are several courses (Principles of Ergonomics in the DEH and Safety Engineering in the MINED) offered by these two departments which are taken by students in this program from both departments. The OSEP in the MINED will have more of an engineering emphasis while that in the DEH will have more of a health emphasis. Students will have the freedom (and will be encouraged) to take as many elective courses as possible from both departments in order to ensure broad-based training in both the engineering and the health aspects of ergonomics and safety.

### *JUSTIFICATION, SIGNIFICANCE & UNIQUENESS OF THE PROGRAM*

Ergonomic deficiencies are becoming a major concern for workers in many areas (industry, health care etc) and are responsible for most occupational musculoskeletal injuries and illnesses. In recent years, ergonomics has been the center of attention for the Occupational Safety and Health Administration (OSHA) where Ergonomic Standards are expected to be promulgated soon (1995).

Given the importance of ergonomics to industry and OSHA, there are few well-trained ergonomic professionals around the U.S. Thus, there is a need to develop a graduate program geared toward training individuals in the field of ergonomics.

This program is unique in the State of Ohio as it provides a training environment in the field of Occupational Safety and Ergonomics which utilizes existing expertise (faculty), courses and facilities within the Colleges of Medicine and Engineering. As this program dovetails with an existing Educational Resource Center (housed in the Department of Environmental Health) sponsored by the National Institute for Occupational Safety and Health, the availability of future student support is very promising. In addition it requires no additional faculty or laboratory facilities. It is the only program of its kind in Ohio and ranks in the top 10 in the country in strength of faculty and other resources. Employment opportunity for graduates is excellent. Since most employers want a person trained in both Industrial Hygiene and Ergonomics our graduates will be particularly well suited. For example, a 1993 graduate of our MS in Industrial Hygiene program with a minor in Ergonomics has been hired a major multinational petroleum company to set up their office ergonomics program.

Graduate Education Programs in Environmental Hygiene Science and Engineering

Department of Environmental Health  
University of Cincinnati, Cincinnati, OH 45267-0056

**OCCUPATIONAL SAFETY AND ERGONOMICS PROGRAM FOR MASTER OF SCIENCE DEGREE**

Required Courses

Quarter		Number	Credits
Autumn Year 1	System Safety I	20-263-621	3
	Environmental Health Seminar	26-904-701	1
	Air Sampling and Analysis I	26-904-741	3
	Introduction to Biostatistics	26-904-787	4
	Intro to Physiology	26-904-785	3
	Env. Hygiene & Safety Tech.	26-904-707	<u>3</u>
			17
Winter	Environmental Health Seminar	26-904-702	1
	System Safety II	20-263-777	3
	Safety Engineering & Product Liability	20-265-779	3
	Industrial Ventilation	26-904-779	3
	Physical Aspects of Env.	26-904-790	<u>3</u>
	Industrial Hygiene & Safety Practice	26-904-905	13
Spring	Environmental Health Seminar	26-904-703	1
	Special Topics in Industrial Hygiene	20-263-721	3
	Principles of Ergonomics♦	26-904-792	3
	Intro to Measurement Techniques in Ergonomics♦	26-904-748	3
	Intro to Epidemiology	26-904-776	<u>3</u>
			13
Summer	Ergonomic Internship*		
Autumn Year 2	Health Physics and Radiation Protection	20-252-640	3
	Environmental Health Seminar	26-904-701	1
	Occup. Health, Hygiene and Safety Workshop	26-904-819	1
	Organizational Behavior	22-415-771	3
	Hazardous Waste Management	26-904-834	2
	Biomechanical and Physiological Aspects of Muscular activities♦	26-904-744	3
	Masters Thesis Research	26-904-791	3
	Occupational Safety and Health Team	29-566-815	1
	Electives		<u>+ Var</u>
			17

- a) This program includes several courses from the Department of Mechanical, Industrial and Nuclear Engineering.
- b) The student is expected to take all courses listed above (47 credits) and additional electives totalling at least 3 credits
- c) During the summer between Year 1 and 2, the graduate student is expected to work as an occupational safety ergonomic intern or to work on his/her Master's thesis under the guidance of the Thesis Committee.
- d) During the second year, the student is required to take a minimum of one credit of "Teaching Practicum in Environmental Health", 26-904-725/726/727, (see description on next page).
- e) Can be arranged during any quarter or in the summer of 1st year.
- ♦ If Scheduling conflict occurs or with permission of advisor and program director, these courses can be substituted with comparable courses in ergonomics from the college of engineering. (See elective list).

## OCCUPATIONAL SAFETY AND ERGONOMICS PROGRAM FOR MASTER OF SCIENCE DEGREE

Quarter	Course	Number	Credits
Winter Year 2	Teaching Practicum	26-904-726	1-3
	Masters Thesis Research	26-904-791	Variable
	Occup. Health, Hygiene and Safety Workshop	26-904-820	1
	Ethics in Research	26-950-730	1
	Team Building in Occupational Safety and Health Setting	29-566-816	1
Spring Year 2	Masters Thesis Research	26-904-791	Variable
	Occup. Health, Hygiene and Safety Workshop	26-904-821	1

### ADDITIONAL NOTES

- For "Industrial Hygiene and Safety Practice" students must attend all field trips and write reports on three and should attend the orientation sessions for this class in the Fall Quarter. Students are strongly encouraged to attend the orientation session for this class during Fall Quarter.
- Teaching Practicum. There is a requirement of a minimum of one credit of teaching practicum for M.S. students in the second year of study. The teaching practicum requirement applies to all full and part-time graduate students irrespective of source of funding. Conduct of one laboratory experiment in the Air Sampling and Analysis sequence carries one graduate credit, two experiments carry two graduate credits, for example. In conducting experiments, the student is responsible for all attendant duties such as setup, laboratory teaching, cleanup, report reviewing and grading. Practicum assignments in other courses are also available. Each single credit hour is approximately equal to thirty hours of experience.
- An acceptable Master's thesis demonstrating critical judgment is required. Upon acceptance of a "Statement of Intent", the thesis is performed under the guidance of an appointed committee. While working on the thesis, the student may sign up for thesis credit, up to 15 credit hours per quarter.
- Students with financial support are required to maintain satisfactory progress towards a degree. This generally requires at least 15 credit hours each quarter. The standard tuition fee allows up to 19 credit hours per quarter.
- All requirements must be completed no later than 7 years from entry into the degree program.
- Graduate students wishing to pursue a Ph.D. degree in the Environmental and Industrial Hygiene Program may, with permission and upon acceptance into the program, proceed without a M.S. degree.
- Also consult "Guidelines for the Degree of Master of Science", "Policy for External Thesis Work", and other information provided by the Graduate Studies Office of the Department of Environmental Health.

Graduate Education Programs in Environmental Hygiene Science and Engineering

Department of Environmental Health

University of Cincinnati, Cincinnati, OH 45267-0056

**OCCUPATIONAL SAFETY AND ERGONOMICS PROGRAM FOR  
MASTER OF SCIENCE DEGREE**

Electives

Quarter	Course	Number	Credits
Autumn	Introduction to Biomechanics	20-263-685	3
	Work Measurement and Wage Incentives	20-267-720	3
	Ergonomic Internship	26-905-881	1-3
Winter	Energy and the Environment	26-904-772	2
	Industrial Work Physiology	20-263-750	3
	Introduction to Air Pollution	20-257-661	3
	Regression Analysis	26-904-788	3
	Interface Design	20-267-655	3
	Ergonomics in Design	20-267-751	3
	Anthropometry and Occupational Biomechanics	20-267-752	3
	Environmental Toxicology	26-904-782	3
	Fire Protection Engineering	20-265-777	3
	Ergonomic Internship	26-905-881	1-3
Spring	Aerosol Measurement	26-904-743	2
	Experimental Design	26-904-789	3
	Nonparametric Statistics	26-904-795	3
	Basic Principles of Environmental Law	20-257-657	3
	Hazardous Waste Disposal	20-257-721	3
	Engineering Safety II	20-263-778	3
	Environmental Quality Management	26-904-835	2
	Epidemiology of Cancer	26-904-898	3
	Experimental Design	26-904-789	3
	Human Body Dynamics	20-263-687	3
	Management of Professions	20-265-640	3
	Risk Assessment	26-904-987	4-5
	Safety Engineering and Management	20-265-778	3
Ergonomic Internship	26-905-881	1-3	

Please consult the University of Cincinnati "Courses of Instruction Bulletin" for a more extensive listing of courses.

## ATTACHMENT C

### OCCUPATIONAL SAFETY AND HEALTH SEMINARS IN THE DEPARTMENT OF ENVIRONMENTAL HEALTH SEMINAR SERIES

<u>Date</u>	<u>Presenter</u>	<u>Topic</u>
November 27, 1991	Richard Hornung, Ph.D.	A Statistical Model for Prediction of Retrospective Exposures in an Occupational Mortality Study
December 4, 1991	Marion Moses, M.D.	Health Status & Occupational Exposures Among Ohio/Florida Migrant Farm Workers
March 4, 1992	Nicholas Ashford, Ph.D.	Monitoring the Worker for Exposure and Disease: Scientific, Legal and Ethical Considerations in the Use of Biomarkers
April 22, 1992	Jane Lipscomb, R.N. Ph.D.	Pregnancy Outcome in Women Potentially Exposed to Occupational Solvents: Findings From a Community-Based Study and Implications for Clinical Practice
April 29, 1992	John Heussner, Ph.D., CIH	Responding to Catastrophic Industrial Accidents
May 13, 1992	Paul Lloyd	A Review of the Legislation and Working Practices for the Protection of Workers From Back Injury in the UK
November 25, 1992	Wm. Pendorf, Ph.D, CIH	To Be Announced
December 2, 1992	David Hoel, Ph.D.	Cancer Trends

**OCCUPATIONAL SAFETY AND HEALTH SEMINARS IN THE DEPARTMENT  
OF ENVIRONMENTAL HEALTH SEMINAR SERIES**

**1993-94**

<b><u>Date</u></b>	<b><u>Presenter</u></b>	<b><u>Topic</u></b>
September 29, 1993	Robert M. Clark, Ph.D.	Modeling Contaminant Propagation in Drinking Water Distribution Systems
October 27, 1993	Klaus Willeke, Ph.D.	Performance of Bioaerosol Samplers
January 12, 1994	Thomas Waters, Ph.D.	Manual Materials Handling
February 9, 1994	Ann Middaugh, M.D.	Building-related Illnesses-Medical Aspects
February 16, 1994	Patricia Stewart	Retrospective Exposure Assessment for Epidemiological Studies
February 23, 1994	F. Gerberick, Ph.D.	Examination of the Local Lymph Node Assay for Use in Contact Hypersensitivity Risk Assessment
March 2, 1994	James Perkins, Ph.D.	The Efficacy of Chemical Protective Clothing
March 30, 1994	Paul Barron, Ph.D.	Fiber Measurement & Classification
April 6, 1994	Ellen K. Silbergeld, Ph.D.	Lead & Reproduction or Are Men the Forgotten Sex?
April 27, 1994	James Lockey, M.D.	A Retrospective Cohort Morbidity, Mortality & Nested Case-Control Study of the Respiratory Health of Individuals Manufacturing Refractory Ceramic Fiber & RCF Products
May 18, 1994	Marvin Dainoff, Ph.D.	Ergonomics of Work With Video Display Terminals
June 1, 1994	S.K. Kashyap, M.D., Ph.D.	Occupational Cancer in India/Urinary Bladder Cancer: A Case Study

<u>Date</u>	<u>Presenter</u>	<u>Topic</u>
September 21, 1994	Raymond R. Suskind, M.D.	Environmental Health in the Kettering Laboratory: An historical Perspective
September 28, 1994	Dennis O'Brien, Ph.D.	Application of Real-Time Monitoring to Identification of Exposure Sources
October 12, 1994	Sergey Grinshpun, Ph.D.	Personal Sampling of Airborne Particles & Microorganisms in Occupational Environments
October 19, 1994	Robert McKnight, MPH, ScD	Occupational Health & Safety Research on Farms: The Kentucky Experience
November 2, 1994	Marcie Francis, Ph.D.,	An Example of the Use of a Reproductive Occupational Epidemiology Study in regulatory Decision Making

#### Winter Quarter 1995

January 11, 1995	Douglas Dockery, Sc.D.	Epidemiologic Evidence for Health Effects of Particulate Air Pollutants
February 1, 1995	Kim Dietrich, Ph.D.	Standard of Care in Cases of Pediatric Lead Poisoning: Scientific Foundations
February 8, 1995	James D. Crapo, M.D.	Antioxidants in the Lung
February 15, 1995	Carl E. Cerniglia, Ph.D.	Bioconversion & Biodegradation of Xenobiotic Chemicals
February 22, 1995	Muin J. Khoury, M.D., Ph.D.	Epidemiologic Approaches to Gene-Environment Interactions
March 1, 1995	R. Hayes Bell, Ph.D.	Occupational Safety and Health Practice in a Global Environment
March 8, 1995	Jay R. Wilkins, Ph.D.	Ohio Farm Family Health Study

### Fall Quarter 1995

<u>Date</u>	<u>Presenter</u>	<u>Topic</u>
September 20, 1995	Raymond R. Suskind, M.D.	Environmental Health in the Kettering Laboratory: An Historical Perspective
September 27, 1995	Bruce Freeman, Ph.D.	Nitric Oxide Regulation of Tissue Oxygen Radical Reactions: The Good, the Bad & the Ugly
October 4, 1995	Dana Mirkin, M.D.	Health and Safety Aspects of Acrylonitrile
October 11, 1995	Henry Weiner, Ph.D.	Liver Mitochondrial Aldehyde Dehydrogenase: Studies on Catalysis, Import & Processing
October 18, 1995	Warner Kalow, M.D.	Ecogenetics of Parkinson's Disease
November 1, 1995	Emil A. Pfitzer, Sc.D.	Perspectives on Testing for Carcinogenicity
November 29, 1995	Kenneth Ramos, Ph.D.	Molecular Basis of Carcinogen-Induced Atherosclerosis

### Winter Quarter 1996

January 3, 1996	Rita Loch, Ph.D.	Uterine Muscle as a Target of Environmental Toxicants
January 10, 1996	Randy R. Wickett, Ph.D.	Noninvasive Evaluation of the Epidermal Permeability Barrier
January 17, 1996	Mary H. Ward, Ph.D.	Drinking Water, Dietary Nitrates and the Risk of non-Hodgkin's Lymphoma
January 24, 1996	Tom Kawabata, Ph.D.	The Role of Benzo(a)pyrene Metabolism in its Immunotoxicity
January 31, 1996	James H. Liu, M.D.	Epidemiology of Involutional Osteoporosis - Impact of Intervention Therapies
February 14, 1996	Michael DeVito, Ph.D.	Agent Orange in Vietnam: Past,

<u>Date</u>	<u>Presenter</u>	<u>Present and Future Studies Topic</u>
February 21, 1996	Stephanie Shore, Ph.D.	Effects of Cytokines on Human Airway Smooth Muscle
February 28, 1996	Eula Bingham, Ph.D.	Work Histories - Evaluating New Participatory Methods A Team Effort

Spring Quarter 1996

<u>Date</u>	<u>Presenter</u>	<u>Topic</u>
April 3, 1996	Rosalind A. Schoof, Ph.D.	Studies on the Bioavailabaility of Metals in Soil
April 17, 1996	Donald R. Lynam, Ph.D.	Dietary Calcium Modifies the Response of Bone to Physical Activity
May 1, 1996	Linda S. Birnboim, Ph.D.	Toxic Equivalency of Dioxin and Related Compounds
May 8, 1996	Al Bourquin, Ph.D.	Bioremediation of TCE-contaminated Ground Water Through Bioaugmentation: Field Demonstration
May 15, 1996	Sidney Wolfe, M.D.	Health Advocacy
May 29, 1996	Donald A. Fox, Ph.D.	Lead-Induced Apoptosis in the Developing Retina

OCCUPATIONAL SAFETY AND HEALTH SEMINARS IN THE DEPARTMENT  
OF ENVIRONMENTAL HEALTH SEMINAR SERIES

1996-97

Fall Quarter 1996

<u>Date</u>	<u>Presenter</u>	<u>Topic</u>
September 25	Raymond R. Suskind, M.D.	Environmental Health and the Kettering Laboratory: An Historical Perspective
October 2, 1996	Aaron Blair, Ph.D.	Pesticide Exposure and Cancer
October 9, 1996	David F. Utterback, Ph.D.	Retrospective Benzene Exposure Characterization for Epidemiologic Analysis
October 23, 1996	Richard Costlow, Ph.D.	Toxicology: A Strategic Factor for Decision Makers
November 6, 1996	Martha A. Waters, Ph.D.	Evaluation of Cosmic Radiation Exposure and Cabin Air Quality for Flight Attendants

Winter Quarter 1997

January 8, 1997	Harriet Burge, Ph.D.	Airborne Fungi and Public Health
January 15, 1997	Michael L. Dourson, Ph.D.	The Use of Mechanistic Data in Flow Modelling to Support a Biologically-based Inhalation Cancer Risk Assessment for Formaldehyde
February 12, 1997	William Morgan, Ph.D.	DNA Damage - Induced Genomic Instability
February 26, 1997	Samuel H. Wilson, M.D.	Perspective on New Approaches in Environmental Health Research
March 12, 1997	John McLachlan, Ph.D.	Estrogens and Estrogenic Chemicals May Act Differently During Development

Spring Quarter 1997

<u>Date</u>	<u>Presenter</u>	<u>Topic</u>
April 9, 1997	Heide S. Cross, Ph.D.	Vitamin D and Calcium in Human Colorectal Carcinogenesis: From Epidemiology to Molecular Biology
April 23, 1997	Jonathan Wiest, Ph.D.	Genetic Alterations, Inheritance, and Early Detection of Lung Cancer
May 7, 1997	Clem Furlong	Human Paraoxonase Polymorphism: Role In Insecticide and Lipid Metabolism
May 14, 1997	Arthur C. Upton, M.D.	Environmental Health: Progress and Prospects
May 21, 1997	Dorothy Canter, Ph.D.	Evolving Health Effects Issues in Incineration Risk Assessment
June 4, 1997	John Dement, Ph.D.	A Case Control Study of Asthma Among Construction Workers

Fall Quarter 1997

October 1, 1997	Michelle Schaper, Ph.D.	Occupational Exposure to Metal - Working Fluids
October 8, 1997	Kevin Driscoll, Ph.D.	Particle-Induced Inflammation-Mechanisms And Consequences
October 29, 1997	Cheng Hong, Ph.D.	Aural Fusion Frequency Test and Its Application Value
November 12, 1997	Steven Kleeberger, Ph.D.	Genetic Modelling of Susceptibility to Inhaled Pollutants
December 3, 1997	Frank M. Renshaw, Ph.D.	Role of Industrial Hygiene in Industrial Accident Prevention

## ATTACHMENT D

**COMPOSITION OF CURRENT RESEARCH COMMITTEE  
FOR M.S. AND PH.D. STUDENTS  
1992**

<u>Student/Degree</u>	<u>Advisor</u>	<u>Other Committee Members</u>
T. Buchta/M.S.	C. Rice, CIH	P. Gartside (Biostat), J. Lockey (Occup Med)
C.C. Chen/Ph.D.	K. Willeke, CIH	H. Ayer (Ind Hyg), R. McKay (Occup Med), D. O'Brien (Eng-Ind Hyg-NIOSH)
R. Emerich/M.S.	A. Bhattacharya	P. Succop (Biostat), H. Ayer (Ind Hyg)
S. Giolando/Ph.D.	W. Tabor	P. Scarpino (Eng-Micro-biology), J. Glaser (EPA), & R. Vestal (Biol Sci)
C. Hughes/M.S.	C. Rice, CIH	P. Gartside (Biostat), J. Lockey (Occup Med)
P. Jensen/Ph.D.	S. Clark, CIH	C. Rice (Ind Hyg), P. Succop (Biostat), J. Posner (Chem-NIOSH)
U. Krishnan/Ph.D.	K. Willeke, CIH	R. Shukla (Biostat), G. Talaska (Ind Hyg), D. O'Brien (Eng-Ind Hyg-NIOSH)
M. Lee/M.S.	W. Tabor	H. Kagen (Ind Hyg)
K. Machol/M.S.	C. Rice, CIH	J. Lockey (Occup Med), P. Gartside (Biostat)
T. Rittgers/M.S.	C. Rice, CIH	H. Ayer (Ind Hyg), P. Gartside (Biostat)
G. Smith/M.S.	G. Talaska, CIH	H. Kagen (Ind Hyg), C. Rice (Ind Hyg), K. Wallingford (Ind Hyg-NIOSH), J. Zey (Ind Hyg- NIOSH)
M. Thompson/M.S.	K. Willeke, CIH	P. Scarpino (Eng-Microbiology)
M. Xu/Ph.D.	K. Willeke, CIH	A. Bhattacharya (Ind Hyg), S. Pratsinis (Clin Eng), P. Biswas (Env Eng)
S. Rucker/M.S.	S. Clark, CIH	A. Sussell (NIOSH)-pending, W. Pan (Biostatistics)-pending

**COMPOSITION OF CURRENT RESEARCH COMMITTEE FOR M.S. AND PH.D. STUDENTS**

<u>Student/Degree</u>	<u>Advisor</u>	<u>Other Committee Members</u>
A. Bagchee/Ph.D.	A. Bhattacharya	R. Bornschein (Epi), R. Huston (Mech. Eng) P. Succop (Biostat)
B. Camacho/M.S.	S. Clark	W. Pan (Environ Epi), S. Rucker (pending)
C.W. Chang, Ph.D.	K. Willeke	P. Baron (NIOSH), S. Clark (Ind Hyg), J. Donnelly (Ind Hyg), S. Grinshpun (Ind Hyg), P. Succop (Biostat)
S. Chiou/Ph.D.	A. Bhattacharya (pending)	P. Succop (Biostat), G. Talaska (Ind Hyg), T. Waters (NIOSH)
R. Echavarria/M.S.	C. Rice	E. Bingham (Environ Policy), G. Talaska (Ind Hyg), F. Toca (External Ind Hyg)
R. Emerich/M.S.	A. Bhattacharya	H. Ayer (Ind Hyg), P. Succop (Biostat)
G. Enescu/M.S.	C. Rice	G. Moss (NIOSH)
A. Fisher/M.S.	S. Grinshpun	K. Willeke (Ind Hyg)
R. Goodman/M.S.	S. Clark	Not yet established
P. Jensen/Ph.D.	S. Clark, CIH	C. Rice (Ind Hyg), P. Succop (Biostat), J. Posner (Chem-NIOSH)
S. Kalatoor, Ph.D.	K. Willeke	A. Bhattacharya (Ind Hyg), G. Talaska (Ind Hyg), P. Baron (NIOSH), S. Grinshpun (Ind Hyg)
T.J. Lentz/Ph.D.	C. Rice	Not yet established
K. Machol/M.S.	C. Rice, CIH	J. Lockey (Occup Med), P. Gartside (Biostat)
R. Mazon/Ph.D.	S. Clark	Not yet established
S. Neilson/M.S.	S. Clark	Not yet established
Y. Qian, M.S.	K. Willeke	A. Bhattacharya (Ind Hyg), S. Grinshpun (Ind Hyg)
T. Rittgers/M.S.	C. Rice, CIH	H. Ayer (Ind Hyg), P. Gartside (Biostat)

ATTACHMENT C (CONTINUED)

G. Smith/M.S.	G. Talaska, CIH	H. Kagen (Ind Hyg), C. Rice (Ind Hyg), K. Wallingford (Ind Hyg-NIOSH), J. Zey (Ind Hyg-NIOSH)
S. Stewart/M.S.	S. Grinshpun	K. Willeke (Ind Hyg)
J. Tobler/M.S.	W. Tabor	Not yet established
P. Tsai/M.S.	G. Talaska	Not yet established
J. Warren/M.S.	A. Bhattacharya	G. Lemasters (Occup Epi)

**COMPOSITION OF CURRENT RESEARCH COMMITTEE FOR M.S. AND PH.D. STUDENTS**  
**September 1994**

<u>Student/Degree</u>	<u>Advisor</u>	<u>Other Committee Members</u>
A. Bagchee/Ph.D.	A. Bhattacharya.	R. Bornschein (Epi), R. Huston (Mech. Eng) P. Succop (Biostat)
K. Bostic/M.S.	S. Clark, CIH	Not Yet Established
E. Burroughs/Ph.D.	W. Tabor	J. Reid (Env Policy), J. Posner (NIOSH & W. Pan (Biostat)
B. Camacho/M.S.	S. Clark, CIH	W. Pan (Biostat & Epi), S. Rucker (Ind Hlth & Safety)
S. Chiou/Ph.D.	A. Bhattacharya	P. Succop (Biostat), G. Talaska (Ind Hyg), T. Waters (NIOSH)
R. Echavarria/M.S.	W. Tabor	J. Reid (Env Policy) & W. Pan (Biostat & Epi)
J. Eberhard/Ph.D.	W. Tabor	E. Bingham (Env Policy), P. Bishop (Env Hlth Eng), B. Ault (Chemistry) & J. Reid (Env Policy)
R. Emerich/M.S.	A. Bhattacharya H. Ayer (Ind Hyg)	P . S u c c o p ( B i o s t a t ) ,
R. Goodman/M.S.	S. Clark, CIH	Not yet established
G. Hall/M.S.	C. Rice, CIH	J. Lockey (Occup Med) & P. Gartside (Biostat)
T.J. Lentz/Ph.D.	C. Rice, CIH	Currently completing Qualifying Examination
K. Machol/M.S.	C. Rice, CIH	J. Lockey (Occup Med), P. Gartside (Biostat)
R. Mazon/Ph.D.	S. Clark, CIH	J. Reid (Env Policy), H. Goddard (Economics) & J. Arantes (Eng) - Pending
S. Neilson/M.S.	S. Clark, CIH	M. Waters (NIOSH) & C. Rice (Ind Hyg)
Y. Qian/M.S.	K. Willeke, CIH	A. Bhattacharya (Ind Hyg), S. Grinshpun (Ind Hyg)
T. Rittgers/M.S.	C. Rice, CIH	H. Ayer (Ind Hyg), P. Gartside (Biostat)
G. Smith/M.S.	G. Talaska, CIH	H. Kagen (Ind Hyg), C. Rice (Ind Hyg), K. Wallingford (Ind Hyg-NIOSH), J. Zey (Ind Hyg-NIOSH)
P.J. Tsai/M.S.	G. Talaska, CIH	S. Clark (Ind Hyg) & W. Pan (Biostat & Epi)

**COMPOSITION OF CURRENT RESEARCH COMMITTEE FOR M.S. AND PH.D. STUDENTS**  
November 1995

<u>Student/Degree</u>	<u>Advisor</u>	<u>Other Committee Members</u>
C. Blasio/M.S.	S. Clark, CIH	R. Bornschein (Epi) & H. Spitz (Nuc Eng)
K. Carwardine/M.S.	G. Talaska, CIH	
M.J. Chen/M.S.	S. Clark, CIH	P. Succop (Biostat) & B. Memrath (Env Hyg)
S. Chiou/Ph.D.	A. Bhattacharya	P. Succop (Biostat), G. Talaska (Ind Hyg), T. Waters (NIOSH)
R. Drexelius/M.S.	G. Talaska, CIH	P. Succop (Biostat) Waters, Clark (Ind Hyg)
R. Goodman/M.S.	C. Rice CIH	J. Lockey (Occ Med) & P. Succop (Biostat)
B. Hauck/M.S.	K. Willeke, CIH	
C. Huang/Ph.D.	S. Clark, CIH	K. Willeke (Ind Hyg) & G. Talaska (Ind Hyg) (Academic Committee)
M. Jenkins/Ph.D.	S. Clark, CIH	A. Bhattacharya (Ind Hyg), R. Bornschein (Epi), Henry Spitz (Nuc Eng)
T.J. Lentz/Ph.D.	C. Rice, CIH	J. Dement (Duke Univ), P. Succop (Biostat), J. Lockey (Occup Med)
C. Lai/Ph.D.	A. Bhattacharya	P. Succop (Biosat), Waters, S. Clark (Ind Hyg)
L. Luo/Ph.D.	S. Clark, CIH	Not yet established
K. Machol/M.S.	C. Rice, CIH	J. Lockey (Occup Med), P. Gartside (Biostat)
G. Mainelis/Ph.D.	K. Willeke, CIH	
R. Mazon/Ph.D.	S. Clark, CIH	J. Reid (Tox)
R. McCartney/M.S.	G. Talaska, CIH	C. Rice (Ind Hyg) & D. Warshawsky (Tox)
E. Puhala/M.S.	G. Talaska, CIH	G. Lemasters (Occup Med) & Col J. Joyce (USAF-Wright Patterson)
Y. Qian/Ph.D.	K. Willeke	A. Bhattacharya (Ind Hyg), S. Grinshpun (Ind Hyg), J. Donnelly (Ind Hyg), P. Barron (NIOSH)

**T. Rittgers/M.S.**

**C. Rice, CIH**

**H. Ayer (Ind Hyg), P. Gartside (Biostat)**

**L. Smith/M.S.**

**A. Bhattacharya**

**G. Lemasters (Occup Med), Col. J. Joyce (USAF-Wright  
Patterson)**

**N. Sweet/M.S.**

**G. Talaska, CIH**

**X. Xu/Ph.D.**

**S. Clark, CIH**

COMPOSITION OF CURRENT RESEARCH COMMITTEE FOR M.S. AND PH.D. STUDENTS  
June 1996

<u>Student/Degree</u>	<u>Advisor</u>	<u>Other Committee Members</u>
V. Aizenberg/Ph.D.	S. Clark, CIH	Not yet established
R. Bagchee/M.S.	S. Clark, CIH	J. Reid (Tox) & P. Succop (Biostat)
C. Blasio/M.S..	S. Clark, CIH	R. Bornschein (Epi) & H. Spitz (Nuc Eng)
T. Bloom*/Ph.D.	C. Rice, CIH	Not yet established
T. Bliss*/M.S.	S. Clark, CIH	Not yet established
D. Burks/M.S.	S. Clark, CIH	Not yet established
E. Burroughs*/Ph.D.	W. Tabor	J. Reid (Tox), J. Posner (NIOSH), G. Moore (EPA) & W. Pan (Biostat)
K. Carwardine/M.S.	G. Talaska, CIH	S. Clark (IH)
M.J. Chen/M.S.	S. Clark, CIH	P. Succop (Biostat) & B. Menrath (Env Hyg)
R. Drexelius/M.S.	G. Talaska, CIH	P. Succop (Biostat), T. Waters (NIOSH), Clark (Ind Hyg)
R. Goodman*/M.S.	C. Rice, CIH	J. Lockey (Occ Med) & P. Succop (Biostat)
E. Gorsuch/M.S.	S. Clark, CIH	Not yet established
B. Hauck/M.S.	S. Grinshpun	K. Willeke (IH) & R. Bornschein (Epi)
C. Huang/Ph.D.	S. Clark, CIH	K. Willeke (Ind Hyg) & G. Talaska (Ind Hyg) (Academic Advisory Committee)
M. Jenkins/Ph.D.	S. Clark, CIH	A. Bhattacharya (Ind Hyg), R. Bornschein (Epi), Henry Spitz (Nuc Eng)
L. Kincl/M.S.	S. Clark, CIH	Not yet established
W. King*/M.S.	S. Clark, CIH	Not yet established
C. Lai/Ph.D.	A. Bhattacharya, CPE	P. Succop (Biosat), T. Waters (NIOSH), S. Clark (Ind Hyg)
T.J. Lentz/Ph.D.	C. Rice, CIH	J. Dement (Duke Univ), P. Succop (Biostat), J. Lockey (Occup Med)
X.J. Lin/Ph.D.	K. Willeke, CIH	Passed Qualifying Examination

<u>Student/Degree</u>	<u>Advisor</u>	<u>Other Committee Members</u>
G-H Liu*/M.S.	S. Clark, CIH	Not yet established
L. Luo/Ph.D.	A. Bhattacharya, CPE	Not yet established
M-L. Luo/M.S.	S. Clark, CIH	Not yet established
K. Machol*/M.S.	C. Rice, CIH	J. Lockey (Occup Med), P. Gartside (Biostat)
G. Mainelis/Ph.D.	K. Willeke, CIH	Not yet established
R. McCartney/M.S.	G. Talaska, CIH	C. Rice (Ind Hyg) & D. Warshawsky (Tox)
D. Meyers/M.S.	S. Clark, CIH	Not yet established
C. Morley/M.S.	S. Clark, CIH	Not yet established
C. Newman/M.S.	S. Clark, CIH	Not yet established
M. Paraniuk*/M.S.	S. Clark, CIH	Not yet established
E. Puhala/M.S.	G. Talaska, CIH	G. Lemasters (Occup Med) & Col J. Joyce (USAF-Wright Patterson)
Y. Qian/Ph.D.	K. Willeke, CIH	A. Bhattacharya (Ind Hyg), S. Grinshpun (Ind Hyg), J. Donnelly (Ind Hyg), P. Barron (NIOSH)
T. Rittgers*/M.S.	C. Rice, CIH	H. Ayer (Ind Hyg), P. Gartside (Biostat)
L. Smith/M.S.	A. Bhattacharya, CPE	G. Lemasters (Occup Med), Col. J. Joyce (USAF-Wright Patterson)
L. Stambaugh*/M.S.	S. Clark, CIH	Not yet established
G. Strassell*/M.S.	A. Bhattacharya, CPE	Not yet established
N. Sweet/M.S.	G. Talaska, CIH	K. Jayasimhulu (IH), E. Burroughs (NIOSH) & L. Ewers (NIOSH)
D. Woody*/M.S.	S. Clark, CIH	Not yet established
X. Xu/Ph.D.	S. Clark, CIH	Not yet established

\*Part-Time

COMPOSITION OF CURRENT RESEARCH COMMITTEE FOR M.S. AND PH.D. STUDENTS  
September 1997

<u>Student/Degree</u>	<u>Advisor</u>	<u>Other Committee Members</u>
V. Aizenberg/Ph.D.	S. Grinshpun	S. Clark (Ind Hyg) & K. Willeke (Ind Hyg)
E. Auyang/M.S.	C. Rice, CIH	Not yet established
R. Bagchee*/M.S.	S. Clark, CIH	J. Reid (Tox) & P. Succop (Biostat)
T. Bloom*/Ph.D.	C. Rice, CIH	Not yet established
T. Bliss /M.S.	S. Clark, CIH	Not yet established
L. Borland/M.S.	S. Clark, CIH	Not yet established
D. Burks*/M.S.	G. Talaska, CIH	C. Rice (Ind Hyg) & R. Shukla (Biostat)
E. Burroughs*/Ph.D.	W. Tabor	J. Reid (Tox), J. Posner (NIOSH), G. Moore (EPA) & W. Pan (Biostat)
K. Bussa/M.S.	S. Clark, CIH	Not yet established
J. Cardarelli II/Ph.D.	S. Clark, CIH	Not yet established
M.J. Chen/Ph.D.	S. Clark, CIH	P. Succop (Biostat) & B. Menrath (Env Hyg)
K.T. Choe/M.S.	S. Grinshpun	Not yet established
C. Collins/M.S.	S. Clark, CIH	Not yet established
L. Delaney/M.S.	C. Rice, CIH	Not yet established
R. Echavarria*/M.S.	C. Rice, CIH	S. Clark (Ind Hyg) & P. Succop (Biostat)
F. Grimsley/Ph.D.	S. Clark, CIH	Not yet established
J. Harney/M.S.	S. Clark, CIH	Not yet established
L. Kincl/Ph.D.	A. Bhattacharya, CPE	Not yet established
W. King*/M.S.	S. Clark, CIH	Not yet established
C. Lai/Ph.D.	A. Bhattacharya, CPE	P. Succop (Biosat), T. Waters (NIOSH) & S. Clark (Ind Hyg)
R. Liang/M.S.	S. Clark, CIH	Not yet established
X. Lin/Ph.D.	K. Willeke, CIH	Passed Qualifying Examination

<u>Student/Degree</u>	<u>Advisor</u>	<u>Other Committee Members</u>
G-H Liu/M.S.	C. Rice, CIH	P. Succop (Biostat) & S. Clark (Ind Hyg)
M.L. Lu/Ph.D.	A. Bhattacharya, CPE	Not yet established
L. Luo/Ph.D.	A. Bhattacharya, CPE	S. Clark (Ind Hyg), P. Succop (Biostat), A. Bagchee (Ind Hyg) & T. Waters (NIOSH)
K. Machol*/M.S.	C. Rice, CIH	J. Lockey (Occup Med) & P. Gartside (Biostat)
G. Mainelis/Ph.D.	K. Willeke, CIH	S. Grinshpun (Ind Hyg), A. Bhattacharya (Ind Hyg) & P. Baron (NIOSH)
J. Mangharam/M.S.	A. Bhattacharya, CPE	A. Bagchee (Ind Hyg) & P. Succop (Biostat)
D. Meyer*/M.S.	W. Tabor	Not yet established
M. Paraniuk*/M.S.	S. Clark, CIH	Not yet established
Y. Qian*/Ph.D.	K. Willeke, CIH	A. Bhattacharya (Ind Hyg), S. Grinshpun (Ind Hyg) & P. Barron (NIOSH)
T. Rittgers*/M.S.	C. Rice, CIH	H. Ayer (Ind Hyg) & P. Gartside (Biostat)
T. Solomon/Ph.D.	S. Clark, CIH	Not yet established
L. Stambaugh*/M.S.	S. Clark, CIH	Not yet established
G. Strassell*/M.S.	W. Tabor	Not yet established
Z. Wang/Ph.D.	K. Willeke, CIH	Not yet established
D. Woody*/M.S.	S. Clark, CIH	K. Ashley (NIOSH) & P. Succop (Biostat)
S. Wurzelbacher/Ph.D.	S. Clark, CIH	Not yet established
X. Zavon*/M.S.	W. Tabor	H. Shertzer (Tox) & E. White (NIOSH)

\*Part-Time

## ATTACHMENT E

**Course Title:** Effective Methods for Worker Health and Safety Training

**Credits:** 2 gr

**Instructor:** Dr. Carol Rice, Director of the Midwest Consortium for Hazardous Waste Worker Training, an eight-state consortium of labor-affiliated and university training programs will be the primary instructor. The group has developed adult learning training materials since 1987, with funding from the National Institute of Environmental Health Sciences (NIEHS).

**Purpose:** Students will learn the principles of health and safety training for adult learners and demonstrate their understanding through design and/or implementation of a 2-hour training program.

**Topics:**

1. How adults learn (2 hours)
2. What knowledge, skills and abilities must be learned (6 hours)
3. Elements of an interactive training program (4 hours)
4. Evaluation methods (4 hours)
5. Project presentations (4 hours)

**Off-campus learning opportunities:** Two local worker training centers, both funded by NIEHS, are available for project development and pilot testing. Students may also observe state-of-the-art worker training at one or both location.

### **Textbooks:**

Szudy E and Arroyo MD (1994). The Right to Understand: Linking Literacy to Health and Safety Training. Berkeley, CA: Labor Occupational Health Program.

USDOL-OSHA (1992). Training Requirements in OSHA Standards and Training Guidelines, OSHA 2254 (revised), Washington DC: U.S. Government Printing Office.

Wallerstein N and Rubenstein HL (1993). Teaching about Job Hazards. Washington DC: American Public Health Association.

### **References on Reserve:**

#### Theses/Dissertations

Caparaz A (1989). Development and Evaluation of a Health and Safety Program for Foundry Workers, a thesis submitted to the University of Cincinnati, Cincinnati, OH.

Webster S (1991). Application of Real-time and Video Monitoring in a Work Practice Training Program to Reduce Solvent Exposure, a thesis submitted to the University of Cincinnati, Cincinnati, OH.

Mansfield NJ (1993). Application of Instructional Design Theory to Lesson Planning for Superfund Incident Commander Training, a dissertation submitted to Vanderbilt University, Nashville, TN.

### Journal Articles

Kolp P, Sattler B, Blayney M and Sherwood T (1993). Comprehensibility of Material Safety Data Sheets, *Am J Indust Med*, 23:135-141.

Randolph L (1993). Issues in Notification: Reflections of a Public Health Worker, *Am J Indust Med*, 23:53-59.

Zimmerman DE (1993). Reading, Readability and Legibility Research: Implications for Notification Letters, *Am J Indust Med*, 23:61-69.

Berger PK, Gunto SJ, Rice C and Haley JV (1996). Estimating the Impact of Health and Safety Training Using the Retrospective Pretest Design, *App Occup Env Hyg J*, (in press).

Weaver CL, Berger PK, Gunto SJ, Rice C and Dwyer R (1996). Perceptions of Site Worker Training and Job Issues by Women, Minorities and White males: Survey Results and Recommendations to Improve Training, *New Solutions*, (in press).

### OSHA Regulations (29 CFR 1910)

146, 147, 119, 120, 1200.

### Midwest Consortium for Hazardous Waste Worker Training Reports

Source: Department of Environmental Health  
PO Box 670056  
Cincinnati, OH 45267-0056

The Process of Instrument Development: Knowledge Tests and Simulations Exercises

The Item Writer's Manual

Readability Analysis Summary of the Municipal First-on-the Scene Manual

40-Hour Program Follow-up Impact Evaluation

A Cohort Analysis of Trainee Perceptions of Risk-related Issues

Decontamination Card Sort Exercise

## ATTACHMENT E

**Course Title:** Methods to Obtain Complete Occupational Histories

**Credits:** 2 gr

26-904-845 (permission)

**Instructors:** Drs. Carol Rice and Glenn Talaska are Associate Professors in the industrial hygiene program; Dr. Douglas Linz is an Associate Professor in occupational medicine; Dr. Susan Pinney is an Assistant Professor and epidemiologist, and head of the medical surveillance unit at the Center for Occupational Health. The group has worked informally to assist students in understanding methods of eliciting occupational histories for various purposes, and will interact in the course presentation and practical experience in the clinical setting and with reference materials.

**Purpose:** Students will learn state-of-the-art approaches to eliciting complete occupational histories, use the primary sources of descriptions of industrial processes, interview workers who come to the Center for Occupational Health and provide written evaluations of potential exposures related to the reported employment history.

**Topics:**

1. The occupational history elements (4 hours)
  - company name, address
  - dates
  - job title, activities
  - materials used
  - modifiers of exposure (e.g., ventilation, personal protective equipment)
  
  - differentiate between medical diagnosis/care, medical surveillance, epidemiologic research
2. Memory jogging (4 hours)
  - co-workers
  - plant descriptions
  - other similar processes
3. Resources (4 hours)
  - printed
  - electronic
  - trade associations/organizations
4. Practicum (6 hours)
  - complete three occupational history interviews
  - prepare reports on each

**Textbooks:** None required. Extensive resources available in the Departmental libraries.

**References on Reserve:**

**Journal Articles**

**Gerin M, Siemiatycki J. The Occupational Questionnaire in Retrospective Epidemiologic Studies: Recent Approaches in Community Based Studies, Appl Occup Env Hyg J, 6:495-501, 1991.**

**Dosemeci M, Cocco P, Gomez M, Stewart PA, Heineman EF, Effects of Three Features of a Job-Exposure Matrix on Risk Estimates, Am J Epidemiol, 1994.**

**Bond GG, Bodner KM, Sobel W, Shellenberger RJ, Flores GH, Validation of Work Histories Obtained from Interviewers, Am J Epidemiol, 128:343-351, 1988.**

**Stewart WF, Stewart PA, Occupational Case-control Studies: 1. Collecting Information on Work Histories and Work-related Exposures, Am J Ind Med, 26:297-312, 1994.**

**Whitten II WB , Leonard JM, Directed Search Through Autobiographical Memory, Memory & Cognition, 9:566-579, 1981.**

**Rice C, Heineman EF, A Method to Evaluate Work History Information: Application to a Case-control Study of Mesothelioma, submitted for publication.**

ATTACHMENT F

LIST OF PUBLICATIONS  
ENVIRONMENTAL AND INDUSTRIAL HYGIENE  
1992 - 1997

(\*denotes authorship by an Industrial Hygiene student)

(†denotes authorship by an Occupational Ergonomics/Safety Student  
or Safety Engineering Student)

(bold indicates Environmental & Industrial Hygiene Faculty)

\*Aizenberg, V., Bidinger, E., **Grinshpun, S.A., Willeke, K.,** Hamed, A. and Tabakoff, W., "Air flow and particle velocities near a personal aerosol sampler with curved, porous aerosol sampling surface", *Aerosol Science and Technology* (submitted, 1997).

Albers, T.A., Li, Y., Lemasters, G., Sprague, S., Stinson, R. and **Bhattacharya, A.**, "An ergonomic education and evaluation program for apprentice carpenters", *Amer. Jour. of Industrial Medicine*, 32:641-646, 1997.

Albert, R., Miller, M.; **Talaska, G.,** Underwood, P., Cody, T. and Andringa, S., "Epidermal cytokinetics, DNA adducts and dermal inflammation in the mouse in response to exposure to repeated benzo(a)pyrene exposures", *Toxicol. Appl. Pharmacol.*, 136:67-74, 1995.

Ayer, H.A., \*Wahl, G. and **Willeke, K.**, "Branch entry losses in industrial ventilation systems: New methods of analysis and presentation", *Proceedings of the Third International Symposium on Ventilation for Contamination Control* (R.T. Hughes, H.D. Goodfellow and G.S. Rajhans, editors), pp. 329-332, American Conference of Governmental Industrial Hygienists, Cincinnati, OH, 1993.

Ayer, H.E., "The origins of health standards for quartz exposure", Letter to the Editor, *Am. J. Public Health*, 85:1453-1454, October 1995.

Ayer, H.E., "The origin of the U. S. respirable mass standard for silica", *Appl. Occup. Environ. Hyg.*, 10:1027-1030, 1995.

Ayer, H.E., "Real time monitoring of coolant mist emissions", In: The Industrial Metalworking Environment -- Assessment and Control: Proceedings of the Symposium in Dearborn, Michigan, November 13-16, 1995, by the American Automobile Manufacturers Association, Washington, D.C., AAMA, pp. 29-0293, 1996.

**Bagchee, A., Bhattacharya, A.,** Succop, P.A. and Houston, R.L., "Functional locomotion and obstacle negotiation in children with chronic lead exposure" (in preparation, 1997).

**Bagchee, A., Bhattacharya, A.,** Succop, P. and \*Emerich, R. "Postural stability assessment during task performance", *Occupational Ergonomics* (in press, 1997).

Baron, P.A. and **Willeke, K.**, "Aerosol Fundamentals" in *Aerosol Measurement: Principles, Techniques and Applications* (K. Willeke and P.A. Baron, editors), pp. 8-22, Van Nostrand Reinhold, New York, NY, 1993.

- Baron, P.A. and Willeke, K., "Gas and Particle Motion" in *Aerosol Measurement: Principles, Techniques and Applications* (K. Willeke and P.A. Baron, editors), pp. 23-40, Van Nostrand Reinhold, New York, NY, 1993.
- Berger, P.K., Gunto, S.J., Haley, J.V., and Rice, C., "Estimating the impact of health and safety training using the retrospective pretest design", *Appl. Occup. Env. Hyg.*, 11(10):1198-1203, 1996.
- Betemps, E.J., Buncher, C.R. and Clark, C.S., "Proportional mortality analysis of wastewater treatment system workers by birthplace with comments on amyotrophic lateral sclerosis", *JOM*, 36(1):31-35, 1994.
- Bhattacharya, A., Shukla, R., Dietrich, K.N., Miller, J., \*Bagchee, A., Bornschein, R.L., Cox, C. and Mitchell, T., "Functional implications of postural disequilibrium due to lead exposure", *Neurotoxicology*, 14(2-3): 179-190, 1993.
- Bhattacharya, A., "Quantitative posturography as an early monitoring tool for chemical toxicity" In: *Biological Monitoring Interpretation: A Practical Approach* (S. Que Hee, editor) Publ. Van Nostrand Reinhold, 1993.
- Bhattacharya, A., Shukla, R., Dietrich, K. and Bornschein, "Effect of early childhood lead exposure on six year old children's postural balance", *Developmental Medicine and Child Neurology* 37:861-878, 1995.
- Bhattacharya, A., Succop, P., \*Chiou, S., \*Lai, C., Bagchee, A., et al., "Effect of task environmental factors on workers' postural balance", (submitted for review, 1997).
- Bhattacharya, A., Smelser, D. T and Berger, O., "Effect of succimer therapy on postural balance of a nine year old child: A case study", (in press, 1996)
- Bhattacharya, A. and McGlothlin, J., (eds) "Occupational ergonomics: Theory and applications" a book to be published by Marcel and Dekker Inc., pp 800, 1996.
- Bhattacharya, A., Greathouse, Warren J.L., Lemasters, G., Dimov, M, Applegate, H. and Stinson, R., "An ergonomic walkthrough observation of carpentry tasks: A pilot study", *Applied Occupational and Environmental Hygiene Journal*, 12(4):278-287, 1997.
- Blair, A., Stewart, W.F., Stewart, P.A., Sandler, D.P., Axelson, O., Vineis, P., Checkoway, H., Savitz, D., Pearce, N. and Rice, C., "A Philosophy for dealing with hypothesized uncontrolled confounding in epidemiologic investigation", *Medicini Lavoro*. (submitted).
- \*Brueck, S., Lehtimäki, M., \*Krishnan, U. and Willeke, K., "Method development for measuring respirator exhalation valve leakage", *Applied Occupational and Environmental Hygiene*, 7:174-179, 1992.
- \*Buchta, T.M., Rice, C.H., Lockey, J.E., Lemasters, G.K., and Gartside, P.S., "A comparative study of the NIOSH 7400 "A" and "B" counting rules using Refractory Ceramic fibers", *App. Occup. Environ. Hyg.* (in press, 1997).

Buttner, M.P., Willeke, K. and Grinshpun, S.A., "Sampling and analysis of airborne microorganisms", IN: *Manual of Environmental Microbiology* (Eds. C.J. Hurst, G. Knudsen, M. McInerney, L.D. Stetzenbach and M. Walter), ASM Press, Washington, DC, U.S.A., 629-640, 1996.

Caruso, J.L., Winget, G.D., McGinnis, J. and Jayasimhulu, K., "Shoots of rosemary and sage cultured In Vitro as possible sources of Carnosic Acid", A reported inhibitor of the human immunodeficiency virus protease", *Am. Soc. of Plant Physiologists*, 290-291, 1995.

Caruso, J.L., Callahan, J., DeChant, C., Jayasimhulu, K. and Winget, G.D., "Rosemary cultured *in vitro* as a source of carnosic acid", (submitted, 1997).

Caruso, J.L., Winget, G.D., McGinnis, J. and Jayasimhulu, K., "Shoots of rosemary and sage cultured *in vitro* as possible sources of Carnosic Acid, A reported inhibitor of the human immunodeficiency virus protease", *Am. Soc. Of Plant Physiologists*, 290-291, 1995.

\*Chang, C.W., \*Hwang, Y.H., Grinshpun, S.A., Macher, J.M. and Willeke, K., "Evaluation of counting error due to colony masking in bioaerosol sampling", *Applied and Environmental Microbiology*, 60(10):3732-3738, 1994.

\*Chang, C.W., Grinshpun, S.A., Willeke, K., Macher, J.M., Donnelly, J., Clark, S. and Juozaitis, A., "Factors affecting microbiological colony count accuracy for bioaerosol sampling and analysis", *Am. Ind. Hyg. Assoc. J.*, 56(10): 979-986, 1995.

Checkoway, H. and Rice, C.H., "Time-weighted averages, peaks, and other indices of exposure in occupational epidemiology", *Am. J. Ind. Med.* 21:25-33, 1992.

\*Chen, C.C. and Willeke, K., "Characteristics of face seal leakage in filtering facepieces", *American Industrial Hygiene Association Journal*, 53(9):533-539, 1992.

\*Chen, C.C. and Willeke, K., "Aerosol penetration through surgical masks", *American Journal of Infection Control*, 20:177-184, 1992.

\*Chen, C.C., Lehtimäki, M. and Willeke, K., "Aerosol penetration through filtering facepieces and respirator cartridges", *American Industrial Hygiene Association Journal*, 53(9):566-574, 1992.

\*Chen, C.C., Lehtimäki, M. and Willeke, K., "Loading and filtration characteristics of filtering facepieces", *American Industrial Hygiene Association Journal*, 54(2):51-60, 1993.

Cheu, J., Talaska, G., Miller, M., Rice, C. and Warshawsky, D., "Benzo[a]pyrene coated ferric oxide and aluminum oxide particles: Uptake metabolism and DNA binding in hamster pulmonary alveolar macrophages and tracheal cells *in vitro*", *Carcinogenesis*, 18:167-175, 1997.

Cheu, J., Talaska, G., Miller, M., Rice, C. and Warshawsky, D., "Benzo[a]pyrene coated ferric oxide and aluminum oxide particles: uptake, metabolism and DNA binding in hamster pulmonary alveolar macrophages and tracheal epithelial cells *in vitro*", *Carcinogenesis*, 167-175, 1997.

**Clark, C.S., Bornschein, R.L., Pan, W., Roda, S., Menrath, W. and Grote, J.,** "Urban soil lead abatement demonstration project", Volume IV: Cincinnati Report, U.S. Environmental Protection Agency, Office of Health and Environmental Assessment, Washington, D.C., EPA/600/AP-93/001D, July 1993.

**Clark, S., Bornschein, R.L., Pan, W., Menrath, W. and Roda, S., Habes, D.J.,** "An examination of the relationship between the HUD floor lead loading clearance level for lead-based paint abatement", *Appl. Occup. Environ. Hyg.*, 10(2):107-110, 1995.

**Clark, S., Bornschein, R.L., Pan, W., Menrath, W. and Roda, S.,** "An examination of the relationships between the HUD floor lead loading clearance level for lead-based paint abatement, surface dust lead by a vacuum collection method and pediatric blood level", *Appl. Occup. Environ. Hyg.*, 10(2):107-110, 1995.

**Clark, S. and Scarpino, P.,** "Disinfection of microbial aerosols" In: *Modeling Disease Transmission and Its Prevention by Disinfection*, Chapter 7, (C. Hurst, editor) Cambridge University Press, 1996.

**Clark, S., Bornschein, R.L., Pan, W., Menrath, W., Roda, S. and Grote JoAnn,** "The relationship between surface dust lead loadings on carpets and the blood lead of young children", *Environ. Geochemistry and Health*, 18:143-146, 1996.

**Culp, S.J., Roberts, D.W., Talaska, G., Lang, N.P., Fu, P.P., Lay, J.O., Teitel, C.H., Snawder, J.E., Von Tungeln, L.S. and Kadlubar, F.F.,** "Immunochemical <sup>32</sup>P-postlabelling and GC/MS detection of 4-aminobiphenyl-DNA adducts in human peripheral lung in relation to metabolic activation pathways involving pulmonary N-oxidation and peroxidation", *Muta. Res.*, 378:97-112, 1997.

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APPENDIX A  
**TITLES OF MASTER'S THESES RELATED TO INDUSTRIAL HYGIENE**  
(Past Five Years)

Student Name	Year	Advisor	Title of Thesis
Mei Juan Chen	1997	Clark	The Evaluation of the Relationship Between Blood Lead and Environmental Lead in the Hud Lead Hazard Control Grant Program
Emily L. Gorsuch	1997	Grinshpun	Method for Evaluating GUV Inactivation of Biocontaminated Surfaces
Cuiling Huang	1997	Grinshpun	Method for Measuring the Spatial Variability of Aerosol Penetration through Respirator Filters
J. Clinton Morley	1997	Clark	Evaluation of a Portable X-Ray Fluorescence Instrument for the Determination of Lead in Workplace Air Samples
Christine S. Newman	1997	Talaska	Development of a Highly-Sensitive Transportable Method for On-Site Analysis of Benzene in Exhaled Air
Leslie B. Smith	1996	Bhattacharya	Effects of Chronic Low Level Exposure to Jet Fuel on Postural Balance of U.S. Air force Personnel
Christopher J. Blasio	1996	Clark	Dissolution of Radium-226 from Soil Contaminated with Naturally Occurring Radioactive materials Subjected to Accelerated Aging
Krista D. Carwardine	1996	Talaska	Evaluation of Abrasive Hane Cleansers on Dermal Carcinogen Absorption from Used Gasoline Engine Oils
Robert J. Drexelius	1996	Talaska	Application on the formation of DNA Adducts in the Skin and Lung Tissue of Mice Dermally Exposed to Used Gasoline Engine Oil
Regina A. McCartney	1996	Talaska	Detection of DNA-Adducts by <sup>32</sup> P-Postlabeling Methods in the Exfoliated Urothelial Cells of Mchanics Exposed to Used Engine Oil
Nathanial D. Sweet	1996	Talaska	A Field Method for near Real-Time Analysis of Perchloroethylene in End-Exhaled Breath
Robert J. Goodman	1996	Rice	An Evaluation of Within and Between Worker Exposure to Refractory Ceramic Fibers
Brian C. Hauck	1996	Grinshpun	Field Testing of New Multidirectional Sampling Inlet For Airborne Particulates: Simultaneous Measurement of Total Dust, Fungal Spores and Lead
Edward S. Puhala II	1996	Talaska	An Evaluation of Time and Gender Differences Related to Jet Fuel Exposures in the U.S. Air Force

**TITLES OF MASTER'S THESES RELATED TO INDUSTRIAL HYGIENE  
(Past Five Years)**

Kimberly D. Bostic	1995	Bhattacharya	Determination of Physiological Workload in Carpenters Performing Various Carpentry Tasks
Ronald T. Emerich	1995	Bhattacharya	The Effect of Task and Slope on Postural Stability and the Perceived Sense of Loss of Balance
Debora F. Hurst	1995	Que Hee	Occupational Photosensitivity in Grocery Store Workers
Gretchen S. Hall	1995	Rice	A Comparison of Exposures to Refractory Ceramic Fibers Over Multiple Shifts
Yinge Qian	1995	Willeke	Dynamic Size Spectrometry of Airborne Microorganisms: Laboratory Evaluation and Calibration
Brenda L. Camacho	1994	Clark	Evaluation of confounding Factors and Their Effects on Air Lead Sampling Results During Residential Lead-Abatement
James M. Warren	1994	Bhattacharya	Ergonomic Assessments of Carpenters
Shelby L. Stewart	1994	Grinshpun	Effect of Impaction Stress on Microbial Recovery when Sampling onto Agar
Jill M. Tobler	1994	Talaska	Determination of the Most Appropriate Sampling Time for DNA-Carcinogen Adducts in Mice Due to Exposure to Used Gasoline Motor Oil Regarding Both Single and Chronic Dosing Regimens
Pei-Jung Tsai	1994	Talaska	The Effect of Single and Multiple Dermal Applications of Used Gasoline Engine Oil (UGEO) on DNA Adduct Formation in the Skin and Lungs of Mice
Shiow-Yi-Chiou	1994	Bhattacharya	Effect of Workers' Shoe Wear on Objective & Subjective Assessment of Slipperiness
Gabriela Enescu	1994	Rice	Exposure Assessment of Health Care Workers in a Hospital to Extremely Low Frequency Electric and magnetic Fields
Amy Jo Fisher	1994	Willeke	Laboratory Fume Hoods: Efficacy of Particle containment
Bradley L. Aaron	1994	Clark	Evaluation of National Priorities List Hazardous Waste Site Assessment and Ranking Methodology in EPA Region V
Gavin J. M. Smith	1994	Talaska	A Study on Personal Exposures to Asphalt Fume During Asphalt Road Paving
Jill F. Cudnik	1993	Talaska	An Evaluation of the Effects of Two Hand Cleaners on the Risk of Carcinogen Absorption from Used Gasoline Engine Oils with Respect to the Exposure - Cleaning Interval
Martin C. Lee	1993	Tabor	Arsenic Availability and Speciation in Contaminated Soils
Paul A. MacKinnon	1993	Rice	Electron Microscopy Study of Refractory Ceramic Fibers

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**TITLES OF MASTER'S THESES RELATED TO INDUSTRIAL HYGIENE  
(Past Five Years)**

Robert G. Smith	1993	Ayer	A Study in the Effect of the Moisture Content of coal on the Dustiness of the Coal
Pai-Tsang Huang	1993	Tabor	Meta-analysis of the Frequencies of Arsenism in Different Endemic Areas
Christine Pippenger	1993	Bhattacharya	Effects of a Respirator Helmet and Postural Fatigue on Upright Balance
Steven W. Rucker	1993	Clark	Worker Protection During Lead-Based Paint Abatement
Lisa Warner Greathous	1993	Bhattacharya	Ergonomic Risk Factors Associated with Carpentry Tasks
Mark W. Thompson	1992	Willeke	Method for Determining the Viable Fraction of Bioaerosols

## APPENDIX B

**TITLES OF PH.D. THESES RELATED TO INDUSTRIAL HYGIENE  
(LAST FIVE YEARS)**

Student Name	Year	Advisor	Title of Thesis
Salvatore Giolando	1992	Tabor	The Fate of Azo Dyes in Aerobic Microbial Degradation Systems: C.I. Acid Orange 7 and C.I. Acid Red 151
Usha Krishnan	1992	Willeke	Development and Validation of a Dichotomous-Flow Quantitative Respirator Fit Test
Frank B. Liebhaber	1992	Willeke	Determining the Size and Electrical Charge of Airborne Particles by the Combined Use of Optical and Filtration Properties
Lynda Ewers	1992	Clark	Development of a Screening Model for the Determination of the Relative Bioavailability of Lead in Environmental Samples
Paul Jensen	1993	Clark	Development of Prediction Methods for Determining Solvent Exposures Using a Nonspecific Sensor
Eugene White	1993	Tabor	Isolation and Characterization of a Pseudomonas Strain, Isolate TW1008, Which Aerobically Metabolizes 4'-[2-Hydroxy-1-naphthyl]azo] - Benzenesulfonic Acid
Ching-Wen Chang	1994	Willeke	Study of the Colony Masking Effect in Bioaerosol Sampling and Analysis
Suresh Kalatoor	1994	Willeke	Aerosol Sampling With Low Wind Sensitivity
Angshuman P. Bagchee	1995	Bhattacharya	Functional Locomotion and Obstacle Negotiation in Children With Chronic Lead Exposure
Jeffrey S. Eberhard	1995	Tabor	Fate of Azo Dyes in the Environment: A Physico-Chemical Basis for Bioavailability, Stability, and Partitioning Among Water, Sediment and the Biota
Clinton Cox	1995	Que Hee	Urinary 2-Thiothiazolidine-4-Carboxylic Acid, Thioethers, and Compounds Responsive to the Iodine-azide Test as Biomarkers for Carbon Disulfide Exposure of Rats and Humans
Shiow-Yi Chiou	1996	Bhattacharya	Assessment of Postural Instability During Semi-Dynamic Task Performance on Slippery Surfaces
Rubens Mazon	1996	Clark	A Hazard Ranking System Suitable for Developing Countries
Mark Jenkins	1997	Bornschein	Production of Anthropometric Bone and Tissue Lead X-Ray Fluorescence Phantoms Using a Polyurethane and Calcium Carbonate Matrix
Thomas Lentz	1997	Rice	The Potential Significance of Airborne Fiber Size Parameters to the Development of Pleural Plaques in Workers Who Manufacture Refractory Ceramic Fibers

**APPENDIX C  
NIOSH TRAINING GRANT PROGRAM GRADUATES  
ACADEMIC YEAR 9/1/92 TO 9/30/97**

Grantee: University of Cincinnati

Academic Program: Industrial Hygiene

NAME*	Date Entered Program	Date Program Completed	Date Degree Awarded	DEGREE RECEIVED FROM PROGRAM**	CURRENT EMPLOYMENT STATUS (Job title/employer)	CURRENT BUSINESS ADDRESS (Or last known address)
Lisa M. Ende*	September 1989	September 1992	September 1992	MS/IH	Industrial Hygienist Ecology & Environment Inc.	Cincinnati, OH
Lynda Ewers	September 1988	December 1992	December 1992	PhD/IH	Industrial Hygienist NIOSH	Cincinnati, OH
Salvatore Giolando	September 1986	September 1991	September 1992	PhD/IH	Industrial Hygienist Procter & Gamble Co.	Cincinnati, OH
Yu-Li Huang*	September 1989	June 1992	June 1992	MS/IH	Industrial Hygienist Taiwan Government	Taiwan, ROC
Usha Krishnan*	September 1986	September 1992	September 1992	PhD/IH	Assistant Professor Illinois State Univ.	Normal, IL
Frank B. Liebhaber*	September 1989	September 1992	September 1992	PhD/IH	Industrial Hygienist USAF-Environmental	Wiesbaden, Germany
Gregory Piacitelli*	September 1989	June 1992	June 1992	MS/IH	Industrial Hygienist NIOSH	Cincinnati, OH
Ronald Marchioni*	September 1990	June 1992	June 1992	MS/IH	Industrial Hygienist USAF	San Antonio, TX
Paul Schwarz*	September 1981	September 1992	September 1992	MS/IH	Industrial Hygienist Quantum - USI Division	Cincinnati, OH
Angela Weber	September 1990	June 1992	June 1992	MS/IH	Industrial Hygienist NIOSH	Cincinnati, OH
Jill Cudnik	September 1990	August 1993	August 1993	MS/IH	Industrial Hygienist State of North Carolina OSHA	Department of Labor Raleigh, NC

\*Please specify by asterisk those Program graduates that did not receive NIOSH financial support.

\*\*Please also specify specialist area as noted on degree. In Occupational Medicine please specify if resident or other graduate.

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ACADEMIC YEAR 9/1/92 TO 9/30/97**

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NAME*	Date Entered Program	Date Program Completed	Date Degree Awarded	DEGREE RECEIVED FROM PROGRAM**	CURRENT EMPLOYMENT STATUS (Job title/employer)	CURRENT BUSINESS ADDRESS (Or last known address)
Lisa Warner Greathouse*	September 1990	March 1993	March 1993	MS/IH	Industrial Hygienist Texaco, Inc.	Houston, TX
Eugene White*	September 1987	March 1993	March 1993	PhD/IH	Research Industrial Hygienist, NIOSH	Cincinnati, OH
Pai-Tsang Huang*	September 1991	June 1993	June 1993	MS/IH	Industrial Physician	Taipei, Taiwan
Paul Jensen*	September 1985	December 1993	December 1993	PhD/IH	Industrial Hygienist NIOSH	Cincinnati, OH
Martin Lee	September 1989	August 1993	August 1993	MS/IH	Industrial Hygienist Dow Corning	Louisville, KY
Paul MacKinnon*	September 1991	August 1993	August 1993	MS/IH	Industrial Hygienist SECOR	Calgary, Alberta
Christine Pippinger*	September 1991	June 1993	June 1993	MS/IH	Industrial Hygienist U.S. Coast Guard	Seattle, WA
Steven Rucker	September 1991	June 1993	June 1993	MS/IH	Industrial Hygienist University of Cincinnati	Industrial Health & Safety Cincinnati, OH
Robert Smith*	September 1986	August 1993	August 1993	MS/IH	Industrial Hygienist Mine Safety and Health Administration	Arlington, VA
Mark Thompson*	September 1989	March 1993	March 1993	MS/IH	Industrial Hygienist AIG Consultants	San Francisco, CA
Eugene White*	September 1987	March 1993	March 1993	PhD/IH	Research Industrial Hygienist, NIOSH	Cincinnati, OH
Bradley Aaron	September 1991	March 1994	March 1994	MS/IH	Unknown	Detroit, MI

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ACADEMIC YEAR 9/1/92 TO 9/30/97**

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Academic Program: Industrial Hygiene

NAME*	Date Entered Program	Date Program Completed	Date Degree Awarded	DEGREE RECEIVED FROM PROGRAM**	CURRENT EMPLOYMENT STATUS (Job title/employer)	CURRENT BUSINESS ADDRESS (Or last known address)
Brenda Camacho	September 1992	December 1994	December 1994	MS/IH	Industrial Hygienist State of Oregon, OSHA	Portland, OR
Ching-Wen Chang*	September 1989	March 1994	March 1994	PhD/IH	Industrial Hygienist Institute of Occupational Safety & Health	Council of Labor Affairs Executive Yuan Taipei, Taiwan, R.O.C.
Shiow-Yi Chiou*	September 1991	June 1994	June 1994	MS/IH	PhD Candidate University of Cincinnati	Department of Environmental Health Cincinnati, OH
Gabriela Enescu	September 1992	June 1994	June 1994	MS/IH	Industrial Hygienist 3M	Columbus, OH
Amy Fisher	September 1992	June 1994	June 1994	MS/IH	Industrial Hygienist Procter & Gamble, Co.	Cincinnati, OH
Suresh Kalatoor*	September 1991	September 1994	September 1994	PhD/IH	Industrial Hygienist Racal Filter Tech. Ltd.	Brockville, Ontario K6V 5V8 Canada
Steve Neilson	September 1992	September 1994	September 1994	MS/IH	Industrial Hygienist U.S. Navy	Crane, IN
Gavin Smith	September 1989	March 1994	March 1994	MS/IH	Industrial Hygienist Enviro Health	Cincinnati, OH
Shelby Stewart	September 1992	September 1994	September 1994	MS/IH	Industrial Hygienist City of Cincinnati	Office of Environmental Management Cincinnati, OH Cincinnati, OH
Jill Tobler	September 1992	September 1994	September 1994	MS/IH	Industrial Hygienist Procter & Gamble Co.	Cincinnati, OH
Pei-Jung Tsai*	September 1992	September 1994	September 1994	MS/IH	Industrial Hygienist	Taiwan

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ACADEMIC YEAR 9/1/92 TO 9/30/97**

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Academic Program: Industrial Hygiene

NAME*	Date Entered Program	Date Program Completed	Date Degree Awarded	DEGREE RECEIVED FROM PROGRAM**	CURRENT EMPLOYMENT STATUS (Job title/employer)	CURRENT BUSINESS ADDRESS (Or last known address)
James Warren*	September 1991	December 1994	December 1994	MS/IH	Industrial Hygienist	Aiken, SC
A.P. Bagchee*	September 1990	March 1995	March 1995	PhD/IH	Industrial Hygienist University of Cincinnati	Department of Environmental Health Cincinnati, OH 45267-0056
Kimberly Bostic	September 1993	December 1995	December 1995	MS/IH	Industrial Hygienist State of North Carolina OSHA	Winston-Salem, NC
Clinton Cox*	September 1983	December 1995	December 1995	PhD/IH	Industrial Hygienist U.S. EPA-NAREL	Montgomery, AL
Jeffery Eberhard*	September 1991	June 1995	June 1995	PhD/IH	Industrial Hygienist Morton Analytical	Cincinnati, OH
Ronald Emerich	September 1989	December 1995	December 1995	MS/IH	Industrial Hygienist Easatman Kodak	Rochester, NY
Gretchen Hall	September 1993	June 1995	August 1995	MS/IH	Industrial Hygienist State of Oregon, OSHA	Portland, OR
Debora Hurst*	September 1978	August 1995	August 1995	MS/IH	Industrial Hygienist Bioenvironmental	Wright Patterson Airforce Base
Yinge Qian*	September 1990	June 1995	June 1995	MS/IH	Ph.D. Candidate University of Cincinnati	Department of Environmental Health Cincinnati, OH
Christopher Blasio	September 1994	August 1996	August 1996	MS/IH	Industrial Hygienist LTV Steel Co.	Cleveland, OH
Krista Carwardine	September 1994	June 1996	August 1996	MS/IH	Industrial Hygienist Procter & Gamble Co.	Cincinnati, OH

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ACADEMIC YEAR 9/1/92 TO 9/30/97**

Grantee: University of Cincinnati

Academic Program: Industrial Hygiene

NAME*	Date Entered Program	Date Program Completed	Date Degree Awarded	DEGREE RECEIVED FROM PROGRAM**	CURRENT EMPLOYMENT STATUS (Job title/employer)	CURRENT BUSINESS ADDRESS (Or last known address)
Shiow-Yi Chiou*	September 1993	June 1996	June 1996	PhD/IH	Industrial Hygienist NIOSH (NRC Fellow)	Morgantown, WVA
Robert Drexelius	September 1994	June 1996	August 1996	MS/IH	Industrial Hygienist General Electric	Cincinnati, OH
Robert Goodman* (PT)	March 1992	June 1996	June 1996	MS/IH	Industrial Hygienist PEI Associates	Cincinnati, OH
Brian Hauck	September 1994	June 1996	August 1996	MS/IH	Industrial Hygienist State of Oregon, OSHA	Portland, OR
Rubens Mazon*	September 1992	June 1996	June 1996	PhD/IH	Professor of Environmental Management EAESP-Fundacao Getulio Vargas	Av. Nove De Julho, 2029 CEP 01313, S. Paulo, SP Brazil
Regina McCartney	September 1994	June 1996	August 1996	MS/IH	Industrial Hygienist Dames & Moore	Cincinnati, OH
Edward Puhala	September 1994	March 1996	March 1996	MS/IH	Industrial Hygienist Goodyear	Akron, OH
Leslie Smith*	September 1994	June 1996	August 1996	MS/IH	Industrial Hygienist USAF	San Antonio, TX
Nathaniel Sweet	September 1994	June 1996	August 1996	MS/IH	Industrial Hygienist State of Oregon, OSHA	Portland, OR
Mei Juan Chen*	September 1994	June 1997	June 1997	MS/IH	Data Analyst and Ph.D. Candidate University of Cincinnati	Department of Environmental Health Cincinnati, OH

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ACADEMIC YEAR 9/1/92 TO 9/30/97**

Grantee: University of Cincinnati

Academic Program: Industrial Hygiene

NAME*	Date Entered Program	Date Program Completed	Date Degree Awarded	DEGREE RECEIVED FROM PROGRAM**	CURRENT EMPLOYMENT STATUS (Job title/employer)	CURRENT BUSINESS ADDRESS (Or last known address)
Emily Gorsuch	September 1995	June 1997	June 1997	MS/IH	Industrial Hygienist OxyChem	Kenton, OH
Cuiling Huang*	September 1994	June 1997	June 1997	MS/IH	Data Analyst Allegheny University of The Health Science	Hahnemann School of Medical Education Philadelphia, PA
Mark Jenkins	March 1994	June 1997	June 1997	PhD/IH	Industrial Hygienist Fernald	Cincinnati, OH
Thomas Lentz	September 1992	June 1997	June 1997	PhD/IH	Industrial Hygienist NIOSH	Cincinnati, OH
Clinton Morley	September 1995	August 1997	August 1997	MS/IH	Industrial Hygienist NIOSH	Cincinnati, OH
Christine Newman	September 1995	August 1997	August 1997	MS/IH	Seeking employment	Cincinnati, OH

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## 2. OCCUPATIONAL HEALTH NURSING

### A. ACADEMIC TRAINING (MASTER'S LEVEL)

Major changes in the health care system during 1992 through 1996 impacted strongly on nursing and nursing education. This impact influenced the nature and direction of the Occupational Health Nursing program. Two major areas of change in the OHN program were leadership and curriculum.

#### a. Program Leadership and Faculty

From 1988 to 1994, Dr. Linda Shortridge served as Director of the occupational health nursing program with assistance from Dr. Sue Davis, Director of the Community Health master's program and Christine Graeter, RN, MSN, COHN-S, Adjunct Clinical Faculty. Nan Migliozi, RN, MSN, Director of Occupational Health and Safety for the State of Ohio, and Janice Dees, RN, MSN, Corporate Director of Occupational Health and Safety for Procter and Gamble were contracted to teach selected occupational health nursing courses. Program focus during this time was external and directed toward marketing of the program to the local and regional business community, and toward outreach efforts directed to OHN practitioners.

In 1994 Dr. Shortridge accepted a research position at the University of Oregon Health Sciences Center and Dr. Davis assumed leadership as Acting Director. Formal faculty support of the program was expanded to include not only Christine Graeter, RN, MSN, COHN-S but also Ursula Meyer, RN, MSN, COHN, and Donna Gates, RN, MSN, MPH, PhD. Ms. Migliozi and Ms. Dees continued as volunteer faculty, providing lectures on selected course content and supervision of student field experiences.

Dr. Davis was appointed Director of the program in 1997 and given full-time occupational health nursing responsibilities. With changing leadership, the OHN faculty directed team efforts toward increasing internal visibility within the College and University, as well as maintaining external visibility within the community. To guide these efforts, an OHN advisory Committee of practicing OHNs was established.

Outcomes of leadership efforts include increased integration of occupational health nursing and environmental health content in graduate and undergraduate community health courses, and a strengthening of interdisciplinary interaction and research for both students and faculty across occupational health and safety disciplines. One OHN clinical faculty member uses occupational health settings for student experience and lectures on occupational health nursing in undergraduate courses. Other OHN faculty lecture on occupational health and safety in various graduate core and specialty courses. Volunteer faculty were expanded from two masters prepared OHN nurses to 9 volunteer faculty, increasing the pool of practicing OHNs available to provide support for programmatic efforts. One volunteer faculty member, Mary Lou Jones, RN, MSN, COHN-S provides major support for student recruitment and teaching, by representing the program at conferences, and teaching selected content in OHN courses. Judy McMillan, RN, MSN, COHN-S, Julie Snow, RN, MSN, COHN-S, safety director at Good Samaritan Hospital, Janice Dees, RN, MSN, COHN-S, Marianne Grady, RN, MSN, COHN-S, Connie Heintx, RN, MSN, COHN-S, Carolyn Klinger, RN, MSN, COHN-S, Janet Ehlers, RN, MSN, COHN-S, Nan Migliozi, RN, MSN, COHN-S, Carolyn Klinger, RN, MSN, COHN-S, and Monica Sahleh, RN, MSN, COHN-S all provide classroom and practicum support.

In addition to the community support, the program has experienced significant support administrative support from the College Dean, Dr. Andrea Lindell and from the Department Head, Dr. Janice Dyehouse. This support included the opportunity for Dr. Davis to take OHN nursing courses, increased salary support for OHN faculty efforts, and full faculty recognition of Ms. Graeter's position.

#### b. Program Plan

To meet demands of the changing health care system, curriculum revision has been a major program focus since 1992. During the 1992-93 academic year, a needs assessment for an adult nurse practitioner was completed by Drs. Davis and Shortridge. Based on results of the assessment plans the program direction changed from adult to family nurse practitioner. The curriculum for a family nurse practitioner (FNP) program was developed during the fall and winter quarters of the 1993-94 academic year. and approved by the College in March.1994, and by the University in April, 1994.

The program was implemented Fall, 1994 with Dr. Davis as Acting Director. Dr. Jo Ann Ruiz-Bueno was hired in 1995 to assume responsibility as Director. OHN students may elect to take the practitioner option, focusing on occupational health settings, while completing the master's degree or they may return after graduation to complete a post-master's certificate as an adult nurse practitioner (See appendices). The post-master's program is 22 quarter credits and can be completed in three quarters. Courses include pathophysiology, advanced health assessment, pharmacology, two courses in nursing management of chronic and acute health problems and 600 hours of supervised clinical practice. Students taking the nurse practitioner option as part of the master's degree, substitute management practice for clinical practice in occupational health settings. Completion of the program allows the graduate to sit for the national certifying examination as an adult nurse practitioner. The first Occupational Health Nursing Master's student was admitted into the Occupational Health Nursing/Nurse Practitioner course sequence in the Fall of 1995. This student chose to move into the MSN/PhD program rather than complete the nurse practitioner option. A second student in the OHN-NP sequence, chose to complete only the OHN portion of the program. One OHN graduate has been admitted into the post-master's program.

During the 1994-95 academic year Occupational Health Nursing courses were reviewed and evaluated by faculty, students and practicing occupational health nurses. This review formed the basis for revision of the occupational health nursing program during a College-wide revision of baccalaureate, master's and doctoral curricula. Also during this year, OHN faculty took leadership in submitting a University Faculty Development Proposal for refining the current interdisciplinary seminar for occupational health and safety professionals. Although the proposal was not funded, the interdisciplinary health and safety faculty worked cooperatively in revising the course.

College -wide curricular revision began in the Summer quarter of 1995 and courses for the new curriculum were developed during the 1996 - 97 academic year. Implementation of revised curricula began Autumn Quarter, 1997.

The revised OHN master's program consists of core courses taken by all masters students, and additional core courses taken in one of two tracks. The Client Systems track is designed for nurse practitioners and acute care advance practice nurses and consists of three additional core courses: physiology, pharmacology and advanced health assessment. The second track, Health Care Systems, is designed for students focusing on health systems administration (Occupational Health Nursing,

Community Health Nursing, and Nursing Service Administration) and consists of four courses in health systems administration. These courses are coordinated and taught by faculty from each of the systems majors to ensure application of concepts to specific specialty practice.

The OHN program consists of a total of 67 graduate credit hours: 19 masters core credits, 12 nursing systems administration core credits, and 34 occupational health nursing and occupational health and safety credits . A comparison of the old and revised OHN master's curriculum is presented in Table 1.

Total OHN program credits increased from 60 to 67 credit hours. The previous program could be completed in four quarters with 14 to 17 credits taken per quarter. The academic load was heavy for a student population with work and family responsibilities. Students exhibited high levels of anxiety and fatigue in meeting course and field work expectations, and most requested summer course work. The revised curriculum addresses these concerns by increasing the program to five quarters with 12 to 16 credits per quarter. The program is scheduled for consecutive quarters, including the summer quarter. Although the elective course has been eliminated, the decreased number of credits per quarter for full-time students gives the freedom to add electives or to complete an independent study in specialized areas of occupational health and safety, or to work with faculty on research studies. This freedom was not possible for full-time students in the old curriculum.

#### Core Courses Required for all Graduate Nursing Students in the College of Nursing and Health:

Total credit allocation for master's core courses changed from 22 quarter credits to 19 quarter credits. Courses in theory, research and statistics serve as the foundation for practice, as well as, the means for testing practice. The previous courses of Masters Proseminar and Issues were combined into one course (Role, Issues & Ethics in Advanced Practice Nursing 29-560-802) to eliminate duplication of content and to further emphasize ethics. A new course in Health Policy, Organization, and Finance emphasizes structure and function of the health care system, as well as, financing and management of health care systems. Informatics provides an understanding of information technology essential for practice, as well as, fiscal and organizational management. The final masters core requirement is a capstone experience which replaces the Thesis/Project/ Comprehensive Examination requirement. The Capstone Project evolves out of the student's practice experiences and has a program or intervention evaluation focus Which culminates in a finished written evaluation report to be presented to the business/industry partners. The capstone requirement sets the expectation that students will engage in a scholarly project.

#### Health Systems Administration Courses:

Occupational Health Nursing remains an option under the Community Health major. This allows students to sit for the Advanced Community Health Certification examination administered through the American Nurses Credentialing Center. This certification is essential for graduates of the OHN master's program to apply for Advance Practice status under current Ohio Board of Nursing regulations. (Although graduates need to take the Community Health certification examination, they are also strongly encouraged to take the Occupational Health Nursing - Specialist certification examination given through the American Board of Occupational Health Nurses (ABOHN). ABOHN, however, cannot be recognized by the Ohio State Board of Nursing for certification of advanced practice, since a master's in nursing is not required to take the examination.)

The curriculum review of 1995-1996 disclosed that Community Health (occupational health & community health) and Nursing Service Administration majors overlapped significantly in areas of organizational theory, planning and evaluation, financial and human resource management. This led to reconceptualization of the three programs into a health systems administration focus to blend better with a business culture and with the contemporary health care system. Common content was consolidated into three new health systems management courses. The course, Organization and Management of Health Care systems (29-560-817) provides knowledge and skills to function in a managed care environment, including content on case management for selected populations, including workers compensation. This new content and the related field experiences in case management in occupational settings significantly strengthens the student's ability to carry out case management functions, analyze organizational models for delivery of occupational health services (including managed care) and function in a business culture. Financial Management in Health Services (29-560-815) and Human Resource Management (29-560-816) provide students with skills to develop and manage health services and project budgets, build and manage teams and mediate disputes. The health services courses replace the three credit management elective in the old curriculum, and incorporate management concepts previously covered in OHN III. The courses are co-planned and implemented with OHN faculty.

Two courses, Community Health Assessment and Planning and Implementation and Evaluation, in the old curriculum were combined into one three credit course covering health planning and program evaluation (29-566-814). Community health roles and ethical concepts were moved into the master's core course, Role, Issues & Ethics. Course projects, such as a comprehensive assessment, analysis and evaluation of a worker population, were moved into practice courses. Content in project management previously in the Implementation & Evaluation was moved into the OHN course, Leadership Skills in OHN (29-566-813)

#### Occupational Health Nursing and Occupational Health and Safety Courses:

Epidemiology (26-904-776), Environmental Health and Safety (26-904-707), Survey of Toxicology (26-904-782), and Basic Industrial Safety (26-904-873), continue to be required interdisciplinary courses. The three quarter interdisciplinary Occupational Health, Hygiene and Safety Seminar (26-904-819,820,821) remains unchanged, and allows student teams representing each of the disciplines to work collaboratively on an actual problem in an occupational health and safety setting.

Occupational Health & Safety Team (29-566-815), and Team Building in Occupational Health Settings (29-566-816) are new one (1) credit interdisciplinary courses taught out of the College of Nursing and Health. These courses were developed with input from all ERC disciplines, and are planned and taught collaboratively. The OH & S Team course, exposes students to the four core disciplines, and assists students to identify interdisciplinary roles and responsibilities through walk-through evaluations of occupational settings. The course is concurrent with the first quarter of the OH & S Seminar (26-904-873). NON-ERC students (graduate and upper-division undergraduate) are invited to take the course as a way to encourage potential students to consider occupational health and safety as a career option

The team-building course is an interactive two day workshop designed to develop team skills for use in occupational settings. Faculty and students from each of the four disciplines participate in the workshop. The course serves as a vehicle for students to enhance and develop team skills to work

effectively in the Interdisciplinary Seminar. This course is open only to ERC disciplines, but depending on evaluations, it has the potential for being offered for continuing education, as well as, for credit.

OHN course revisions include, additional content in OHN clinical knowledge, regulatory requirements, and working in a business culture. Alumni are used as guest lecturers to provide role modeling, networking opportunities and a contemporary view of occupational health nursing. Additional reading and reference resources in team-building, occupational health nursing protocols, and marketing of occupational health services were added to the library. Lastly, classroom and practice hours were brought into line with College policy, that is, one credit awarded for each hour in classroom work and one credit for three hours in field work.

Introduction to Occupational Health Nursing (29-566-810) is a two (2) credit course covering foundational concepts of occupational health and safety. Occupational settings, OHN functions, priorities in occupational health research, legislative standards and the interdisciplinary nature of occupational health and safety are presented. The course is offered concurrently with Occupational Health and Safety Team (29-566-815), so that the context of occupational health and safety and OHN roles are explored concurrently. This course is open to upper division and non-matriculated BSNs who are interested in exploring occupational health nursing as a career option.

The second OHN course, Advanced Practice in Occupational Health Nursing (29-566-811) emphasizes prevention of occupational disease and injury and the nursing management of occupational related illness and injury. The course builds on content from Toxicology (26-904-782), Environmental health & Safety (26-904-707), Health Planning (29-566-814) and Primary Prevention (29-566-843). This course is taken concurrently with the course Primary Prevention (29-566-843) which covers social, behavioral and biological theories and research relative to health promotion and disease prevention, along with interventions for protecting and promoting the health of individuals and populations.

Leadership Skills in OHN (29-566-813) is taken the last quarter of study. The emphasis is on application of business principles to the delivery of occupational health. This course is designed to strengthen OHN managerial and collaborative skills.

#### Practice Experiences:

The curriculum structure was changed so that seminar and practice are separate courses. This increases flexibility in program progression and allows non-nursing ERC students to take the seminar courses without concurrent practice experiences. The change also offers increased flexibility with scheduling practice experiences. This is especially advantageous for part-time students. Thirty two preceptors in clinical, management, educator, consultant and researcher roles have agreed to mentor OHN students.

Practice experiences were expanded through the addition of a planned internship (Practicum in OHN 29-566-817) during the Summer quarter. A previous need assessment indicated strong interest in the internship by both students and various organizations. This in-depth experience assists students to synthesize content from nursing, occupational health and safety, policy and governmental regulations, health planning and evaluation. In Advanced Practice OHN Practicum (29-566-812) develop and/or designing direct care OHN services for a worker population, and explore practice roles. The

Leadership Skills Practicum course (29-566-814) provides an opportunity for students to work with nurse managers in various industrial and corporate settings.

## Recruitment

Recruitment remains a major programmatic effort. Occupational health nursing continues to be an area of low visibility within the local and regional nursing community. This low visibility requires significant efforts to educate potential students about opportunities and benefits of practicing advanced nursing in occupational settings. Recognition of this issue has led to increased recruitment efforts. The goal of the program is to admit one doctoral student every year to every other year, and to admit four to six masters students each year. Since 1994, this goal has been consistently met. Recruitment includes personal follow-up of all inquiries, coordination with the Office of Student Affairs to talk with all incoming groups of students about occupational health nursing, recruitment mailings to all graduating BSN students, representation at recruitment fairs and state OHN conferences, and dissemination of information from University Public Affairs.

## **B. RESEARCH TRAINING**

### **a. Program Plan**

Since the inception of the doctoral program in 1990, the purpose of the OHN research training program has been to strengthen and expand existing research in occupational health nursing at the University of Cincinnati ERC, and incorporate the priority research areas identified by NIOSH into doctoral research in nursing. In addition, the research training program seeks to increase the number of research studies in the priority areas identified by the American Association of Occupational Nursing. Students with an occupational health focus are strongly encouraged to select the majority of cognates from the interdisciplinary courses in the Department of Environmental Health and to collaborate with Environmental Health faculty in the development of their research focus.

Research opportunities are abundant within the College, the Department of Environmental Health, and outside the University. Cognates and electives for doctoral students are available in the Department of Environmental Health, providing opportunities to interact with doctoral students in the other core programs as well as toxicology and epidemiology. Collaboration continues with industry/government to identify additional opportunities for student and faculty research. Proctor and Gamble, NIOSH and the Collage Foundation are currently supporting doctoral student research. Students are expected to complete pilot studies or work on established studies as they progress through their program of studies.

The curriculum for the doctoral program is shown in Table 2.

Table 2  
Curricular Plan for Nursing Doctorate

Autumn Quarter		Winter Quarter		Spring Quarter	
Year 1					
Credit	Course	Credit	Course	Credit	Course
3 4 3 3 13	History & Phil of Nurs Sci Nursing Research Advanced Statistics Cognate	3 4 3 3 13	Develop & Constr of Nurs Theory Qual Research Methods Advanced Statistics Cognate	3 4 3 3 13	Anal & Eval of Nurs Theory Quant Research Methods Hlth Policy & Ethical Issues in Nurs Sci Advanced Statistics
Year 2					
3 3-6 3-6 12	Seminar: Phenomena of Concern to Nursing Cognates Electives	3 3-6 3-6 12	Seminar: Relationships Among Phenomena of Concern to Nurs Cognates Electives	Candidacy Examination 1 - 12 cr Dissertation or additional course work	
Year 3 - 7					
Dissertation (Minimum of 27 credits). Additional course work may be taken in support of dissertation research					

**b. Leadership and Faculty Research Qualifications**

The leadership for research training in OHN is the responsibility of all participating faculty that serve as advisors and committee members on research projects and dissertations. These efforts for OHN students are coordinated by Dr. Davis. In addition, Dr. Davis teaches one doctoral course in the second year of study, is currently serving on two doctoral committees, and is chair for two other doctoral committees. Drs. Gates, Dyehouse and Fitzwater also mentor OHN doctoral students. Drs. Talaska, Bhattacharya, Bornschein, and Pinney from Environmental Health, along with Dr. Genaidy in Engineering have all mentored OHN doctoral students in research.

OHN faculty interact with other ERC faculty and NIOSH scientists to identify and develop opportunities for research. Dr. Davis has developed a five year research plan with Professor A. Genaidy from the College of Engineering. Pilot work and instrument validation has been conducted for a study of the effects of fatigue and cognitive functioning in back pain and injury in nursing home personnel. Doctoral students from engineering and nursing have participated in this research project.

To date one student, Karen Martin has graduated from the PhD program (1994). Currently, there are four OHN students in the doctoral program. Joanne Randolph is completing her research in strategies for preventing carpal tunnel syndrome. The second doctoral student, Robert Nester, is in the process of conducting a study with NIOSH titled "Adolescent Occupational Safety and Health in the Vocational-Technical Environment: A pre-diffusion Analysis of Policy and Practice", and will defend his dissertation in the Fall of 1998.. The third student, Cindi Kelly, is in the early stages of dissertation

research on "Outcomes of a Health Initiative Program for Employees". Ms. Kelly is being supported through Procter and Gamble. The fourth student, Susan Green, is focusing on agricultural health and is completing her second year of study. This student was also the recipient of the 1996 Honorary Commissioner of Agriculture in recognition of efforts in Farm Safety and Health for Kentuckians, Kentucky Commissioner of Agriculture. She will complete her candidacy examinations in the winter quarter of 1999.

#### c. Program Evaluation

The graduate curriculum evaluation format used in the College is a comprehensive survey of key people and components that make up the graduate program as well as those employers and agencies that utilize the graduates of the program. The College evaluation plan has specific components to maintain an ongoing curriculum evaluation process. Such a process is useful for determining which program objectives are being achieved and which are not. This process can also be used in future program development and ongoing long-term evaluation. The evaluation model requires the collection of data in five areas: 1. Archival Data, those data obtained from graduate student records: previous education, professional work experience, drop-out and/or completion dates, GPA and specialty area. 2. Current Students complete an evaluation instrument that includes demographic data, evaluation of the different aspects of the master's program, and provisions for personal and professional development. 3. Graduates of the Program are sent questionnaires specific to their majors designed to elicit demographic data, evaluation of the different aspects of the master's program and the graduates' opinions regarding the relevance of the program to their current positions and career goals. In addition to the informed consent, the graduates are asked if they would allow the solicitation of information from their employers in relation to their particular academic, administrative, or clinical settings. 4. Employers of the Graduates are thus identified. The employers are asked to respond to a questionnaire that requests information about the competencies or preparation of the graduates for the roles they play and the satisfaction of the employers in relation to the graduates' performance. 5. Faculty Data include a curriculum vitae, committee lists, quarterly evaluations of courses and faculty teaching, as well as, scholarship, research, professional involvement and preparation. The evaluation process began in 1996.

In addition to the College's graduate program evaluation, a brief evaluation of each graduate program is conducted annually by the Division of Graduate Studies. Every four years a thorough assessment of each graduate program in the University is conducted by the Division of Research and Advanced Studies. The OHN Director assesses the flexibility of the curriculum and interactions with related departments, and reviews the coursework and research plans of doctoral students with an occupational health focus. She is also a member of the Curriculum Subcommittee that evaluates the doctoral program.

#### d. Program Support from Other Sources

A source of financial assistance for doctoral students is the University Graduate Scholarships and teaching/research assistantships. Each carries with the award, full tuition and fees, doctoral students and two master's student have been funded through these awards. Out-of-state tuition was funded through graduate studies monies for one doctoral student and one master's student. In addition, support is available for full-time study through the Professional Nurse Traineeship Program sponsored by the DHHS, Division of Nursing. Doctoral students are encouraged to compete for University Summer Research Fellowships from the University of Cincinnati Division of Graduate Studies. The

College, Institute for Nursing Research provides grant writing assistance and opportunities for doctoral students to engage in on-going faculty projects. Doctoral students are strongly encouraged to seek external funding for research projects from private and public funding sources such as the National Institute of Nursing pre-doctoral fellowships, and the American Nurses Foundation. Competition for these funds is strong, and in many instances students are competing with well established researchers for these external funds. One doctoral student received dissertation support through NIOSH, and is completing a predoctoral research fellowship with NIOSH. Procter and Gamble has contracted to support a second doctoral student in her dissertation work on behavioral and economic outcomes of a health incentive program for employees.

A third student has funding from W.K. Collage Foundation to study intervention for "Empowering Farm Women to Reduce Hazards to Family Health and Safety on the Farm". The same student has funding from the National Institute of Health, Division of Nursing Research for a study titled "Empowering Rural Adolescents in Risk Reduction" and another in collaboration with three other investigators titled "Rural Women Using the Internet to Access Breast Cancer Information" funded by NAPBC Information action Council's Bridging the Gap Initiative, ROW Sciences.

e. Faculty & Student publications/theses 1992-1997 (Nursing)

Marks, B. "Revision and pilot testing of a decision-making questionnaire for adults with mental retardation" Thesis, 1992.

Shortridge, L. (1992). Patterns in maternal and infant morbidity and mortality. In B. Valanis, Epidemiology in Nursing and Health Care, (2nd ed.), Appleton-Century-Croft.

Shortridge, L. and Valanis, B. (1992). Principles of epidemiology, in Stanhope and Lancaster (Eds.) Community Health Nursing, Mosby.

Ehlers, Janet, "Occupational health and safety education in agricultural vocational education", Thesis, 1992.

Grady, Mariann, "Measurement of health care workers self-reported attitudes toward occupational exposure to bloodborne diseases and universal precautions", Thesis, 1992.

Sorenson, Paul, "Effect of knowledge and perception of threat upon universal precautions behaviors", Thesis, 1992

Martin, K.J. (1992). Stress related workers' compensation claims recommendations involving records release. American Association of Occupational Health Nurses, 40(8), 370-375.

Martin, K.J. (1992). Machine safety: proper safeguarding techniques. American Association of Occupational Health Nurses, 40(6), 279-283.

Grady, MA; Shortridge, L; Davis, L & Klinger, CS. (1993). Measurement of health care workers' self-reported attitudes toward occupational exposure to bloodborne disease and universal precautions. AAOHN Journal, 41(11) 533-540.

- Martin, K.J. (1993). Being off work, preparing to return to work: how client-nurse interactions can affect employee well being. AAOHN Journal, 41(12), 574-578.
- Martin, K.J.; Shortridge, LA & Dyehouse, JM (1993). Corporate perspective of the role of the occupational health. Research in Nursing and Health, 16(4), 305-311.
- Baluyut R, Genaidy AM, Davis LS, Shell RL, & Simmons RJ. (In press). Use of visual perception in estimating static postural stresses: magnitudes and sources of errors. Ergonomics
- Martin, K.J.; Eisenberg, C.; McDonald, G. & Shortridge, L (1994) Application of the Menninger Return-to-Work scale among injured workers in a production plant. Journal of Rehabilitation, 60 (2) 42-46.
- Davis, S. (1995). Older adults beliefs about alcohol use/abuse. A paper presented at the "Research & Education Dissemination Conference: The effects of alcohol across the life span", April 28, 1995, Covington, KY.
- Flemming, M., Dyehouse, J. & Sommers, M. (1995). Substance abuse and dependency. In E. Sullivan (Ed.). Nursing Care of Substance Abusing Clients. St. Louis: C.V. Mosby.
- Dyehouse, J., & Sommers, M.S. (1995). Brief intervention as an advanced practice strategy for seriously injured victims of multiple trauma. AACN Clinical Issues: Advanced Practice in Acute and Critical Care, 6(1), 53-62.
- C. Graeter (1995) "Strategic Management for Total Quality in Health Care", at the First Caribbean Regional Occupational Health Nursing Seminar, "Worksite Health Promotion for Healthcare Cost Containment and National Development", April 4, Kingston, Jamaica.
- C. Graeter (1995) "Strategic Management for Total Quality in Health Care" Graduate Class in Public Health, University of West Indies, April 6, Kingston, Jamaica.
- Gates, D.M. (1995). Workplace violence. AAOHN Journal, 43 (10), 536-544.
- Gates, D.M. & Horstman, S.W. (1995) Occupational health and safety professionals' attitudes toward workplace violence. Applied Occupational and Environmental Hygiene Journal, 10(2), 79-83.
- Martin, K.J. (1995). Questions from practice: a basis for research. AAOHN Journal 43 (9) 482-488.
- Martin, K.J. (1995). Workers Compensation: case management strategies. AAOHN Journal 43, (5) 245-250.
- Martin, K.J. (1995). Occupational health nurses in disability management. In M. Lacerte & D.E. Shrey (Eds.), Principles & practices in disability management. Orlando, FL: Destach Press.
- Martin, K.J. & Kuchinski, B. (1995). Occupational health nursing. In National Institute for Occupational Safety and Health, Occupational diseases: A guide to their recognition (3rd.), Section 2.4. Washington D.D.: NIOSH.

- Meyer, M.U. & Graeter, C.J. (1995). The health professional's role in disaster planning: A strategic management approach. AAOHN Journal, 43 (1), 29-39.
- Meyer, M.U. & Graeter, C.J. (1995). Computer resources: Finding the system that supports your nursing practice. AAOHN Journal, 43 (1), 29-39.
- Workman, L, Davis, S & Anderson, D (1995). An Analysis of Critical Care Nurses' Work & Perception of Nurses Knowledge & Attitudes Toward Continuity. A paper presentation at the "10th Annual Critical Care Symposium", April 11 & 12, Miami Valley Hospital, Dayton, OH.
- Jones, Susan. (1996). A partnership empowering women to reduce farm injuries and illnesses. A presentation at The third Annual NIOSH Agricultural Health and Safety Conference, Iowa City, IA, March 24-26.
- Jones, Susan. (1996). A partnership empowering women to reduce farm injuries and illnesses. A presentation at Kappa Theta, Sigma Theta Tau meeting, April 9.
- Jones, Susan. (1996). A partnership empowering women to reduce farm injuries and illnesses. A presentation at the summer Conference of the National Institute for Farm Safety, Fort Mitchell, KY, June 23-24.
- Nester, RM. (1997). Occupational safety and health administration: Building partnerships. AAOHN Journal, 44(10): 493-499.
- Gates, DM. Violence and Caregivers in Nursing Homes: A focus group study, a paper presentation at the Psychosocial Nursing Research Conference, Wabash, Indiana, September 19, 1997.
- Jones, Susan. (1977). Health promotion in country stores. A paper presentation at the 8th Nurse Educators Conference in the Rockies, Copper Mountain Resort, CO, August 6-9.
- Jones, Susan. (1997). Health promotion in country stores. Poster presentation at the Summer Conference of the National Institute for Farm Safety, Indianapolis, IN, June 25-27.
- Jones, Susan. (1997). Health promotion in country stores. Poster presentation at 13th Congress of the International Association of Agricultural Medicine and Rural Health, The University of Iowa, Iowa City, IA September 7-9.
- Gates, DM, Fitzwater, E. & Meyer, U (submitted, 1998). violence against caregivers in Nursing homes: Expected, Tolerated and accepted. Journal of Gerontological Nursing.
- Gates, DM. An action plan to prevent and control workplace violence, a paper presentation at the American Occupational Health Conference, Boston, April 26, 1998.
- Jones, Susan & Goldy, D. (1998). Green tobacco sickness. The Nurse Practitioner: The American Journal of Primary Care.
- Jones, Susan (1998). Empowering farm women to reduce hazards to family health and safety on the farm. Journal of Agromedicine.

### 3. OCCUPATIONAL MEDICINE

#### A. BACKGROUND

In 1947, the Department of Environmental Health of the University of Cincinnati (UC) College of Medicine created an Occupational Medicine Residency Training Program. The mission of the residency program was and is to graduate physicians who will assume leadership positions in academic, private, corporate and governmental occupational health programs. The residency program has received NIOSH-ERC training program support since the inception of the ERC program, is fully accredited by the Accreditation Council for Graduate Medical Education, and satisfies the training requirements for board certification in Occupational Medicine by the American Board of Preventive Medicine and the American Osteopathic Board of Preventive Medicine. There have been about 200 graduates. Several times that number of students, residents and practicing physicians have been trained as a part of the undergraduate medical curriculum, rotations for visiting physicians, and continuing education programs including the Occupational Medicine Training Course (formerly the Mini-Residency Program in Occupational medicine for Physicians).

The residency training program, provides a unique approach to occupational medicine training in its curricular configuration, the breadth of experience offered and its depth of faculty support. Unlike traditional programs which require one year of didactic training culminating in a Master of Public Health (M.P.H.), followed by one year of clinical work, the U.C. program affords the opportunity for integration of academic and clinical experiences through the two years. Three training tracks, clinical, research and business, offer career-specific training options to the residents. The program leads to a Master of Science degree, following completion of a required thesis project.

#### B. SIGNIFICANT FINDINGS

When judged by: the *quantity* of graduates; the *quality* of the program as assessed by professional accomplishments and opinions of its graduates; and evidence of developing *self-sufficiency*, the UC OEM Residency Training Program has made major strides since the 1991 NIOSH-ERC training grant application.

The total number of graduates completing their training, in part because of funding available through the ERC Training Grant, is 23 spanning the most recent five year training period. Thus, from the standpoint of *quantity* the UC program is one of the most productive nationally.

Perhaps the best *quality* measure of a training program is the professional accomplishments of its graduates. A survey of residency program graduates during the 1990-91 to 1994-95 academic years was recently conducted with a 91% participation rate. All graduates are employed in full-time occupational and environmental medicine practices. All but one graduate in the past 10 years successfully passed the board certifying examination in Occupational Medicine through the American Board of Preventive Medicine. Graduates continue to assume leadership positions in the field. Of the 23 graduates since September 1, 1992, 15 have taken full-time clinical occupational positions, 5 have joined the UC faculty, 2 are employed in full-time corporate occupational health positions and one

works at NIOSH. Dr. Borron (92), formerly, an Assistant Professor of Emergency Medicine at the Case Western Reserve University is performing clinical research at the University of Paris, France. Dr. Deitchman (92) is employed at NIOSH with responsibility for linking their occupational interests with the public health concerns of the CDC. Dr. Louis (92) directs the OEM program for the Wright-Patterson AFB and Dr. Zelnick (92) has assumed directorship for OEM for the US Air Force. Drs. Ross, Like, Agatep, Forte, and Freeman have joined the UC faculty and five other graduates have joined practices locally and are available to serve as clinical preceptors. Dr. Ross, MD, JD, is employed part-time through NIOSH working with Dr. George Gebus, Director of OEM for the Department of Energy, developing medical screening programs for current and former workers exposed to ionizing radiation. She also teaches a course on Occupational and Environmental Health Law through the UC College of Law. Dr. Trout continues as a full-time employee in the HETAB Medical Section, NIOSH, and has joined the volunteer faculty in the Department of Environmental Health at the University of Cincinnati, coordinating the UC/NIOSH-HHE 18-month practicum residency training program. Dr. Freeman has joined the full-time, tenure track faculty in Occupational and Environmental medicine at the University of Cincinnati and is Deputy Director, Occupational and Environmental Medicine Residency Training Program.

In this survey graduates were asked to rate the perceived helpfulness of the primary training program components to their practices on a scale of 1 (not at all helpful) to 5 (extremely helpful). Mean ratings were 4.1 for academic course work, 4.2 for clinical preceptorships, 4.1 for Industrial preceptorships, and 3.3 for research experience. Comments on the research requirements reflected some uncertainty about the value of the experience when judged against the time and effort required. Program administration was rated at 4.2 for academic advisor and 4.6 for program director.

The final measure of program strength is *self-sufficiency*. Residency stipends have been increased by nearly 50% and are at the national mean (Range \$28,000 to \$30,000 per year). In addition, residents receive tuition remissions, family health benefits, and \$500/year to support educational expenses and cost of travel to professional meetings. Administrative and financial support through the Department of Environmental Health, the College of Medicine and the University Hospital continue.

New funding sources have been identified for the residency program, which simultaneously allows more residents to be trained and provides a certain amount of fiscal resiliency, should federal graduate medical education funding wane. For example the Procter and Gamble Company will be funding up to two practicum year fellowships and NIOSH has provided support for a combined NIOSH-HHE/UC Occupational Medicine Residency Training Program described in more detail later in this document.

### **C. BODY OF REPORT**

The residency training program has continued to evolve by adding new academic courses and preceptorships and new faculty with knowledge and expertise in areas which compliment existing faculty. New course offerings include an Occupational and Environmental Health Law course through the College of Law taught by Dr. Ross, JD, MD, a toxicology course team taught by James Donovan, MD, MS, CIH, and Laura Rosato, Ph.D., an Industrial Processes walk through course taught by Dr.

Donovan, a Survey of Public Health Course, taught by Douglas Linz, MD, MS, and a Management course taught by Dr. Andrew Freeman, MD, MS, MBA. Curricula have been developed for lecture series on the Nuclear Industry and Radiation Health, the Social, Cultural and Behavioral Aspects of Medicine and Computer Applications in OEM. New preceptorships include an occupational law practicum with a local plaintiff's firm, a multi-disciplinary back clinic, an industrial preceptorship at the Wright Patterson Air Force Base, and an enhanced practicum in the University Health Service (UHS) which now has responsibility for all UC employees and athletes. A clinical training experience at the Cincinnati Veterans Administration Hospital is currently available on an elective basis.

With the formation of the Alliance Hospital system here in Cincinnati combining The Christ, The Jewish, The St. Luke's, and The University Hospital, a hospital-based practicum rotation has been developed through OccNet, centered at The St. Luke's Hospitals of Northern Kentucky. Dr. James Keller, MD, MS, a graduate of the UC Occupational Medicine Program serves as the preceptor.

The preceptorship program based at the former Fernald uranium processing facility, currently managed by Fluor Daniel, has been expanded and enhanced. Fluor Daniel provides support for faculty and resident participation in the health and safety program at Fernald. Residents spend between one and one-half and two days per week working in combination with Dr. Andrew Freeman and the site occupational physician, Dr. Doran Christensen. Activities include participation in the worker radiation safety training program which enables residents to suit up and wear SCBA. Residents meet with representatives of site safety and hygiene and are given a tour of the facility and a detailed overview of the site safety plan. Each resident is required to complete a project as part of this required industrial practicum experience. This project generally involves reviewing and updating specific health and safety programs which makes an important contribution to the employer while simultaneously providing valuable learning opportunities for the resident.

The evolving Procter and Gamble Fellowship Program enables residents to work with numerous board-certified occupational medicine physicians, industrial hygienists, occupational health nurses, safety engineers, security personnel and others in completing corporate occupational medicine projects of current importance to the health and safety team at Procter and Gamble. These projects have been quite varied, including program design and evaluation, comparing proposed and ongoing P&G programs to those at other corporations, development of standardized health and safety programs for international sites modeled on existing programs at US sites, and performing multidisciplinary health and safety audits at plant sites. Resident work with physicians who are jointly responsible for the complete spectrum of medical services at Procter and Gamble. They travel, attend meetings, training seminars, and conferences as needed to accomplish the program goals.

The University of Cincinnati/NIOSH-HHE joint residency training position involves residents as functioning members of the Hazard Evaluations and Technical Assistance Branch (HETAB) Medical Section staff. The resident performs two primary activities: a) designing and conducting field investigations (Health Hazard Evaluations [HHE]) in a variety of worksites; and b) providing technical assistance to the general public and other health professionals regarding many types of occupational health issues.

The Medical Section is composed of 6 physicians, 1 Ph.D. nurse, 2 Ph.D. epidemiologists, 1 Dr.P.H. dentist, 1 Ph.D. psychologist, 2 epidemiology assistants, and 3 secretaries. The Medical Section works closely with an Industrial Hygiene Section composed of 22 industrial hygienists and engineers.

NIOSH HHEs are investigations of known or suspected occupational health hazards in the workplace, and may occur anywhere in the United States. Most HHEs involve working with an industrial hygienist. Many HHEs will involve at least one site visit to the workplace involved. All HHEs are completed by writing a final report or letter which is provided to the employees, employers, and other interested parties. Submission of manuscripts to peer-reviewed journals and presentation of current work at local and national conferences is encouraged when appropriate. The other primary activity of the HETAB MS is to provide information in response to public inquiries on occupational health topics.

Residents are encouraged to take part in all training sessions in Cincinnati planned for the current Epidemic Intelligence Service Officers by the Centers for Disease Control and Prevention (CDC) at NIOSH. These activities vary in frequency and content throughout the year.

The Occupational and Environmental Medicine residents are able to participate in training opportunities offered by the CDC in Cincinnati as short courses. These courses occur periodically and cover a wide range of topics including software training (word processing, statistics, and graphics applications), public speaking, scientific writing, and information retrieval.

The training program continues to make major continuing education contributions via the four week Occupational Medicine Training Course. This program is now being offered to allied occupational health professionals including occupational health nurses, nurse practitioners and physician assistants. The one month long Area Health Education Center-approved Occupational and Environmental Medicine Clerkship continues to provide in depth exposure for 6 to 12 fourth year medical students each year. The program has developed an Environmental Medicine Curriculum along the lines recommended by the Institute of Medicine in the text Environmental Medicine. We intend to introduce the case studies as part of the existing medical school curriculum this Fall. The program continues to offer individualized training for visiting students and residents and the OM History Course for industrial hygiene students, team-taught by OM & IH faculty has been formally approved by the University Graduate Council. A Residency Handbook has been developed as a living document to provide the latest program information to the residents.

Over the last five years, faculty commitment to the Occupational and Environmental Medicine Residency Training Program has continued to grow with current core faculty listed in Table 1. Major faculty changes include the addition of Drs. Agatep, Forte, Like and Ross, and most recently Dr. Andrew G. Freeman, who is Deputy Occupational and Environmental Medicine Residency Program Director. Dr. Freeman has prior training and experience in the area of computers in medicine and has obtained an MBA degree which will enable him to develop curricular content in the area of medical management and computer applications in occupational and environmental medicine. Dr. Vikas Kapil, formerly Director of University Health Services, has recently departed from the University and will continue to contribute to the program as a Volunteer Faculty Member. We eagerly anticipate the arrival

of Dr. John Andrews, formerly Director of Science for the Agency for Toxic Substance and Disease Registry (ATSDR) who is trained and certified in Internal Medicine and Occupational Medicine, and General Preventive Medicine. We anticipate that Dr. Andrews will continue to provide the leadership formerly provided by Dr. Kapil and, in addition, hope to develop specific training experiences and curricular content in the field of Environmental Medicine.

The research program in Occupational and Environmental Medicine has continued to flourish under the direction of Dr. James E. Lockey, MD, MS, Director of the Division of Occupational and Environmental Medicine, as well as the Center for Occupational Health. All residents must complete a formal thesis project in order to fulfill the requirements for obtaining the Master of Science degree. In addition, the program supports visiting scientists pursuing a Master of Science degree program and residents who choose to avail themselves of the availability of their research training track. The research program flourishes, at least in part, because of the large number of ongoing research programs through the Division of Occupational and Environmental Medicine and the Department of Environmental Health. Studies include pulmonary effects of refractory ceramic fibers and absorbent gelling material, biomonitoring of organic solvent exposed workers and formaldehyde exposed workers, various genetic studies, and cohort studies of radiation exposed populations. Table 2 lists Master of Science thesis topics for Occupational and Environmental Medicine residents. Over the last five years funded NIOSH ERC Training Grant, the program has offered Master of Science research training to five visiting scientists from South Korea and Venezuela. In addition, in conjunction with the Industrial Hygiene Program, a three month training experience was recently provided to two visiting physician specialists from Poland, one a doctor recently completing her training in Occupational Medicine and the other physician currently completing her residency training in Environmental Medicine.

The training facilities available to support the Occupational and Environmental Medicine Program are unparalleled and include the renovated Kettering Laboratory opened in 1993. The addition consists of 100,000 square feet and houses many of the department's offices, research and teaching facilities. In addition, the combined facilities of the Center for Occupational Health and the University Health Services (UHS) located in the Christian R. Holmes Hospital Division of the University Hospital provides a model University-based training site for residents and students. In addition, as new preceptorships are added to the program, the medical facilities associated with these preceptorship sites also become available for use by our residents.

Table 3 is the NIOSH Training Grant Program Graduates for academic years 1992 through 1997 (a five year span).

In summary, over the last five years, the University of Cincinnati Occupational and Environmental Medicine Residency Training Program has continued to flourish in large part because of ongoing support through the NIOSH ERC Program. The Program has graduated a large number of Occupational and Environmental Medicine specialists who have assumed leadership positions in the field and have scored well on certifying examination. The Program is fully accredited through the Accreditation Council for Graduate Medical Education, Residency Review Committee, Preventive Medicine. The Program has enhanced its funding base and the financial support of its residents, and has seen significant improvements in both the academic and practicum phases of the training program. The research program has continued to flourish as each resident is required to complete a Master of Science thesis project. This program also supports visiting scientists from abroad. The program is developing

new curricular content in medical management and computer applications in Occupational and Environmental Medicine, and has instituted combined training programs with the corporate health and safety programs of the Procter and Gamble Company, worldwide, located in Cincinnati, and with the Health Hazard Evaluation (HHE) Program, headquartered at the local NIOSH facility. The faculty has grown in parallel with the growth of the program. Residents have made contributions to the scientific literature through publication of their Master of Science theses and through peer review publications and professional presentations. Facilities to support the program have grown enormously in the way of a large addition to the academic and research offices of the Department and through addition of new clinical space through the Center for Occupational and University Health Services.

#### **D. STUDENT PUBLICATIONS**

A listing of resident publications from 1991 to date is included in Table 4.

TABLE 1

Percent Effort and Teaching Responsibilities for  
Core Occupational and Environmental Medicine  
Faculty and Staff

	% Effort	Courses/Clinical Taught
Denise E. Agatep, MD	20	1
James R. Donovan, MD, MS	20	3
Thomas E. Forte, MD, MS	20	1
Andrew G. Freeman, MD, MS, MBA	20	2
Grace K. Lemasters, PhD	20	1
Anne C. Like, MD	10	1
Douglas H. Linz, MD, MS	60	2
James E. Lockey, MD, MS	40	2
Roy T. McKay, PhD	20	3
D. Ann Middaugh, MD, MS	15	3
Susan M. Pinney, PhD	10	0
Clara Sue Ross, MD, JD	20	2
Raymond R. Suskind, MD	30	2

TABLE 2

Master's Theses for Current and Recent (since 1990) OEM Residents

<u>Resident</u>	<u>Masters Thesis Research Project</u>
Denise Agatep	A Study of Early Markers of Coal Workers Pneumoconiosis
Victor Angel	Mass Psychogenic Illness in a Hospital Surgery Department (in progress)
Robin Baver	Occupational Carpal Tunnel Syndrome in a Cohort of Vehicle Assembly Workers
Stephen W. Borron	Reproduction of a 1930's Asbestos Cohort (with Manville)
Robert Boyer	Change in Pulmonary Function When Testing Technicians Are Accountable to an Internal Peer Review
Evan Davies	Evaluation of a Denaturium Benzoate (Bitrex) Qualitative Respirator Fit Test
Thomas Forte	Misdiagnosis of Lung Disease by Pulmonary Function Testing of Workers Who Have Had Palatal Surgery
Andrew Freeman	An Evaluation of Pressure-Monitored Leak Checks in Detecting Industrial Respirator Leakage
David Garling	An Expert System for Post-Myocardial Infarction Return to Work Evaluation
Gregory M. Jewell	Longterm Outcome of Patients with Occupationally-Related Carpel Tunnel Syndrome
David R. Johnson	The Utilization of Total Lung Capacity in Screening Asbestos Exposed Workers Who Smoke
Jacob Kammer	Renal Function in Fernald, OH, Area Residents Drinking from Uranium-contaminated Wells (in progress)
James Keller	Cluster Analysis of Symptomatic Building Occupants in Building Related Illness
Brian Knapp	Formulation of a Predictive Model for Ice-related Falls by Identifying Significant Weather-related Risk Factors at a Midwestern Air Force Base
Wei H.Kuo	Postural Balance in Wastewater Workers
Timothy N. Lee	Clinical Characteristics of "Basement Flu"

Anne Like	Methodology Study of the Agreement of Responses on Closed-ended and Open-ended Occupational History Questionnaires
Ali Lopez	A New Method to Identify Excessive Hesitating Starts in Spirometry Testing
David J. Louis	A Study of Illness Related Lost Time in Transport Aircraft Crew Members
James T. Lutz	Respiratory Irritation Effects of Fibrous Glass (with Manville)
Leonid Macheret	Occupational Causes of Sarcoidosis - A Questionnaire Evaluation (in progress)
Douglas J. McKimm	A Case Control Study Evaluating Workers Diagnosed with Pleural Changes Secondary to Refractory Ceramic Fiber Exposure
Marycel Q. Mendez	Effects of Lighting, Workload, and Respirator Use on Maintenance of Postural Equilibrium
D. Ann Middaugh	Sick Building Syndrome: Evaluation of Two Workforces
Evelyn Mobley	Disability Case Management: An Impact Assessment in a Highly Industrialized Organization
Donna E. Pratt	Age Effects on Maintenance of Postural Equilibrium (in progress)
Clara S. Ross	Chronic Pulmonary Effects of Recurrent Polymer Fume Fever (in progress)
M. Y. Sankar	Carpal Tunnel Syndrome in Surgeons Using Fiber Optic Techniques (in progress)
Glenn M. W. Scott	Diagnosis and Natural History of Carpal Tunnel Syndrome, An Analysis of the ASPN (Ambulatory Sentinel Practices Network Data Set (with NIOSH)
John C. Shively	Pulmonary Effects of Diatomaceous Earth
Nancy K. Wiese	Pulmonary Effects of Refractory Ceramic Fibers
George P. White	A Physiologic Method for Respirator Fitness Determination
Sanford D. Zelnick	Visual Fields in Wearers of Full Face Respirators

TABLE 3

## NIOSH Training Grant Program Graduates: 1992-1997

Grantee Institution: University of CincinnatiAcademic Program: Occupational Medicine

Name #	Date Entered Program	Date Program Completed ##	Date Degree Awarded	Degree Received from Program ###	Current Employment Status (Job title/employer)	Current Business Address (Or last known address)
Deepak G. Azad, MD, MPH *	09/01/96	08/30/97	None	None - previous MPH 1989 from NY Medical College, Valhalla, NY	unknown	4108 Maplewood Drive, New Albany, IN 47150
Marsha L. Bailey, MD, MPH	07/01/96	06/30/97	None	None - previous MPH 1992 from St. Louis University	Medical Director/Center for Occupational Health and Medicine	2501 East High Street Springfield, OH 45505
Andrew G. Freeman, MD, MS	07/01/95	06/30/97	06/13/97	Master of Science June 1997	Assistant Professor/ University of Cincinnati	PO Box 670182, Cincinnati, OH 45267-0182
Mark S. O'Brien, MD, MS *	07/01/96	06/30/97	None	None - previous MS 1996 from Purdue University	Medical Director, PV Corp Hlth, Parkview Corporate Health	8797 East Crow Road, Syracuse, IN 46567
Douglas B. Trout, MD, MHS *	01/12/93	06/07/97	None	None - previous MHS 1985 The Johns Hopkins School of Hygiene and PH	Medical Officer/NIOSH	(R-10), Robert A. Taft Laboratories, 4676 Columbia Parkway, Cincinnati, OH 45226
Thomas E. Forte, DO, MS	7/1/94	6/30/96	6/30/96	Master of Science	Occupational Physician, COH, University Hospital	PO Box 670458 Cincinnati, OH 45267-0182

Brian E. Knapp, MD, MS	7/1/94	6/30/96	12/96	Master of Science	MedClinic Mercy Hlth Care Sys Occup Health	3160 Folsom Blvd Sacramento, CA 95816
Denise E. Agatep, MD, MS	9/1/94	8/1/96	8/97	Master of Science	Occupational Physician	609 Shadowlawn Ln Loveland, OH 45140
Robin S. Baver, MD, MPH	7/1/95	6/30/96	None	None - previous MPH 7/95 U. of Michigan	Occupational Physician NAVISTAR	6125 Urbana Road Springfield, OH 45502
Douglas J. McKimm, MD, MS	9/1/91	3/31/96	8/95	Master of Science	Occupational Physician QES Inc.	1219 Morts Pass Cincinnati, OH 45215
James D. Keller, MD, MS	3/1/93	6/2/96	6/13/97	Master of Science	Medical Director OccNet, Northern KY St. Luke Hospital	7380 Turfway Rd Florence, KY 41042
Robert L. Boyer, MD	6/14/93	1/29/96	pending	Master of Science	Medical Director Centura Health	700 South 8th St Canon City, CO 81212
Nauman Jameel Mufti, MD, MPH	7/1/94	12/31/95	None	None - previous MPH 8/88 U. of Oklahoma	Baptist Center Care Occupational Clinic	1420 Donelson Pike, Suite B15 Nashville, TN 37217
David J. Garling, PhD, MD, MS	10/1/92	9/30/94	6/96	Master of Science	Occupational Physician	6093 S. Kingston Circle Englewood, CO 80111- 5732
Evan J. Davies, DO, MS	7/1/93	6/30/95	12/97	Master of Science	St. Elizabeth Business Health	150 Medical Village Dr Edgewood, KY 41017
Timothy N. Lee, MD, MS	7/1/92	6/30/95	8/96	Master of Science	Occupational Physician	105 S. James Landing Smithfield, VA 23430
Anne C. Like, MD, MS	7/1/93	6/30/95	6/96	Master of Science	Staff Physician University Health Services	PO Box 670460 Cincinnati, OH 45267- 0460

Clara Sue Ross, MD, JD	7/1/92	6/30/94	pending	Master of Science	Staff Physician University Health Services	PO Box 670460 Cincinnati, OH 45267- 0460
M. Y. Sankar, MD	7/1/92	6/30/94	pending	Master of Science	Medical Director St. Elizabeth MC W. Carrollton Workplace Health	303 Fame Road, Suite A West Carrollton, OH 45449
James E. Lutz, MD	7/1/91	6/30/93	pending	Master of Science	Medical Director Bethesda Care Norwood	4594 Montgomery Rd Cincinnati, OH 45212
Marycel Mendez (Quintero), MD (NOTE: MS, no residency training)	9/23/91	12/30/92	12/92	Master of Science	Federal Government of Venezuela	1344 Sassafras Ave Altamonte Springs, FL 32714
Donna E. Pratt, MD	7/1/91	6/30/93	pending	Master of Science	Occupational Physician	PO Box 851 Williamsville, NY 14231-0851
Glenn M.W. Scott, MD, JD	10/1/91	9/30/93	9/94	Master of Science	Occupational Physician	500 East Harwood Rd # 3004 Euless, TX 76039

# = Please specify by asterisk those Program graduates that did not receive NIOSH financial support.

## = For Occupational Medicine graduates use this column to specify date for certificate of completion of residency.

### = Please also specify specialty area as noted on degree.

## TABLE 4

### List of Resident Publications 1991 to Date

- Borron SW, Forman SA, Lockey JE, Lemasters GK, Yee LM. An early study of pulmonary asbestosis among manufacturing workers: Original data and reconstruction of the 1932 cohort. AJIM 1997; 31:324-334.
- Eis NJ, Linz DH. Elevated blood lead in children and antisocial behavior: The benefits of screening and lead paint abatement versus the medical and societal costs of adult criminal behavior. (Submitted to J Amer Med Assoc, July, 1997)
- Johnson DR, Mathias CGT. Allergic contact dermatitis from dental acrylic. Am J Contact Dermatitis 1993;4:90-92.
- Kuo W, Bhattacharya A, Succop P, Linz D. Postural stability assessment in sewer workers. J Occup Environ Med 1996;36(1):1-8.
- Linz DH, Garling DJ. Principles of neurotoxicology. In: Brooks SM (ed) Environmental Medicine: Concepts and practice. 1995.
- Linz DH, Pinney SM, Keller JD, White M, Buncher CR. Cluster analysis applied to building-related illness. (Accepted with revision: J Occup Environ Med) 1997.
- Lockey JE, Ross CS. Indoor air quality medicolegal issues. J Allergy and Clinical Immunology 1994;94(2):417-22.
- Lockey JE, Ross CS. Radon and man-made vitreous fibers. J Allergy and Clinical Immunology 1994;94(2):310-17.
- Lockey JE, Wiese NK. Health effects of synthetic vitreous fibers. Clinics in Chest Medicine: Occupational Lung Diseases 1992;13(2):329-40.
- Sack D, Linz D, Shukla R, Rice C, Bhattacharya A, Suskind R. Health status of pesticide applicators, postural stability assessment. J Occup Med 1993;35(12):1196-1202.
- Seliga R, Bhattacharya A, Succop P, Wickstrom R, Smith D, Willeke K. Effect of workload and respirator wear on postural stability, heart rate and perceived exertion. American Industrial Hygiene Association Journal 1991;52(10):417-22.
- Wakeman MA, Lockey JE. Other pneumoconioses. In: Cullen MR, Rosenstock L. (eds). Textbook of Clinical, Occupational and Environmental Medicine. Philadelphia: W. B. Saunders, 1994.
- White GW, Mathias CGT. Occupational contact dermatitis due to antimony. J Occ Med 1993;35:392-95.
- Wiese NK, Lockey JE. Man-made vitreous fiber, vermiculite and zeolite. In: Rom WN (ed). Environmental and Occupational Medicine, Second Edition. New York: Little Brown and Company. 1992.
- Zelnick SD, McKay RT. Visual field loss while wearing full face respiratory protection. Am Indust Hyg Assoc J 1994;55:315-21.

## 4. OCCUPATIONAL SAFETY

### A. SIGNIFICANT FINDINGS

The five year period between 7-1-92 and 6-30-97 was very productive for the ERC Occupational Safety Program. During the past two years, the program began a transition from a single occupational safety focus to occupational safety/ergonomics. Additional courses in safety and ergonomics were available as electives for the students. In addition a new core course was developed: Occupational Safety Engineering (20-267-520). A plan to revise the core for the safety/ergonomics program was completed in 1996-1997 for implementation in 1997-1998. The new courses were Industrial Environment : Engineering Evaluation and Control (20-267-653) and Interface Design (20-267-655). Evaluation of the core and elective courses will continue through 1997-1998 and beyond to produce a balanced curriculum for safety, ergonomics, and research methodology for MS and Ph.D. level students.

During the five year period, 10 Ph.D. and 60 MS degrees were awarded. All 10 Ph.D. and 46 of the MS degrees were Industrial Engineering majors with safety specialization. The other MS majors included 12 ME, 1 Chemical Eng., and 1 Civil Eng. (reference Appendix C). The University has provided full tuition waivers for all NIOSH supported trainees.

In addition to the NIOSH support, funding for students has been obtained from several industrial organizations. These included Hudson Speciality Foods, James River Corporation, The Kroger Company, Fluor Daniel Corporation, General Electric Aircraft Engines, Crocker Fels Co., and Ergo Accommodations, Inc. In addition, the Institute of Advanced Manufacturing Sciences (IAMS) has assisted interdisciplinary industrial plant visits, and provided facilities for meetings and research.

Outreach and continuing education efforts have been active during the five year period. Examples of outreach include providing assistance to other universities, e.g., University of South Florida; consulting about safety with industrial firms; presenting seminars and short courses in safety engineering and ergonomics.

### B. OCCUPATIONAL SAFETY OVERVIEW

#### a. Background

The occupational safety program is made possible through a wide range of University courses and faculty, and the NIOSH funding support of the Cincinnati ERC. The majority of courses are taught by faculty from the colleges of Medicine and Engineering through the departments of Environmental Health (EH), and Mechanical, Industrial and Nuclear Engineering (MINE). The major goal of the occupational safety training and research program is to provide graduate engineers with specialized courses and experiences that will enable them to become practicing safety professionals or researchers in the field.

Safety engineering courses were initially developed at the undergraduate and graduate levels in 1975 coinciding with the beginning of the industrial engineering program in the College of Engineering. Between 1975 and 1986, prior to NIOSH funding, several students completed M.S. degrees with course work that related to occupational safety. Also, during this time period the first Ph.D. with safety specialization was completed in 1987 by Linda Cahill-McQuiston (the first female to complete the Ph.D. in the MINE Department).

The program offers graduate study leading to the M.S. and Ph.D. degrees in Industrial Engineering, Mechanical Engineering or Nuclear Engineering with a specialization in Safety for both full-time or part-time students. The majority of the students are enrolled in Industrial Engineering. In addition, the program offers a wide selection of safety courses to the engineering student not concentrating in occupational safety but wanting to gain some awareness and insight about this important field. Consequently, several safety courses of most interest to the working professional are scheduled during late afternoons or early evenings to accommodate the engineer working full-time in the greater Cincinnati area and desiring to pursue an advanced degree on a part-time basis. For example, enrollment in the System Safety I and II courses is typically 25 to 30; only 7 or 8 of these students receive NIOSH traineeships.

#### **b. Required Core Courses**

The 27 hours of required core courses for the program during the past five years included Occupational Safety Engineering (20-267-520), a two-quarter sequence in System Safety (20-265-621 and -622), Fire Protection Engineering in Facility and Process Design (20-265-777), Environmental Hygiene and Safety Technology (26-904-707), Safety Engineering Design and Management (20-265-778), Safety Engineering and Product Liability (20-265-779), Occupational Health and Safety Workshop (26-904-819, -820 and -821), and Occupational Biomechanics (20-267-752). Working with a faculty advisor, the student selects a sequence of elective courses for the M.S. or Ph.D. which will best align with his/her career objectives.

#### **c. Unique Program**

During the past five years, the uniqueness of the UC ERC Occupational Safety program consisted of the following three characteristics:

##### **The UC-NIOSH Connection**

A unique relationship with local NIOSH laboratories to permit our students to serve as NIOSH guest researchers and interns. For example, two of the NIOSH supported graduate students were working on various assignments in Dr. Swanson's laboratory. In the case of Awwad Dababneh, part of this work was utilized for his M.S. thesis requirements. His NIOSH based thesis was entitled "Assessment of Mental Workload by Heart Rate Variability." Mr. Dababneh recently completed the Ph.D. A second student, Omar Mohamed, was a Ph.D. candidate. The topic of his dissertation was "Testing and Assessing the Postural Stresses Associated with Sedentary Work." In addition to the students working in NIOSH laboratories, NIOSH personnel are on campus as lecturers, committee members, and students. For example, Michael Gressel from the research staff of NIOSH who recently completed his M.S. thesis "Methods for Characterizing Emissions from Laser Printers," has been a full-time doctoral student since September 1996, supported by NIOSH under its long-term training program. Finally during 1996-1997 Dr. Janet Haartz, Director Biomedical and Behavioral Sciences Division, while on special leave, spent 6 months in the MINE Department as a visiting scientist.

##### **Practical Experience of Trainees**

Students entering the program since the beginning of NIOSH support in 1986 have all had a minimum of one and one-half years of work experience. This adds practical insight to the learning process.

In addition, for most of the required safety engineering courses and several of the elective courses, the students complete team-based projects interacting with local industry.

### **The Industrial Focus**

The program has emphasized manufacturing, warehousing/distribution, and system safety. The MINE Center for Robotics and the Ergonomics and Biomechanics laboratories offer highly specialized facilities that enhance the manufacturing and system safety focus of the program. The warehousing/distribution emphasis has been expanded with affiliation in the Multi-university Material Handling Research Center. In addition, there is close cooperation with the Institute of Advanced Manufacturing Sciences to further develop linkage between student groups and the greater Cincinnati area manufacturing sector. The students have opportunities to work with safety engineering and health professionals employed by a number of local firms, e.g., General Electric Aircraft Engines, James River Corp., The Procter & Gamble Company, The Kroger Company, Chiquita Brands, Hydro System Company and Hudson Foods Corporation.

The program has been designed to produce a safety specialist that in addition to comprehensive engineering skills and safety knowledge, has excellent mathematical/quantitative abilities, and an orientation to manufacturing and warehousing/distribution. The system safety part of the program is a key factor to enhance hazard identification, risk assessment/management, and the integration of safety and health considerations into the overall business activity.

#### **d. Faculty**

As previously mentioned, the occupational safety program is made possible through a wide range of existing University courses and faculty. The majority of courses are taught by faculty from the colleges of Medicine and Engineering through the departments of Environmental Health, and Mechanical, Industrial and Nuclear Engineering.

The participating faculty supported in part by the NIOSH grant have diverse backgrounds and experience, and collectively represent a unique human resource for graduate education and research in occupational safety. For example, each of them holds a terminal degree from a different major university. Their academic majors include industrial engineering, mechanical engineering, and bio-medical engineering. Their academic and professional involvement, research specializations, and consulting experience represent an even greater professional breadth.

The commitment of the faculty greatly exceed the amount of grant support in two ways. First, those partially supported expend more time working with students and/or teaching than their respective grant support levels. For example, all core and elective courses are taught by faculty supported on general funds as part of their academic year assignments.

Secondly, there are numerous faculty in the departments of EH and MINE who teach elective courses and serve on graduate student committees that are not supported by the grant. For example, in MINE Dr. Ernest Hall, Geier Professor of Robotics, teaches elective courses in control and automation and serves on committees. Professor Hall holds a Ph.D. in Electrical Engineering which adds considerable breadth of specialization to our faculty group. Also, Dr. Benita Beamon, Assistant Professor of Industrial Engineering, teaches an elective course in Material Handling Systems and serves on committees. In

addition, Dr. Amit Bhattacharya in EH teaches ergonomics and biomechanics courses and serves on committees for the safety students.

During the past five years, the following full-time faculty have been working to develop the program and facilitate safety engineering:

Richard L. Shell, Professor of Industrial Engineering and Professor of Environmental Health  
(Program Director, Occupational Safety)  
University of Iowa, B.S.M.E (I.E. Option), 1961  
University of Kentucky, M.S.M.E., 1963  
University of Illinois, Ph.D., 1970  
Human performance, occupational safety/management, and manufacturing engineering

Jose Arantes, Assistant Professor of Industrial Engineering  
Instituto Tecnológico de Aeronautica, Brazil, B.E.M.E., 1978  
Katholieke Universiteit te Leuven, Belgium, M.S.I.M., 1982  
University of Michigan, Ph.D., 1991  
Simulation and production planning, inventory control, logistics, and operations research modeling

Max L. Brown, Professor of Mechanical Engineering  
University of Cincinnati, B.S.M.E., 1959  
Ohio State University, M.S. (M.E.), 1960  
Ohio State University, Ph.D., 1968  
Machine design safety and product liability

Ash M. Genaidy, Associate Professor of Industrial Engineering  
Cairo University, B.S., 1980  
University of Miami, M.S., 1983  
University of Miami, Ph.D., 1987  
Biomedical engineering, human factors, occupational biomechanics, and safety

Anil Mital, Professor of Industrial Engineering and Professor of Medicine and Rehabilitation  
Allahabad University, B.E., 1974  
Kansas State University, M.S.I.E., 1976  
Texas Technological University, Ph.D., 1980  
Ergonomics and occupational safety

Ronald L. Huston, Professor of Mechanics  
University of Pennsylvania, B.S.M.E., 1959  
University of Pennsylvania, M.S.(E.M.), 1961  
University of Pennsylvania, Ph.D., 1962  
Human body mechanics, crash analysis and human factors

Rodney J. Simmons, Assistant Professor of Industrial Engineering  
California State University, B.S., 1975  
California State University, M.S., 1976

Harvard University, S.M., 1978

Texas A&M University, Ph.D., 1993

System and occupational safety engineering/management, fire protection engineering, industrial hygiene, and product liability

In addition to the above MINE faculty several EH faculty hold adjunct appointments in Industrial Engineering and lecture in specific classes and serve on graduate committees. These include:

Dr. Amit Bhattacharya, Adjunct Professor of Industrial Engineering

Dr. C. Scott Clark, Adjunct Professor of Industrial Engineering

Dr. Klaus Willeke, Adjunct Professor of Industrial Engineering

In addition to full-time faculty in MINE and EH, the following off-campus adjuncts have taught courses, served on committees, and/or interface with student research in areas relating to the program:

Marvin D. Mills, Adjunct Professor of Safety

West Virginia State College, B.S., 1941

New York University, M.S., 1949

New York University, Ed.D., 1973

Occupational Safety

Thomas R. Huston, Adjunct Associate Professor of Industrial Engineering

University of Cincinnati, Engineering Science, B.S., 1980

University of Cincinnati, M.S.M.E., 1981

University of Cincinnati, Ph.D., 1985

Statistics, engineering economy, and product liability

Steven L. Sauter, Adjunct Professor of Human Factors

University of Wisconsin-Madison, B.A., 1968

University of Wisconsin-Madison, M.A., 1972

University of Wisconsin-Madison, Ph.D., 1975

Occupational stress, safety, and health

Naomi G. Swanson, Adjunct Associate Professor of Industrial Engineering

Dakota Wesleyan University, B.A., 1980

University of Wisconsin-Madison, M.A., 1983

University of Wisconsin-Madison, Ph.D., 1989

Ergonomics and psychosocial stressors

e. Publications

Example publications during the five year period are included in Appendix B.

f. Summary

The five year period between 7-1-92 and 6-30-97 was very productive for the ERC Occupational Safety Program. There has been a recent transition from occupational safety to occupational

safety/ergonomics. New courses have been added to the curriculum including a new introductory course: Occupational Safety Engineering (reference Appendix A for course outline). In addition two other courses have been updated for the program: Industrial Environment: Engineering Evaluation and Control, and Interface Design. During the five year period 10 Ph.D. and 60 M.S. degrees were awarded.

In addition to NIOSH support, funding for students has been obtained from several industrial organizations. Also, the University of Cincinnati has provided full tuition waivers for all NIOSH supported trainees. Out reach and continuing education activities have been active during the five year period.

The UC ERC occupational safety program has three unique characteristics:

- Many of the NIOSH supported trainees serve as guest researchers and interns at the local NIOSH laboratories.
  
- All students entering the program have had a minimum of one and one-half years of work experience.
  
- The program has emphasized manufacturing, warehousing/distribution, and system safety.

The program has been designed to produce a safety specialist that has comprehensive engineering skills and safety knowledge.

The faculty supporting the program has diverse backgrounds and experience and collectively represent a unique human resource for graduate education and research in occupational safety. Faculty from the departments of EH and MINE teach required and elective courses, and serve on graduate student committees representing a strong interdisciplinary academic team.

# **APPENDIX A**

## **Course Outline for Occupational Safety Engineering**

## DEPARTMENT OF MECHANICAL, INDUSTRIAL & NUCLEAR ENGINEERING

### Occupational Safety

#### Bulletin Description

20-267-520. Occupational Safety. 3 cr. An engineering approach to the control of loss exposures in business and industry. Course considers risks to employees, facilities, production, market position, and the environment. 3 lec.

#### Purpose of Course

The purpose of this course is to prepare the engineer and other professionals to work effectively in the field of occupational health and safety which has undergone significant change over the past two decades. There are many reasons for this. Some of the more prominent include the following: technological changes that have introduced new hazards in the workplace; proliferation of health and safety legislation and corresponding regulations; increased pressure from assertive regulatory agencies; realization by industrial executives that a safe and healthy workplace is typically a more productive workplace; skyrocketing health care and worker's compensation costs; increased pressure from environmental groups and the public; a growing interest in ethics and corporate responsibility; professionalization of health and safety occupations; increased pressure from labor organizations and employees in general; and rapidly mounting costs associated with product safety and other types of litigation. All of these factors, when taken together, have made the job of the modern health and safety professional more challenging and more important than it has ever been.

#### Textbook

Goetsch, David L., Occupational Safety and Health, Second Edition, Prentice-Hall, 1996

#### Course Format

<u>Date</u>	<u>Topic(s)</u>	<u>Chapter(s)</u>
9-25	Introduction and assignment of group project	
9-30	Overview of health and safety movement, past and present	1
10-2	Accidents and their effect on industry, cost and lost time; theories of accident causation	2,3
10-7	The OSHAct, standards, codes and liability	4
10-9	Workers' compensation, monetary impact, disabilities, fraud/abuse, and the future	5
10-14	Health and safety personnel: engineer, industrial hygienist, occupational physician, and occupational health nurse; stress and safety, workplace and personal	6,7

10-16	Health, safety, and competition in the global marketplace, the relationship between health and safety and productivity; preparing for emergencies	18,19
10-21	Safety analysis and hazard prevention, and hazard analysis	20
10-23	Accident investigation and reporting	21
10-28	Safety promotion, policy, rules, regulations, and employee/union participation	22
10-30	Mid-term examination	
11-4	Health and safety training including job safety analysis as a training technique	23
11-6	The impact of automation on safety engineering and the workplace	25
11-11	Ethics and occupational safety, the professionals role in ethics	26
11-13	Exposure to blood borne pathogens in the workplace including OSHA's standard	27
11-18	Group project presentations: mechanical hazards and safeguarding; falling, impact, acceleration and lifting hazards	8,9
11-20	Group project presentations: heat and temperature standards; pressure standards and hazards	10,11
11-25	Group project presentations: electrical hazards; fire hazards	12,13
11-27	Thanksgiving Day Holiday (no class)	
12-2	Group project presentations: toxic substances and explosive hazards; radiation hazards	14,15
12-4	Group project presentations: noise and vibration hazards. Review for final exam	16
12-11	Final examination, 1:30-3:30 pm	

## **BIBLIOGRAPHY**

### **Books**

Anton, Thomas J., Occupational Safety and Health Management, 2nd Edition, McGraw-Hill, 1989.

Asfahl, C. Ray, Industrial Safety and Health Management, 3rd Edition, Prentice Hall, 1995.

Bollinger, Nancy J., and Robert H. Schutz, NIOSH Guide to Industrial Respiratory Protection, U.S. Department of Health and Human Services, Centers for Disease Control, National Institute for Occupational Safety and Health, Division of Safety Research, September 1, 1987.

Brauer, Roger L., Safety and Health for Engineers, Van Nostrand Reinhold, 1994.

Corn, Morton, and Jacqueline K. Corn, Training and Education in Occupational Hygiene: An International Perspective, Annals of the American Conference of Government Hygienists, Cincinnati, OH 1988.

Kuhre, W. Lee, Practical Management of Chemicals and Hazardous Wastes, Prentice Hall, 1995.

Managing for Products Liability Avoidance, CCH Business Law Editors, CCH Incorporated (Chicago, IL), 1994.

Manuele, Fred A., On the Practice of Safety, Van Nostrand Reinhold, 1993.

Roberts, Joseph M. Sr., OSHA Compliance Manual, Reston-Prentice Hall, 1976.

Roland, Harold E., and Brian Moriarty, System Safety Engineering and Management, 2nd Edition, John Wiley, 1990.

Shell, Richard L., and Rodney J. Simmons, An Engineering Approach to Occupational Safety and Health in Business and Industry, Institute of Industrial Engineers (Norcross, GA), 1990.

#### **Other**

Journal of Safety Management, National Safety Management Society, Weaverville, Carolina (Quarterly).

Occupational Hazards (monthly).

Occupational Health and Safety (monthly).

Safety and Health (monthly).

## **APPENDIX B**

### **Example Publications 7-1-92 through 6-30-97**

- "Use of Visual Perception in Estimating Static Postural Stresses: Magnitudes and Sources of Error," *Ergonomics*, (R. Shell).
- "Manufacturing Engineering Education Using Industrial Projects and Combined Multidisciplinary Teams from Several Universities," *Proceeding, International Conference on Education in Manufacturing, Society of Manufacturing Engineers*, 1996 (M. Brown, E. Seidman and Thompson).
- "Shape Optimal Design and Finite Element Analysis," *Applications of Management Science: Engineering Applications*, v. 5, 1996 (J. Arantes, S. Ananthasivan and A. Houshmand).
- "A Comprehensive Lifting Model: Beyond the NIOSH Lifting Equation," *Ergonomics*, (J. Hidalgo, A. Genaidy, W. Karwowski, D. Christensen, R. Huston and J. Stambough), 1995.
- "A Cross-Validation Estimation of Static Non-neutral Postures: Magnitudes and Sources of Errors," *Ergonomics*, 38 (9), pp. 1841-1850, (R. Baluyut, A. Genaidy, S.L. Davis, R.L. Shell and R.J. Simmons).
- "Do Back Supports Relieve the Load on the Lumbar Spine?," *Ergonomics*, 38 (5), pp. 996-1010, (A. Genaidy, D.M. Christensen, R.J. Simmons).
- "Modeling and Design of Automated Manufacturing Control Systems Using Object-Oriented Timed Petri Nets," *SME Transactions on Robotics Research*, (R. Shell).
- "An Energy Theorem for Developing Testing Functions for Numerical Simulation of Dynamic Systems," *Journal of Dynamic Systems, Measurement, and Control*, Vol. 117, No. 3, pp.419-438, 1995, (R. Huston, D. Zhang and C.Q. Liu).
- "Computational Methods for Studying Impact in Multibody Systems," *Computers and Structures*, Vol.57, No. 3, pp. 421-425, 1995, (R. Huston and C.C. Chang).
- "Head Injury Reduction in Automobile/Pedestrian Impact - New Structural Designs Using DYNA3D," *Shock and Vibration*, Vol. 1, No. 6, pp. 559-568, 1994, (R. Huston, D.R. Lemmon and M. Wu).
- "Modeling, Simulation and Analysis of an Automated Materials Handling System," *International Journal of Physical Distribution & Logistics Management*, Vol. 24, No. 8, pp. 15-32, 1994 (R. Shell, G. Okogbaa and G. Clark).
- "Flexibility Effects in Multibody Systems," *Computer-Aided Analysis of Rigid and Flexible Mechanical Systems*, NATO ASI Series E: Applied Sciences - Vol. 286, pp. 351-376, Klumer Academic Publishers, 1994, (R. Huston and Y. Wang).
- "Macro-Ergonomics Risk Assessment in Nuclear Remediation Industry," at the Ergonomics Society Conference, United Kingdom, 1995 (A. Genaidy).

- “An Assessment of Musculoskeletal Strain Experienced by Nurses in the Workplace,” at the Ergonomics Society Conference, United Kingdom, 1995 (A. Genaidy).
- “Finite Population Queuing Models without Immediate Return to the Source,” presented at the INFORMS National Conference, New Orleans, October 28-31, 1995 (J. Arantes).
- “Cyclic Scheduling with Set-ups,” presented at the INFORMS National Conference, New Orleans, October 28-31, 1995 (J. Arantes).
- “Minimizing Transmitted Variation in Parameter Design: An Integer Nonlinear Programming Approach,” INFORMS National Conference, New Orleans, October 28-31, 1995 (J. Arantes).
- “System Safety and Risk Management for Design Engineers and Managers,” a 32-hour professional development course presented at the Naval Undersea Warfare Center Division, Newport, Rhode Island, August 1-22, 1995 (R. Simmons).
- “The Role of the Manufacturing Engineer in Reducing Vulnerability to Product Liability,” presented in the Manufacturing Process II class, University of Cincinnati, May 25, 1995 (R. Simmons).
- “Strategies for Incorporation of Occupational Health and Safety into the Mechanical and Industrial Engineering Curricula,” presented at a NIOSH-sponsored work-shop on incorporating occupational health and safety concepts into engineering curricula, Tufts University, Boston, MA, May 15-16, 1995 (R. Simmons).
- “System Safety in the Service of the Arts III: The Art Studio as a Teaching Resource for Occupational Health and Safety Engineering,” presented to the School of Natural and Applied Sciences, University of Houston - Clear Lake, Houston, Texas, March 24, 1995 (R. Simmons).
- “Comprehensive Review for the Certified Safety Professional Examination,” presented as a 4-day short course (32 hours), through the Continuing Education program of the NIOSH-supported Educational Resource Center, March 21-24, 1995 (R. Simmons).
- “Occupational Noise Exposure: Recognition, Evaluation and Control,” presented to the Acoustics II class, University of Cincinnati, January 19, 1995 (R. Simmons).
- “Analysis of Temporomandibular Joint Forces During Whiplash,” ASME Winter Annual Meeting, Chicago, 1994 (R. Houston, D.R. Lemmon and M.Y. Wu).
- “SUPERCASH - A Three-dimensional Crash Victim Simulation Program,” ASME Winter Annual Meeting, Chicago, 1994 (R. Houston, D.R. Lemmon and M.Y. Wu).
- “Health Surveillance Process,” The American Society of Safety Engineers, Local Chapter, Cincinnati, November 1994 (A. Genaidy).
- “Reorganization for Enhanced Productivity,” The Eighth Annual Engineering Conference, University of Cincinnati, 1994 (R. Shell).

- "Incentives and Gainsharing," Internal Revenue Service Seminar/Workshop, Washington, DC, 1994 (R. Shell).
- "Analytical Model of Merging Operations in a Conveyor Network," Bi-annual ORSA/TIMS Conference, Detroit, 1994 (J. ARANTES).
- "Optimal Sequencing Retrievals in an Automated Storage Retrieval System, Bi-annual ORSA/TIMS Conference, Detroit, 1994 (J. Arantes).
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- "Performance Variability as an Indicator of Fatigue and boredom Effects in a VDT Data-Entry Task," *International Journal of Human-Computer Interaction*, Vol. 6, No. 1, 1994, pp. 37-45 (R. Shell, C. Pan and L. Schleifer).
- "Physical Fatigue in High and Very High Frequency Manual Materials Handling: Perceived Exertion and Physiological Indicators," *Human Factors*, 36 (2), pp.219-231, 1994, (M. Brown, A. Mital and H. Foononi-Fard).
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- "University of Cincinnati/Xavier University Engineering Design Clinic Quality Enhancement/Cost Savings Clinic Program," *Proceedings, Conference Resource Book on Design in Mechanical Engineering*, 1993 (M. Brown and E. Seidman).
- "Manufacturing System Cell Formation and Evaluation," *International Journal of Production Research*, (R. Shell, G. Okogbaa, M. Chen, and C. Chanchit).
- "Robot Control Using Neural networks with Adaptive Learning Steps," *Proceedings, Society of Photo-Optical Instrumentation Engineers Conference*, Cambridge, MA, 1993 (R. Shell, W. Golnazarian, E. Hall).
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- "A 2-Factor Heuristic for Flowshop Scheduling," presented at the Bi-annual TIMS/ORSA Conference, Boston, MA, April 24-27, 1994 (J. Arantes, K. Lawrence, G. Reeves and R. Stawicki).
- "Forecasting Multiple Events: A Multicriteria Approach," presented at the Bi-annual TIMS/ORSA Conference, Boston, MA, April 24-27, 1994 (J. Arantes, K. Lawrence, G. Reeves and R. Stawicki).
- "Noise-Induced Hearing Loss," presented in the senior-level course, Acoustics II in the Department of Mechanical, Industrial and Nuclear Engineering, University of Cincinnati, March 15, 1994 (R. Simmons).
- "OSHA's Chemical Process Safety Standard," presented to the Department of Chemical Engineering senior seminar, University of Cincinnati, March 8, 1994 (R. Simmons).
- "Industrial Hygiene for Chemical Engineers," presented to the Department of Chemical Engineering senior seminar, University of Cincinnati, March 1, 1994 (R. Simmons).
- "Optional Configuration of Multiarm Robots," presented at the ISRAM '94 Conference, Maui, Hawaii, 1994 (R. Huston).
- "Computational Methods for Studying Impact in Multibody Systems," presented at the Second U.S. National Congress on Computational Mechanics, Washington, DC, August, 1993 (R. Huston and A. Chang).

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"Risk Homeostasis Theory: A Perspective," presented at the 11th International System Safety Conference, Cincinnati, OH July 28-August 2, 1993 (R. Simmons and P. Kopardekar).

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"Automobile Hood Design for Pedestrian Safety," presented at the 11th System Safety Conference, Cincinnati, OH, July 1993 (R. Huston and D. Lemmon).

"Analysis of Locking Dynamics of 'Windowshade' Comfort Retractors in Three-Point Automobile Seat Belts," presented at the 11th International System Safety Conference, Cincinnati, OH, July 1993 (R. Huston).

"Human Factors and Affordances in Product Design - Implications for System Safety," presented at the 11th International System Safety Conference, Cincinnati, OH, July 1993 (R. Huston and B. Huston).

"Flexibility Effects in Multibody Systems," presented at the NATO Advanced Study Institute on Computer Aided Analysis of Rigid and Flexible Mechanical Systems," Troia, Portugal, July 1993, (R. Huston and Y. Wang).

"Weighting Judgmental Forecasts," The 13th International Symposium on Forecasting, Pittsburgh, PA, June 9-12, 1993 (J. Arantes, K. Lawrence, S. Lawrence and R. Stawicki).

"CSP Review Course," a 72-hour course (for 20 safety engineers) reviewing the material covered in the ASP and CSP exams offered by the Board of Certified Safety Professionals. Presented at the Fernald Environmental Management Project, Fernald, OH, January-June 1993 (R. Simmons).

"Effects of Helmet Mass on Neck Dynamics During Impact in Sports," presented at the ASTM Symposium on Head and Neck Injuries in Sports, Atlanta, GA, May 1993 (R. Huston).

"Optimization of Tool Path in Face Milling Operation by Linear Programming Models," presented at the 2nd IE research Conference, Los Angeles, CA, May 26-27, 1993 (J. Arantes, P. Sriramulu).

"Travel Time Models for AS/RS with Multiple I/O Stations," presented at the 2nd IE Research Conference, Los Angeles, CA, May 26-27, 1993 (J. Arantes, S. Kompella).

"Staircase Tool Path Face Milling Optimization Using Linear Programming," TIMS/ORSA, Chicago, May 16-19, 1993 (J. Arantes, P. Sriramulu).

"Risk Management and System Safety For Engineers," presented to General Electric Medical Systems, Milwaukee, Wisconsin, April 27-29, 1993 (R. Simmons).

"Postural Stress Analysis," presented to the "Principles of Ergonomics," course, Department of Environmental Health, College of Medicine, University of Cincinnati, April 9, 1993 (A. Genaidy).

"Postural Stress Analysis in Industry," presented at the Ergonomics Society Conference, Edinburgh, Scotland, April 9, 1993 (A. Genaidy).

"Ergonomic Protective Equipment in Industry," presented at the All-Ohio Safety and Health Congress, Columbus, OH, April 1993 (A. Genaidy).

"Active Microbreaks Effects on Musculoskeletal Comfort Ratings in Meatpacking Plants," All-Ohio Safety and Health Congress, April 1, 1993 (R. Simmons and A. Genaidy).

"Noise-Induced Hearing Loss," presented in the senior-level course, Acoustics II in the Department of Mechanical, Industrial and Nuclear Engineering, University of Cincinnati, March 12, 1993 (R. Simmons).

"Accident Investigation for the Chemical Engineer," presented to the Department of Chemical Engineering senior seminar, University of Cincinnati, January 19, 1993 (R. Simmons).

"System Safety Analysis Applied to Material Handling," presented at the Material Handling Focus '93, Fort Lauderdale, FL, January 14-16, 1993 (R. Simmons).

"Control of Toxic Materials," presented to the Department of Chemical Engineering senior seminar, University of Cincinnati, January 12, 1993 (R. Simmons).

"Occupational Safety and Health: the Chemical Engineer's Role," presented to the Department of Chemical Engineering senior seminar, University of Cincinnati, January 5, 1993 (R. Simmons).

"University of Cincinnati Engineering Design Clinic Internship Program," Resource Guide Innovation Design Education, 1993 Engineering Design Education Conference (ASME) Paper A-5 (M. Brown and L. Seidman).

"University of Cincinnati/Xavier University Engineering Design Clinic Quality Enhancement Cost Savings Clinic Program," Resource Guide to Innovation in Design Education, 1993 Engineering Design Education Conference (ASME), Paper A-6 (M. Brown and L. Seidman).

*Computer-Aided Ergonomics*, Taylor & Francis, London, 1991 (W. Karwowski, A. Genaidy, S. Asfour).

"Developing Clerical And Administrative Standards," Chapter 7, *Maynard's Industrial Engineering Handbook*, 4th Edition, McGraw-Hill, (New York) 1992 (T. Seidel and R. Shell).

"Measurement of Automated Processes," Chapter 4, *Maynard's Industrial Engineering Handbook*, 4th Edition, McGraw-Hill (New York) 1992 (R. Shell).

"Measurement of Low-Quantity Work," Chapter 2 *Maynard's Industrial Engineering Handbook*, 4th Edition, McGraw-Hill (New York) 1992 (R. Shell).

"Control of Redundant Robot Manipulators," Twenty-Second Annual Modeling and Simulation Conference, Pittsburgh, 1991, published in *Modeling and Simulation* (W. G. Vogt and M.H. Mickle Eds.) Part 4, University of Pittsburgh Press, 1991, pp. 1888-1894 (R. Huston and T. King).

"Time Based Manufacturing for Total Integraton," *Proceedings, First Africa-USA International Conference on Manufacturing Technology*, Lagos, Nigeria, January 11-14, 1993, (R. Shell).

"Production Performance Standards, Incentives, and Worker Stress," *Proceedings, Annual, Conference American Psychological Association*, Washington, DC, November 19-22, 1992, (R. Shell).

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"Performance Variability as an indicator of Fatigue and Boredom in Electornic-monitored Data Entry Work," *Work with Display Units, Proceedings 3rd International Scientific Conference*, (Berlin) 1992 (C. Pan, R. Shell, L. Schleifer).

"A Review and Reappraisal of Electronic Performance Monitoring, Performance Standards, and Stress Allowances," *Applied Ergonomics*, Vol. 23, No. 1, February 1992 (R. Shell and L. Schleifer).

"A Multi-level Incentive Model for Service Organizations," *Applied Ergonomics*, Vol. 23, No. 1, February 1992 (R. Shell, R. Allgeier).

"Finite Element Analysis of Pedstrian Head Impact Onto Automobile Hoods," *Visions*, Issue 5.2, 1992, pp. 12-15 (R. Huston, D. Lemmon, M. Wu, and D. Zuby).

"Multibody Dynamics-Modeling and Analysis Methods," Feature Article *Applied Mechanics Reviews*, Vol. 44, No. 3, pp 109-117 (R. Huston).

"Can Visual Perception be Used to Estimate Body Part Angles?" *Ergonomics*, (A. Genaidy, R. Simmons, L. Guo, J. Hidalgo).

"A Comparative Study of the Myoelectric Amplitude Characteristics for Arm Holding Tasks," *Journal of Human Ergology*, 1992 (A. Genaidy, J. Hidalgo, W. Karwowski).

"A Psychophysical Approach to Determine the Frequency and Duration of Work-Rest Schedules for Manual Handling Operations," *Ergonomics*, (A. Genaidy and S. Al-Rayes).

Physical Training: A Tool for Increasing Work Tolerance Limits for Employees Engaged in Manual Handling Tasks, *Ergonomics*, 1992 (A. Genaidy W. Karwowski, L. Guo, J. Hidalgo, G. Garbutt).

Effects of Job-Simulated Flexibility and Strength-Flexibility Training Protocols on Maintenance Employees Engaged in Manaul Handling Operations," *Ergonomics*, 1992 (L. Guo, A. Genaidy, J. Warm, W. Karwowski, J. Hidalgo).

"Effects of a Job-Simulated Exercise Programme on Employees Performing Manual Handling Operations," *Ergonomics*, (A. Genaidy, N. Davis, E. Delgado, S. Garcia, E. Al-Herzella).

Compression Tolerance Limits of the Lumbar Spine. *Ergonomics*, 1992 (A. Genaidy, S. Wally, T. Khalil, J. Hidalgo).

“Another Look at Orthogonal Curvilinear Coordinates in Kinematic and Dynamic Analysis,” *Journal of Applied Mechanics*, 1991 (R. Huston, C. Liu).

“University of Cincinnati/Xavier University Engineering Design Clinic Quality Enhancement/Cost Savings Clinic Program,” *Proceedings, Conference Resource Book on Design in Mechanical Engineering*, (M. Brown and E. Seidman).

“University of Cincinnati Engineering Design Clinic Internship Program,” *1993 M.E. Department Heads Conference Resource Book on Design in Mechanical Engineering*, (M. Brown and E. Seidman).

“EGRD: Expert Gear Reducer Designer,” *Proceedings, 6th International Conference on CAD/CAM Robotics & Factories of the Future*, August 19-22, 1991, (London) T. Boronkay, M. Brown, G. Vanderhorst).

“Establishing Performance Indicators,” Time Compression Management Seminar/Workshop, Institute of Industrial Engineers, Cincinnati, OH, February 24-25, 1992 and San Jose, CA, March 30-31, 1992 (R. Shell).

“Automobile Crash-Victim Modeling and Simulation - A Comprehensive Analysis,” presented at the 23rd Annual Pittsburgh Conference on Modeling and Simulation, Pittsburgh, PA, 1992 (R. Huston and Ming-Yi Wu).

# **APPENDIX C**

## **Listing of Graduates**

<b>Name</b>	<b>Date Degree Awarded</b>	<b>Degree Received from Program</b>	<b>Current Employment Status</b>
David Powell*	12-96	MS (IE)	Project Mgr.
David Roark*	12-96	MS (IE)	Plant Engineer
Frank Bachman	6-97	MS (IE)	G.E. Project Engineer
William Barone*	6-97	MS (IE)	Ph.D. Student
Juan Rodriquez*	3-97	MS (IE)	Project Engineer
Barbara Miller	8-97	MS (IE)	Mgr. EH & Safety
Omar Mohamed	6-97	PhD (IE)	Part-time teaching
Jeff Garascia	12-96	PhD (IE)	Senior Research Engineer
Randolph Minnich*	6-95	MS (ME)	General Electric Aircraft Engines
Flavio Penteado*	6-95	MS (Che)	Rhome Poulene Process Safety Engr.
Riyad Shamma*	6-95	MS (IE)	Self employed Consultant
Michael Skalski*	6-95	MS (ME)	General Electric Aircraft Engines
Jeff Stiff*	6-95	MS (ME)	General Electric Aircraft Engines
Eric Weinholts*	6-95	MS (IE)	Belcan
Michael Cortez*	6-95	MS (IE)	Corporation in Minila
Luz Hernandez*	6-95	PhD (IE)	Corpovan
Parimal Kopardekar*	6-95	PhD (IE)	SDRC
Tim Miller*	6-95	MS (IE)	Western Atlas
Gary Weckman*	6-96	PhD (IE)	Assistant Professor of IE Texas A&M Univ.-Kingsville

<b>Name</b>	<b>Date Degree Awarded</b>	<b>Degree Received from Program</b>	<b>Current Employment Status</b>
Ehap Sabri*	6-96	MS (IE)	PhD Student in IE University of Cincinnati
Nicholas Photopolous*	8-96	MS (IE)	Seeking Employment
Ali Alhemoud*	3-96	PhD (IE)	Employed in Kuwait
Wanek Golnazarian*	12-95	PhD (IE)	Assistant Professor University of Vermont
Lin Guo*	12-95	PhD (IE)	Assistant Professor Xavier University
Lu Hernandez*	12-95	PhD (IE)	Safety Engineer Corpoven, S.A.
Gary S. Earnest, P.E.*	8-96	MS (IE)	Industrial Engineer NIOSH
Michael Gressel, CSP*	8-96	MS (IE)	Chemical Engineer NIOSH
David Roard*	6-96	MS (IE)	Plant Engineer Sumitomo Brake Systems
Michael Russo*	6-96	MS (IE)	Industrial Engineer Fujitec, Inc.
Howard Etkind, CSP*	3-96	MS (IE)	Safety Engineer U.S. Dept. Of Energy
Barbara Lantry-Miller	8-96	MS (IE)	Manager, EH&S Michelman, Inc.
Andrew Park	6-96	MS (IE)	Quality/Safety Engineer Rittal Corp.
Stefan Duma	6-96	MS (IE)	PhD Student (ME) University of Virginia
Awaad Dababneh	12-95	MS (IE)	PhD Student (IE) University of Cincinnati
Stephen Bickel	3-96	MS (IE)	Ergonomics Engineer Universal Energy Systems
David Powell	8-96	MS (IE)	Technical Leadership G.E. Aircraft Engines
Sharon Yee	8-96	MS (ME)	EHS Associate G.E. Aircraft Engine Co.

Name	Date Degree Awarded	Degree Received from Program	Current Employment Status
Eric Weinholts	12-95	MS (IE)	Engineer Belcan Engineering
William Rainey	8-96	MS (IE)	Design Engineering Fluor Daniel, Inc.
Rafael Bluyut*	12-93	MS (IE)	PhD Student
Ron Bartos, CSP,P.E.*	6-94	MS (IE)	Senior Safety Engr. FERMCO
Jim Biaglow	6-94	MS (IE)	Cincinnati Milacron
Robert Brokamp*	6-94	MS (IE)	Senior Engineer Jacobs Engr.
Tim Copeland*	6-94	MS (IE)	Engineer BF Goodrich Aero.
John Cottrill*	6-94	MS (ME)	Lehr Precision, Inc.
Jeff Feiler	12-94	MS (IE)	Design Engineer Davidson Crane & Conveyor
Jeff Garascia	12-93	MS (IE)	PhD Student at UC
Luz Hernandez*	6-94	MS (IE)	Corpoven
Bill Heyser*	6-94	MS (IE)	***
Jeff Heyser*	6-94	MS (ME)	Hill-Rom
Eric Martin*	6-94	MS (IE)	General Electric Aircraft Engines
Viorel Moga*	6-94	MS (ME)	***
Umee Mustag*	6-94	MS (ME)	***
Faisal Qureshi*	6-94	MS (ME)	***
Riyad Shamma*	6-94	MS (IE)	PhD Student at UC
Christin Shoaf*	6-94	MS (ME)	PhD Student at UC
Philip Stuebbe	6-94	PhD (IE)	Consultant
Desmond Wai*	12-94	MS (IE)	***
Mark Wanek*	6-94	MS (CE)	Manager G.E. Aircraft Engine
James Boeksen*	6-93	MS (IE)	Procter & Gamble
Michele Daniel	6-93	MS (ME)	Belcan Engineering

<b>Name</b>	<b>Date Degree Awarded</b>	<b>Degree Received from Program</b>	<b>Current Employment Status</b>
John Chudzik*	3-93	MS (ME)	Procter & Gamble
Mariali Falcon*	6-93	MS (IE)	Corpoven
Verna Fitzsimmons	12-92	MS (IE)	Assistant Professor IE
William Lucas	3-93	MS (IE)	PhD Student, IE
Stevan Talevski	12-92	MS (IE)	PhD Student, IE
Kimberley Sturdivant	12-92	MS (IE)	3-M Company
Sherry Gardner	9-92	MS (IE)	PhD Student
William Rainey	12-92	MS (IE)	PhD Student
Stevan Talevski	12-92	MS (IE)	PhD Student

## 5. HAZARDOUS SUBSTANCES ACADEMIC TRAINING PROGRAM

### A. BACKGROUND

The Hazardous Substances Academic Training (HSAT) program at the University of Cincinnati is an emphasis area within the Environmental and Industrial Hygiene program. Students selecting the HSAT area have two additional required courses and also attend a 40-hour health and safety class for hazardous waste site workers. Several other industrial hygiene courses have been strengthened in hazardous substance content and additional courses have been developed. The program therefore impacts all students taking industrial hygiene core courses, whether taking courses as part of their Environmental and Industrial Hygiene major or as electives. The HSAT program offers additional training in Biological Monitoring and Risk Assessment for those students pursuing the HSAT program as an area of concentration or who select these courses for other reasons. Although the HSAT program is officially a part of the M.S. degree program, these courses are also taken by the students pursuing the Ph.D. degree in Environmental and Industrial Hygiene. Students in other programs in the Department of Environmental Health, in programs in epidemiology and toxicology, and elsewhere in the University of Cincinnati, particularly in Civil and Environmental Engineering and Mechanical, Industrial and Nuclear Engineering.

The existing required industrial hygiene course in Hazardous Waste Management has been strengthened through HSAT funding by the addition of a field trip to Northern Ohio to view active hazardous waste operations (a double-lined secure landfill for chemical wastes and an emergency response and remediation operation center) and by incorporation into the class of computer software such as those for the modelling of chemical releases into the air and ground-water and for risk assessment. A special laboratory exercise has been developed for a core industrial hygiene course where students make use of a chemical monitoring data set developed to simulate an actual industrial chemical release incident. Students attend hazardous waste worker training programs and related courses offered through the EPA-supported Haliburton-NUS training center located in Cincinnati or through one of the local programs in the NIEHS-supported hazardous waste worker training centers with which the Department of Environmental Health is involved such as the Midwest Consortium for Hazardous Waste Worker Training and the ICWUC Center for Worker Health and Safety Education. A formal course in worker training was approved by the University during 1996-97. Thus far there have been nine graduates of the program, two of which were in the 1996-97 academic year.

### B. ACADEMIC TRAINING

#### a. Goals and Objectives

The HSAT program is designed to enhance the hazardous substances content of training for all students in the Environmental and Industrial Hygiene program and to provide an option for those students who seek additional training in this area.

#### b. Need for Program

The faculty in the Environmental & Industrial Hygiene program came to the conclusion in 1985 that industrial hygiene students needed specific training in the hazardous substances and waste area and attempted to meet part of this need through establishing a course in Hazardous Waste Management as a

required course. Since that time we have received consistent feedback from students and documentation from professional organizations that such training is indeed very important for practicing industrial hygienists. Our advisory committee has indicated this need and recent graduates of the program who have been working for at least one year independently indicated the importance of the HSAT program to their professional practice. The questionnaires sent by the HHS Office of Inspector General in 1995 to selected graduates of industrial Hygiene programs of the Educational Resources Centers, revealed that respondents suggested that there should be "more courses in hazardous waste management".

### c. Training Program Plan

The HSAT plan consists of an enhancement of the hazardous substances content of existing required courses in the Environmental & Industrial Hygiene program ( Hazardous Waste Management and Air Sampling and Analysis I and II), requiring two additional courses for students selecting the HSAT option and encouraging all students, particularly those in the HSAT option, to attend forty-hour hazardous waste courses that are available at several locations in Cincinnati and the surrounding area. The two additional required courses are Human Biological Monitoring and Biomarkers and Applied Risk Assessment for Industrial Hygienists; the latter was developed especially for this program. In addition, formal courses in Effective Methods for Worker Health and Safety Training and Methods to Obtain Complete Occupational Histories have been developed and are available to students. Trainees are invited to participate in sessions at the Annual Trainer meeting sponsored by the Midwest Consortium for Hazardous Waste Worker Training.

### Recent Changes in the Program

An interactive Confined Spaces CD-ROM was acquired through the HSAT program and examined by several students and faculty. It was used in the required course in Basic Industrial Safety in the Spring Quarter of the last academic year. This CD-ROM was demonstrated at the meeting of industrial hygiene programs in Charleston, S.C. in February 1997 that was organized by Drs. Clark and Rice. New software for risk assessment, SmartRisk, was purchased and used in the Hazardous Waste Management class. It is also being considered for use in a presentation by us in the new Master of Industrial Hygiene program at the BVM Engineering College in India. The Crystal Ball software that allows distribution of population parameters and exposure conditions to be used in risk assessments has been purchased and integrated into courses. During Winter Quarter 1997 a laboratory demonstration of Level A personnel protective clothing and direct reading instruments methods to characterize site exposures was presented by staff at the EPA-supported hazardous materials training center for the Air Sampling and Analysis II class. A similar session that also included radiation monitoring exercises has been made for students in the Hazardous Waste Management class.

### Plans for Future

A module on air contamination resulting from hazardous chemical releases using available software will be developed for use in other locations such as in the Masters in Industrial Hygiene program in India. In the Hazardous Waste Management class an example using an episode similar to the Bhopal disaster as a case study will be considered. The module will be prepared in a form that is suitable for use with distance learning methods. The use of electronic resources will be expanded to include access to a variety of models for the examination of releases to air and water environments. Plans will be developed for more suitable space for the student computer laboratory which now occupies two small adjacent rooms.

A session on hazardous substances Internet resources was developed for the Environmental and Industrial Hygiene students course and has been conducted at the Health Sciences Library by their staff. Listings of relevant web sites have been also developed by Drs. Clark and Rice and is being constantly updated. Resource listings identified through the Midwest Consortium for Hazardous Waste Worker Training are also available to the class.

### Curriculum

The curriculum in the HSAT option within the Environmental & Industrial Hygiene program is shown below, first as the listing of required courses by quarter of the academic year, and then as a listing of electives in the quarter that they are offered.

## ENVIRONMENTAL AND INDUSTRIAL HYGIENE PROGRAM FOR MASTER OF SCIENCE DEGREE

Required Classes with Hazardous Substance Option or Expanded Through the  
HSAT Program Are in Bold Type

Quarter	Course	Number	Credits
Autumn Year 1	Environmental Health Seminar	26-904-701	1
	Environmental Hygiene & Safety Technology	26-904-707	3
	<b>AIR SAMPLING &amp; ANALYSIS I (modified)</b>	26-904-741	3
	Introduction to Occupational Health	26-904-781	1
	Introduction to Physiology	26-904-785	3
	Introduction to Biostatistics	26-904-787	4
	Occupational Health, Hygiene & Safety Workshop	26-904-819	1
	Special Topics in Industrial Hygiene	26-905-981	2
	The Occupational Health & Safety Team	29-566-815	1
			19
Winter Year 1	Environmental Health Seminar	26-904-702	1
	<b>AIR SAMPLING &amp; ANALYSIS II (modified)</b>	26-904-742	3
	Industrial Ventilation	26-904-779	3
	Environmental Toxicology	26-904-782	3
	Physical Aspects of the Environment	26-904-790	3
	Occupational Health, Hygiene & Safety Workshop	26-904-820	1
	Industrial Hygiene and Safety Practice	26-904-905	3
	Team Building in Occupational Health and Safety Settings	29-566-816	1
			18
Spring Year 1	Environmental Health Seminar	26-904-703	1
	Aerosol Measurement	26-904-743	2
	Industrial Hygiene and Safety Laboratory	26-904-775	3
	Introduction to Epidemiology	26-904-776	3
	Principles of Ergonomics	26-904-792	3
	Occupational Health, Hygiene & Safety Workshop	26-904-821	1
	Basic Industrial Safety	26-904-873	2
	Electives		

Summer Year 1	Environmental and Industrial Hygiene Internship (Optional)		
Autumn Year 2	Environmental Health Seminar	26-904-701	1
	Teaching Practicum in Environmental Health <sup>a</sup>	26-904-725	1 (min)
	Occupational Health, Hygiene & Safety Workshop	26-904-819	1
	<b>HAZARDOUS WASTE MANAGEMENT (modified)</b>	26-904-834	2
	Health Physics I	20-252-640	3
	Research	26-904-891	Var
	Electives		
Winter Year 2	Environmental Health Seminar	26-904-702	1
	Ethics in Research	26-950-730	1
	Occupational Health, Hygiene & Safety Workshop	26-904-820	1
	<b>SPECIAL TOPICS-APPLIED RISK ASSESSMENT<sup>b</sup></b>	26-904-891	3
	Research	26-904-891	Var
	Electives		
Spring Year 2	Environmental Health Seminar	26-904-703	1
	<b>RISK ASSESSMENT<sup>b</sup></b>	26-904-987	4-5
	<b>HUMAN BIOLOGICAL MONITORING &amp; BIOLOGICAL MARKERS</b>	26-904-843	3
	Occupational Health, Hygiene & Safety Workshop	26-904-821	1
	Research	26-904-891	Var
	Electives		

- a) May be taken any quarter Year 2.  
b) A student needs to register for only one of these two courses.

## ELECTIVES

### HAZARDOUS SUBSTANCE OPTION IN ENVIRONMENTAL AND INDUSTRIAL HYGIENE PROGRAM FOR MASTER OF SCIENCE DEGREE

Quarter	Course	Number	Credits
Autumn	Chemical Principles of Environmental Systems	20-257-647	4
Autumn	Instrumental Methods of Analysis of Pollutants I	26-904-901	3
Autumn	Methods to Obtain Complete Occupational Histories (p)*	26-904-845	2
Winter	Environmental Issues in Geotechnical Engineering	20-257-632	3
Winter	Environmental Biology & Microbiology Laboratory	20-257-650	1
Winter	Introduction to Air Pollution and Its Control	20-257-661	2
Winter	Meteorological Dispersion Modeling	20-257-668	3
Winter	Public Policy and Environmental Health	26-904-750	2
Winter	Energy & Environment	26-904-772	1
Winter	Instrumental Methods of Analysis of Pollutants II	26-904-902	3
Winter	Effective Methods for Worker Health and Safety Training	26-904-846	2
Spring	Management of Professionals	20-265-640	3
Spring	Advanced Topics in Environmental Water Quality	20-257-652	3
Spring	Basic Principles of Law	20-257-657	3
Spring	Hazardous Waste Disposal	20-257-721	3
Spring	Energy & Environment	26-904-772	1
Spring	Environmental Quality Management	26-904-835	2
Spring	Instrumental Methods of Analysis of Pollutants III	26-904-903	3
Spring	Effective Methods for Worker Health and Safety Training	26-904-846	2
Summer	Quality Control and Quality Assurance in Environmental Toxicology & Chemistry	26-904-749	3

(p) permission of instructor

\*may be taken any quarter.

#### d. Trainees and Recruitment Methods

There are usually four students enrolled in the HSAT option within the Environmental & Industrial Hygiene Master of Science program: two second year students and two first year students. These students are recruited from among the applicants to the Environmental & Industrial Hygiene program based on interest expressed by the applicants.

To publicize the HSAT program, the recruitment brochure for the Environmental & Industrial Hygiene has been modified to include a description of the HSAT option. The HSAT Advisory Committee also helps to increase awareness of the program.

e. Program Management Leadership and Staff

The program is under the overall leadership of the primary faculty involved with the HSAT program: Scott Clark, Ph.D. PE, CIH (Director), Carol Rice, Ph.D., CIH (Deputy Director), Jon Reid, Ph.D., DABT and Glenn Talaska, Ph.D. CIH. The specific roles of these and other faculty in the program are indicated in the following table.

**CORE, SUPPORTING AND ADJUNCT FACULTY**

NAME	AFFILIATION	AREA OF COMPETENCE
<b>CORE FACULTY</b>		
Scott Clark, PhD, PE, CIH	Env'l Health, Univ Cinti	Haz Waste Management
Jon Reid, PhD, DABT	Env'l Health, Univ Cinti	Risk Assessment
Carol Rice, PhD, CIH	Env'l Health, Univ Cinti	Exposure and Worker Trng
Glenn Talaska, PhD, CIH	Env'l Health, Univ Cinti	Biological Monitoring
<b>SUPPORTING FACULTY</b>		
Roy E. Albert, MD	Env'l Health, Univ Cinti	Risk Assessment
Stuart Baxter, PhD	Env'l Health, Univ Cinti	Toxicology
Milovan Beljin, PhD	Civil/Env'l Eng, Univ Cinti	Ground-water Modelling
Amit Bhattacharya, PhD	Env'l Health, Univ Cinti	Biomech.-Ergonomics
Eula Bingham, PhD	Env'l Health, Univ Cinti	Policy & Admn./Toxicol.
Ralph Buncher, PhD	Env'l Health, Univ Cinti	Biostatistics
Peter Gartside, PhD	Env'l Health, Univ Cinti	Biostatistics
Sergey Grinshpun, PhD	Env'l Health, Univ Cinti	Aerosol Science
Judy Jarrell, EdD	Env'l Health, Univ Cinti	Cont Educ-Haz Waste & Lead Inspection/Supervisor
Grace Lemasters, PhD	Env'l Health, Univ Cinti	Epidemiology
Douglas Linz, MD, MS	Env'l Health, Univ Cinti	Occupational Medicine
James Lick, MD, MS	Env'l Health, Univ Cinti	Occupational Medicine
Roy McKay, PhD	Env'l Health, Univ Cinti	Respiratory Studies
Wm. Menrath, MS	Env'l Health, Univ Cinti	Lead Abatement/Haz Waste
Susan Pinney, PhD	Env'l Health, Univ Cinti	Epidemiol/Work Histories

Tiina Reponen, PhD	Env'l Health, Univ Cinti	Aerobiology
Eugene Spitz, PhD	Nuclear Engr, Univ Cinti	Health Physics
Paul Succop, PhD	Env'l Health, Univ Cinti	Biostatistics
Wilson Tabor, PhD	Env'l Health, Univ Cinti	Haz Waste Bioremed.
Klaus Willeke, PhD, CIH	Env'l Health, Univ Cinti	Aerosol Science
<b><u>Adjunct Faculty</u></b>		
Richard Boehnke, RS	Toronto (Ont) Public Hlth Dept	Lead Abatement
Richard Fulwiler, ScD, CIH	Technology Leadership Associates	Occupational Health
Paul Jensen, PhD, CIH	NIOSH	Chem Release Models
John Pesce	Star Industries, Melrose, MA	Lead Abatement
James Romine, MS, CIH	PRC Env'l Management, Inc.	Haz Waste-Cont Educ
David Utterback, PhD, CIH	NIOSH	Radiation Studies
Thurman Wenzel, PhD, CIH	NIOSH	Non-ionizing Radiation

An External Advisory Committee meets annually with HSAT faculty and students to review the program (Attachment A - List of Members).

The commitment, breadth, reputation and strength of many of these faculty are described elsewhere in this report (Industrial Hygiene and Occupational Medicine).

#### f. Program Evaluation

Courses are evaluated each quarter and the results are shared with the instructor and other program faculty. In addition, program graduates occasionally communicate to us how the program as a whole has been useful to them. Other alumni of the Environmental and Industrial Hygiene program are periodically solicited for comments on the program and suggestions sought on its improvement. The opinions of the External Advisory Committee on the program's content and overall productivity are also sought. The agenda and minutes for the 1997 meeting of this committee are included (Attachment B).

#### g. Program Support for Other Areas

The program has considerable support from other areas such as the NIEHS-supported Midwest Consortium for Hazardous Waste Worker Training, headed by Carol Rice, Ph.D., CIH, Deputy Director of the HSAT program. The University of Cincinnati provides tuition scholarships for all full-time students in the program who receive NIOSH HSAT stipends. During the 1996-97 year, for example, faculty from the Environmental and Industrial Hygiene program were Principal Investigators on research

grants/contracts for a total of about \$2,700,000 and on training grants/contracts with a total of \$1,800,000. Much of this effort is used to directly or indirectly support the HSAT program.

Faculty are involved in numerous other projects for which they are co-investigators. For example, Dr. Eula Bingham has three research projects at DOE sites including development of work histories of construction trades employers. At both Hanford and Oak Ridge, the work will lead to a system for using site characteristics of potential hazards and work histories obtained by interview to determine medical surveillance needs for workers. Drs. Rice, Pinney (Epidemiology) and Succop (Biostatistics) collaborate on these hazardous substances projects.

ATTACHMENT A

HAZARDOUS SUBSTANCE ACADEMIC TRAINING  
EXTERNAL ADVISORY COMMITTEE

Nadine Grady  
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1600 Gest St.  
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Fred Halvorsen, PhD., PE, CIH  
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John S. Morawetz, Director  
ICWU Center for Worker Health and Safety Education  
329 Race Street  
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(513) 621-8882

Bruce Potoka  
Project Officer  
Environmental Response Training Program  
U.S. Environmental Protection Agency  
Cincinnati, OH  
(513) 569-7537

Thomas H. Row  
Senior Staff Assistant to Laboratory Director  
Oak Ridge National Laboratory  
P.O. Box 2008  
Oak Ridge, TN 37831

**HAZARDOUS SUBSTANCES ADVISORY COMMITTEE**

**MINUTES OF JANUARY 20, 1997 MEETING**

**Hazardous Substances Academic Training (HSAT) Faculty Present:  
Scott Clark, Carol Rice, Glenn Talaska**

**Current and Former Students Present:**

**Krystyn Bussa, 1st Year  
Joshua Harney, 1st Year  
Christine Newman, 2nd Ye  
Regina McCartney, Graduated 1996  
Laurel Kincl, 2nd Year**

**Others:**

**Steve Rucker, 1993**

**The meeting was held in the Vernon Manor Hotel and was called to order at 4 P.M. by Scott Clark.**

**An agenda (attached), a draft of which had been previously distributed, served as the outline for the discussions. Also distributed with the agenda was a copy of the summary sheet of the recent five-year competitive renewal of the program, the curriculum, an outline of the new Worker Training course, a listing of the graduates of the program and outline of the upcoming meeting of all NIOSH-supported HSAT programs (copies attached).**

## Review of Five Year Competitive Renewal

A copy of the summary sheet for the most recent review of the University of Cincinnati HSAT program was distributed and areas where the Advisory Committee input was needed were highlighted. Among these areas were: needs assessment to determine whether 2-3 graduates per year were adequate and evaluation of program. Since four of the eight total graduates of the program have positions outside the region, it is evident that more than a regional market is being served. One of the four, however, was promoted from a position within the region to a facility of the same company on the West Coast. Only one of the eight was currently in a position that was exclusively in the Hazardous Substances area, the others had industrial hygiene positions with some hazardous substances responsibilities. (Note: at a recent meeting of all of the NIOSH-supported HSAT programs, it became evident that the vast majority of HSAT graduates have hazardous substances responsibilities as only a part of their job).

Members of the Committee questioned the students concerning adequacy of the curriculum and whether there were courses they would like added or modified.

Risk Assessment While risk assessment was thought to be very important, the view was expressed that less emphasis should be placed on pharmacokinetics and more on applications. (Note: the pharmacokinetics-oriented risk assessment course will probably not be offered in the future because the responsible faculty member is retiring and another major contributor suddenly passed away earlier this academic year. The Applied Risk Assessment course, developed specifically for the HSAT program, will continue). Dr. Row offered the services of Oak Ridge National Laboratory contractor personnel to either present a series of application-oriented sessions at the University or as an alternative, we could plan a visit to Oak Ridge. Faculty will follow-up on this offer.

Laboratory Equipment Students expressed some concern that some laboratory equipment, particularly of the direct-reading variety, was not as available for laboratory courses as desired. The Advisory Committee suggested that manufacturer representatives be contacted for on-campus demonstrations. Another suggestion was that attendance at the AIHCE be used to visit the exhibits which have traditionally displayed the latest such equipment available. In recent years Bruce Potoka has facilitated the conduct

of hands-on demonstrations and mini-labs involving direct reading instruments at their training center in Cincinnati during the annual visit by the Hazardous Waste Management class. He offered to expand this portion of the visit to the training facility. A visit to the facility for demonstrations of equipment is currently planned for another class in the regular IH curriculum: Air Sampling and Analysis II (Note: in later discussions faculty expressed the view that sometimes more learning can occur with a demonstration that involves an older piece of equipment where the principles of operation are more evident than through many of the newer "black box" units.)

**Safety and Ergonomics** There was general agreement among all present that safety and ergonomics were very important elements in the curriculum that were especially important in the hazardous substances area. Safety problems, often aggravated by ergonomic-related situations, accounted for the majority of health problems in the hazardous materials area. A recommendation was made that the safety training elements of the program be enhanced. The thesis project of Laurel Kincl, involving a postural stability study of workers wearing protective clothing, was discussed. This research will be conducted with the cooperation of the USEPA at their Cincinnati Training Center.

**Recent Changes in the Program** The Applied Risk Assessment class, offered for the first time in 1996, was briefly discussed. Carol Rice presented elements of the new worker training course (outline attached) which takes advantage of local experience and resources such as the ICWU Worker Training Center, directed by Advisory Committee member John Morawitz. This course is very innovative and will be very important for HSAT students; it was agreed that worker training will be an increasingly important responsibility for many industrial hygienists, especially those involved with hazardous substances where training requirements were among the most stringent. Glenn Talaska discussed the chemical spill exposure scenario that has been added to one of the required lab classes. This scenario integrates statistical data analysis with use of spread sheets for a reality-based exposure situation.

**Report on Graduates** Regina McCartney briefly discussed her position with a national consulting company with a local office. Faculty discussed briefly the positions of other graduates and our communications with them. Their HSAT training had helped each of them in their jobs and they often had substantially more

**training in this area than other recent hires of their employers, putting them at an advantage for promotions and new responsibilities.**

**Currently enrolled students Each of the four current students had a few comments and discussed their relative position in the program, their overall satisfaction with it and their plans.**

**Other Topics A very important part of the Hazardous Waste Management class in recent years has been the visit to the OHM facility in Findlay Ohio where they are able to see a number of important elements of emergency response and remedial action. This visit is coupled with a trip to a RCRA chemical landfill operated by Envirosafe near Toledo, Ohio.**

**Date of Next Meeting A meeting next year at about the same time and with the same format was suggested. Members of the Advisory Committee reiterated their offers to help. They were thanked for their attendance and overall support of the program.**

**The meeting was adjourned at about 6 p.m.**

## **6. OVERVIEW AND CENTER ADMINISTRATION**

### **A. INTRODUCTION**

Since its inception the Cincinnati Education and Research Center (ERC) has provided education, consultation, community service and research to workers, employees and citizens drawn from a catchment area including much of the Midwestern United States. The ERC at the University of Cincinnati true to the Center concept has a full complement of Core Programs. This Center provides multidisciplinary programs for academic and research training in the major fields of Occupational Safety and Health and related disciplines and Continuing Education/Outreach. These disciplines include: Occupational Medicine, Occupational Health Nursing, Industrial Hygiene, Occupational Safety and a Hazardous Substances Academic Training Program within Industrial Hygiene. All core educational units provide curricula not only for their own graduate students but contribute significantly to the teaching and research experiences of students in all programs. This interdisciplinary aspect of the ERC is the keystone of productive occupational and environmental health education, research and service. The interdisciplinary interactions are summarized for the ERC in a central location of this application in the Center Administration narrative.

### **B. ADMINISTRATION OF THE CENTER**

The administrative functions of the University of Cincinnati Education and Research Center are carried out through the Center Director, Deputy Director, the Senior Business Administrator, and the individual Program Directors. Dr. Scott Clark was named Center Director in 1994 following the retirement as Department Director by Dr. Roy E. Albert who had been Director of the Educational Resource Center since his arrival in 1985 to become Director of the Department of Environmental Health. Dr. Scott Clark, Industrial Hygiene Program Director since 1988, was the Deputy Director of the ERC under Dr. Albert for four years. Douglas Linz, M.D., Director of the Occupational Medicine program has served as Deputy Director. Mary Susan Zavos serves in the capacity of senior business administrator and Ms. Jean Malone served as applicant and student records staff for the ERC.

A new Director of the Department of Environmental Health has assumed leadership, Marshall Anderson, Ph.D., effective in late June 1996. Dr. Anderson was previously a member of the Cancer Center of the University of Colorado Health Sciences Center and Director of Research at the Cancer Research Institute of St. Mary's Hospital in Colorado. Prior to moving to Colorado he was the Chief of the Laboratory of Molecular Toxicology at the National Institute of Environmental Health Sciences. His major research interests are the role of oncogenes and tumor suppressor genes in lung cancer, the identification of susceptibility genes in human lung tumor development, and the early detection of lung cancer. He has a strong background in numerous areas that will promote continued excellence in the Department of Environmental Health, and will strengthen the cancer programs. Dr. Anderson has expressed a goal to increase occupational and environmental epidemiology studies that bring together the exposure assessment, occupational medicine, epidemiology, biostatistics and molecular genetic strengths of the Department.

The ERC Director, with the help of the Deputy Director, maintains continuous communication with the individual programs. The Director has ultimate responsibility for the proper development and

effective function of each program. Each program, however, functions with relative independence under the leadership of its own Program Director. The Center Director and Program Directors collectively make all major policy decisions including teaching staff, research programs, curriculum development, program planning and implementation, allocation and utilization of funds, coordination of teaching and research efforts and program review and evaluation. Periodic meetings are held for these decisions as well as to facilitate communication.

The Senior Business Administrator and other staff manage the financial operation of the ERC Center, prepare and maintain budgets of all component programs and advise the program directors on the fiscal aspects of each respective program.

### **C. EXTERNAL ADVISORY COMMITTEE**

An External Advisory Committee has been established for the Center composed of individuals selected because of their specific knowledge of particular academic core(s), their interdisciplinary experience or because they represent a broader constituency, such as organized labor. The individual core programs also have frequent interactions with members of the Committee. The current composition of the External Advisory Committee is shown in Attachment A.

### **D. OUTSIDE SUPPORT TO SUPPLEMENT THE ERC**

Outside support to supplement the ERC is obtained from research grants and contracts, special training grants for the Continuing Education program, from private contributions and from the University. The University provides University Graduate Scholarships, for example, that are available for industrial hygiene, occupational medicine, occupational health nursing and occupational safety students. A limited number of University Graduate Assistantships are also available. The Department of Environmental Health established a policy to supplement stipends for Ph.D. students up to \$11,000/year for 1995-96, \$12,000 for 1996-97 and \$15,000 per year for 1997-98. The supplemental funds are provided through grants and contracts available to the faculty and for the first two years of the Ph.D. program by University funds.

### **E. INDIVIDUAL PROGRAMS AND LOCATIONS**

This ERC is located on the contiguous East and West campuses of the University of Cincinnati. The Industrial Hygiene and Occupational Medicine Programs are located in the Department of Environmental Health of the College of Medicine; and the Occupational Health Nursing Program is located in the Department of Community Health Nursing in the College of Nursing and Health. Both of these colleges are located in the large Medical Center complex (East Campus) comprised by the Colleges of Medicine, Nursing and Health, and Pharmacy, three component University hospitals--The General Division, the C.R. Holmes Division and the Children's Hospital Medical Center. The Occupational Safety Program is located in the Department of Mechanical, Industrial, and Nuclear Engineering of the College of Engineering on the West Campus, approximately one mile from the Department of Environmental Health. The College of Nursing is midway between the College of Engineering and the Department of Environmental Health.

All trainees are able to avail themselves of course offerings of other University colleges, e.g.: Business Administration and Law, and other local universities, e.g.: Xavier University, through a consortium among institutions of higher education in the Greater Cincinnati area.

## **F. NEW PROGRAM DEVELOPMENT**

Dual programs in Occupational Safety and Ergonomics has been developed which involves both the Department of Environmental Health and the Department of Mechanical, Industrial and Nuclear Engineering. Students are able to enter the programs through either Department depending on their background and interests. Courses are taken from both Departments. One of the industrial hygiene stipends for the year 1996-97 was used for a student with these interests who applied through the Department of Environmental Health. Thus far two students have completed this program, taking courses from programs of both Departments!

Two new courses were recently developed "Effective Methods for Worker Health and Safety Training" (2 gr. cr.) and "Methods to Obtain Complete Occupational Histories". The latter course will be offered jointly by faculty of two of the ERC programs: Dr. Doug Linz (Occupational Medicine), Drs. Carol Rice and Glenn Talaska (Industrial Hygiene) and by Dr. Susan Pinney (Epidemiology). These courses are described in more detail in the Industrial Hygiene Program section.

The Hazardous Substances Academic Training Program was initiated shortly after the start of the five-year period covered in this report. Much of its development occurred during this reporting period.

The Occupational Health Nursing Program has developed a Research Training Component. This is in recognition of the need to prepare nurses at the doctoral level to advance the knowledge base in occupational health nursing. In particular, this program will focus on research in disorders of reproduction, youth in the workplace and musculoskeletal/traumatic injury. Dr. Douglas Linz of the Occupational Medicine program and Dr. Ash Genaidy from Industrial Engineering, will work closely with Dr. Sue Davis on this research training program. The first student to graduate from the Ph.D. program, Karen Martin, received her degree in June 1994.

## **G. INTERDISCIPLINARY INTERACTION**

Interdisciplinary interaction is enhanced by the ERC components being in close proximity to each other, by the Center being based in a comprehensive Department of Environmental Health which also contains faculty in other disciplines involved in occupational safety and health such as biostatistics, epidemiology and toxicology and by the close interaction among the faculty.

The students in the four core academic programs are involved in interdisciplinary interactions on several levels through classroom, research and field experiences:

- the interdisciplinary workshop series,
- research projects involving interdisciplinary interactions among faculty, students and staff,

- academic courses with students from other occupational safety and health disciplines,
- clinic and field projects and worker training activities.

### Interdisciplinary Workshop

All students in the core academic programs participate in the three-quarter Occupational Health, Hygiene and Safety Workshop which is offered for one graduate credit each quarter. The goal of this workshop is to enhance the ability of the trainees to work effectively in small interdisciplinary groups. This is accomplished through a series of seminars by interdisciplinary teams of occupational safety and health professionals, from local industries, through small group discussions and through projects that the teams select and work on throughout the year. The teams are composed of at least one trainee from each of the four core disciplines wherever possible; a faculty member from one of the cores serves as advisor. During the Spring Quarter final reports are presented by the teams with each participant being involved in the presentation. During most of this reporting period second year industrial hygiene students served as facilitators during their second year. A recent evaluation of the workshop resulted in recommendations to increase the number of credits to two per quarter and require the workshop for only one year for each student. Topics of the workshop projects from recent years are as follows:

A Noise Characterization of the Atrium, Dept. of Environmental Health  
 Analysis and Evaluation of Hazards Involving Carpet Installation  
 Assessment of University Hospital Utility Plant  
 Ergonomic Assessment Pilot Study in the University Hospital Cafeteria  
 Health and Safety Evaluation of a Hospital Laundry Facility  
 Health and Safety Evaluation of the University of Cincinnati's College Conservatory of  
 Music Parking Garage  
 Noise Assessment and Control Project  
 Ral Partha Enterprises, Inc.  
 Survey of a Cosmetology Facility at Southern Hills Joint Vocational School  
 The Mason-Deerfield Joint Fire District

Research projects involving interdisciplinary interactions include the following:

**Refractory ceramic fibers study:** Study of health effects of current and former workers at US plants focussing on respiratory system (morbidity and mortality) and exposure assessments.

Faculty involved: Lockey (Occupational Medicine), Rice (Industrial Hygiene) and Lemasters (Occupational Epidemiology). ERC students involved: P. MacKinnon, G. Hall, C. Hughes, T. Buchta (Industrial Hygiene) and D. McKimm (Occupational Medicine).

**Chem Lawn Study** Cross-sectional health study of current residential pesticide applicators. Faculty involved: Linz and Suskind (Occupational Medicine), Rice (Industrial Hygiene) Bhattacharya (Industrial Hygiene & Ergonomics). Students involved: David Sack (Occupational Medicine).

NIOSH-supported Study of Ergonomics of Task Performances on Slippery Surfaces This study, conducted in the collaboration with the Greater Cincinnati Occupational Health Center, involves a Ph.D. student in Occupational Safety (Bingshi Wang) advised by Amit Bhattacharya (Industrial Hygiene) with other committee members from the Occupational Safety program (Drs. Shell, Simmons and Arantes). Mr. Wang has completed all of the courses in the Occupational Safety and Ergonomics tracks in both the Occupational Safety and Industrial Hygiene programs. He recently had a manuscript based on his research accepted for publication. A June 1996 Ph.D. graduate in Industrial Hygiene (Shiow-Yi Chiou) recently completed her doctoral dissertation on this project with a committee composed of Drs. Bhattacharya and Succop (Biostatistics).

Cumulative Trauma Disorders in Carpenters. This five-year NIOSH-supported study (Lemasters-Occ Med-PI) has had three M.S. theses projects in Industrial Hygiene completed with research under the overall direction of Amit Bhattacharya, Ph.D. (Industrial Hygiene) and also involving Grace Lemasters, Ph.D. (Occupational Medicine/Epidemiology) and Margaret Atterbury, M.D. (GCOHC, Occupational Medicine), students James Warren, Lisa Greathouse (Warner) and Kim Bostic (Industrial Hygiene).

Three Occupational Medicine residents (Kuo Wei, M.D., David Sack, M.D. and Donna Pratt, M.D.) have recently conducted research in Dr. Bhattacharya's laboratory with other committee members including Doug Linz, M.D. (Occupational Medicine)

Longitudinal Prospective Pulmonary Study of Paper Products Workers. This five-year industry-funded study involves Anne Like (Occupational Medicine) and a multi-disciplinary faculty, Drs. Pinney (Nursing, Epidemiology) and Linz (Occupational Medicine) and Co-Principal Investigators Roy McKay, Ph.D. (Toxicology, James E. Lockey, M.D. (Occupational Medicine), Carol Rice, Ph.D. (Industrial Hygiene), Glenn Talaska, Ph.D. (Industrial Hygiene, Toxicology), Vicki Hertzberg, Ph.D. (Biostatistics and Linda Levin, Ph.D. (Biostatistics), Epidemiology).

US Air Force-supported Study of Personnel Exposed to Low Levels of Jet Fuel Two Industrial Hygiene M.S. students (Les Smith and Ed Puhala) are in the final stages of completing their research with interdisciplinary committees composed of Drs. Bhattacharya (Industrial Hygiene/Ergonomics), Lemasters (Occupational Medicine/Epidemiology) and Col. John Joyce (Industrial Hygienist-US Air Force).

Classroom and field activities provide important opportunities for student interaction. Each is outlined below.

### Classroom Activities

Many classes required of one or more ERC cores are attended by students from a variety of disciplines. For example the biostatistics and epidemiology classes serve students from many departments from across the University. Among the courses required or frequently taken by more students from more than one of the core occupational safety and health disciplines are:

Environmental Hygiene and Safety Technology (26-904-707): required by Industrial Hygiene, Occupational Safety, Occupational Medicine and Occupational Health Nursing.

Introduction to Occupational Health (26-904-781): required of industrial hygiene students and selected lectures are required by Occupational Health Nursing, Occupational Safety(elective)..  
Introduction to Physiology (26-904-785): Required by Industrial Hygiene, Occupational Safety (elective).

Air sampling & Analysis I (26-904-741). Required by Industrial Hygiene and Occupational Safety (elective).

Basics of Occupational Medicine (26-904-786). Required by Occupational Medicine, Industrial Hygiene (elective), Occupational Safety (elective).

Industrial Hygiene and safety Practice (26-904-905) Required by Industrial Hygiene, Occupational Safety (elective), Occupational Medicine (elective).

Hazardous Waste Management(26-904-834) Required by Industrial Hygiene, Occupational Safety (elective).

Survey of Environmental Toxicology(26-904-782) Required by Industrial Hygiene and Occupational Health Nursing.

Basic Industrial Safety (26-904-821) Required of Industrial Hygiene and Occupational Health Nursing, Occupational Safety (elective).

#### Clinic and Field Projects and Worker Training

An Occupational Nursing Ph.D. Student (Rachel Bachman) is currently performing a research elective in the Center for Occupational Medicine Clinic with Drs. Doug Linz and James Lockey on Occupational Sorccidosis: A Questionnaire Evaluation for her thesis.

The new course on Methods to Obtain Complete Occupational Histories will facilitate involvement of ERC and other students in activities of the Center for Occupational Health. Using the previous Special Topics mechanism several Industrial Hygiene students gained experience in occupational history-taking. This course is recommended as an elective for occupational health nursing students.

The Midwest Consortium for Hazardous Waste Worker Training and the ICWU Center for Chemical Worker Health and Safety Education both provide students with opportunities to interact with other occupational health and safety disciplines in the operation and evaluation of worker training activities. Examples of such activities are pretraining physicals provided by occupational medicine residents, observation of training delivery using participatory techniques and assistance with delivery of training. A number of students have also been involved in field projects with NIOSH staff and at the Greater Cincinnati Occupational Health Center (GCOHC).

#### Interdisciplinary Research Initiatives

Special student research initiative funds made available to ERCs by NIOSH were used to fund three interdisciplinary research projects during the last year of this reporting period and to enhance the projects

in the Occupational Health, Hygiene and Safety Workshop. A requirement for the research projects was that at least three occupational safety and health-related disciplines be involved. The projects funded were a study of take-home contamination of pesticides in migrant farm workers and their families in Northern Ohio, occupational health problems in a local shirt manufacturing facility and problems associated with exposure to lubricating oils in agricultural areas. Completion of those projects occurred after the current reporting period and results will be presented in later reports.

#### **H. MEETING REGIONAL NEEDS AND EVALUATION OF IMPACT OF PROGRAM**

Frequent contact with employers and with alumni assist us in constantly improving our program to make them more useful to regional, national and international needs. Each of the core programs have their own methods for program evaluations and through contact with each other, provide useful information regarding interdisciplinary needs. For example, interaction between Industrial Hygiene and Occupational Safety core faculty lead to the development of a joint Occupational Safety and Ergonomics program, meeting the needs of students applying to each of the core programs. Similarly, the need for more worker training expertise by occupational safety and health students, stimulated in part by the inclusion of worker training requirements in new regulations (e.g.: Hazardous Waste & Lead Abatement), resulted in the formal development of a course in Worker Training.

The employers of our most recent graduates are indicated in Appendix C for each core program.

ATTACHMENT A

EXTERNAL ADVISORY COMMITTEE

EDUCATIONAL RESOURCE CENTER  
UNIVERSITY OF CINCINNATI

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*George Gebus, M.D., MPH, FACOEM*  
*Office of Occupational Medicine*  
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*Ms. Nan Migliozi, R.N., M.S.N.*  
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*Mr. Dan Radford*  
*Executive Secretary-Treasurer*  
*AFL-CIO Labor Council*  
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*(513) 421-1846; FAX: (513) 345-8833*

*Ms. Harriet Applegate (ALTERNATE)*  
*Director*  
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## 7. CONTINUING EDUCATION/OUTREACH

### A. BACKGROUND

The Office of Continuing Education, Department of Environmental Health, University of Cincinnati College of Medicine continues the tradition begun in 1949 of offering short courses in environmental and occupational health and safety. Established in 1983, the Office of Continuing Education assumed the coordination of the administrative and marketing functions of the program, allowing faculty to concentrate their efforts on course development. Through this cooperative effort the Office of Continuing Education has built a national reputation for offering excellence in environmental/occupational health and safety short courses. Continuing education courses presented through this program are multi-faceted, ranging from one-day seminars on selected topics to four-week intensive training programs. These courses reflect the reputation, strength, and diversity of the ERC faculty.

The Office of Continuing Education offers courses in all four ERC core areas: occupational medicine, occupational health nursing, environmental/industrial hygiene, and occupational safety. The program is interdisciplinary, utilizing faculty from the College of Medicine, the College of Nursing and Health, the College of Engineering (both from the Clifton campus and Section Road facility), the University College Department of Math and Applied Sciences, and the College of Education. The role of the Continuing Education Office includes the development of new short courses, the coordination of interdepartmental continuing education programming, marketing, administration, and program evaluation. The Director of the Office of Continuing Education is Judy L. Jarrell, M.A., Ed.D., Field Service Associate Professor. The Cincinnati ERC/CE Office also handles the responsibility of the ERC/CE conference booth, which is displayed at four to five national conferences each year.

All ERC continuing education courses are developed with the expertise of course directors. Course directors are responsible for the technical content of their short courses and serve as principal instructors. The majority of course directors are members of University faculty. When appropriate, however, experts outside the University are utilized.

A formal ERC/CE Advisory Committee, formed in the Spring of 1996, works with the CE Director in strategic planning for marketing/advertising, course and instructor evaluations, new course development, and innovative directions for the program. Committee meetings are usually held in the form of conference calls. The following persons serve on this committee:

Glenn Markle, PhD, College of Education  
Kay Hayes, MPH, former ERC/CE Director  
Robert A. Herrick, PE, DEE, CIH, consultant  
Richard Fulwiler, ScD, CIH, consultant  
Douglas Linz, M.D., M.S., occupational physician  
Judith Pflaumer, R.N., OHN, occupational health nurse

## B. FACULTY COMMITMENT/BREADTH

The dedication and commitment of the faculty to continuing education is evidenced by the number of courses offered at least yearly. For example, our "Occupational Ergonomics" course is offered at least once yearly directed by Dr. Amit Bhattacharya of our Environmental & Industrial Hygiene core group. The "Survey of Industrial Hygiene" has been offered at least once yearly for several years. Many Environmental Health Department faculty members participate in this training course. "Introduction to Industrial Toxicology," directed by C. Stuart Baxter, PhD, of the Environmental Health Dept. faculty, has been offered at least once a year for the past six years. Asbestos and lead abatement courses, as well as OSHA safety courses, are offered several times throughout the academic year.

The "Occupational Medicine Training" course continues to provide training for physicians practicing occupational medicine. This program, directed by Douglas Linz, M.D., consists of a two-week session followed by two, one-week sessions taken over the span of a year. Eighty physicians are accepted into each session. The occupational medicine training program is nationally recognized for its excellence and the program has just celebrated its 50th anniversary.

Occupational Health Nursing short courses are offered both in the Department of Environmental Health and the College of Nursing and Health continuing education programs. Anita Finkelman, M.S.N., R.N., directs the College of Nursing and Health Continuing Education program. This program has presented nursing continuing education courses for over twenty years. Faculty participation in the past year includes: Ann McCracken, PhD, RNC, Peter Stern, MD, Donald Shrey, Ph.D., Christine Graeter, RN, MSN; and Patricia Wahl, R.N., Ph.D., among others (see table 1).

The development of new courses is also evidence of faculty commitment. For example, the following are some of the new courses which were developed and offered in the last five academic years:

- √ Create Opportunities for Success (for OHNs)
- √ Lead Inspection Training
- √ Fundamentals of Environmental H&S Compliance
- √ New Horizons in Safety Program Management
- √ Fundamentals of Occupational S&H Compliance
- √ OSHA Lockout/Tagout & Electrical Work Practice Standards
- √ Compliance Guidelines for ADA
- √ Occupational & Environmental Toxicology for Physicians
- √ Science for the Non-Scientist
- √ Asbestos Air Monitoring Technician
- √ Water Quality & Hazardous Materials Management
- √ Environmental Risk Assessments
- √ Use of Real-Time Instruments to Solve Industrial Hygiene and Ergonomic Problems
- √ Dealing With Workplace Politics (Nursing)
- √ OSHA Regulations (Nursing)
- √ Health Policy Topics (Nursing)
- √ Lead Inspector Refresher
- √ Lead Supervisor Refresher
- √ Lead Risk Assessor Refresher

- √ Using the Internet to Access Health & Safety Resources
- √ Human Performance Improvement: A Practical & Expanded Ergonomic Approach

In addition to developing new courses for the Cincinnati ERC, Drs. Scott Clark and Judy Jarrell, with the help of William Menrath of the Environmental Health Department, continue to work on the revision of the U.S.EPA-approved Lead Abatement Training for Supervisors and Contractors course curriculum. The grant for this work was expanded to include the development of the U.S.EPA-approved Lead Abatement Project Designer course, expected to be completed by Spring, 1998. Drs. Clark and Jarrell, and specialists William Menrath and John Pesce are working on the development of the course.

### **C. FACULTY REPUTATION STRENGTH**

#### **a. University Faculty (~52)**

[NOTE: Please refer to individual Program sections for a discussion of the reputation and strength of the University faculty utilized in continuing education short courses.]

In addition to the distinguished faculty listed above, and by the other Program Area Directors, several other University faculty play an integral role in the continuing education program. Judy Jarrell, M.A., Ed.D., in addition to directing the ERC/CE Program, instructs in several of the short courses and developed a train-the-trainer course in which she is the primary instructor. Dr. Jarrell's expertise in program development and evaluation, and regulated mandatory continuing education, is sought by state and national organizations for consultations. She is also active as a presenter at conferences in these topic areas (see "Outreach" section)..

Glenn Markle, Ed.D., from the College of Education, is the course director for "Science for the Non-Scientist" and assists Dr. Jarrell with instruction in the "Effective Training Techniques for Lead Abatement Trainers" course.

Steven Scheer, M.D., Director, Dept. of Physical Medicine & Rehabilitation, and Donald E. Shrey, Ph.D., Director, Disability Management in the Dept. of Physical Medicine & Rehabilitation, play a substantial role as instructors in our "Occupational Medicine Training" short courses. Timothy Keener, Ph.D., associate professor of civil & environmental engineering, lectures on air pollution in our "Comprehensive Review for Industrial Hygiene Professionals" and "Industrial Ventilation" courses.

#### **b. Non-University Faculty (~35)**

Besides these outstanding educators, the Continuing Education Program utilizes the expertise of non-University personnel. Involved in the asbestos abatement training courses are: Mr. Robert Herrick, P.E., CIH (a safety and health consultant formerly a corporate industrial hygienist for Owens Corning Fiberglas for thirty years), Mark Karaffa, M.S., CIH, and James Romine, M.S., CIH, CHMM (consultants and graduates of our IH program), Larry Wilson (former OSHA inspector), D. Wesley Newhouse (environmental attorney), Kurt Varga, PhD, and Barry Sands (environmental consultants), and Timothy Walsh (asbestos contractor).

Non-University personnel involved in the lead abatement training courses are: Richard Boehnke of the Dept. of Public Health, City of Toronto, Ontario, Canada; John Pesce (Massachusetts Master Lead Inspector--nationally known lead abatement training instructor and teacher in similar courses throughout the country) of Star Industries, Boston, MA; D. Wesley Newhouse (environmental attorney); Salvatore Cali, M.S. of the University of Illinois; and Penny Williams, a health & safety consultant with Sheridan Safety Consultants.

Robert Willson, M.S., CIH is course director of "Industrial Noise Control" and lectures in "Comprehensive Review for Industrial Hygiene Professionals" and "Industrial Ventilation" short courses. Mr. Willson has many years' experience in industrial hygiene and specializes in the control of noise. He has been president of Beta Associates, Inc., an industrial hygiene consulting firm, for over ten years. Prior to that, he was an industrial hygienist with PEDCo, Inc. and NIOSH.

Charles Nenadic, M.S., J.D., CIH, P.E., is course director of the "Comprehensive Review for Industrial Hygiene Professionals," "Industrial Ventilation," "Indoor Air Quality," and "Survey of Industrial Hygiene." Mr. Nenadic served as a commissioned officer with NIOSH for six years, and is now president of Consolidated Environmental Services, Inc., an industrial hygiene consulting and training company.

Mary Malotke, IHIT, is course director of our "Bloodborne Pathogen Exposure Assessment & Program Management" short course for nurses, and "Fundamentals of Environmental Compliance," and "Asbestos Air Monitoring Technician" short courses. Ms. Malotke is owner and president of TENCON Consulting and TechniTrain, Inc. Previous to the establishment of these two firms she was an environmental manager for Procter & Gamble.

James Romine, MS, CIH, CHMM, is director of our "Hazardous Materials Management Review" and "Air Sampling for Toxic Substances" courses and instructs in our "Survey of Industrial Hygiene" and "Asbestos Abatement Training" courses. Mr. Romine is a graduate of the industrial hygiene program at the University of Cincinnati.

Howard Etkind, M.S., CSP, REP, (with the U.S. Department of Energy), has taken over directorship of our "Certified Safety Professional Comprehensive Review" course for safety professionals wishing a review course to prepare for the certification examination.

The proximity of the Cincinnati ERC to NIOSH research facilities frequently results in collaboration with NIOSH scientists as instructors and curriculum specialists.

#### **D. COURSES OFFERED BY SPECIALTY AREA**

The following table shows the development of continuing education course offerings by program over the past five years.

**Total ERC Continuing Education Course Offerings**

<u>Acad. Year</u>	<u>Medicine</u>	<u>Nursing</u>	<u>Hygiene</u>	<u>Safety</u>	<u>Asbestos</u>	<u>Other</u>
1992-1993	5	20	14	23	37	1
1993-1994	6	17	25	12	60	6
1994-1995	9	22	24	6	55	11
1995-1996	9	23	20	15	45	6
1996-1997	7	20	26	24	38	7(Ergo)

**Total Trainees in Continuing Education Course Offerings**

1992-1993	2,239
1993-1994	2,826
1994-1995	2,795
1995-1996	2,646
1996-1997	2,741

**E. OUTREACH ACTIVITIES**

The faculty of all four core programs as well as the director of the continuing education program participated in all aspects of outreach activities: educational development; presentation/lectures/awareness seminars; consultations; and miscellaneous other activities. This Center continues to be an appreciated resource to Cincinnati, Ohio, the region, the U.S., and the international arena of environmental and occupational health and safety.



DEPARTMENT OF HEALTH & HUMAN SERVICES

# Memorandum

Date November 20, 1998  
From Principal Engineer, OECSP

Subject Final Progress Report for entry into NIOSHTIC/NTIS for  
NIOSH Training Grant No. T42 CCT 510420

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):

Title: University of Cincinnati Occupational Safety and Health Education and Research Center

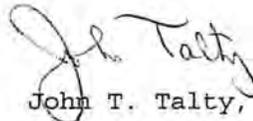
Center Director: C. Scott Clark, Ph.D., P.E., CIH  
Department of Environmental Health  
University of Cincinnati  
Cincinnati, OH 45267-0056

Grant No.: T42 CCT 510420

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 T. Talty, P.E., DEE

cc: T. Meinhardt/B. Kuchinski

Enclosure

fpr.cinerc