Final Progress Report

University of North Carolina
Chapel Hill, NC 27599-7469

Occupational Safety and Health Education and Research Center

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ABSTRACT

The purpose of the North Carolina Occupational Safety and Health Education and Research Center (NC OSHERC) is to train practitioners and researchers in the disciplines of Industrial Hygiene (IH), Occupational Health Nursing (OHN), Occupational Safety/Ergonomics (OS/E), Occupational Epidemiology (OE), and Health Services Research in Occupational Safety and Health (HSROSH).

The NC OSHERC is administered by an Executive Committee consisting of Center Director (Bonnie Rogers, DrPH, COHN-S, LNCC, FAAN) who also serves as the Program Director for Occupational Health Nursing and the Health Services Research in Occupational Safety and Health Program; Leena Nylander-French, PhD, Industrial Hygiene Program Director; Dana Loomis, PhD, Occupational Epidemiology Program Director; Gary Mirka, PhD, Safety/Ergonomics Program Director; and Kathleen Buckheit, MPH, Director of Continuing Education and Outreach and the Hazardous Substance Training Program. All programs are located at the University of North Carolina, Chapel Hill, excepting Safety/Ergonomics which is at North Carolina State University in Raleigh, NC.

The NC OSHERC utilizes advisory boards for the overall Center and independently for several of the programs listed above. These committees consist of members from industry, government, and academia, and they provide input regarding curricula; needs assessment; and regional, national, and global perspectives on occupational health and safety. Each program area has a representative to the Center Advisory Board (see end document attachments). The Center Advisory Board has an additional labor/community and government representative and meets with the ERC Executive Committee to coordinate the advisory process, propose actionable items, and facilitate changes within the ERC.

During the period from July 1, 2003 to June 30, 2006 the UNC ERC graduated a total of 31 students in the core disciplines, and offered over 369 continuing education courses to nearly 6,630 professionals. The ERC remains committed to its mission of providing high quality education for the occupational and safety field.

SIGNIFICANT FINDINGS

The North Carolina Occupational Safety and Health Education and Research Center (NC OSHERC) continues to fulfill its mission by educating occupational health and safety professionals and researchers at all levels. The following significant items are noted:

1. Table 1 presents the 3 year summary for enrollments, support, and graduates for all programs at the NC OSHERC. Enrollments continue to be relatively stable in the Industrial Hygiene (IH) and growing in Occupational Health Nursing (OHN) and Continuing Education (CE) programs. Occupational Epidemiology (OE) and Health Services Research in Occupational Safety and Health (HSROSH) began programs in 2001 and 2000, respectively, so program graduates are limited.
2. In addition to the residential program, the Occupational Health Nursing program has developed and implemented a distance education program which has been very successful.
3. The Safety/Ergonomics Program at NCSU has successfully rejoined the NC OSHERC.
4. The Duke Occupational Medicine program made application to rejoin the NC OSHERC as of July 2006.
5. The interdisciplinary course which was added as a NC OSHERC requirement for all NIOSH trainees is now available as an online course.
6. A new interdisciplinary seminar series has been implemented and is offered four times per year both on campus and webcast.
7. NORA funds have been instrumental in providing student support for NORA related research.
8. The principal sources of funding for faculty and staff in all program areas remain state funds and research grants.
9. NIOSH support for students has been extremely important and without stipends and tuition awards, it is unlikely many of the students would make application.
10. All disciplinary courses are now offered both on campus and online.

Table 1
Enrollments, Graduates, CE Summaries 2003-2006

Core Enrollment		Total
	IH	30
	OHN	64
	OS/E	18
	OE	179
	HSROSH	6
Trainees Supported		
	IH	19
	OHN	64 (full/partial)
	OS/E	5
	OE	8
	HSROSH	9
Number of Graduates		
	IH	15
	OHN	6
	Safety	9
	OE	1
	HSROSH	0
Continuing Education (enrollments)		
	IH	992
	OHN	884
	OE	271
	Safety	1,122
	Other	3,361
	Total	6,630
Continuing Education (courses)		
	IH	80
	OHN	16
	OE	14
	Safety	82
	Other	177
	Total	369

Center Administration

The NC OSHERC is located at the School of Public Health with collaborating units at NC State University and Duke University. All curricular programs are accredited by the Council on Education in Public Health. Dr. Bonnie Rogers is Director of the NC OSHERC. The purpose of the program is to train practitioners and researchers in the disciplines of industrial hygiene (IH), occupational health nursing (OHN), safety/ergonomics (S/E), occupational epidemiology (OE), and health services research in occupational safety and health (HSROSH). Each program area report is included in this document.

Industrial hygiene trainees typically obtain a master's degree over a 2-year course of study which includes a minimum of 30 semester hours and a thesis or technical report. The IH program offers MSEE, MSPH, and MS degrees to engineers and scientists; as well as the PhD option for qualified applicants. PhD students spend an additional three to four years beyond the master's degree to complete original research and write a dissertation.

The OHN program offers MPH and MS degrees fully accredited by the National League for Nursing Accreditation Commission. The MPH program is offered on-campus and by distance education format which has been very successful. The MPH program in OHN prepares occupational health nurse specialists for positions in leadership, program planning and evaluation, or management of occupational health programs. The program leading to the MS degree prepares graduates in program planning and evaluation with emphasis on the development of research skills as beginning researchers.

The Occupational Safety and Ergonomics Training program trains practitioner and research engineers in the area of occupational safety and health with MS degrees. The focus in this particular training program is on engineering solutions to occupational safety and health and ergonomics problems.

The Occupational Epidemiology program trains scientists with a high level of intellectual and technical skill, who will develop and apply the theory, methods and substance of epidemiology to engage with challenging occupational health problems and to prepare the occupational health

workforce of the future. The course of study in Occupational Epidemiology is designed for trainees with a Master's degree in a related field and leads directly to the PhD.

The Health Services Research in Occupational Safety and Health is designed at the doctoral level to prepare researchers in this field of study.

The Continuing Education (CE) Program provides education and training programs consistent with workforce needs to prepare workers for their job responsibilities and to avoid exposure to occupational hazards. The CE Program focuses on the interdisciplinary nature of the actual work roles and responsibilities of the health and safety professionals and technical employees.

Continuing education is provided through short courses offered onsite and at semi-annual Institutes within the southeast region. The Industrial Hygiene, Occupational Safety, and Environmental Technician Certificate Programs require 6 units each of non-academic credits that are taken at 3 Institute meetings and focus on interdisciplinary needs of the students in courses of 2.5 or 4.5 days in length. All courses are open to anyone and are attended by students in all disciplines.

The Hazardous Substance Training Program provides continuing education that provides focused training for employees who need education on subjects dealing with hazardous substances.

Outreach

The NC OSHERC provides numerous outreach activities across program areas. We conducted a survey and needs assessment of program graduates in March 2005 and found high satisfaction with our program and also what respondents indicated about future needs and challenges for occupational safety and health (OSH) for the next 3-5 years. Faculty and trainees are engaged in numerous research, educational, service outreach activities to the broader occupational health and safety community. Selected examples only are described here.

Duke faculty and residents participate in a number of educational outreach activities directed outward towards other institutions, business, government agencies and occupational health practitioners locally, nationally, and globally. The Duke Occupational and Environmental Medicine (DOEM) Electronic Forum is a unique resource in the field of occupational medicine. Founded in 1993 by DOEM faculty member Dr. Gary Greenberg who is now with the UNC, OHN Program, the list reaches more than 3,500 current subscribers located in more than 60 countries. The list serves occupational health professionals including physicians, nurses, industrial hygienists, government public health officials, industry groups and university researchers to provide a forum for announcements, dissemination of text files and academic discussion and allow presentation of clinical vignettes, synopses of new regulatory issues and reports of interesting items from publications elsewhere.

In the OHN Program, OHN and Case Management Certification Review Courses have consistently documented a 96% passing rate, elevating the status of the OHN professional and preparing the OHN for more critical and complex interdisciplinary responsibilities. The OHN: Introduction to Principles and Practice Course has been reported by OHNs and employers to prepare new and experienced nurses with an expanding scope of practice. All

OHN faculty teach in the OHN: Introduction to Principles and Practice co-sponsored by the NC OSHERC and the NC State Health Department. During this course the Worksite Assessment Guide (WAG) developed by Dr. Rogers is discussed and has been distributed to more than 240 OHNs. The WAG has also been distributed to OHNs across the country, and several OHN academic programs (UAR, UCLA, UAB, UMD), and is published for use in at least two books.

The textbook written by Dr. Bonnie Rogers, Occupational and Environmental Health Nursing: Concepts and Practice, 2nd Edition (2003) is in use throughout the world by OHNs in practice, faculty in other universities, and other ERCs as both a required textbook and to integrate OSH principles and concepts within existing curricula. This book has also been translated into Spanish. The book co-authored by Dr. Rogers, Susan Randolph, and Karen Mastroianni, Occupational Health Nursing Guidelines for Primary Clinical Conditions, 3rd Edition (2002) is widely used as a protocol guide for OHNs and physicians in clinical practice. Several businesses have adopted these guidelines "as their own" for practitioner use by thousands of nurses. Requests for curriculum materials, such as the Worksite Assessment Guide and articles are frequently received and filled as well as reprints of the many articles authored by Dr. Rogers.

A partnership is in place with the National Council for Occupational Safety and Health (National COSH), an advocate for worker safety and health. The director, Tom O'Conner, is on the NC OSHERC Advisory Board, the Health Services Research in Occupation Safety and Health Advisory Board, Continuing Education Advisory Board, and also teaches a class on the Labor Perspective in PUBH 785, Interdisciplinary Approaches to Occupational Health. Allen McNeeley who is the Director of NC OSHA is a member of the NC OSHERC Advisory Board and also teaches a class on worker safety and health in PUBH 785. Also, Dr. Rogers volunteers with the Orange County Literacy Council, is a literacy tutor, and has provided

significant consultation to them on health literacy for workers. Dr. Rogers has also provided awareness information to St. Thomas More School on musculoskeletal injuries from students carrying heavy backpacks.

NORA related interdisciplinary seminars, described in the Interdisciplinary Section, are offered as outreach to the OSH community. Invitations are broadcast through the interdisciplinary environmental and OSH groups within the region for their members and colleagues to participate in the web casts that are presented quarterly. Continuing Education Units are available to those who request them through UNC.

The IH/Exposure Assessment Concentration (EAC) core faculty are involved in number of educational and outreach activities in the national and international level including conference organization, grant and manuscript reviews, and consultation. Three of the core EAC faculty members are Certified Industrial Hygienist (CIH) in Comprehensive Practice by the American Board of Industrial Hygiene. The core faculty in the EAC focus area has published almost 500 peer-reviewed articles in scientific journals, of which 107 have been published (17 of these publications were a joint effort of the EAC faculty) since our last competitive renewal in 2002.

Dr. Gary Mirka, Safety/Ergonomics core, has presented a variety of awareness seminars that have impacted both practitioners and workers. Dr. Mirka presented a seminar to the DOEM group in May 2005 entitled "Duke Occupational Medicine Grand Rounds/Journal Club: Ergonomic Intervention Effectiveness Research".

Dr. Mirka worked with the Safety Committee of the American Furniture Manufacturers Association (AFMA) to develop their "Voluntary Guidelines for the Furniture Manufacturing Industry". This project represented one of the first industry-initiated efforts to develop such a guideline, a cornerstone component of Federal OSHA's efforts in the area of ergonomics.

The team that participated in the development of the guideline consisted of engineering, industrial hygiene, occupational medicine professionals.

The Safety and Ergonomics Program area has on-going interactions with the Ergonomics Center of North Carolina, a group of safety and ergonomics professionals that provide training, education, and consultative services to North Carolina Industry. These interactions have been primarily in the joint conduct of research projects.

Dr. Loomis, Occupational Epidemiology, is a member of the Management Group for the Scientific Committee on Epidemiology of ICOH (the International Commission on Occupational Health), past Chair of the Safety and Occupational Health Study Section, which advises NIOSH and NIH on occupational health research, and has served on other advisory committees for NIOSH, NIH, the National Center for Environmental Health, the IOM, and other state, national and international bodies. He also serves the scientific community as North American Editor for the journal *Occupational and Environmental Medicine*, the leading international journal of occupational safety and health research, and as a member of the editorial boards of the *Journal of Occupational and Environmental Hygiene, Archivos de Prevención de Riesgos Laborales,* and *Ciencia y Trabajo*. For the latter two journals, published in Spain and Chile, respectively, his charge is to assist with journal development and the dissemination of high-quality, original research in the Spanish language. He has also contributed to OSH capacity-building efforts in South America, through contributions of teaching materials for a distance-education program on occupational health in Chile and to the development of an executive Master's program in occupational health at the Federal University of Bahia in Brazil. He is on the advisory board for an industrial hygiene training program at the University of South Carolina.

The NORA Interdisciplinary Seminars are now web cast so that distance education professionals are able to attend and actively participate. Electronic notices are listed in the

School of Public Health activities of the week which goes to all faculty, students, local public health departments, and others. We are also including notification to the NC Department of Labor, Occupational Safety and Health Division, state public health department, and universities with an OSH program.

The CE Director participates on the Advisory Board of the Occupational Safety Program at NC A&T State University, a historically black college, developing a partnership with a NIOSH TPG. This Board participation also informs faculty and students about the CE Programs. Many students have taken advantage of free tuition for the CSP Review course and invitations to attend several other courses have been extended to complement their academic courses.

Interdisciplinary Coordination

The administrative core of the NC OSHERC fosters the interdisciplinary interaction of all programs in the training programs. Several strategies are used to accomplish this: orientation for trainees; an interdisciplinary occupational health course; integrated disciplinary coursework including field projects and class projects; NORA seminar series; interdisciplinary CE courses, and research, all of which involve program trainees and faculty.

An annual orientation/update is held usually in August for all NIOSH-funded trainees. The Center director discusses the mission of the NC OSHERC and its relationship to NIOSH, new Center initiatives, and the trainees get to meet each other and faculty in the different disciplines. In conjunction with the orientation, one of the four (increased from three last year) NORA Interdisciplinary Seminars is held. All NIOSH funded trainees are required to attend and participate in at least 3 of the NORA Interdisciplinary Seminars held each year. Each training program area (Occupational Health Nursing, Industrial Hygiene, Safety and Ergonomics, Occupational Epidemiology, Health Services Research in Occupational Safety and Health) is responsible for developing the seminar and securing a speaker on a rotating basis.

All NIOSH-funded trainees are and will continue to be required to take PUBH 785, Interdisciplinary Approaches to Occupational Health. This course is taught online; interdisciplinary students attend interdisciplinary-based lectures, conduct a virtual walk-through of an animal facility laboratory, and select an industry or specific hazard of their interest, and research and present their findings discussing interdisciplinary roles.

Trainee interaction occurs from attendance by industrial hygiene, occupational health nursing, and safety/ergonomics trainees in industrial hygiene, toxicology, and safety courses (PHNU 787 - industrial hygiene; ENVR 423 - Industrial Toxicology; ENVR 432 - Safety/Ergonomics; PUBH 785 – Interdisciplinary Approaches –previously described);

(except safety students do not take this basic safety course). Students from other disciplines (e.g., epidemiology, health behavior, and medicine) also take these courses. This coursework provides the student with the skills necessary to learn about and develop a good understanding of an interdisciplinary framework for service delivery and research. Students learn about interdisciplinary roles and collaboration necessary to improve the health and safety of the worker and work environment. Students from all core disciplines, participate in field experiences, conduct joint walk-throughs, collaboratively work together to address problems in occupational health, and make joint presentations related to the problem.

Trainees from all disciplines are encouraged to attend CE courses sponsored by the NC OSHERC and registration fees are waived. Trainees attend courses such as, workers' compensation, basic industrial hygiene, advanced safety, toxicology, legal concerns, ergonomics, biohazard science, case management, hearing conservation, and respiratory protection.

Faculty and trainees from the disciplines interact on several research projects. Students have worked with other students and faculty from occupational medicine, epidemiology, and occupational nursing on research projects ranging from commercial fishing, construction, healthcare, to traditional manufacturing industry. These opportunities have helped to broaden the trainees' perspectives on occupational safety and health issues. Examples of recent projects that include both faculty and trainees:

1. **Low Back Injury Prevention in the Homebuilding Industry**
   Participants: Dr. Gary Mirka (Safety and Ergonomics, NCSU), Dr. Hester Lipscomb, Dr. John Dement, Dr. Samuel Moon (Occupational Medicine, Duke University), Dr. Leonard Bermard (Construction Engineering, NCSU)

2. **Ergonomic Interventions for the Furniture Manufacturing Industry**
   Participants: Dr. Gary Mirka (Safety and Ergonomics, NCSU), Dr. Hester Lipscomb (Epidemiology, Duke University)

3. **Learning Curve Analysis of a patient Lift Assist Device**
   Participants: Stephanie Reid, Dr. Gary Mirka (Safety and Ergonomics, NCSU), Dr. Hester Lipscomb (Epidemiology, Duke University)

Occupational Injuries Amoung Commercial Fishers

Participants: Dr. Dana Loomis, Kristen Kucera (Epidemiology, UNC-CH), Dr. Gary Mirka (Safety and Ergonomics, NCSU), Mary Anne MacDonald (Ethnographer, Duke University)

4. **Musculoskeletal Injuries to Nurses in Hospitals**

Participants: Dr. Bonnie Rogers, Judy Ostendorf, Kathleen Buckheit, Courtney Stanion (HSROSH, UNC) A large number of nurses and safety professionals attend the industrial health courses, a large number of industrial health and nurses attend the safety courses, etc. This is due to the demands of employers requiring expertise in more than one area; i.e., industrial health, safety, environmental and occupational health nursing., Katie Slavin (OHN, UNC); Dr. Gary Mirka (Safety and Ergonomics, NCSU), plus safety graduate students.

NARRATIVE

INDUSTRIAL HYGIENE

The mission of the UNC-CH Industrial Hygiene Training Program is to educate and train highly qualified scientists in both the principles of research and the practice of occupational hygiene for mitigating exposure and disease. The Program encompasses a full range of applications in occupational hygiene, including sample collection, analysis, statistical and toxicokinetic modeling, and interpretation of exposure data in order to investigate the relationships between exposure and development of disease. The location of the program within the Department of Environmental Sciences and Engineering in the School of Public Health provides unique resources and interdisciplinary opportunities for education of the individuals able to develop cost-effective, reliable exposure assessment methods and control solutions, which are needed by today's rapidly changing industry. The industrial hygiene program at the UNC-CH is well positioned to provide research training at Master's and doctoral level in the areas of exposure assessment and control technology for human exposures to both airborne and dermal hazards.

The industrial hygiene faculty identifies itself as the Exposure Assessment and Control (EAC) focus group, which includes industrial hygiene, exposure assessment, and air pollution control (Table 2). There are 7 full-time faculty members in the industrial hygiene program and 9 adjunct faculty members. The program has an extremely strong and broad exposure assessment group, which provides unique and innovative methods and state of the art statistical knowledge and tools to evaluate exposures. We continue to provide trainees with research experience in conducting filed studies to develop exposure assessment methods, to investigate exposure-dose-response relationships, and to calibrate models for the optimal control of exposure. Furthermore, the EAC group has an important link to the Epidemiology and Biostatistics departments, which provide the knowledge base needed to investigate the level of risk associated with a given exposure and how the control of such risk can be achieved.

The students in the EAC can select to obtain one of the following degrees: Master of Science (MS), Master of Science in Public Health (MSPH), Master of Science in Environmental Engineering (MSEE), or Doctor of Philosophy (Ph.D.). All three MS-degree programs require 2 years of course work and submission of a master's technical report or thesis, which describes a relevant research project, and an oral defense/ presentation of the work before a faculty committee. Appropriate projects involve laboratory research, development of theory, and/or fieldwork. The offered core courses (Table 3) and advanced courses (Table 4) for Master's students are given below. The Department of Environmental Sciences and Engineering requires a seminar (ENVR400) and a Unifying Concepts course (ENVR401) designed to expose all ENVR students to the fundamental principles common to the field. Students in the EAC focus also take industrial hygiene core courses specified in Table 3. In addition, students take enough elective courses selected from the advanced courses listed in Table 4 to bring the total number of credits earned to a minimum of thirty semester hours.

Students in the MSEE program must take ENVR750 Principles of Industrial Ventilation, ENVR751 Ventilation Design Problem, and ENVR754 Air Pollution Control. Students in the MSPH program must take two general public health courses, one from the Department of Health Behavior and Health Education (HBHE600 or alternative) and one from the Department of Health Policy and Administration (HPAA600 or alternative). In addition to the core courses listed below, most students take several advanced courses (listed below the core courses). Students are encouraged to take courses taught by faculty outside the EAC focus area faculty after consultation with their faculty advisor.

EAC students are encouraged to enroll in continuing education courses offered through the ERC that cover materials related to professional practice not presented through our regular academic courses. Students can also take courses at Duke University (e.g., occupational diseases, biohazards) or at North Carolina State University (e.g., noise, ergonomics and safety) through a reciprocity agreement with those schools.

All NIOSH funded students are required to take PUBH785: Interdisciplinary Approaches in Occupational Health (3 credits), attend a minimum number of interdisciplinary seminars, and attend an NC OSHERC orientation meeting. Other interdisciplinary activities noted in industrial hygiene include students taking courses with occupational health nursing students, safety students, and physicians in toxicology, industrial hygiene, and safety/ergonomics courses and working on projects together. Students also engage in joint collaborative research.

There are few formal course requirements for the Ph.D. degree; the actual courses required are determined by the doctoral committee. Students in this program typically spend between one and two years in course-work prior to taking their qualifying examinations. The examinations include both written and oral components and cover basic knowledge of the principles of industrial hygiene as well as a proposal for a research project. The student is then responsible for conducting an independent research project, which contains sufficient new information for a minimum of three peer-reviewed publications. The doctoral program is usually completed within four to five years.

Every Master's, doctoral, and postdoctoral trainee receives instruction in the responsible conduct of research either through course work (e.g., ENVR411) or through special training. All students working in the laboratory are required to attend courses, which cover laboratory safety procedures; specific training is also required before engaging in experiments involving biological materials. All students engaged in procedures with human biological material are immunized for Hepatitis B and are instructed in safe procedures for handling and disposing these materials in accordance with requirements of the UNC Health and Safety Office. All students involved with research projects involving use of human and animal subjects are required to complete the CITI course in the Protection Human Research Subjects (http:/www.citiprogram.org), which is sponsored by the Human Research Ethics UNC-CH. Examples of programs of study are shown in Tables 5-8.

Table 2
Industrial Hygiene Faculty

Faculty Member	Position	Area of Competence
Core Faculty		
Leena A. Nylander-French	Assistant Professor	Exposure Assessment, Dermal Exposure, Biological Monitoring
Michael R. Flynn	Professor	Ventilation, Mathematical Modeling of Exposure
Don Fox	Professor	Air Chemistry, Exposures
Richard Kamens	Professor	Indoor Air, Exposures to PAH's
David Leith	Professor	Engineering Controls, Aerosol Physics
Stephen M. Rappaport	Professor	Exposure Assessment, Biological Monitoring
Parker C. Reist	Professor	Aerosol Science
Marc Serre	Assistant Professor	Exposure Assessment, Mathematical Modeling of Exposure
Lori Todd	Associate Professor	Exposure Assessment, Community Outreach
Joint and Adjunct Faculty		
Doug Crawford-Brown	Professor	Risk Assessment and Radiological Health, Department of Environmental Sciences and Engineering, UNC
John Dement	Adjunct Associate Professor	Exposure Assessment, Hazardous Materials; Duke University Medical Center, Durham, NC
David Ensor	Adjunct Professor	Aerosol Physics; Research Triangle Institute, RTP, NC
Ray Hackney	Adjunct Lecturer	Biohazards and Industrial Hygiene; Health & Safety Office, UNC
Tim Hitchcock	Adjunct Associate Professor	Ergonomics & Radiological Hygiene; IBM, RTP, NC
Dana Loomis	Joint Professor	Occupational Epidemiology; Department of Epidemiology, UNC
Woodhall Stopford	Adjunct Assistant Professor	Occupational Medicine; Duke University, Durham, NC
Don Tyndall	Adjunct Professor	Radiological Health; Diagnostic Science and General Dentistry, UNC
Russel Wiener	Adjunct Assistant Professor	Aerosol Physics; USEPA Environmental Monitoring Systems Lab, RTP, NC
Nelson Couch	Adjunct Associate Professor	Radiological Hygiene; Radiation Safety Office, NCSU, Raleigh, NC

Curriculum

Table 3. Core Courses:

Number	Title	Credit	Semester	Faculty
ENVR 400	Seminar Series	1	Both	ENVR Faculty
ENVR 401	Unifying Concepts	3	Both	Faculty
BIOS 545	Principles of Experimental Analysis	3	Both	Biostatistics faculty
EPID 600	Principles of Epidemiology	4	Both	Epidemiology faculty
ENVR 411	Laboratory Techniques and Field Measurements	3	Fall	Nylander-French, Weinberg, Whalen
ENVR 416	Introduction to Aerosol Science	4	Fall	Leith
ENVR 516	Aerosol Science Laboratory (alternate years)	2	Fall	Leith
ENVR 430	Health Effects of Environmental Agents, OR	3	Fall	Ball, Nylander-French
ENVR 423	Industrial Toxicology, OR	2	Spring	Stopford
ENVR 470	Environmental Risk Assessment, OR	3	Spring	Crawford-Brown
ENVR 732	Health Effects of Outdoor and Indoor Air Pollution	3	Fall	Hazucha
ENVR 422	Air and Industrial Hygiene	3	Fall	Fox
ENVR 263	Radiation Hazards Evaluation I	3	Spring	Couch
ENVR 432	Occupational Safety and Ergonomics (PHN286)	3	Fall	Faculty
ENVR 433	Health Hazards of Industrial Operations	3	Spring	Flynn
ENVR 750	Principles of Industrial Ventilation	3	Fall	Flynn
ENVR 992 ENVR 993	Master's Technical Report, OR Master's Thesis	3	Both	Core Faculty

Table 4. Advanced Courses:

Number	Title	Credit	Semester	Faculty
ENVR 770	Biological Monitoring	2	Spring	Nylander-French
ENVR 751	Ventilation Design Problems	1	Fall	Flynn
ENVR 754	Air Pollution Control	3	Spring	Leith
ENVR 768	Micro-Environmental Air Flow Modeling (odd years)	3	Fall	Flynn
ENVR 769	Advanced Methods of Exposure Assessment (even years)	3	Spring	Rappaport
ENVR 784	Environmental Law	3	Fall	Heath
ENVR 468	Advanced Functions of Temporal GIS	3	Fall	Serre
ENVR 765	Model-Based Exposure Mapping and Risk Assessment	3	Spring	Serre
MAE 510	Effects of Noise and Vibration on Man (NCSU)	2	Fall	Faculty
MAE 514	Noise and Vibration Control (NCSU)	3	Spring	Faculty

Course Requirements IH Program

- The Department of Environmental Sciences and Engineering requires a seminar (ENVR400) and a Unifying Concepts course (ENVR401).
- MSEE requires Principles of Industrial Ventilation (ENVR750), Ventilation Design Problem (ENVR751), and Air Pollution Control (ENVR754).
- MSPH requires, one course in Health Behavior and Health Education (HBHE600 or alternative) and one in Health Policy and Administration (HPAA600 or alternative).
- EAC focus industrial hygiene core courses are specified in Table 1 and the advanced courses in Table 2. Depending of students' interests and educational goals the course curriculum is tailored for each student individually.

Table 5
Possible Coursework for a Student Interested in:
Exposure Assessment Emphasizing Biomarkers
IH Program

Year I (MS/Ph.D.)

Fall	Spring
BIOS 600 (3) Principles of statistical inference	BIOS 545 (3) Principles of experimental analysis
EPID 600 (4) Fundamentals of epidemiology	ENVR 442 (3) Biochemical and molecular toxicology
ENVR 430 (3) Health effects of environmental agents	ENVR 770 (2) Biological monitoring
Seminar (1)	Seminar (1)

Year II (MS/Ph.D.)

Fall	Spring
EPID 785 (3) Environmental epidemiology	ENVR 740 (2) Principles of chemical carcinogenesis
EPID 745 (2) Molecular techniques for public health	ENVR 769 (3) Advanced methods of exposure research
ENVR 707 (3) Advanced toxicology	ENVR 471 (3) Quantitative risk assessment
Seminar (1)	Seminar (1)

Year III (Ph.D.)

Fall	Spring
BIOS 665 (3) Analysis of categorical data	ENVR 728 (3) Analysis of trace organics
ENVR 991 (5) Research in environmental health	ENVR 991 (6) Research in environmental health sciences
Seminar (1)	Seminar (1)

Year IV (Ph.D.)

Fall	Spring
ENVR 991 (8) Research in environmental health	ENVR 991 (8) Research in environmental health sciences
Seminar (1)	Seminar (1)

Participation in Ph.D. Research:
Each Ph.D. student in EAC conducts a research project, which will be reported in the form of a dissertation. Some EAC students perform laboratory research related to the development or application of methods of environmental or biological monitoring. Others perform field studies to characterize environmental exposures and to investigate the effects of covariates upon these exposures. Regardless of the topic, each project must contain sufficient original work to allow a minimum of three refereed publications for which the student is first author. The EAC student and his/her advisor make primary decisions regarding curricula, dissertation topics, and related issues. The advisor is looked upon as the principal source of guidance, helping to provide opportunities for the student to write and review grant applications and manuscripts and offering assistance in other ways to enrich the student's academic experience.

Table 6
Possible Coursework for a Student Interested in:
Exposure Assessment Emphasizing Airborne Exposures
IH Program

Year I (MS/Ph.D.)

Fall	Spring
BIOS 600 (3) Principles of statistical inference	BIOS 545 (4) Principles of experimental analysis
ENVR 416 (4) Introduction to aerosol science	ENVR 433 (4) Health hazards of industrial operations
EPID 600 (4) Fundamentals of epidemiology	Seminar (1)
Seminar (1)	

Year II (MS/Ph.D.)

Fall	Spring
ENVR 767 (3) Modeling for environmental risk	ENVR 470 (3) Environmental risk assessment analysis
ENVR 430 (3) Health effects of environmental agents	ENVR 769 (3) Advanced methods of exposure assessment
Seminar (1)	Seminar (1)

Year III (Ph.D.)

Fall	Spring
ENVR 766 (3) Stochastic environmental health	ENVR 770 (2) Biological Monitoring Modeling
ENVR 991 (5) Research in environmental health sciences	ENVR 991 (6) Research in environmental health
Seminar (1)	Seminar (1)

Year IV (Ph.D.)

Fall	Spring
ENVR 991 (8) Research in environmental health sciences	ENVR 991 (8) Research in environmental health sciences
Seminar (1)	Seminar (1)

Participation in Ph.D. Research:
Each Ph.D. student in EAC conducts a research project, which will be reported in the form of a dissertation. Some EAC students perform laboratory research related to the development or application of methods of environmental or biological monitoring. Others perform field studies to characterize environmental exposures and to investigate the effects of covariates upon these exposures. Regardless of the topic, each project must contain sufficient original work to allow a minimum of three refereed publications for which the student is first author. The EAC student and his/her advisor make primary decisions regarding curricula, dissertation topics, and related issues. The advisor is looked upon as the principal source of guidance, helping to provide opportunities for the student to write and review grant applications and manuscripts and offering assistance in other ways to enrich the student's academic experience.

Table 7
Possible Coursework for a Student Interested in:
Spatiotemporal Exposure Assessment
IH Program

Year I (MS/Ph.D.)

Fall	Spring
BIOS 600 (3) Principles of statistical inference	BIOS 545 (4) Principles of experimental analysis
ENVR 468 (3) Advanced functions of temporal GIS	ENVR 463 (3) Random field modeling of physical processes
ENVR 768 (3) Micro environmental air flow modeling processes	ENVR 765 (3) Model-based exposure mapping and risk assessment
Seminar (1)	Seminar (1)

Year II (MS/Ph.D.)

Fall	Spring
BIOS 550 (3) Basic Elements of probability and statistical inference I	BIOS 551 (3) Basic elements of statistical inference II
STAT 154 (3) Measure and integration theory	ENVR 766 (3) Stochastic environmental health modeling
STAT 322 (3) Environmental statistics OR	ENVR 769 (3) Advanced methods of exposure assessment
STAT 664 (3) Applied statistics	Seminar (1)
Seminar (1)	

Year III (Ph.D.)

Fall	Spring
BIOS 660 (3) Probability and statistical inference I	BIOS 662 (4) Intermediate statistical methods
ENVR 991 (6) Research in environmental health sciences	ENVR 991 (5) Research in environmental health sciences
Seminar (1)	Seminar (1)

Year IV (Ph.D.)

Fall	Spring
ENVR 991 (8) Research in environmental health sciences	ENVR 991 (8) Research in environmental health sciences
Seminar (1)	Seminar (1)

Participation in Ph.D. Research:
Each Ph.D. student in EAC conducts a research project, which will be reported in the form of a dissertation. Some EAC students perform laboratory research related to the development or application of methods of environmental or biological monitoring. Others perform field studies to characterize environmental exposures and to investigate the effects of covariates upon these exposures. Regardless of the topic, each project must contain sufficient original work to allow a minimum of three refereed publications for which the student is first author. The EAC student and his/her advisor make primary decisions regarding curricula, dissertation topics, and related issues. The advisor is looked upon as the principal source of guidance, helping to provide opportunities for the student to write and review grant applications and manuscripts and offering assistance in other ways to enrich the student's academic experience.

Table 8
Possible Coursework for a Student Interested in:
Exposure Modeling and Control
IH Program

Year I (MS/Ph.D.)

Fall	Spring
BIOS 600 (3) Principles of statistical inference	BIOS 545 (4) Principles of experimental analysis
ENVR 763 (3) Mathematical modeling	ENVR 433 (3) Health hazards of industrial operations
ENVR 750 (3) Principles of industrial ventilation	EPID 600 (3) Fundamentals of epidemiology
Seminar (1)	Seminar (1)

Year II (MS/Ph.D.)

Fall	Spring
ENVR 768 (3) Microenvironmental air flow modeling	ENVR 754 (3) Air pollution control
ENVR 416 (4) Introduction to aerosol science	ENVR 769 (3) Advanced methods of exposure assessment
ENVR 516 (2) Aerosol science laboratory	ENVR 463 (3) Random field modeling
Seminar (1)	Seminar (1)

Year III (Ph.D.)

Fall	Spring
ENVR 991 (8) Research in environmental health sciences	ENVR 991 (8) Research in environmental health sciences
Seminar (1)	Seminar (1)

Year IV (Ph.D.)

Fall	Spring
ENVR 991 (8) Research in environmental health sciences	ENVR 991 (8) Research in environmental health sciences
Seminar (1)	Seminar (1)

Participation in Ph.D. Research:
Each Ph.D. student in EAC conducts a research project, which will be reported in the form of a dissertation. Some EAC students perform laboratory research related to the development or application of methods of environmental or biological monitoring. Others perform field studies to characterize environmental exposures and to investigate the effects of covariates upon these exposures. Regardless of the topic, each project must contain sufficient original work to allow a minimum of three refereed publications for which the student is first author. The EAC student and his/her advisor make primary decisions regarding curricula, dissertation topics, and related issues. The advisor is looked upon as the principal source of guidance, helping to provide opportunities for the student to write and review grant applications and manuscripts and offering assistance in other ways to enrich the student's academic experience.

OCCUPATIONAL HEALTH NURSING

The Occupational Health Nursing Program offers the Master of Public Health (MPH) and the Master of Science (MS) degrees with specialization in Occupational Health Nursing are offered in the Public Health Leadership Program , and the PhD in Epidemiology with a concentration in Occupational Health Nursing through the Department of Epidemiology.

The MPH program requires a minimum of 42 credits of which 20% may be transfer-in credits as is permitted for all students by the Graduate School. This program is taken on-campus and through distance education. The MPH program in Occupational Health Nursing prepares occupational health nurse specialists for positions in leadership, program planning and evaluation, or management of occupational health nursing programs. The program leading to the MS degree prepares graduates in program planning and evaluation; however, emphasis is on the development of research skills as beginning researchers. The MPH student can complete the degree in 11/2 years while two years of full-time study is required for the MS student. Students have 5 years to complete the program.

The goal of the Occupational Health Nursing (OHN) Program is to provide education, training, and research experience to occupational health nursing professionals so as to transfer learned knowledge to promote and protect the health of the workforce. Program objectives include:

1. Provide MPH training both on-campus and via distance education, MS degree education residentially on-campus, and the PhD degree in Epidemiology with a concentration in Occupational Health Nursing
2. Provide interdisciplinary learning opportunities and experiences.
3. Provide integrated/applied learning through practicum experiences.
4. Provide trainees with opportunities for scholarly demonstration of knowledge learned (e.g., master's paper publications, presentations, dissertations).
5. Offer continuing education/outreach to the occupational safety and health community.

In the master's degree program, trainees are prepared to take leadership/management positions in industry, government, and other occupational health settings, act as consultants to business, industry, and government, and provide program planning and evaluation expertise.

The OHN specialty is broad and dynamic requiring a sound foundation in the sciences of public health, occupational health, and nursing within an interdisciplinary framework which is an essential integrated building block. The master's curriculum content in OHN contains three components: the public health sciences; the occupational health nursing core studies and OHN functional role courses, and practicum; and the occupational health sciences interdisciplinary cognates. The illustrative programs of study for MPH and MS degree programs are shown in Tables 9, 10, and 11. All students in the MPH or the MS degree program take the same core courses in the public health sciences, excepting coursework in health services administration and behavioral sciences, which is only for the MPH students. All OHN students take the occupational health nursing core studies, functional role, and occupational health cognates. MS students are required to take research methods/statistics coursework for research skills development.

Specialization in occupational health nursing requires foundational courses from the public health sciences, specifically epidemiology (EPID 160), biostatistics (BIOS 101/110), health administration (HPAA 119), environmental sciences (ENVR 101), and behavioral sciences (HBHE 131) (Please note that course numbers have changed this year). Coursework in epidemiology provides a foundation for epidemiological inquiry; biostatistics provides for application of statistics in the planning, coordination and analysis of projects, research, and data; environmental sciences coursework introduces the student to basic concepts in environmental health, e.g., air and water pollution, food safety, hazardous substance exposure, and environmental policy and management; behavioral sciences addresses social and behavioral theories applied to health motivating; and coursework in health policy/administration focuses on organizational and human resources management.

Through a theoretical and conceptual framework, the OHN Program prepares the student as a specialist in occupational health nursing. OHN course content uses an occupational health nursing model based on system's theory developed by this director/author to emphasize OHN roles, worksite assessment, interdisciplinary functioning, health promotion and prevention, management, program planning and administration including cost-benefit/effectiveness in occupational settings. The OHN courses (PHNU 281, PHNU 282) and practica (PHNU 283, PHNU 284, and PHNU 396) are sequenced so that students begin by learning theories, concepts and principles in occupational health nursing and then applying these at the worksite, i.e., assess work-related health problems, and plan, implement, and evaluate occupational health programs/projects. Students have a variety of applied learning experiences e.g. walkthroughs, health promotion projects, and seminar leadership and teaching opportunities including a presentation and discussion of each student's individual philosophy of occupational health nursing and a jointly prepared and presented topic of occupational health nursing interest. For example, students this year presented topics on smoking cessation in the workplace, ergonomics, and the occupational health nursing impact. Students also conduct joint walk-throughs in the context of a system's analysis approach making joint presentations and providing an individually written paper.

Table 9
MPH Occupational Health Nursing Program
Sample Guide for Distance Learning Education Format**

Year 1 (See Note:)

Summer (Fall Registration)	Fall	Spring
PHNU 781 (3)[2]	EPID 600 (3)[1] HPAA 600 (3)[1] PHNU 783 (2)*	ENVR 600 (3)[1] ENVR 423 (3)[1] PUBH 785 (3)[1] PHNU 784 (2)*

Year 2

Summer (Fall Registration)	Fall	Spring
PHNU 782 (3)[2]	BIOS 600 (3)[1] PHNU 787 (2)[1] PUBH 748 (2)[1]	PUBH 746 (3)[1] HBHE 600 (3)[1]

Year 3

Summer (Fall Registration)	Fall	Spring
PHNU 886 (3) PUBH 992 (3)	ENVR 432 (3)[1]	

Minimum credits required for graduation = 42

1 = internet-based
2 = on campus course (1 week)
* PHNU 783/784 required for students without occupational health nursing experience.
** With the continued development of the online format, changes in curriculum may occur.

Certifications
- CITI Course in Protection of Human Research Subjects **(first year)**
- CPR, AED, & First Aid (anytime)
- Spirometry (anytime)
- Hearing Conservation (anytime)

Note:
- *This format is fluid and is constructed as a guide to which course offerings may vary in the semester in which they are offered.*
- *This program of study can be completed in approximately 2-2½ years as outlined above. However, you have five years from admission within which the program must be completed.*
- *Independent study/transfer in credit (20% of total program credits may be transferred in with approval).*

Number	Hours	Title
BIOS 600	3hr.	Principles of Statistical Inference
ENVR 600	3hr.	Environmental Health
ENVR 423	3hr.	Industrial Toxicology
ENVR 432	3hr.	Occupational Safety and Ergonomics
EPID 600	3hr.	Principles of Epidemiology
HBHE 600	3hr.	Social and Behavioral Sciences in Public Health
HPAA600	3hr.	Introduction to Health Policy and Administration
PHNU 744	3hr.	Roles and Functions of Public Health Nursing
PHNU 781	3hr.	Occupational Health Nursing I
PHNU 782	3hr.	Occupational Health Nursing II
PHNU 783*	2hr.	Occupational Health Nursing Field Practicum I
PHNU 784*	2hr.	Occupational Health Nursing Field Practicum II
PHNU 787	2hr.	Fundamentals of Industrial Hygiene
PHNU 886	3hr.	Field Practice in Public Health
PUBH 740	1-3hr.	Special Issues in Public Health Practice
PUBH 746	3hr.	Program Planning and Evaluation
PUBH 748	2hr.	Policy Development
PUBH 785	3hr.	Interdisciplinary Approaches to Occupational Health
PUBH 992	3hr.	Master's Paper

Table 10
MPH Occupational Health Nursing Program
Sample Guide for On Campus Education Format

Year 1

Summer (Fall Registration)	Fall	Spring
PHNU 781 (3)[2]	EPID 600 (3)[1] HPAA 600 (3) PHNU 783 (2)*	ENVR 600 (3) [1] ENVR 423 (3)[1] PUBH 785 (3) [1] PHNU 784 (2)*

Year 2

Summer (Fall Registration)	Fall	Spring
PHNU 782 (3)[2]	BIOS 600 (3) [1] PHNU 787 (2)[1] PUBH 748 (2)[1]	PUBH 746 (3)[1] HBHE 600 (3)[1]

Year 3

Summer (Fall Registration)	Fall	Spring
PHNU 866 (3) PUBH 992 (3)	ENVR 432 (3)[1]	

Minimum credits required for graduation = 42

1 = Internet based
2 = On-campus course (1 week; however course completion extends throughout semester
* PHNU 783/784 required for students without occupational health nursing experience.

Certifications
- CITI Course in Protection of Human Research Subjects **(first year)**
- CPR, AED, & First Aid (anytime)
- Spirometry (anytime)
- Hearing Conservation (anytime)

Note:
- This format is fluid and is constructed as a guide to which course offerings may vary in the semester in which they are offered.
- The program of study can be completed in 2-2½ years as outlined above. However, you have 5 years from admission within which the program must be completed.
- Independent study/transfer in credit (20% of total program credits may be transferred in with approval

Number	Hours	Title
BIOS 600	3hr.	Fundamentals of Biostatistics/Principles of Statistical Inference
ENVR 600	3hr.	Environmental Health
ENVR 422	3hr.	Air and Industrial Hygiene
ENVR 423	3hr.	Industrial Toxicology
ENVR 432	3hr.	Occupational Safety and Ergonomics
EPID 600	3hr.	Principles of Epidemiology
HBHE 600	3hr.	Social and Behavioral Sciences in Public Health
HPAA600	3hr.	Introduction to Health Policy and Administration
PHNU744	3hr.	Roles and Functions of Public Health Nursing
PHNU 781	3hr.	Occupational Health Nursing I
PHNU 782	3hr.	Occupational Health Nursing II
PHNU 783*	2hr.	Occupational Health Nursing Field Practicum I
PHNU 784*	2hr.	Occupational Health Nursing Field Practicum II
PHNU 787	2hr.	Fundamentals of Industrial Hygiene
PHNU 886	3hr.	Field Practice in Public Health
PUBH 740	1-3hr.	Special Issues in Public Health Practice
PUBH 746	3hr.	Program Planning and Evaluation
PUBH 748	2hr.	Policy Development
PUBH 785	3hr.	Interdisciplinary Approaches to Occupational Health
PUBH 992	3hr.	Master's Paper

Table 11
MS Occupational Health Nursing Program
Sample Guide for On Campus Education Format

Year 1

Summer (Fall Registration)	Fall	Spring
PHNU 781 (3)	EPID 600 (3) BIOS 600 (3) PHNU 783 (2)* HBHE 750 (4)	ENVR 600 (3) ENVR 423 (3) PHNU 784 (2)* PUBH 785 (3)

Year 2

Summer (Fall Registration)	Fall	Spring
PHNU 782 (3) PHNU 886 (3)	PUBH 748 (2) ENVR 422 or PHNU 787 (2) ENVR 432 (3) Elective (3)	BIOS 545 (3) PUBH 993 (3) Elective 1

Certifications

CITI Course in The Protection of Human Research Subjects **(first year)**
Spirometry
Hearing Conservation
CPR, AED, & First Aid

Minimum credits required for graduation = 45

Number	Hours	Title
BIOS 600	3hr.	Fundamentals of Biostatistics/Principles of Statistical Inference
BIOS 545	3hr.	Principles of Experimental Analysis
ENVR 600	3hr.	Environmental Health
ENVR 422	3hr.	Air and Industrial Hygiene
ENVR 423	3hr.	Industrial Toxicology
ENVR 432	3hr.	Occupational Safety and Ergonomics
EPID 600	3hr.	Principles of Epidemiology
HBHE 750	4hr.	Applied Research Methods in Health Behavior and Health Education
PHNU 744	3hr. .	Roles and Functions of Public Health Nursing
PHNU 781	3hr.	Occupational Health Nursing I
PHNU 782	3hr.	Occupational Health Nursing II
PHNU 783*	2hr.	Occupational Health Nursing Field Practicum I
PHNU784*	2hr.	Occupational Health Nursing Field Practicum II
PHNU 787	2hr.	Fundamentals of Industrial Hygiene
PHNU 886	3hr.	Field Practice in Public Health
PUBH 740	1-3hr.	Special Issues in Public Health Practice
PUBH 746	3hr.	Program Planning and Evaluation
PUBH 748	2hr.	Policy Development
PUBH 785	2hr.	Interdisciplinary Approaches to Occupational Health
PUBH 993	3hr.	Master's Thesis

* PHNU 783/784 required for students without occupational health nursing experience.

Note: Students are required to complete the 45 credit minimum through elective courses. While PHNU 744 (Roles and Functions of Public Health Nursing) and PUBH 746 (Program Planning and Evaluation) are recommended as electives, students are encouraged to select courses that meet specific learning needs.

PHNU 283/284 practica are concurrent during the academic semesters and are required for students without OHN experience. The concentrated field practicum, PHNU 396 (5-8 weeks), is required of all students, and enables them to develop and implement advanced OHN practice projects and synthesize the practice within their functional roles. Occupational health nursing students complete PHNU 248 Policy Development which helps to increase students' knowledge and skill related to administration, management, and policy impact. This helps to fulfill a program goal of enhancing students' skills in leadership roles in public health and occupational health nursing. Health care financing, cost containment, and the economic impact of health care within an ethical framework is emphasized throughout the program. Role development is fostered by the attitudes, commitment, expertise, and activities of the faculty and preceptors, who serve as role models.

Research Training

Program Plan/Curriculum

The objective of the doctoral training program is to prepare the student for academic and research career with specialized knowledge and skills in epidemiology and occupational health sciences/nursing. The PhD in Epidemiology is the academic doctoral degree. The PhD is a research degree centered around a major research project. Pre-doctoral candidates work toward a PhD in the Department of Epidemiology with a concentration in Occupational Health Nursing.

The doctoral degree awarded to trainees is the Doctor of Philosophy, which is granted by the UNC Graduate School, requires that each student spend at least four semesters in residence, two of which must be continuous, and two of which must be at the Chapel Hill campus. At least nine semester units of course work must be taken each semester. Beyond this general residency requirement stipulated by the Graduate School, each department has its own specific requirements.

- **Curriculum**

A program of study is developed for trainees to meet competencies in epidemiology/occupational health nursing, research an area of interest, and develop research skills to ensure appropriate extension of occupational health/nursing knowledge. Through doctoral education, occupational health nursing doctoral students are able to:

1. acquire advanced research methods and biostatistical skills;
2. develop expertise in epidemiology and occupational epidemiology to relate research expertise to the understanding of occupational illnesses/injuries and work conditions; and
3. integrate epidemiology, occupational health, and nursing concepts to identify work-related hazards to improve worker health and work conditions.

The academic requirements focus on the development of competence in the following areas:

4. Subject area knowledge relevant to the public health and occupational and environmental sciences;
5. An understanding of methods of monitoring, surveillance, and prevention of work-related illnesses/injuries;
6. Knowledge of the elements of the workplace environment and the interactions including: industrial processes, demography of the worker population, and biological, chemical, enviromechanical, physical, and psychosocial hazards;
7. Development of hypotheses in the field of occupational health that can be quantified and tested;

8. Knowledge and ability in the application of research methodology, findings, and interpretations, with emphasis on occupational health nursing applications; and
9. Skill in communication of concepts of occupational health in both written and oral presentations.
10.

The coursework required for the PhD in Epidemiology/Occupational Health Nursing includes Epidemiology departmental required coursework, and occupational health nursing requirements of an additional 13 credit hours related to occupational health which includes 6 elective credits selected in consultation with the nursing advisor. The additional coursework including EPID 276 (Occupational Epidemiology), PUBH 285 (Interdisciplinary Approaches in Occupational Health), and PHNU 241 (Doctoral Seminars in Occupational Health) are all interdisciplinary courses so there is cross-disciplinary interaction. In addition to coursework, the doctoral program requires completion of a doctoral preliminary examination with written and oral components, practica in research and teaching, approval of a suitable dissertation, and a final oral defense of the dissertation. The doctoral preliminary written examination includes a substantive component which will assess trainee's basic competence in epidemiology/occupational health nursing concepts.

Every trainee is required to participate in research; thus students must complete a supervised research practicum that provides hand-on experience in the conduct of epidemiologic investigations. This might include field collection of occupational health data, interviewing, and subject recruitment. Practicum activities require advance approval by the student's advisor. Students are typically involved in mentored research activities throughout their student careers which is generally interdisciplinary.

Research Dissertation

Each candidate is required to submit a dissertation reflecting research of such scope, originality, depth, scholarship, and skill in presentation as to indicate that the student has a command of the subject and has demonstrated an ability to contribute fresh knowledge or perspectives on the subject. Although the research topic can vary widely within the realm of areas covered by the program, particular emphasis is placed on studies of human health effects in relation to occupational agents and prevention of occupational problems. The subject matter of the research should reflect the interest of the student and program faculty and serve to expand the knowledge base concerning the etiology, diagnosis, and prevention of injury and human disease of occupational origin. The focus of the research and its relationship to occupational health nursing is integral to the dissertation and is monitored by the occupational health nursing faculty advisor. Dissertations usually take two to three years to complete.

Doctoral research is carried out under the supervision of a faculty advisor, who chairs a doctoral committee of 4 other faculty members. The research is reported in a formal dissertation, which must be presented in a public, oral defense and approved by the doctoral committee. Doctoral candidates are required to submit at least 2 papers based on the dissertation for publication in peer-reviewed journals prior to the defense of the dissertation.

Final Oral Examination (Defense of the Dissertation)

The final defense is considered to be the student's opportunity to present the final product of his or her labors to the doctoral committee and other faculty and students. This allows for a discussion and criticism of the presentation and the final written document, as well as of the scientific work presented, its merits and findings.

Research Focus Areas

Faculty in epidemiology have a wide and diverse area of interest and topics in occupational health. Several of these areas are consistent with the National Occupational

Research Agenda (NORA) priorities. Occupational health nursing faculty have strong research interests in both laboratory and applied sciences. Research in the area of biomarker development, hazard identification, exposure, prevention, and intervention methods are well focused.

This plan describes an interdisciplinary program of study for graduate students in Occupational Health Nursing who wish to obtain a doctoral degree. The research training program was NIOSH-approved in May 1997; however, to date we have had only three occupational health nursing students enrolled in the program. One student has graduated, one student decided to transfer to the occupational epidemiology program to devote a sole focus in that area, and one student remains enrolled thus making it difficult to develop/maintain a cadre of occupational health nursing students. Because of very limited enrollment, we decided it was not cost-effective to continue this program and the final students received funding through June 2006.

Faculty provide teaching, advisement, research experiences, and service opportunities for students. We also hired Dr. Gary Greenberg, MD part-time to provide occupational medicine expertise, managing the OEM-listserve now, within the OSHERC and collaborating across program areas. Faculty are listed in Table 12.

Table 12
Faculty, Occupational Health Nursing Program

CORE FACULTY	COMPETENCE AREA
Bonnie Rogers, DrPH, COHN-S, LNCC, FAAN	Occupational Health Nursing, Epidemiology, Ethics, Health Care Worker Hazards
Judith Ostendorf, MPH, COHN-S	Occupational Health Nursing, Ergonomics
Susan Randolph, MSN, COHN-S	Occupational Health Nursing, Agriculture
Gary Greenberg, MD	Occupational Medicine
Dana Loomis, PhD	Epidemiology
Kathleen Buckheit, MPH, COHN-S	Occupational Health Nursing, Ergonomics
ADJUNCT FACULTY	
Ruth Barlow, MS, COHN-S, CCM	Occupational Health Nursing, Case Management
Kay Campbell, EdD, COHN-S	Occupational Health Nursing, Health Promotion
Elise Handleman, MEd, COHN-S	Occupational Health Nursing, Ergonomics
Judith Holder, PhD	Occupational Mental Health
Elizabeth Lawhorn, MSN, COHN-S, CCM	Occupational Health Nursing, Health Promotion
Karen Mastroianni, MPH, COHN-S	Occupational Health Nursing, Health Education
Sam Moon, MD, MPH	Occupational Medicine, Disability Management, Ergonomic
Mary Olshewski, COHN-S, MPH	Occupational Health Nursing
Amy Pearson, COHN-S, MPH	Occupational Health Nursing
Grace Rome Schnackenberg, MS, COHN-S, CCM	Occupational Health Nursing, Counseling
Patricia Travers, MS, COHN-S	Occupational Health Nursing, Disability Management
Olga Tompkins, COHN-S, MPH	Occupational Health Nursing
Jon Wallace, MBA, CSP	Occupational Safety

OCCUPATIONAL SAFETY AND ERGONOMICS PROGRAM

The goals and objectives for the Occupational Safety and Ergonomics (OS&E) Program Area are to provide education, training, and support to master's level graduate students seeking an advanced engineering degree with an emphasis in OS&E. The regional need for practitioner engineers trained in safety and ergonomics can be seen by examining the injury and illness statistics of the furniture, home construction, and agriculture industries – industries of significant importance to the economy of North Carolina and the region. These industries all have injury/illness rates higher than those for private industry as a whole and the prevention of occupational injuries and illnesses can have a significant impact on these industries and their workers. The rationale for housing a training grant within a department of engineering relies on the fact that it is generally recognized that engineering controls are the most effective methods for reducing the incidence and severity of occupational injuries. The main thrust of our program is teaching students how to recognize, evaluate and control occupational safety hazards. The training provided through this program has been and will continue to be a combination of traditional classroom instruction, applied occupational safety fieldwork, and basic and applied research training.

The Program Area Director, Dr. Gary Allen Mirka, Professor of Industrial and Systems Engineering, has been a member of the faculty of the department since 1992 and has provided substantial leadership and expertise to the existing Safety and Ergonomics Training Program. Dr. Mirka was the co-director of the NCSU Safety TPG from 2001-2003 and has been the Program Director of the Safety and Ergonomics Program Area of the NC OSHERC for the last three years. Dr. Mirka is the sole administrator of the Safety and Ergonomics Program Area. He is responsible for coordinating the course offerings, recruiting students to the program, assigning students to program area advisors, and assuring that the program area students follow the required curriculum and gain the necessary research training.

Dr. David Kaber is an Associate Professor in the Department of Industrial and Systems Engineering and is a core faculty member of the program area. Dr. Kaber's expertise and research efforts are focused on occupational safety and health, situation awareness in complex systems automated systems (level of control and adaptive automation), human factors in teleoperation and telerobotics (telepresence), and human-machine system/interface.

Dr. Simon Hsiang is the newest faculty member of our program area, beginning his employment as an Associate Professor of Industrial and Systems Engineering at NCSU in August 2005.

Dr. Nelson Couch is an Adjunct Assistant Professor of Industrial Engineering and is a core faculty member in this program due to the important classroom teaching contribution that he makes. While Dr. Couch has a broad expertise in occupational safety applications (was named a Fellow of the American Industrial Hygiene Association in 2004) his particular area of emphasis is the area of radiation safety.

Curriculum

Over this reporting period the Safety and Ergonomics Program Area was focused exclusively on the training at the master's level. In addition to the traditional coursework training, our program places a heavy emphasis on research training for our master's students. All students who participate in the NIOSH trainee program participate in our on-going funded research efforts as a fundamental part of their training. The program curriculum follows in Table 13.

Table 13
Occupational Safety and Ergonomics Program

Program curricula, course requirements, and sample curricula by academic program
Master's-Level Training. The training of the MS-level students is focused on producing high-quality practitioners with a good understanding of research methods. There are two groups of students that this master's-level program will support. The first group (Group A) will be full time graduate students (thesis-option) who will enter the program having already completed a baccalaureate degree. This is typically a two-year degree program. The second group of students (Group B) will be students that are pursuing a five-year combined BS-MIE degree that is offered by the Department of Industrial and Systems Engineering. This is a relatively new program in our department and is available only to our very best students (GPA>3.5). This program allows the students to replace up to three undergraduate courses with their graduate equivalent and "double count" the credit hours. It typically takes these students an additional year to finish the course requirements for the master's degree, but after five years they leave with both the BSIE and MIE degrees. Based on full-time enrollment, Group A students would be expected to graduate in two years and Group B students would be supported for the fifth year of their combined program. All master's-level trainees (both Group A and Group B) will take a specific set of required courses to satisfy the safety and ergonomics requirements, participate in on-going, sponsored research in the laboratory and are required to take a total of 30 credit hours for graduation (17 of these credit hours have a safety or ergonomics focus). All master's-level trainees will engage in an Applied Practicum in OS&E, to demonstrate skill competence and participate in funded research activities to develop their research skills. All trainees will graduate with the skills necessary to recognize, assess, and develop and implement engineering and administrative controls for general occupational safety and ergonomics hazards.
The safety and ergonomics training provided in this program comes from both required and elective courses. A short description of each of the required courses and the most often selected electives is provided here to describe the breadth of the program coursework.

IE 540: Human Factors in Systems Design

Basic concepts of ergonomics and their application to design of human-machine systems and products. Consideration of human behavioral and biological capabilities and limitations in design for human efficiency, safety and comfort. Systems development cycle; human-machine function allocation; task and skill analysis; systems evaluation; anthropometry. Design of control and display systems, instrument panels, workplaces, seating and tools.

IE 541: Occupational Safety Engineering

Occupational accident-injury study; morbidity, mortality; investigation and analysis. Hazard control; energy countermeasure strategies; control technology. Impact biomechanics, trauma and survivability. Risk assessment; systems safety analysis. Product design, manufacturing defects, system failures and human error as causative factors. Safety program development. Near-accident reporting. OSHA compliance; standards. Accident, trauma and forensic case studies from manufacturing, motor carrier and construction industries.

IE 544: Occupational Biomechanics

Anatomical, physiological, and biomechanical bases of physical ergonomics. Strength of biomaterials, human motor capabilities, body mechanics, kinematics and anthropometry. Use of bioinstrumentation, active and passive industrial surveillance techniques and the NIOSH lifting guide. Acute injury and cumulative trauma disorders. Static and dynamic biomechanical modeling. Emphasis on low back, shoulder and hand/wrist biomechanics.

IE 741: Systems Safety

The process of system safety combines management decision-making, engineering analyses and risk assessment into a comprehensive, systematic approach for managing safety issues. This course will familiarize the student with techniques for identifying and recognizing potential safety hazards and the concept of risk assessment. Various system safety techniques (listed below) will be explored together with their application to hazard analysis and control. Use of situations in the industrial environment and case studies will help to illustrate the usefulness of various system safety techniques.

IE 796A: Applied Practicum in Occupational Safety & Ergonomics

Capstone course for those students participating in the Occupational Safety and Ergonomics Training Program. Application of the skills and techniques learned in program to the recognition, evaluation, and control of occupational safety hazards. Students will work in a local company and provide "consultative services" in occupational safety.

PUBH 285: Occupational Health: Interdisciplinary Approaches

Overview course on occupational health focusing on interdisciplinary approaches to address complexities of workplace exposures, impact of work-related hazards, and interactions on health. Here students attend lectures conducted by an interdisciplinary team of faculty, participate in joint interdisciplinary workplace walk-throughs, and develop and present joint research-based projects

ENV 135: Industrial Toxicology

Toxicological assessment of and a case presentation of related exposure is given. A conceptual approach is utilized to design appropriate programs to prevent worker ill health due to industrial toxicant exposure. In this course students attend interdisciplinary classes either on-campus or on-line, participate in "live" chat sessions, and jointly prepare and present a paper on a chemically-related issue e.g. radon exposures, danger in dry cleaning, or cyanide in gold processing – all student projects.

In terms of the sequence/curriculum, sample curricula for each degree are shown below. Required safety/ergonomics courses are shown in **bold.** All courses are three credit hours unless otherwise specified. Note that while the ENV 135 course was not a specified "required" course in the curriculum of the recently graduated students, their overwhelmingly positive response to this course has changed its status from an elective to a required course in these curricula.

Sample MSIE curriculum:

Semester 1: IE 514 Manufacturing Product Engineering
IE 544 Occupational Biomechanics
IE 723 Production Planning, Scheduling and Inventory Control
IE 601 Industrial Engineering Seminar (1 credit hour)

Semester 2 IE 601 Industrial Engineering Seminar (1 credit hour)
IE 540 Human Factors in Systems Design
IE 541 Occupational Safety Engineering
ST 516 Experimental Statistics For Engineers II

Semester 3 ENV 135 Industrial Toxicology (2 credit hours)
IE 741 Systems Safety Engineering
IE 695 Master's Thesis Research

Semester 4 **IE 796A Applied Practicum In Occupational Safety**
PSY 745 Human Performance
PUB 285 Occupational Health: Interdisciplinary Approaches (2 credit hours)
IE 695 Master's Thesis Research

Safety Concentration: The above sample curriculum shows one set of course options available to the students. To satisfy the Safety concentration requirements, students can select from the courses (or equivalents) listed below. Courses in italic type face are required for the trainees. In total there are 17 credit hours of required safety and ergonomics coursework and an additional 2 credit hours of safety and ergonomics electives.

IE 540: Human Factors in Systems Design
IE 541: Occupational Safety Engineering
IE 544: Occupational Biomechanics
IE 741: Systems Safety
IE 796A: Applied Practicum in Occupational Safety & Ergonomics
PUBH 285: Occupational Health: Interdisciplinary Approaches – offered at UNC-CH
ENVR 135: Industrial Toxicology – offered at UNC-CH
IE 796B: Research Practicum in Occupational Safety & Ergonomics
ENVR 134: Air and Industrial Hygiene – offered at UNC-CH
ENVR 137: Occupational Safety and Ergonomics – offered at UNC-CH
ENVR 138: Health Hazards of Industrial Operations – offered at UNC-CH
MAE 510: Effects of Noise and Vibration
MAE 514: Industrial Noise Control
EPID 125: Injury and Violence as Public Health Problems – offered at UNC-CH
EPID 160: Principles of Epidemiology – offered at UNC-CH
EPID 168: Fundamentals of Epidemiology – offered at UNC-CH
EPID 268: Theory and Quantitative Methods in Epidemiology – offered at UNC-CH
EPID 276: Occupational Epidemiology – offered at UNC-CH

Required Applied Practicum in Occupational Safety & Ergonomics: The applied practicum is part of the programs for the express purpose of giving trainees an introductory work experience specific to occupational safety and ergonomics. Trainees perform a specific, defined work project through an assigned employer. Each trainee (or team, if a group project) prepares a technical report summarizing the work experience and prepares and presents a seminar at the work site. The evaluation of the end product of the project is evaluated by the sponsor and the course instructor. The projects completed over the past three offerings of this course illustrate the technical content of the course.

OCCUPATIONAL EPIDEMIOLOGY

Occupational Epidemiology is an allied component program of the UNC ERC since 2001. The Program's mission is to train highly-qualified scientists who will develop and apply the theory, methods and substance of epidemiology to protect workers' safety and health. Doctoral-level training to prepare scientists for careers in occupational health and safety research and teaching are emphasized.

Occupational epidemiology is the study of the distribution and determinants of disease and injury as they relate to work, and their means of prevention. Occupational epidemiology has been an important field of research and teaching at the University for over 20 years, and considerable strength already exists in this area. The UNC program in Occupational Epidemiology encompasses the full range of traditional applications of epidemiology in occupational health, such as surveillance, etiologic research, and quantification of exposure-disease relations, plus a focus on quantitative methods and innovative applications to the study of social and economic aspects of work and their effects on health. Another distinctive feature of the program is that it will train researchers in occupational injury epidemiology, as well as in classical areas of occupational epidemiology that typically focus on chronic diseases. This opportunity for training in occupational injury epidemiology complements and reinforces the ergonomics and safety program that has joined the ERC. The areas of focus within the Occupational Epidemiology program touch on several of the priority areas embodied in the National Occupational Research Agenda (NORA).

Research training is the centerpiece of the Occupational Epidemiology program. Its primary goals are to train researchers with a high level of intellectual and technical skill who will engage with the most challenging occupational health problems from positions in academia, government, and the private sector, and to prepare the occupational epidemiology faculty of the future, who will educate the following generation of researchers and practitioners. Research training is provided at the pre-doctoral level and leads to the PhD degree. Dr. Dana Loomis served as Program Director.

Programs of Study

Because the backgrounds and interests of trainees are diverse, programs of study are individualized. Beyond the formal requirements, students and their advisors collaborate to tailor individual programs of study centered on the student's area of research. Doctoral students typically take more than the required number of courses by selecting--in consultation with their advisors--additional courses that are directly related to their research areas and career plans.

Epidemiology doctoral students are expected to have an understanding of the major conditions that influence the health of the public, and are strongly encouraged to take substantive epidemiology courses outside their specialty area. Most doctoral students therefore take courses related to major health outcomes, such as Cardiovascular Disease Epidemiology (EPID 256), Cancer Epidemiology (EPID 233), or Infectious Disease Epidemiology (EPID 218), and many also take Perinatal Epidemiology (EPID 219) or Injury as a Public Health Problem (EPID 125). Doctoral students are strongly encouraged to take additional courses in Biostatistics, as well. Many take Analysis of Categorical Data (BIOS 165), and the most quantitatively advanced may choose Probability and Statistical Inference I and II (BIOS 160 and 161). In addition, all students in the Environmental, Occupational, and Injury Epidemiology Program are advised to take at least two courses outside the Department in areas related to their field of specialization. These are typically in environmental sciences, but students may choose from a list of recommended courses covering such diverse areas as toxicology, demography and medical geography.

For NIOSH Occupational Epidemiology trainees, courses beyond the formal requirements are recommended on an individual basis, according to their research areas and career goals. Recommendations for coursework are made by the faculty advisor, and needs for additional coursework are formally evaluated during an Intradepartmental Review that usually takes place during the second year of the doctoral program. For most Occupational Epidemiology trainees, the courses recommended would be in epidemiology, environmental sciences, or biostatistics. Students pursuing certain research areas might be directed to courses in other disciplines, like behavioral sciences or public policy, however. To show the potential diversity of programs, students interested in occupational injury might be encouraged to take Principles of Injury Prevention and Control (EPID 125) and Industrial Safety and Ergonomics (ENVR 147) to supplement the required sequence. Those interested in exposure assessment methods might be encouraged to take Theory and Practice of Exposure Evaluation (ENVR 242) and Biochemical Epidemiology (EPID 223), while students pursuing research in occupational cancer might be directed toward Cancer Epidemiology (EPID 233) and Chemical Carcinogenesis (ENVR 291). All trainees take Interdisciplinary Approaches to Occupational Health (PUBH 285).

Courses for a typical Occupational Epidemiology trainee with a Master's degree are shown in Tables 14 and 15. Most trainees are expected to follow a similar pathway, since, as noted above, they would enter the program with either a Master's from another institution or after completion of the MSPH at UNC.

Because the program is housed in a large, established epidemiology department in a leading school of public health, trainees have the benefit of access to a wide array of courses and research opportunities in epidemiology, environmental health sciences, and other public health disciplines. Within occupational epidemiology, the diverse interests of our program faculty provide trainees with a broad understanding of the field, as well as a number of potential areas for specialization. Our faculty's interests embrace several NORA priority research areas, including fertility and pregnancy abnormalities, musculoskeletal disorders, traumatic injuries, special populations at risk, work organization, and research methods in cancer, risk assessment, and exposure assessment. Despite our breadth, however, we can identify three areas that particularly stand out for their unique approach or concentration of expertise.

Two areas where the UNC program makes a special contribution to occupational epidemiology are in research on occupation and reproduction and the study of occupational injuries, both described above. The reproductive epidemiology focus at UNC is noteworthy for its attention to both maternal and paternal occupational exposures, the number of faculty and students involved, and their significant contribution to the literature.

While the occupational injury epidemiology program is younger and smaller--reflecting the relatively recent growth of injury epidemiology as a subdiscipline--there are few other centers where this type of training is available. With extensive involvement of several faculty members, a substantial number of students, and the UNC Injury Prevention Research Center as a resource, the occupational injury program also makes a special contribution to the field.

A third special contribution of the UNC program is its concern with the social, economic, and political context of occupational health. This focus integrates UNC's traditional orientation toward social and cultural determinants of ill health with contemporary concerns about such issues as special populations at risk, economic globalization, and the changing workplace. The research of several faculty members bears on NORA concerns with the organization of work and special populations at risk, including Prof. Runyan's studies of child labor, Prof. Santana's research on the health of informally-employed workers, Dr. Lipscomb's work with African-American women in the poultry processing industry, and

research by Prof. Loomis on social inequalities in occupational illness and injury risks. Prof. Wing's writings on philosophical aspects of epidemiology and his research on disparities in environmental exposures also address concerns about justice. Interest in these contextual issues is not a circumscribed area of research, however, but rather a perspective that informs the research and teaching of several of our faculty. As examples of the influence of this perspective, the Occupational Epidemiology course includes discussions of child labor and the health of female and minority workers, and student work has included a study of occupational injury in the US-Mexico border region as a unique area undergoing rapid economic and social change. Occupational Epidemiology faculty are shown on Table 16.

Table 14
Courses Required for the PhD in Epidemiology.

Course Number and Title		Credit Hours
Required for the PhD in Epidemiology		
EPID 168	Fundamentals of Epidemiology	4
EPID 201	Epidemiologic Research Methods	3
EPID 268	Theory and Quantitative Methods in Epidemiology	4
EPID 269	Advanced Methods for Epidemiologic Data Analysis	3
EPID 390	Epidemiology Doctoral Seminar	2
BIOS 110	Principles of Statistical Inference	3
BIOS 145	Principles of Experimental Analysis	3
Minimum of two substantive courses in separate areas of Epidemiology (e.g., occupational epidemiology, cancer epidemiology)		6 (minimum)
EPID 394	Dissertation	3 (minimum)
Additional Requirements for Occupational Epidemiology Trainees		
EPID 276	Occupational Epidemiology	3
PUBH 285	Interdisciplinary approaches in occupational health	3

Table 15
Elective courses recommended for Occupational Epidemiology trainees.

Course Number and Title		Credit Hours
Epidemiology		
EPID 125	Principles of Injury Prevention and Control	3
EPID 213	Epidemiologic Surveillance in Public Health	3
EPID 219	Perinatal Epidemiology	3
EPID 223	Biochemical Epidemiology	3
EPID 233	Cancer Epidemiology and Pathogenesis	3
EPID 234	Cancer Epidemiology Methods	3
Environmental Sciences/Industrial Hygiene		
ENVR 141	Air and Industrial Hygiene	3
ENVR 144	Industrial Toxicology	3
ENVR 147	Occupational Safety and Ergonomics	3
ENVR 149	Health hazards of industrial operations	3
ENVR 159	Analytic Thought and Environmental Risk	3
ENVR 168	Comprehensive Radiation Biology	3
ENVR 191	Health Effects of Environmental Agents	3
ENVR 198	Biophysical Theory of Environmental Health	3
ENVR 242	Theory and Practice of Exposure Evaluation	3
ENVR 246	Advanced Methods of Exposure Assessment*	3
ENVR 291	Principles of Chemical Carcinogenesis	3
ENVR 292	Molecular Approaches to Environmental Toxicology	3
Biostatistics		
BIOS 160	Probability and Statistical Inference I	3
BIOS 161	Probability and Statistical Inference II	3
BIOS 164	Survey Sampling	3
BIOS 165	Analysis of Categorical Data	3

*Strongly recommended
Other relevant courses: The Labor Force (SOC 127); Occupations and Work (SOC 246)

Table 16
Occupational Epidemiology Faculty

Core faculty	Areas of Interest in Occupational Epidemiology
Dana Loomis (Professor & Program Director)	Injuries; musculoskeletal disorders, exposure assessment methods; international occupational health; special populations
Marilie Gammon (Associate Professor)	Breast cancer; esophageal cancer; gastric cancer
Andrew Olshan (Professor)	Parental occupation, pregnancy outcome and childhood cancer; exposure assessment methods
Stephen Marshall (Assistant Professor)	Injuries; quantitative methods
Charles Poole (Associate Professor)	Quantitative methods
David Savitz (Professor)	Pregnancy outcome; electromagnetic fields; pesticides & cancer
Jane Schroeder (Assistant Professor)	non-Hodgkin's lymphoma, renal cell cancer, uterine fibroids, pesticides and other agricultural exposures.
Steve Wing (Associate Professor)	Ionizing radiation, social justice and health; philosophy of epidemiology
David Richardson	Cancer; radiation workers; quantitative methods
Jiu-Chiuan Chen	Respiratory diseases; musculoskeletal disorders; exposure assessment
Joint and Adjunct Faculty	**Areas of Interest in Occupational Epidemiology**
John Dement	Exposure assessment, construction
Hester Lipscomb	Musculoskeletal disorders; injuries; construction
Bonnie Rogers	Occupational health nursing, hazards to health workers, ethics
Kenneth Mundt	Surveillance, methods, injury and disability, historical exposure reconstruction, science policy
Carol Runyan	Injuries; violence; young workers; agriculture
Vilma Santana	Mental health; women; work organization
Timothy Wilcosky	Cancer; exposure assessment; quantitative methods

HEALTH SERVICES RESEARCH IN OCCUPATIONAL SAFETY AND HEALTH

This training program began in July 2000 and intends to prepare researchers in Health Services Research in Occupational Safety and Health (HSROSH). The program is housed in the Department of Health Policy and Administration (HPAA) with linkages to the NCOSHERC, the Injury Prevention Research Center (IPRC), and the Cecil G. Sheps Center for Health Services Research (Sheps Center) so that students learning can be enhanced and fostered. The program receives strong institutional support in faculty salary support evidenced by substantial faculty support in HPAA and the Public Health Leadership Program where the NC OSHERC is housed.

The faculty of the HSROSH Program remains unchanged. Dr. Bonnie Rogers continues as NC OSHERC PI/Program Director and Director for the HSROSH Program. Dr. Morris Weinberger continues as Co-Director for the HSROSH Program grant. Susan Randolph continues as Program Coordinator and supporting faculty. The faculty for the program represent researchers and practitioners from a wide variety of disciplines including professionals in health services research, occupational health and safety, economics, epidemiology, injury prevention and control, management systems, and statistics. Exposure to these faculty and disciplines, as well as linkages with external agencies including the NC State Public Health Department, various industry segments, and labor groups, will enhance the students' experiences. Faculty are shown in Table 17.

The objectives of the training program are to provide education, experiences, and a professional environment for trainees to:

1) Develop knowledge and skills in order to conduct independent research in health services research in the field of occupational safety and health.
2) Develop knowledge of the literature, important findings, methodological problems, data availability, and research issues related to the organization, financing, and management of occupational health services and delivery options including an examination of quality, cost-benefit, and cost-effectiveness analyses and evaluation.
3) Learn how to apply currently acceptable statistical analysis techniques to research issues in health services research in occupational safety and health.
4) Develop teaching skills by designing and teaching a course in the area of specialization.
5) Develop a minor or collateral area to bring additional perspectives to problems in health services research.

Training Plan

General Description

For this training program, the PhD in Health Policy and Administration (HPAA) is offered. The program provides the education for those who plan health services research careers in teaching and research. The goal of the program is to provide students the academic foundation, research experience, and professionalization within the health services research and occupational safety and health disciplines to become independent and creative investigators. The training program includes a minimum of 44 credit hours of graduate coursework beyond prerequisites, including the minor. Course credits must include: the departmental core; health services research; occupational safety and health; research methodology; and a minor area. Minor areas can be pursued within the Department of HPAA or through other university departments and may include such disciplines as sociology,

political science, operations research, economics, financial management, epidemiology, demography, biostatistics, or others agreed upon by the student's advisor and the director of the doctoral program.

Each student is required to prepare a dissertation based on original research which tests, extends, or applies a set of concepts or principles from the selected disciplinary area to a problem in health services research in the field of occupational safety and health. Students present and orally defend a dissertation proposal and the dissertation itself. Students sit for a comprehensive examination in their last year of course work, normally during the summer of the second year. It is possible for a well prepared, directed and motivated student to complete the program in three years, but usually longer periods of time are required. However, all requirements for the degree must be completed within eight years from the date of first registration in the Graduate School.

Upon graduation, trainees will be qualified as HSROSH researchers who will work as scientists to explore the relationships between the structure and applications in and effectiveness of the delivery of occupational safety and health services, and how this impacts worker health and safety systems and health. Graduates will be highly desirable researchers in settings such as universities, state health departments, research institutes, industry, government, managed care systems, and worker insurance driven operations.

Enrollment increased from one student in 2001 to five students in 2006, the highest enrollment of all Health Services Research programs compared to other programs in the nation.

Table 17
Faculty for Health Services Research in Occupational Safety and Health

CORE FACULTY	
Morris Weinberg	Health Services Research, primary care, outcomes-research
Tom Ricketts	Rural healthcare, primary care, regionalization of services, political philosophy, policy implementation and development
Bonnie Rogers (PI)	Occupational health/safety, ethics in occupational health, hazards to health care workers
Carol Runyan	Injury prevention and control
SUPPORTING FACULTY	
Edward Norton (Co-PI)	Healthcare economics, long term-care and aging, managed care and mental health, economics
Marisa Domino	Economics of mental health, agency relationships among physicians, patients, and insurers; diffusion of new technologies, and public provision of health care and health insurance to low income populations
William Sollecito	Management systems
Sally Stearns	Health economics, health policy, applied statistical methods
Bryan Weiner	Governance in health care, quality improvement implementation, community health partnerships
Susan Randolph	Occupational health and hazard surveillance
ADJUNCT FACULTY	
David Coble	Safety in occupational health
Carol Epling	Occupational medicine education
Arnold Kaluzny	Assessment, program evaluation, development and operations of strategic alliances in health services
Kerry Kilpatrick	Operations research
Dana Loomis	Occupational epidemiology, health risks to vulnerable groups
Judith Ostendorf	Ergonomics in occupational health
Kay Campbell	Occupational health promotion, disability management

Curriculum of Study

The curriculum of study, beyond the prerequisites, requires approximately 42 credit hours of coursework (approximately 16 courses) excluding credits for the dissertation. Coursework required is inclusive of HPAA departmental core courses which focus on the science, logic, and utility of health services research; health services research methods; occupational safety and health knowledge courses and electives related to the health services research in occupational safety and health; health services/applied research electives from which the students can select coursework in either the health services research or occupational safety and health field that complements the knowledge base needed; and the minor area of study.

1. Coursework

- 2 Doctoral Seminars in health policy, administration, and in organizational theory and health services, HPAA 300, HPAA 301 and HPAA 330;
- 2 courses in Statistical Analysis, HPAA 273 and HPAA 274, or BIOS 163 and 165, or ECON 273 and 274;
- 1 course in Advanced Methodology in Health Policy and Administration Research, HPAA 371;
- 1 seminar on Selected Topics in Health Policy and Administration, HPAA 305;
- 1 seminar in Teaching of Health Services Research, HPAA 304;
- 1 course in health services research methods, HPAA 272;
- 5 courses in occupational safety and health related topics including an integrative seminar.
- 5 courses in the minor area courses;
- 1 monthly research seminar, HPAA 360;
- elective courses in health services research, applied research, or occupational safety and health;
- Doctoral Dissertation, HPAA 394;

Curriculum guide/sequence of courses is shown in Tables 18 and 19.

2. Minor Area Requirements

The Department does not require that a minor be formally declared with the Graduate School, even though the student may elect to do so. At least one course of the minor must be in research or quantitative methods relevant to the minor field, and at least one course must be in theory relevant to the minor field.

If students elect to formally declare a minor in a particular discipline so that it will appear on their transcripts, then all graduate school requirements for doing so must be met. In general, the Graduate School requires that the minor consist of at least 15 credit hours, and that all courses counting towards the minor be listed (or cross-listed) in programs other than the student's major. In addition, the minor should be planned in advance, and both the major and minor programs must give the Graduate School written approval for the program.

Table 18
PhD Program Curriculum
Health Services Research in Occupational Safety and Health

HPAA Core Courses (17 credits)

Course	Title	Credits
*HPAA 300	Doctoral Seminar in Health Policy & Admin I	3
*HPAA 301	Doctoral Seminar in Health Policy & Admin II	3
*HPAA 304	Seminar in Teaching Health Policy & Admin	3
*HPAA 305	Selected Topics in Health Policy & Admin: Advanced Seminar	3
*HPAA 330	Doctoral Seminar in Organization Theory & Health Service Organization	3
*HPAA 360	Policy Seminar in Health Policy & Admin	2
*HPAA 361	Policy Seminar in Health Policy & Admin	2

HPAA Methods Courses (9 credits)

*HPAA 273	Linear Regression Models	3
*HPAA 274	Analysis of Categorical Data	3
*HPAA 371	Advanced Methodology in Health Policy & Admin	3

HPAA Health Services Research (3 credits)†

Select a course from list.

HPAA Minor Area of Study (15 credits)†

Specific courses are determined by minor area of study:
Epidemiology, Economics, Political Science, or Sociology

Occupational Safety & Health Requirements (13 credits)†

*PUBH 241	Seminar in Public Health/Occup. Health	2
*PUBH 285	Interdisciplinary Approaches to Occup. Health	2

Select 9 other credits of electives in Occupational Safety and Health from an approved list or approval from the Program Director.

HPAA Other

*HPAA 394	Doctoral Dissertation	6 (minimum)

* Required course

† While a student must complete 13 credits to fulfill the Occupational Safety and Health (OS&H) requirement, courses taken to fulfill the Health Services Research and Minor Area of Study requirements may also count toward the OS&H credits if they are relevant.

Table 19
Sample Program of Study: EPID Minor
Health Services Research in Occupational Safety and Health

HPAA Core Courses (17 credits)

Course	Title	Credits
*HPAA 300	Doctoral Seminar in Health Policy & Admin I	3
*HPAA 301	Doctoral Seminar in Health Policy & Admin II	3
*HPAA 304	Seminar in Teaching Health Policy & Admin	3
*HPAA 305	Selected Topics in Health Policy & Admin: Advanced Seminar	3
*HPAA 330	Doctoral Seminar in Organization Theory & Health Service Organization	3
*HPAA 360	Policy Seminar in Health Policy & Admin	2
*HPAA 361	Policy Seminar in Health Policy & Admin	2

HPAA Methods Courses (9 credits)

*HPAA 273	Linear Regression Models	3
*HPAA 274	Analysis of Categorical Data	3
*HPAA 371	Advanced Methodology in Health Policy & Admin	3

HPAA Health Services Research (3 credits)†

HPAA 272	Methods for Health Policy Analysis and Technology Assessment	3

HPAA Minor Area of Study – Epidemiology (15 credits)†

*EPID 168	Fundamentals of Epidemiology	4
*EPID 268	Theory & Quantitative Methods in Epid.	5
EPID 125	Injury as a Public Health Problem	3
EPID 276	Occupational Epidemiology	3

Occupational Safety & Health Requirements (13 credits)†

*PUBH 241	Seminar in Public Health/Occup. Health	2
*PUBH 285	Interdisciplinary Approaches to Occup. Health	2

Select 9 other credits of electives in Occupational Safety and Health from an approved list or approval from the Program Director.

Examples listed below.

EPID 125	Injury as a Public Health Problem—3 credits (fulfills OS&H credits)
EPID 276	Occupational Epidemiology—3 credits (fulfills OS&H credits)
HPAA 272	Methods for Health Policy Analysis and Technology Assessment—3 credits (fulfills OS&H credits)

HPAA Other

*HPAA 394	Doctoral Dissertation	6 (minimum)
		TOTAL: 54 (minimum)

* Required course

† While a student must complete 13 credits to fulfill the Occupational Safety and Health (OS&H) requirement, courses taken to fulfill the Health Services Research and Minor Area of Study requirements may also count toward the OS&H credits if they are relevant.

CONTINUING EDUCATION AND OUTREACH

Since 1976, the Center has been committed to the presentation of quality CE programs for occupational safety and health professionals. Based on needs assessments, course evaluations, outreach, and recruitment activities, there continues to be a substantial need for this service, due in part to the ever-changing needs of practitioners and an increased need for an interdisciplinary approach to Continuing Education (CE). The CE Program is responsible for developing, coordinating, and implementing courses that provide information to the various disciplines to enhance their work productivity, and provide professional development. The CE Program includes education and hands-on training required to earn and maintain professional certifications, licensure, and regulatory requirements. This is accomplished by identifying these requirements through various forms of needs assessments, collaborating with qualified faculty and academic advisors, and developing and delivering appropriate courses to meet these needs. Evaluations from various sources serve as quality assurance that courses are effectively and efficiently delivering the NC OSHERC programs and services.

The goals of the CE Program remain to provide top quality education and training to health and safety practitioners in the southeast region through Institutes, contract courses, and onsite short offerings. As in the past, the CE Program focuses on its collaborating with other institutions and agencies to provide the highest quality programs and faculty available. CE Program Director, Kathleen Buckheit, has been Director for three years and is responsible for overseeing the administration of all program development and activities, including: selecting courses and faculty; facilitating development of online courses, ensuring quality for courses, faculty, presentations, and customer satisfaction; providing sound fiscal management; marketing programs and services; developing and conducting outreach and diversity activities. She works closely with the Advisory Boards on these responsibilities.

Industrial Hygiene (IH): More than 20 faculty teach over 20 classes and serve as course directors, instructors, technical advisors, and advisory and planning committee members. As a consultant with a wide variety of health and safety experiences in the public and private sector, Nelson Couch, PhD, CIH, CSP, Chair of the Technician Certificate Program Advisory Board and lead academic faculty member for CE Programs, represents academic faculty from UNC IH and NCSU Safety Programs.

Occupational Health Nursing (OHN): Academic faculty serve as course directors, instructors, and advisory and planning committee members for the CE Program, presenting: *OHN: Introduction to Principles and Practice*; and *OHN*, *OHN Safety Management*, and *Case Management Certification Review Courses*. CE collaborates with the NC Association of Occupational Health Nurses (NCAOHN) and NC Tarheel Association of Occupational Health Nurses (NCTAOHN) with four OHN academic faculty, Bonnie Rogers, DrPH, Judy Ostendorf, MPH, Susan Randolph, MS, and Kathleen Buckheit, MPH, planning, developing, and presenting at semi-annual NCAOHN State Conferences, and local chapter meetings and provide all AV equipment and on-site technical support.

Occupational Medicine (OM): Faculty at UNC-CH, Duke University Medical Center, and private practitioners serve as course directors and faculty in CE OM courses. Dennis Darcey, MD, MSPH and Brian Caveney, JD, MD, MPH from Duke, participate on the CE Advisory Board and develop and present *Workplace Ergonomics* at the NCOSHERC Summer and Winter Institutes. Brian Boehlecke, MD, UNC, teaches the *Pulmonary Function Testing Technician* course.

Occupational Safety and Ergonomics (OS): Academic faculty from NCSU School of Engineering and consultants from their Ergonomics Center plan, develop, and conduct Ergonomics courses with Tamara James, MS, Ergonomics Director for Duke, Tim

McGlothlin, MS, Director of NCSU's Ergonomics Center. Dr. Nelson Couch, a NCSU faculty member, Chairs the Technician Certificate Programs Advisory Board and teaches for CE. Ray Boylston, (first head of NC OSHA and a wealth of experience and knowledge), David Coble, Bill Taylor, and Jim Jones provide a unique team of safety instructors blending their years of varied experiences from OSHA, industry, military and city government. Jon Wallace, co-instructor for the academic Safety and Ergonomics course with Judy Ostendorf (OHN), is course director for the Safety and Health Systems Auditing CE course and is also developing the Fundamentals of Safety online course.

Needs Assessment

Needs assessments during this past grant period were conducted through the following sources:

1. Survey of students attending current continuing education programs.
2. Mailed questionnaire was sent to 5,000 people on the mailing list.
3. Information gathered at NC-OSHERC exhibit booth.
4. Information gathered by NIOSH/ERC booth at conferences
5. Information from the established Advisory Committee.
6. Information gathered through a needs assessment on the web site
7. Survey of students attending current NC OSHERC CE programs: A random survey of 75 student evaluations attending 11 CE courses during 2004-2005 requested 34 courses in "other". Data indicate that students' top courses are: Ergonomics; Safety; Confined Space; Industrial Hygiene Sampling; Lab/Biosafety; and Indoor Air/Mold.
8. Information gathered at NC OSHERC exhibit booth at professional conferences and via the NC OSHERC website for 39 participants: Data collected indicate the top five courses requested are: Certification Review Courses (OHN, IH, OM, SAFETY-100%); Complying with OSHA (62%); Workplace Health Promotion (62%); Industrial Hygiene (56%); Occupational Safety (51%).
9. Information gathered by NIOSH ERC exhibit booth at professional conferences in 2005: The ERC data from 52 participants indicate the top five courses requested are: Risk Assessment (81%); Respiratory Protection (63%); Occupational Safety (60%); Hearing Loss/Conservation Programs (54%); and Ventilation (50%).
10. Results of Needs Assessments conducted by professional Associations: AAOHN 2005 needs assessment data indicate the top five topics are: Worksite Health Promotion/Wellness (71%); Legal Liability/Scope of Practice Issues' (67%); Case Management (67%); Safety/Injury Prevention (65%); and Stress Management (64%).
11. Centerwide needs assessment of March 2005 was sent to 2,834 people on the Center's Email list. Occupational Medicine (OM) had limited audience in this assessment since it was not part of the NC OSHERC. As a Training Program Grant (TPG), Duke OM has conducted its own needs assessment and CE courses that we will use to develop and present OM courses. The Centerwide needs assessment survey listed 56 topics from which survey respondents could choose. Tracking of the effectiveness and impact of professional Certification Review Courses is conducted for CIH, CSP, CHMM, COHN, and COHN/CM. Questionnaire results and Pass/Fail Rates from course attendees are being tracked and indicate highly successful offerings.

Technician Certificate Programs were initiated with IH in 1996 after careful analysis of many methods of surveying students to identify job responsibilities and in what ways they felt

the knowledge and skills were deficient. Safety followed in 1999 with Environmental offered in 2002. From the input of the health and safety professionals in the workforce and the many methods of conducting needs assessments, it was apparent that the scope of practice of the specialty profession has changed and enlarged to cover non-standardized responsibilities that cross over into other disciplines. Now all Certificate Programs all require two week-long courses (4 units or non-academic credits) in the base discipline and two remaining units chosen from a list of about 25 electives every year, applicable to all of the Technician Certificate Programs to best fit the role of the technician. Exams are outcome measurements of acquired skill and knowledge. Since 1996, there have been 678 Certificate Program students, 334 graduated.

Professional Certification Review Courses prepare professionals to pass their relative certification exams, required by many employers for advancement and higher compensation. These courses are interdisciplinary using faculty from all program areas. Comprehensive Industrial Hygiene (CIH); Certified Safety Professional (CSP and ASP); Certified Hazardous Materials Manager (CHMM); Certified Occupational Health Nurse (COHN and COHN-S), Certified Occupational Health Nurse/Case Manger (COHN /CM and COHN-S/CM) are offered. Developed by Safety and OHN faculty for a new OHN certification offered this year, Certified Occupational Health Nurse Safety Manager (COHN/SM and COHN-S/SM) Review Course was offered this Fall.

Distance Education was initiated three years ago to incorporate distance-learning opportunities into the total CE Program based on needs assessments and student requests, beginning with Fundamentals of Industrial Hygiene (FIH). Although most who inquired have taken the course in person, three are currently enrolled. FIH was the first course developed in a web-based format, modeled after the FIH course produced by the UNC OHN and IH Programs for distance learning students. This 4.5-day course, earning 36 contact hours for CEUs, is also offered in the traditional CE format at both semi-annual Institutes. The online format awards the same 4.5 ABIH or 2.9 BCSP points or CEU contact hours and the student has up to 15 weeks to complete the course and earn two units for the Technician Certificate Program. There have been many inquiries from individuals and industries to use this format since January 2005; however, five have registered and three have begun the course Fall 2006. We have had meetings with AIHA to collaborate on a marketing effort to promote the online course together.

HAZARDOUS SUBSTANCE TRAINING

Since 1976, the Center has been committed to the presentation of quality continuing education programs for occupational safety and health professionals. Based on needs assessments, course evaluations, outreach, and recruitment activities, there continues to be a substantial need for HST, due in part to the ever-changing needs of practitioners and an increased need for an interdisciplinary approach to HST. The HST Program targets local and state government employees in the Southeast region.

Goals and Objectives: The HST Program goals are: Provide quality HST training required: for job performance, to meet regulations, and to protect the health and safety of workers in the hazardous substance response and site remediation activities in the Southeast Region IV.

Kathleen Buckheit has been Director of the NC OSHERC CE and HST Programs for 3 years. In her position as HST Director, Ms. Buckheit is responsible for overseeing the administration of all HST Program development and activities, including: selecting courses and faculty; facilitating development of online courses, ensuring quality for courses, faculty, presentations, and customer satisfaction; providing sound fiscal management; marketing programs and services; developing and conducting outreach and diversity activities.

Curriculum - Needs Assessments have been used to identify the types, numbers, and frequency of courses offered, curriculum and course design, and faculty who teach the HST programs. The programs are driven by the results of the analysis of the several forms of determining the need for training and education. Data collected from a variety of sources was used in planning the activities of the HST program and includes recent needs assessments conducted during 2003-2006 through the following sources:

- Surveys are being collected this year (2006) from members of the NC Association of Hazardous Materials Responders of fire, HazMat, and medical responders (In process).
- Several county environmental health groups have collaborated with NC OSHERC and provided their assessment data this year (2006) (In process).
- NC OSHERC is developing a needs assessment survey for NC DENR to be conducted in 2007.
- Needs assessment survey for HST of 112 attendees at the National Environmental Health Association Conference in San Antonio (June 2006) identified the top five courses requested: Biosafety (56%), Disaster Preparedness (56%), Methamphetamine Labs (54%), Environmental Risk Assessment (48%), HAZMAT (48%), Respiratory Protection and Personal Protective Equipment (46%), Sampling of Environmental Exposures (44%). This group represented 32 Southeast Region residents.
- 50 student evaluations from a random survey of 11 HST courses during 2004-2005 indicated that the top HST courses requested were: Confined Space (58%); Occupational Hygiene Sampling (56%); Biosafety (46%); Indoor Air/Mold Remediation (44%); and Ventilation (40%).
- Information gathered at the NC OSHERC exhibit booth at professional conferences and via the NC OSHERC website from 39 participants in 2003: Data collected indicate the top five HST related courses requested are: Respiratory Protection (53%); Lead (43%); HazMat Training (41%); Indoor Air Quality (41%); and Confined Space (41%).
- Information gathered by NIOSH ERC (all ERCs) exhibit booth at professional conferences: The ERC data from 52 participants indicate the top five courses requested are: Regulatory Update (42%); Environmental Risk Assessment (33%); HazCom (33%); and Occupational Hygiene Sampling (30%); and Applied Toxicology (21%).
- AAOHN 2005 needs assessment data indicate the top three HST topics are: Regulatory Compliance (60%); Environmental Health Issues (60%); All-hazard Preparedness (44%).

- Information from the established HST and Technician Certificate Advisory Committees: The Advisory Board reviewed the courses and recommended developing an Environmental Risk Assessment course.
- Centerwide needs assessment of March 2005 was sent to 2,834 people on the Center's email list. The Centerwide needs assessment survey listed 19 HST topics from which survey respondents could choose. The top HST courses are identified by discipline are listed and starred as follows:

Topics identified relative to HST	OHN	IH	Safety	Occ Med
Regulatory Update – OSHA / Workers' Compensation	48% *	29%	41% *	50% *
Environmental Health Issues	38% *	43% *	40% *	50% *
Risk Assessment	30% *	61% *	55% *	0%
Toxicology	18%	36% *	14%	0%
Mold Exposure/ Indoor Air Quality	20% *	39% *	35% *	0%
Respiratory Protection	15%	36%	21%	50% *
Air Sampling	10%	54% *	28% *	0%
Ventilation	3%	39% *	21%	0%
HAZMAT	15%	25%	35% *	50% *
Bioterrorism	33% *	25%	28% *	50% *
Infectious Diseases	23% *	14%	10%	0%
Occupational Reproductive Hazards	15%	61% *	17%	50% *
Occupational Pulmonary Diseases / Asthma	15%	21%	24%	50% *
Agricultural Health and Safety / Pesticides	16%	21%	24%	100% *
Confined Space and Compliance	8%	29%	31% *	0%
Occupational Surveillance / Epidemiology	56% *	50% *	34% *	50% *

This demonstrates that the HST Program is vigilant in responding to the workforce needs on regional and national level and remains on track with its offerings. We rely on mailed surveys and use Internet responses, Emailed surveys, and in-person needs assessment from professional conferences where personal networking and outreach contacts occur.

NORA

The goal of the NORA Research Support Program is to provide a focused effort to support NORA related research training, interdisciplinary research discussion and collaboration, when feasible, and dissemination and applications of research through continuing education. Research training received by trainees is based on the curriculum of study in each department (e.g., epidemiology, occupational health nursing, industrial hygiene).

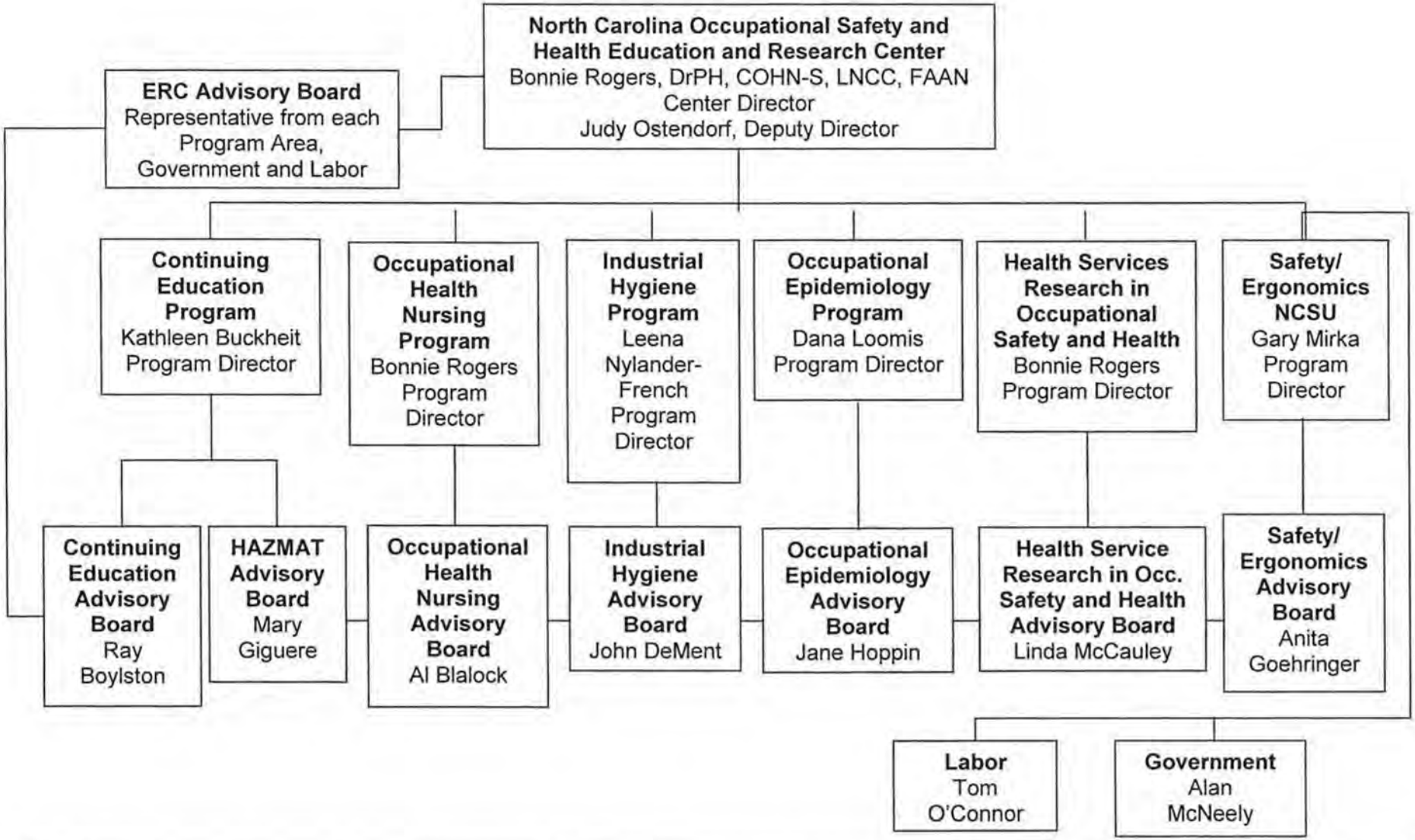
Interdisciplinary research interaction is accomplished in several ways: collaborative research projects among faculty and students where like interests exist which is already being done; participation of students and faculty in the interdisciplinary seminar series and continuing education/outreach events which has a focus on NORA research; and discussion at OSHERC executive Committee (Program Directors) meetings to identify opportunities for students to engage in research projects.

NORA related research projects include the following; a completed Train the Trainer Health Care Provider Initiative on Pesticide Exposure which resulted in the presentation at National Environmental Educational Training Foundation (NEETF) "Pesticide Competency Guidelines"; a Robert Wood Johnson project, Ergonomics and Nursing in the hospital environments involved three OHN faculty, Gary Mirka, NCSU faculty, and one OHN student; this particular project resulted in submission of an R2P NORA proposal and several articles are in process; one of the OHN faculty and one of the students are working on a project titled Effectiveness of Guidelines for Hazardous Substances. Four separate projects related to musculoskeletal disorders and special populations at risk were conducted by students and faculty and resulted in four publications by the same titles: Evaluation of a Redesigned Self-Checkout Station for Wheelchair Users; College Students and Computers, Differences in Trunk Kinematics; and Ground Reaction Forces Between Older and Younger Adults During Lifting, and Effects of Age on Muscle Activity and Upper Body Kinematics during a Repetitive Forearm Supination Task; two projects pertaining to musculoskeletal disorders and intervention effectiveness research were Assessing the Effects of Positive Feedback and Reinforcement in the Introduction Phase of an Ergonomic Intervention and Learning Curve Analysis of a Patient Lift Assist Device and they too, resulted in publications by the same name. Two projects pertaining to low back disorders that also resulted in publications were: The Effect of a Repetitive, Fatiguing Lifting Task on Horizontal Ground Reaction Forces; and A Study of Lifting Tasks Performed on Laterally Slanted Ground Surfaces; Two projects and publications pertaining to musculoskeletal disorders were Ergonomic Interventions for the Reduction of Back and Shoulder Biomechanical Loading when Weighing Calves and A Biomechanical Analysis of Anterior Load Carriage.

CONCLUSION

The NC OSHERC has prepared numerous master's and doctoral level graduates for the workforce prepared to deal with significant occupational health and safety issues and lead and advance the science and professions. Publications produced by trainees and faculty follow.

Technology advancement has fostered the opportunity to provide both academic and continuing distance education learning experiences which will further the opportunities for enrollment for students unable to relocate which to date has been witnessed. We continue to expand and enrich the learning lives of our students, and faculty to better improve the health and safety of our nation's working population.



The ERC Director is Bonnie Rogers. She oversees the OSHERC and the respective Program Directors oversee each program (CE, IH, OHN, EPI, HSROSH) within the ERC. The ERC Advisory Board works directly with the ERC Director. The CE, Hazmat, OHN, EPI, HSROSH and IH Advisory Boards work directly with the Program Director of each respective program area.

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Occupational Health Nursing
Tracking Graduates-Academic Training Report

Trainee Name (if supported by a NIOSH training grant, denote with *)	Date Entered Program	Date Degree Awarded (only if at your institution)	Degree Awarded (also specialty area as noted on degree)	Date of Certificate of Completion (for Occ Med and other Cert programs)	Current Employment (Job Title/Employer)	Employed in OS&H Field or Enrolled in OS&H Academic Program? Y/N
Herlin, Kirsti*	Jan-00	Dec-03	MPH	N/A	Occupational Health Unit Manager; Mehklainen Medical Services	Yes
Schroeder, Judith*	Jan-00	Dec-03	MPH	N/A	Sr Safety Engineer; Intel Corp.	Yes
Tompkins, Olga*	Aug-00	Dec-03	MPH		Manager of Occupational Health; Occidental Oil and Gas Corp.	Yes
Smith, Wanda*	Aug-01	Dec-04	MPH	N/A	Manager Occupational Health Services; Alamance Regional Medical Center	Yes
Zorb, Kathy*	Aug-01	Dec-04	MPH	N/A	Manager, Occupational Health; American Red Cross	Yes
Johnson, Linda Gail*	Aug-99	May-05	MPH	N/A	Director of Community Wellness; Augusta Medical Center	Yes

Industrial Hygiene
Tracking Graduates-Academic Training Report

Trainee Name (if supported by a NIOSH training grant, denote with *)	Date Entered Program	Date Degree Awarded (only if at your institution)	Degree Awarded (also specialty area as noted on degree)	Date of Certificate of Completion (for Occ Med and other Cert programs)	Current Employment (Job Title/Employer)	Employed in OS&H Field or Enrolled in OS&H Academic Program? Y/N
Thomas Buller*	Jan-00	–	Withdrew	–	Unknown	
Thomas Peters*	Jul-00	May-04	Ph.D.	–	Assistant Professor, Univ of Iowa College of Public Health	Y
Russel Bowen*	Aug-01	Dec-03	MS	–	Doctoral student, ENVR, UNC-CH	Y
Donii Fox*	Aug-02	Aug-04	MSPH	–	UNC Health and Safety, Chapel Hill, NC	Y
Thomas Winkler*	Aug-02	Aug-04	MSPH	–	Health & Safety Manager, NCSU Envir Hlth & Safety Ctr	Y
Andrew Imler*	Aug-03	May-05	MSPH	–	IH Surveyor, Enviro-Guard, Inc.	Y
Kenneth Fent*	Aug-03	May-05	MS	–	Doctoral student, ENVR, UNC-CH	Y
Kim Pickett*	Aug-03	May-05	MSPH	–	Reichhold, RTP, NC	Y
Zachary Pekar	Aug-98	Dec-03	Ph.D.	–	Environmental Scientist, US EPA	Y
Brad Taylor	Aug-99	–	MS	–	UNC Memorial Hptl Health & Safety Office	
Elizabeth Howard	Aug-99	–	Ph.D.	–	Leave of Absense	
James Gilbert	Aug-99	–	MS	–	UNC Health and Safety, Chapel Hill, NC	Y
Sangdon Lee	Aug-99	Aug-04	Ph.D.	–	Postdoc Fellow, US EPA	Y
Sangdon Lee	Aug-99	Aug-04	MSPH	–	Postdoc Fellow, US EPA	Y
Sirakarn Leungsakul	Aug-99	Dec-04	Ph.D.	–	Royal Thai Government	Y
Sirakarn Leungsakul	Aug-99	Dec-04	Ph.D.	–	Royal Thai Government	Y

J. Dan James	Aug-00	–	MS	–	Duke University Health & Safety Office	Y
Nadine Czoschke	Aug-00	–	Ph.D.	–	Continuing doctoral student	Y
Yi-Chun (Evelyn) Chao	Aug-00	Aug-05	Ph.D.	–	Post Doc, UNC-CH	Y
T. Renee Anthony	Jan-01	Aug-05	Ph.D.	–	Assistant Professor, Univ of Arizona	Y
C. Delcher	Aug-01	Aug-03	MS	–	GIS Analyst, Virgina Dept of Health	Y
Di Hu	Aug-01	–	Ph.D.	–	Continuing doctoral student	Y
S. Treimel	Aug-01	Aug-03	MS	–	ERG, Inc, Morrisvile NC.	Y
Joachim Pleil	Jan-02	Dec-04	Ph.D.	–	Visiting Scholar, ENVR, UNC-Ch & Research Physical Scientist, US EPA	Y
Campbell Tuskey	Aug-02	Aug-04	MSPH	–	Consultant, Becker & Associates Conulting, Inc.	Y
C-H Cho	Aug-02	Dec-03	MS	–	Continuing doctoral student	Y
Karen Jones	Aug-02	May-04	MSPH	–	LCDR, US Coast Guard	Y
KN Bray	Aug-02	Aug-03	MPH	–	Practicing Medicine, Gastonia, NC	Y
S. Bojja	Aug-02	Dec-03	MPH	–	2004 moved to Chantilly, VA	Y
Joshua J. Brazee	Jan-03	–		–	Leave of Absense	

Occupational Safety and Ergonomics
Tracking Graduates-Academic Training Report

Trainee Name (if supported by a NIOSH training grant, denote with *)	Date Entered Program	Date Degree Awarded (only if at your institution)	Degree Awarded (also specialty area as noted on degree)	Date of Certificate of Completion (for Occ Med and other Cert programs)	Current Employment (Job Title/Employer)	Employed in OS&H Field or Enrolled in OS&H Academic Program? Y/N
Naomi Glasscock	8/15/1994	8/15/2003	Doctor of Philosophy	N/A	HumanCentric Technologies	Y
Komal Bajaj	8/15/2001	8/15/2003	Master of Science in Industrial Engineering	N/A	Caterpillar, Inc	Y
Stephanie Southard	8/15/2003	5/15/2005	Master of Science in Industrial Engineering	N/A	Diosynth RTP, Inc.	N
Jonathan Drum	8/15/2003	8/15/2005	Master of Science in Industrial Engineering	N/A	US Army	Y
Jacklyn Freeman	8/15/2003	5/15/2005	Master of Science in Industrial Engineering	N/A	Milliken	Y
Stephanie Reid	8/15/2003	8/15/2005	Master of Science in Industrial Engineering	N/A	Deloitte	Y

Yu Shu	8/15/2002	1/1/2005	Master of Science in Industrial Engineering	N/A	North Carolina State University Graduate Research Assistant	Y
Gwanseob Shin	8/15/2000	8/15/2005	Doctor of Philosophy	N/A	North Carolina State University Post-Doc Research Assistant	Y
Christopher K. McClernon	8/15/2002	12/15/2003	Master of Science in Industrial Engineering	N/A	USAF Academy, Dept. of Behavioral Sciences & Leadership, USAF Academy, CO	Y

Epidemiology
Tracking Graduates-Academic Training Report

Trainee Name (if supported by a NIOSH training grant, denote with *)	Date Entered Program	Date Degree Awarded (only if at your institution)	Degree Awarded (also specialty area as noted on degree)	Date of Certificate of Completion (for Occ Med and other Cert programs)	Current Employment (Job Title/Employer)	Employed in OS&H Field or Enrolled in OS&H Academic Program? Y/N
Sherry Farr	Aug-98	May-04	PhD		EIS Officer, CDC, Atlanta, GA	Y
Leslie Elliott*	Aug-99	Aug-04	PhD		Epidemiologist, NIEHS, Research Triangle Park, NC	Y
Mina Kato	Jan-99	Aug-03	PhD		Tecnologist II, Fundacentro, Salvador-Bahai, Brazil	Y

Health Services Research
Tracking Graduates-Academic Training Report

Trainee Name (if supported by a NIOSH training grant, denote with *)	Date Entered Program	Date Degree Awarded (only if at your institution)	Degree Awarded (also specialty area as noted on degree)	Date of Certificate of Completion (for Occ Med and other Cert programs)	Current Employment (Job Title/Employer)	Employed in OS&H Field or Enrolled in OS&H Academic Program? Y/N
Julie Seibert*	2000	Current Trainee	Current Trainee	N/A	Research Coodinator (PT) at the Institute of Child Health Policy, University of Florida, Gainesville	Y
John Staley*	2002	Current Trainee	Current Trainee	N/A	Graduate Teaching Assistant (PT), Community Preparedness and Disaster Management Certificate Program, HPAA, UNC-Chapel Hill	Y
Courtney Stanion*	2003	Current Trainee	Current Trainee	N/A	Safety and Health Specialist (PT), Duke Occupational & Environmental Safety Office; Teaching Assistant, Community Preparedness and Disaster Management Certificate Program, HPAA, UNC-Chapel Hill	Y