



PB97-151724

Final Performance Report
NIOSH Training Grant No. T01/CCT710440
Iowa Occupational Safety and Health Training Program
7/1/93-6/30/96

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November 1996

REPRODUCED BY: **NTIS**
U.S. Department of Commerce
National Technical Information Service
Springfield, Virginia 22161

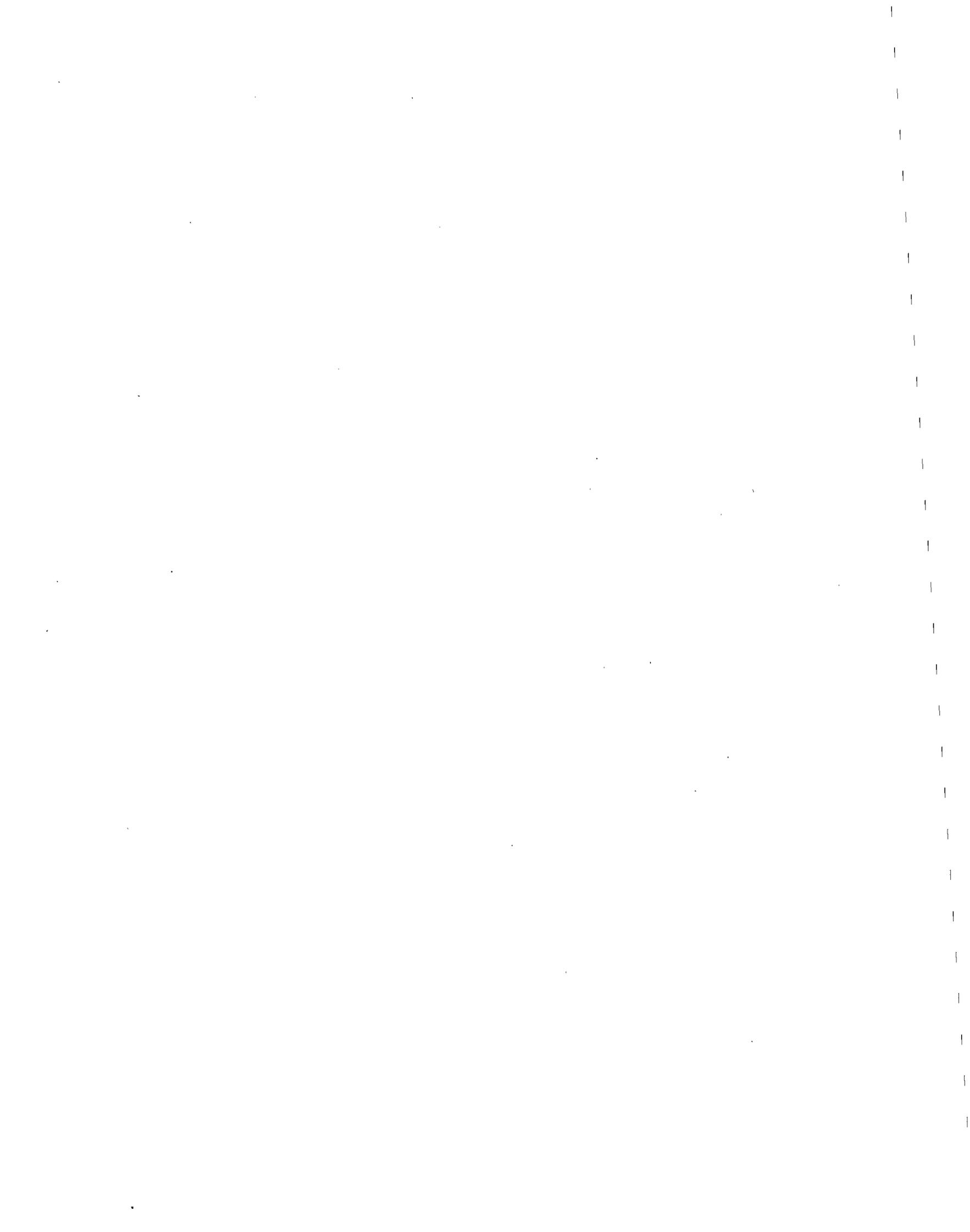


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Abstract

The University of Iowa Occupational Health and Safety Training Program, with support from the National Institute of Occupational Safety and Health, has provided graduate training in industrial hygiene and residency training in occupational medicine since 1982. The primary objective of this training grant is to contribute to the prevention of occupationally related diseases and injuries in the manufacturing and agricultural sectors in Iowa, the region and nationally through training of industrial hygienists (IH) and occupational medicine (OM) physicians. Industrial hygienists are trained for careers in the private sector or government agencies (M.S. degree) or for careers in research (Ph.D. degree). OM physicians are trained for careers in the private sector, government agencies, and academic institutions through the two-year accredited residency providing both an academic year leading to the MS degree and a practicum year. The programs for both IH and OM trainees provide comprehensive training in those fields and encourage active participation in research projects. Areas of specialization in agricultural hygiene and ergonomics are available for IH trainees. Another program characteristic is the active involvement of trainees in the practice of IH and OM through field work and through clinical exposure to occupational problems identified through the outreach program, WORKSAFE IOWA. During the grant period areas of accomplishment are faculty development, improved recruitment methods, enhanced curriculum options, increased research opportunities, and expansion of outreach and educational activities. The industrial hygiene program was accredited by the Accreditation Board for Engineering and Technology and the American Board of Industrial Hygiene (ABET-ABIH) in 1995.

A. Background

In 1982, the University of Iowa Occupational Safety and Health Training Program was begun with NIOSH training project support. This program has provided training for graduate students in industrial hygiene (IH) and for physicians in the occupational medicine (OM) residency. Both IH students and OM residents receive the MS degree in Preventive Medicine and Environmental Health. The IH program was fully accredited by ABET-ABIH in 1995, and there is now an official subtrack in Industrial Hygiene for IH students and their degree will be in this subtrack. IH students have also obtained the PhD degree. Key IH and OM faculty are based on the Oakdale Research Campus at the Institute for Rural and Environmental Health (IREH), formerly named the Institute of Agricultural Medicine and Occupational Health. The IREH houses the Division of Occupational and Environmental Health of the Department of Preventive Medicine and Environmental Health (PMEH) in the College of Medicine. Core courses required for the MS degree are also taught by faculty in the other two divisions in this Department, Epidemiology and Biostatistics.

Since 1982 when the program began, the faculty in OM and IH has expanded in number and breadth. In addition to Dr. Merchant, who began the OM residency in 1982 and directed it until 1992, the College of Medicine has shown strong support for enhancing OM training and research by adding four new physicians, all board certified in OM. One of these faculty members, Dr. Nancy Sprince, an OM physician recognized for research contributions in occupational lung diseases, became director of the OM residency and principal investigator of this training grant in 1992. Other current faculty added since the inception are Dr. Laurence Fuortes, Dr. David Schwartz, and Dr. Craig Zwerling.

Dr. William Pependorf began the IH training program in 1982, and Dr. Stephen Reynolds joined the faculty in 1991. Dr. Reynolds assumed Directorship of the Industrial Hygiene training program on July 1, 1995, when Dr. Pependorf left the University of Iowa and joined the faculty at Utah State University. Dr. Reynolds is a board certified Industrial Hygienist. An active recruitment effort is underway for an additional ABIH certified IH faculty member. Dr. Tom Cook, an ergonomist, joined the Division faculty in 1995. Other faculty include a toxicologist/engineer, environmental engineer, environmental analytic chemist and veterinarian.

Although the training program has been small, the IH program has grown substantially in recent years. The numbers of students and graduates are commensurate with available tuition and/or stipend

support. Graduates of the OM residency are in clinical OM practice and faculty positions at academic institutions. Graduates from the IH program now work for industry, academic institutions and government agencies.

The Institute for Rural and Environmental Health, a nationally recognized outreach and research center, provides excellent learning opportunities for trainees. Five major funded centers are headed by Institute faculty (Appendix A). The Environmental Health Sciences Research Center, funded by NIEHS, promotes multidisciplinary research projects and pilot project support in rural and agricultural health. The Injury Prevention Research Center, funded by CDC/CEHIC, focuses on rural and agricultural injury prevention research. The Great Plains Center for Agricultural Health, funded by NIOSH, focuses on agricultural health and safety research and prevention strategies. A training component of the Center provides support for agricultural health specialists, including occupational physicians and industrial hygienists with a special interest in rural and agricultural health and safety.

Other major Institute Centers include the Iowa Center for Agricultural Safety and Health, funded by the state of Iowa and focusing on preventing disabilities from agricultural disease and injury. This center has developed a network of agricultural medical clinics in rural hospitals throughout the state. The Center for International Rural and Environmental Health, supported by the University of Iowa, Pioneer Hi-Bred International, and the Pan American Health Organization, focuses on research in rural health and the environment in developing countries. Major research and outreach projects may be found in Appendix B

An outreach program of the Institute which has strengthened the training programs for both IH students and OM residents is WORKSAFE IOWA. This program was initially supported by a grant from the W.K. Kellogg Foundation, but is now self-supporting, obtaining revenue from fees from a network of community-based hospitals and fees for service for IH and other consultation services. The program was developed in part to provide training for students and residents by providing supervised field experiences in industrial and clinical settings. WORKSAFE IOWA offers consultation to local industries, workers, and community-based hospitals in occupational and environmental health by faculty OM physicians, staff and faculty IH specialists and health educators. WORKSAFE IOWA has a network of nine affiliate hospitals with OM clinics which provide practicum site rotations for OM residents.

The Division of Pulmonary, Critical Care, and Occupational Medicine of the Department of Internal Medicine also provides for research and clinical training opportunities. Residents are scheduled into the Occupational Medicine Clinic (OMC) weekly during their academic year and practicum years. IH students taking Industrial Hygiene II (63:232) also participate in at least one OMC session to learn occupational history-taking after learning basic principles of occupational history-taking through lecture, discussion and readings.

B. Goals and Objectives

The overall goal is to contribute to occupational disease and injury prevention in industrial, environmental and agricultural sectors of Iowa, the region, and nationally, and internationally, particularly addressing rural needs.

The following are specific objectives of the program:

- To train industrial hygiene professionals needed regionally and nationally for careers in industrial, environmental and agricultural settings and in research at the MS degree level and the PhD degree level.
- To train occupational medicine physicians needed regionally and nationally for clinical and research careers through the Occupational Medicine Residency. This is a two-year program leading to the MS degree in the academic year and offering a second, practicum, year.
- To provide opportunities for supervised research and field experiences for industrial hygienists and occupational medicine physicians in training.
- To provide this training with an interdisciplinary approach that prepares industrial hygienists and occupational medicine physicians to practice as members of an occupational/environmental health team.

C. Summary Report - Occupational Medicine

1. Program Leadership and Faculty

Full-time faculty and occupational medicine physicians

Nancy L. Sprince, MD, MPH, Associate Professor, serves as the Program Director and has principle responsibility for the occupational medicine (OM) training program. As the OM Residency Program Director, she provides leadership and direction for the residency. She advises OM residents, maintains an accredited OM residency program, carries out research in the area of occupational disease and injury, and supervises OM residents in the OM clinic. She also provides research direction for OM residents.

James A. Merchant, MD, DrPH, is a Professor, Director of the Institute for Rural and Environmental Health, and Director of the Division of Occupational and Environmental Health. He advises OM residents, supervises residents in the OM clinic, provides research direction for OM residents, and lectures in their required and elective courses. He directs the outreach program of WORKSAFE IOWA.

Laurence Fuortes, MD, MS, Associate Professor, advises, teaches and offers research direction to OM residents as a faculty member, Director of the University Occupational Health Service, and attending physician in the Occupational Medicine Clinic. He teaches and lectures in several required and elective courses in the program, including the important required course, Environmental Toxicology(63:260).

David A. Schwartz, MD, MPH, Director of the Occupational Medicine Clinic (OMC), provides direction and supervision for the residents in their clinical work in the OMC, advises residents, and provides research experience and supervision for the residents in the area of occupational lung diseases.

Craig Zwerling, MD, PhD, MPH, Director of the Injury Prevention Research Center, advises residents, provides research experiences and leadership in the area of occupational injuries, injury surveillance, epidemiology and prevention, and is an attending physician in the OMC. He is the course Co-Director for a major required course for the residents, Occupational Health (63:191) and the course Co-Director for two important electives, Injury Epidemiology (63:251) and Epidemiology of Occupational Injuries (63:253).

Support faculty include the following:

Peter Thorne, PhD, an inhalation toxicologist also trained as an engineer, who directs an important required course, Environmental Health (63:202) and provides lectures and research opportunities in the area of environmental health, a required component of both academic and practicum training years for residents.

Thomas Cook, PhD, an ergonomics specialist also trained in physical therapy, who provides training in ergonomics during the academic year in his elective course, and during the practicum year through a one-month rotation in ergonomics.

Stephen Reynolds, PhD, CIH an industrial hygienist with a background in chemistry and microbiology who teaches Occupational Health (63:191 with Drs. Zwerling and Merchant.).

Adjunct faculty include the following OM physicians:

Michael Makowsky, MD, Director of the Residency Advisory Committee, and Medical Director of the OM practice at Iowa Methodist Medical Center in Des Moines, IA, has provided supervision for residents during their practicum year rotations at his facility, a WORKSAFE associate clinic. In 1995, Dr. Wesley Brown replaced Dr. Makowsky as Medical Director when Dr. Makowsky moved to an OM position in New Jersey.

Frank LaMarte, MD, an OM physician at Creighton University School of Medicine, Omaha, Nebraska, who has developed a program for medical student and resident instruction in OM at that medical school. He is also available as a supervisor for a practicum rotation for University of Iowa OM residents during their practicum year.

Craig Bainbridge, MD, MS, Medical Director of OM services at St. Luke's Regional Medical Center in Sioux City, IA, is also available as a supervisor for a practicum rotation at this facility, a WORKSAFE associate clinic.

Faculty reputation/strength

The Institute of Rural and Environmental Health is nationally recognized for its research and its regional outreach programs in occupational, environmental and agricultural medicine. Faculty in this program provide leadership in these areas. Key faculty are board certified in occupational and internal medicine and provide clinical supervision for OM residents in the OMC and the University Occupational Health Services. They are reviewers for the major OM journals and have had many years of experience in this field. All faculty have excellent research records and active research programs. Faculty members have collaborated in all areas of OM, including clinical work, research and teaching.

Dr. Sprince is serving a three-year appointment (1995-1998) as a member of the Environmental Health Sciences Review Committee of the National Institute of Environmental Health Sciences (NIEHS). She has served on the Institute of Medicine's Committee to Review the Health Effects in Vietnam Veterans of Exposure to Herbicides, and has served as an NIH site visitor for the General Clinical Research Centers and a member of two NIEHS special committees, one to review grant applications for the NIEHS Academic Awards in Environmental and Occupational Medicine and the other to review grant applications for Environmental Justice awards. She is a recipient of the NIEHS Academic Award in Environmental and Occupational Medicine. She and Dr. Merchant are contributing editor and associate editor (respectively) for the *American Journal of Industrial Medicine*.

Dr. Merchant serves on the NIOSH Board of Scientific Counselors and the Environmental and Occupational Health Policy Planning Committee of the American Thoracic Society, and has also served on the Committee on Enhancement of Occupational and Environmental Medicine for the Institute of Medicine. He also serves on the National Advisory Committee for Occupational Safety and Health (NACOSH). Dr. Merchant is the Principal Investigator for a Health of the Public grant funded by the Robert Wood Johnson/Pew Charitable Trust. The grant provides for University of Iowa collaboration with a local hospital to turn the hospital's rural health network, which spans 13 counties, into a prototype for a comprehensive community care program that can be replicated in other rural areas. He directs the Environmental Health Sciences Research Center, funded by NIEHS, and the Great Plains Center for Agricultural Health Science, funded by NIOSH.

Dr. Zwerling, whose major research interest is in injury surveillance, epidemiology and prevention, has contributed nationally in this field by serving on both the CDC-NIOSH Joint Committee to Formulate National Agenda for Occupational Injury in the 1990s and the CDC Committee on Disabilities and Chronic Conditions. He has been a site visitor for the CDC and for NIOSH. His unique experience combines an excellent research record with previous years of experience as a medical officer for the U.S. Postal Service. He directs the Injury Prevention Research Center, funded by CDC and the Farm Family Health and Hazard Surveillance Project, a cooperative agreement with NIOSH, and is Principal Investigator of a NIOSH SERCA award to investigate risk factors for occupational injury in older workers.

Dr. Schwartz, the recipient of several major federally-funded grants, has made significant research contributions in asbestos-related diseases and respiratory diseases due to grain dust. He co-directs with Dr. Merchant, investigators from the CDC, and Iowa Department of Public Health investigators a study of health effects of exposures in the Persian Gulf War, funded by the CDC.

Dr. Fuortes has initiated and carried out research efforts and collaborations with international colleagues in Costa Rica in the areas of neurobehavioral consequences of occupational exposures to pesticides and the effects of occupation on health of rural workers.

Dr. Thorne's and Dr. Cook's national reputation and strengths are detailed in the IH section.

Core and Supporting Faculty/Areas of Competence:

Faculty	Areas of Competence	Comments/Notes
Nancy L. Sprince, MD, MPH	Occupational Respiratory Disease and Injury	NIEHS Academic Awardee; Director, Residency Program; NIOSH Training Project Director
James A. Merchant, MD, DrPH	Agricultural/Occupational-Respiratory Disease, Rural Health Policy	Director, Division of Occupational and Environmental Health
David Schwartz, MD, MPH	Occupational Respiratory Disease, Incl. Asbestos, Grain Dust	Director, University of Iowa Occupational Medicine Clinic
Craig Zwerling, MD, MPH, PhD	Occupational Injury, Injury Prevention, Drug Testing	Director, Injury Prevention Research Center
Laurence Fuortes, MD, MS	General Occupational Medicine, Toxicology	Director, University Occupational Health Service
Peter Thorne, PhD	Environmental Health, Inhalation Toxicology	Director, Environmental Health Course
Thomas Cook, PhD	Ergonomics	Directs Ergonomics Training
Adjunct Faculty		
Michael Makowsky, MD	General Occupational Medicine, Delivery of Occupational Medicine Services	Former Chair, Residency Advisory Committee; Practicum Site Supervisor (replaced by Dr. W. Brown as practicum site supervisor and Dr. Ken McMains as Chair, RAC in 1995)
Craig Bainbridge, MD	Pulmonary and Occupational Medicine	Adjunct Faculty
Frank LaMarte, MD, MS	General Occ. Medicine, Musculoskeletal, Delivery Occupational Medicine Services	Adjunct Faculty; Creighton University Medical School Faculty

2. Program Plan

In 1992, the University of Iowa OM Residency Program was re-accredited for three years by the Accreditation Council for Graduate Medical Education (ACGME) as a two-year training program offering both academic and practicum years. The program was re-accredited for a five year period in July, 1995. The two-year program currently meets all requirements of the ACGME. The academic year also meets the requirements of the Department of Preventive Medicine and Environmental Health for candidates for the Master of Science degree.

The program is designed for physicians who have completed at least one clinical year of training in a primary care area. The first or Academic Year is directed at completing in two semesters the academic coursework that satisfies the requirements for the MS degree in PMEH and the ACGME requirements for the OM specialty. Residents must successfully complete a total of 38 semester hours (s.h.), up to 12 of which may be approved for transfer credit from medical school courses. The required courses by semester follow:

Fall Semester:

63:158	Principles of Epidemiology	3 s.h.
63:191	Introduction to Occupational Health	3 s.h.
63:202	Environmental Health	3 s.h.
63:200	Intro. to Health Care Organization	3 s.h.
63:280	Occupational/Environmental Health Seminar/Journal Club	0 s.h.

Spring Semester:

63:260	Environmental Toxicology	3 s.h.
63:161	Intro. to Biostatistics	3 s.h.
63:280	Occupational/Environmental Health Seminar/Journal Club	1 s.h.
63:250	Behavioral Medicine	2 s.h.
63:203	Preceptorship in Preventive Medicine and Environmental Health	3 s.h.

Because of the need to complete all of the above required courses, the number of remaining credits available for electives is very limited. Rural Health/Agricultural Medicine is a strongly recommended elective course, which all residents in the last three years have taken. Residents may also choose from many other relevant electives including Industrial Hygiene, Occupational Biomechanics, Occupational Safety, Injury Epidemiology, Epidemiology of Occupational Injuries, Theories of Environmental Policy, Analytical Toxicology, International Health, Advanced Epidemiology Methods, and Special Topics in Toxicology.

During the Academic Year and when possible during the Practicum Year, residents spend one half day per week in the Occupational Medicine Clinic (OMC) of the University of Iowa Hospitals and Clinics (UIHC). This time is limited by required courses held either in the morning or the afternoon each semester in the academic year and the fact that the OMC is only held one day per week. It is hoped that planned expansion of that clinic will allow more time in the OMC for residents. The clinic is staffed by the five OM physicians and 4 nurses. Residents from other specialties, including family practice, internal medicine and psychiatry, spend one-month rotations in the OMC. Patients with a variety of occupational and environmental exposures and diseases are evaluated at the OMC. Each new patient is evaluated by the resident initially, followed by presentation to the attending physician, further evaluation and discussion.

In the Practicum Year, all residents spend at least four months in required practicum rotations at industrial sites or at community-based hospital occupational medicine clinics. These four months meet ACGME requirements for sites which are "within the real world of work" and offer strong industrial/occupational and clinical experience. The other eight months of the practicum year can be spent at a combination of relevant outpatient electives, other industrial or community-based hospital occupational medicine clinics, University Occupational Health Services, and research. Depending on the career goals of the resident and consistent with the goal of the program to provide excellent general occupational medicine training, there is flexibility in the choice of rotations for those remaining eight months of the practicum year. Recent residents have chosen both clinically relevant rotations and research experiences.

Several key practicum sites are worthy of detailed descriptions, since they are a cornerstone of practicum year training. Deere and Company, with corporate headquarters in Moline, Illinois and manufacturing plants in several sites in eastern Iowa, has been a long-time practicum site for this residency program. Deere and Company is a manufacturer of large agricultural equipment and lawn equipment. Corporate medical director, J. Frederic Green, MD, is past president of the American College of Occupational and Environmental Medicine. Dr. Green is a member of the Residency Advisory Committee and a strong supporter of this training program. The rotation at Deere, under the supervision of Dr. Green, offers the residents extensive experience in administrative and corporate aspects of occupational medicine, as well as contact with other members of the occupational health team, especially plant physicians and nurses and industrial hygiene staff. Another industrial site, Aluminum Company of American (ALCOA), also offers strong experience with industrial hygiene staff. ALCOA is a very large aluminum milling and rolling operation with a large industrial hygiene and occupational health staff, including a full-time occupational physician. The rotation at ALCOA provides strong experience in the working relationship between occupational medicine program administration and resolving administrative and operational issues with labor representatives.

The occupational medicine clinics at Iowa community-based hospitals are equally as important as the industrial sites in providing each resident with a broad range of OM experiences. Indeed, these rotations are perhaps the most central in resident training, since most OM career opportunities are in this setting, and most residents enter occupational medicine as OM clinic physicians. Currently, three such clinics are a regular part of resident training. Iowa Methodist Corporate Health and Allen Memorial Hospital are comprehensive, large-city programs with a staff of 2 (Allen) or 4 (Methodist) physicians, as well as occupational health nurses and physical therapists. The Work Fitness Center has 4 physicians, but has a stronger emphasis upon rehabilitation, with a regionally known physical therapy and ergonomics program. All three also have clinic administrators and marketing personnel. Exposure to these staff is important to residents in learning about the administrative and marketing aspects of OM. All three also work extensively with local companies in prevention of injury and illness, diagnosis, treatment and rehabilitation of workers.

To complete the twelve months, residents may also choose from a variety of clinical and research experiences. Related clinical rotations at the UIHC in Departments of Orthopaedics, Dermatology, or Neurology are possible. Residents may participate in faculty research projects. Residents usually also complete a rotation with the University Occupational Health Service, the employee health program for University employees. Often, additional practicum sites are developed to meet resident's needs for individualized practicum year plans. This was true for Drs. Garrels, Dr. Yaldo, Cowl, and Olsen. Every effort is made to design a twelve-month plan that best meets each resident's career goals while fulfilling the educational objectives of the practicum year. Sites established specifically for Dr. Yaldo were two month rotations at Chrysler Corporation in Detroit and two months at a large, suburban multi-specialty clinic offering OM services. Dr. Garrels spent several months in clinical rotations in dermatology, ophthalmology, neurology and drug rehabilitation clinics in Davenport, Iowa. For Dr. Cowl a practicum experience in Minneapolis was arranged at Occupational Medicine Consultants, Inc.

National/Regional Need for Program

The University of Iowa OM residency is a midwestern regional resource for Iowa and contiguous states which have no OM residency program, including Nebraska, Kansas and North and South Dakota. The College of Medicine at the University of Iowa is regularly recognized by national publications for its strength in rural health, particularly primary care services to its ruraly located citizens.

The University of Iowa program in Occupational Medicine continues to work to meet the growing need for trained physicians in Iowa and surrounding midwestern states. While the national need for physicians trained in occupational medicine has been extensively and thoroughly documented, the regional need, although not as well documented, is also clear. Strong evidence of this has come from the WORKSAFE IOWA Occupational Medicine Associates Network, a group of nine local community-based hospital occupational medicine clinics. As these clinics have worked collaboratively with the Institute's WORKSAFE IOWA consultation and outreach program, they have grown and evolved, and required a supply of trained occupational physicians. The Network has affirmed the need for occupational

physicians. Both of the two most recent residency graduates will be working at affiliated clinics and had more graduates been available, the clinics would have been eager to hire them.

Regional needs for outreach services in agricultural medicine will continue to be addressed through a unique network of seven clinics and three additional satellite clinics of the Institute's Iowa Agricultural Health and Safety Network (IA-HASSP). This program was established and continues to be supported by funding from the Iowa Legislature.

The WORKSAFE IOWA and IA-HASSP outreach programs and other Institute continuing medical education activities have filled a regional need for professional education about occupational, environmental and agricultural exposures, and prevention, diagnosis and treatment of illness and injury. Both WORKSAFE and IA-HASSP provide annual or semi-annual in-service training for the staff at their clinical affiliates. Several programs for post-graduate education of physicians and other health professionals are also regularly offered. For several years, Dr. Sprince has directed an annual "Current Topics in Occupational Medicine" course for practicing physicians and other health professionals. In spring of 1996, directed by Dr. Cook, the offering was "Reducing Workplace Injuries & Illnesses through Ergonomics", jointly sponsored by WORKSAFE IOWA, the UI Injury Prevention Research Center, and the UI College of Medicine. In 1995 Dr. Sprince was awarded a grant from the UI College of Medicine Office of Continuing Medical Education to offer a live, interactive video conference over the Iowa Communications Network to physicians in the Fort Dodge area. Twice yearly, WORKSAFE IOWA offers the NIOSH-approved Spirometry Training Course.

The Institute has sponsored several regional or national conferences. The Injury Prevention Research Center (IPRC) sponsored a national conference, "Health Research Using Advanced Driving Simulation" in November of 1994 and a regional conference, "Bicycle and Motorcycle Head Injury Prevention" in December of 1994. The IPRC co-sponsored "Bioinstrumentation and Measurement Summer Workshop" in July 1995. Another conference sponsored was "Rural Health Reform and Implications for the Farm Family" in November, 1994. In December 1993, along with the National Rural Health Association, the Office of Rural Health Policy, and several corporate sponsors, the Institute sponsored a national conference, "Implementing Health Care Reform in Rural America, State and Community Roles." In March of 1996, the Great Plains Center for Agricultural Health at the Institute hosted the Third Annual NIOSH Agricultural Health and Safety Conference attracting national and international attendance to the University of Iowa Campus.

Numerous other continuing education and outreach activities lead by faculty and professional staff from the Institute have targeted diverse audiences, including not only occupational health and safety professionals and paraprofessionals, but also agribusiness personnel, farmers and farm families, and injury prevention and environmental health professionals.

b. Distinctive Program Contributions to the Field

The Institute of Rural and Environmental Health at The University of Iowa has a unique role in meeting statewide needs in occupational, environmental, and agricultural health. During the past three years we have continued efforts in the two unique programs, WORKSAFE IOWA and IA-HASSP.

The WORKSAFE IOWA Occupational Medicine Associates Network program is the basis for a unique, statewide partnership in occupational medicine between academic occupational medicine and community-based hospital clinical occupational medicine. The community hospitals have received consultation in OM and industrial hygiene, education programs, information services, and assistance in program development for their OM clinics.

The Network has continued to provide local practicum sites for resident training at busy, successful occupational medicine clinics, which provide comprehensive OM services to local industries and workers, and have one or more full-time physicians with expertise in OM. At these sites, residents also work closely as part of a team including occupational health nurses, physical therapists and rehabilitation specialists. Dr. Yaldo's practicum year schedule reflected this resource since he rotated through Allen Memorial Hospital and Iowa Methodist Medical Center Occupational Medicine Clinic, both Associate hospitals. Dr. Garrels' rotations included Allen, Iowa Methodist and the Work Fitness Center, a third Associate. Both Dr. Yaldo and Dr. Garrels accepted positions as occupational medicine physicians at Associate Hospitals, Dr. Yaldo at Allen Memorial Hospital and Dr. Garrels at the Work Fitness Center. Dr.

Olsen rotated through Allen Memorial Hospital near the beginning of his rotation schedule in the spring of 1996 and has elected to return near the end as well, spring of 1997. Dr. Cowl will be at Allen Memorial Hospital in the fall of 1996 shortly before the end of his practicum experience. These placements have addressed the statewide need for residency-trained OM physicians and have greatly enhanced the mutually beneficial aspects of the relationship between the clinics and WORKSAFE IOWA.

It is very important to make clear the relationship between the residency (and the university) and WORKSAFE IOWA affiliated hospitals (and their occupational medicine clinics). These community-based hospitals are not part of the university. They are independent, local hospitals and they represent the communities in Iowa with both the population and industrial base necessary to support an occupational medicine clinic and the local administrative commitment necessary to provide support for a vigorous, active clinic. The relationship is one of consultation and cooperation only. The experience of residents in practicum rotations is the same as if they went to non-affiliated strong, comprehensive OM clinics.

The Network has continued to keep the academic faculty informed of the most current OM needs in the real world of work, both informally and through periodic Network meetings. Faculty then incorporate this material into the curriculum for residents, ensuring that graduates are able to carry out the most up-to-date comprehensive practice of occupational medicine. Residents benefit because of participation in a training program that integrates academic expertise and community-based OM.

Through the Associate hospitals' satellite and affiliated smaller hospitals and clinics, the Network reaches parts of rural Iowa that were heretofore unreached by occupational health services and information.

In addition to WORKSAFE IOWA, another important unique core program contribution is the emphasis on occupational health of agricultural workers. Similarly to other OM training programs, we also offer educational experiences related to general industry. However, one of our unique contributions is an emphasis on workers exposed to occupational hazards on farms and in agricultural businesses and environmental exposures important to rural communities.

Throughout their training, residents evaluate patients in the OMC with diverse agricultural exposures, including grain and other organic dusts, pesticides and herbicides, noise and farm machinery. During the year of academic training, their required courses address issues important to farmers and rural communities (including zoonoses, the effect of agricultural chemicals on the worker and the environment, lung diseases caused by organic dusts and machinery-related injuries). An important elective course, Rural Health and Agricultural Medicine (63:209), covers agricultural occupational health and environmental health hazards in rural areas. Dr. Yaldo, Dr. Garrels, and Dr. Olsen took this course and provided important feedback for improvement in the evaluation process.

During the practicum year, rotations are available at practicum sites which provide training in agricultural occupational health. Examples are farm equipment manufacturers (Deere and Company), hospital-based occupational medicine practices that serve agricultural businesses and workers (Allen Memorial Hospital and Iowa Methodist Medical Center), and WORKSAFE IOWA, which offers consultations to agricultural businesses and workers by an industrial hygienist expert in agricultural exposures. In addition to their rotations at WORKSAFE IOWA affiliated Associates, Drs. Garrels, Yaldo, Cowl, and Olsen rotated through Deere and Company.

As a result of this training, our graduates have become resources for other physicians and occupational health professionals as well as expert consultants for agricultural workers and businesses.

c. Interdisciplinary Experiences

The faculty at the Institute of Agricultural Medicine and Occupational Health work in interdisciplinary activities including teaching, research and continuing education. The major required course, Occupational Health (63:191), provides the first exposure to this interdisciplinary approach. The course Co-directors, Dr. Zwerling and Professor Reynolds (who assumed the course co-directorship in the 1994-95 academic year), are an OM physician and Industrial Hygienist, respectively. The course content includes both OM and industrial hygiene. Students in both the industrial hygiene and OM programs take this course together, along with students from other disciplines, including environmental health, physical therapy, health education and nursing. The course directors have increased the interdisciplinary interaction by

assigning students from different tracks to work together in pairs on the required field trip to local industries.

Industrial hygiene students taking Industrial Hygiene II (63:232) have a lecture and discussion on occupational history-taking, followed by at least one session in the OMC, which OM residents attend, observing the OM residents and faculty taking occupational histories. For IH students interested in learning more about occupational history evaluation there is the opportunity to attend further OMC sessions during 63:232 and an additional elective course in the OMC is also under way.

Both OM residents and IH students have participated jointly in the required course, Occupational and Environmental Health Seminar/Journal Club (63:280), which was under the direction of Dr. Sprince for the 1994-95 year. This course is a revised and combined version of the former Seminar and Journal Club. It was very successful in this new format, begun with the 1994-95 academic year. There are on alternating weeks a journal club discussion of an article in the area of occupational and environmental health and a faculty-led research seminar. For the journal club, students, in consultation with the faculty, choose a relevant recent article to review and lead a group discussion of the article. Examples of topics covered in the 1994-95 academic year were agricultural injuries, screening for repetitive strain injuries, asbestos-related diseases, lead exposure, and water pollution. The speakers for the research seminar are faculty provided by three research centers in the division: the Injury Prevention Research Center (IPRC), the Environmental Health Sciences Research Center (EHSRC) and the Great Plains Center for Agricultural Health (formerly called CADIREP).

OM residents have many opportunities to interact with members of the occupational health team during practicum rotations. For example, two WORKSAFE IOWA industrial hygienists are available to conduct workplace evaluations with the residents at local industrial field sites where they are providing consultation. At several practicum sites which are WORKSAFE Associate Hospitals, residents work very closely with safety professionals, occupational health nurses, physical therapists, including those trained in ergonomics, rehabilitation specialists and counselors. Industrial practicum sites also offer particularly strong opportunities in this regard. For example, Deere and Company has occupational physicians and nurses and an extensive safety team, including industrial hygienists and other support staff. The Aluminum Company of America (ALCOA) has a large, active team of safety professionals and occupational health specialists, including a Certified Industrial Hygienist (CIH), occupational health nurses and a full-time, experienced occupational physician.

OM residents also participate in worksite activities with faculty and staff industrial hygienists. Dr. Garrels accompanied Dr. Reynolds on walk-through evaluations along with the students in the Industrial Safety course including visits to the Rock Island Arsenal and Cedar Rapids, Inc., a local industry. Dr. Garrels also participated in Dr. Reynolds' research project on lead exposure in construction workers, resulting in a publication and suggestions for prevention.

Faculty provide a model for interdisciplinary interactions in teaching, research and continuing education activities. For example, Drs. Sprince, Pependorf and Thorne continued to work together closely on a research project assessing exposures related to respiratory and dermal effects in automotive workers exposed to cutting fluids. Dr. Thorne continues to work closely with Dr. Schwartz in a research study investigating the health effects of grain dust exposure. Dr. Sprince is working closely with Dr. Reynolds on research projects on lead exposure in construction workers and health effects of exposure to refuse-derived fuel.

3. Training Candidates

All prospective trainees must have graduated from an accredited medical school and completed at least one year (PGY1) of clinical residency training in an ACGME-acceptable primary care area. Physicians must have an MD or DO degree and a career goal of practice or research in OM. The program has graduates who are active in clinical OM and in research.

Each applicant must submit a statement of their career goals and interest in OM, a CV, three original letters of reference, complete undergraduate and medical school transcripts, verification of the appropriate PGY1 and a copy of their medical license. After review of these materials, qualified candidates are invited to campus to interview with all available OM faculty. The decision to offer a position

is then based upon the results of this process, including background and training, career goals, references and personal interviews.

In recent years, the number of serious inquiries about the program has averaged approximately 30 per year. Of these, three to six complete the application process and are invited to campus for interviews. In the last two years, two residents have completed the program and there were three residents in the program for the 1995-96 academic year, and will be four residents in the program for the 1996-97 year with one finishing November, 1996. Had funding been available, it would have been possible to enroll another resident for the fall of 1995, and an additional resident in 1996. This represents a gain over earlier years and evidence of success of recruiting efforts.

Training Record 1993-1996

NIOSH support for OM residents was for tuition and partial stipend for one resident each year. Since 1993 the following Occupational Residents have completed their M.S. degrees:

<u>Name</u>	<u>Year MS Awarded</u>
Raad Yaldo	1993
Rick Garrels	1994
Steve Olsen	1996
Ellen Ballard	1996
Clayton Cowl	1996 (expected in December, 1996)

Since 1993, the following physicians completed OM residency in our program:

- Raad Yaldo, DO, completed his OM residency in May, 1994. He practiced OM at Allen Memorial Hospital's Occupational Health Service in Waterloo, Iowa following completion of residency and is currently attending law school before returning to OM practice. During his practicum year, Dr. Yaldo did rotations at Chrysler Corporation, Detroit, Michigan, and at an occupational health clinic in the Detroit suburban area, which were designed to accommodate his wish to do rotations near his home town in Michigan, and at regular program practicum sites including occupational medicine clinics at Allen Memorial Hospital, Iowa Methodist Medical Center, Des Moines, and Deere and Company in Moline, Illinois.
- Rick Garrels, MD, completed his residency in May, 1995. Much of his practicum experience had been planned for him in the Iowa/Illinois Quad Cities metropolitan area, where he lives and is currently practicing. His practicum year included clinical rotations with Quad Cities specialists in dermatology, ophthalmology, neurology and chemical dependency as well as new industrial rotations with Alcoa, Inc., and Amana Refrigeration. He also served a rotation at the Deere and Company corporate offices in Moline, Illinois. He did a rotation at the UIHC Orthopaedics Department. He completed hospital-based occupational clinic rotations with Allen Memorial Hospital, Iowa Methodist Medical Center and a newly developed rotation with the occupational medicine clinic of the Work Fitness Center, with locations in Davenport/Bettendorf, Iowa and Moline/Rock Island, Illinois. In June, 1995, Dr. Garrels began a staff position as an occupational medicine physician and is now Medical Director at the Work Fitness Center in Moline, Illinois.

The following is an update on the physicians who were current residents through summer 1996:

- Ellen Ballard, MD, is a practicing physician whose specialty is Physical Medicine and Rehabilitation. She began the Academic Year on a part-time basis in the fall of 1994 and continued her academic coursework through the 1995-96 school year, while also continuing her practice with the St. Luke's Hospital Occupational Medicine Clinic in Cedar Rapids, Iowa. Dr. Ballard completed an M.S. thesis, "Outcomes Research: Comparing the Treatment Results for Two Physicians Treating Occupational Low Back Pain." She received the M.S. degree in July, 1996, after successfully completing the academic year requirements. In August, 1996, Dr. Ballard assumed a new position in another state and will be arranging her practicum experience locally.
- Clayton Cowl, MD completed a residency in Internal Medicine June 30, 1995. During this time, he took some of the courses required for the Academic Year. He completed his Academic Year

requirements first semester (fall, 1995). He is completing a Master's thesis, "An Analysis of U.S. Hot-Air Balloon Crashes, 1964-1995." He will complete his practicum rotations in November, 1996. Dr. Cowl has a strong interest in research and is planning further training in pulmonary medicine to further his interest in occupational respiratory disease.

- Steven Olsen, DO completed a year of family practice residency in Waterloo, Iowa. He began his academic year of our OM residency in the Fall semester of 1995, and completed his M.S. degree in spring of 1996. He began the practicum year in May, 1996. He has a strong interest in the clinical practice of OM in Iowa.

Two new residents, Dr. Deborah Schenck and Dr. Elizabeth Sergi have been accepted into the residency program and will begin their course work fall semester, 1996. Dr. Sergi is being financially supported by the Work Fitness Center in the Quad Cities, an arrangement which has enabled our program to expand the number of qualified residents accepted into the program. Until Dr. Cowl completes his practicum experience in November, we will have four residents participating in the program, the largest number at one time to date.

Having two residents successfully complete the program and enter careers in clinical occupational medicine in the region, establishing individualized residencies for two others, having a total of three residents in the program starting in the Fall of 1995 and four residents starting in the Fall of 1996 have been the greatest accomplishments of the past three years of the current grant. While these numbers are modest, they are realistic for the support available.

D. Summary Report - Industrial Hygiene

1. Program Leadership and Faculty

Full time faculty

- Stephen J. Reynolds, PhD, CIH replaced Dr. William Pendorf as director of the IH program in 1995. A faculty member since 1991, he is an industrial hygienist with a background in chemistry and microbiology. He is responsible for the Occupational Safety (63:192) and Industrial Hygiene (IH I, II, III - 63:231, 63:232, and 63:233) courses, and co-teaches Occupational Health (63:191). He supervises the IH services component of WORKSAFE IOWA.
- Peter Thorne, PhD is a toxicologist - industrial hygienist with backgrounds in both microbiology and chemical engineering. He was recruited to Iowa from the University of Pittsburgh Graduate School of Public Health where he was an assistant professor in industrial environmental health. He is responsible for 63:270 Special Topics in Toxicology and shares teaching responsibilities in Environmental Toxicology (63:260) and Environmental Health (63:202).
- Kelley J. Donham, DVM is a veterinarian with a background in comparative medicine and agricultural health. He is responsible for teaching Rural Health and Agricultural Medicine (63:209) and advising veterinary students in agricultural hygiene.
- Mustafa Selim, PhD, is an environmental chemist with experience in the use of GC/MS and supercritical fluid chromatography in the analysis of pesticides, mycotoxins, and volatile organics. He is responsible for teaching Environmental Sample Analysis (63:195) and its laboratory-based sequel (63:196). He also contributes to IH II 63:232.
- Thomas Cook, PhD has a background in Physical Therapy and Industrial & Biomechanical Engineering with a specific interest in human factors engineering (ergonomics). In addition to teaching Occupational Biomechanics (101:270), he offers a substantial research capability in repetitive motion trauma and back stress, and contributes to Occupational Safety 63:192. In 1995 Dr. Cook joined the faculty of the Department of Preventive Medicine and Environmental Health moving from the Department of Physical Therapy.
- Burton Kross, Ph.D. is an environmental engineer with experience in air and water pollution, and international health. He teaches Environmental Health Policy 63:252 and contributes to student research

experiences. He directs the Center for International Rural and Environmental Health which provides students with support for international research and preceptorships.

- Nancy Lynch, Ph.D. is an environmental engineer with experience in microbiology and bioremediation. She co-teaches Environmental Health with Dr. Thorne, and serves as a research advisor for students.

Adjunct Faculty:

- Laurie Taylor, MS, Health Physicist at the Health Protection Office, teaches in 63:232.
- Peter Waldron, MS, Staff IH, teaches in 63:232.
- Pele Subramanin, Ph.D., Staff Chemist, teaches in 63:232.
- John Rosecrance, Ph.D., Staff Ergonomist, teaches in 63:192.
- Fred Wagner, MS, was past director of the (undergraduate) occupational safety program at the University of Dubuque, and is an adjunct instructor for the industrial safety course (63:192). His participation is directly funded by this training grant.
- LaMar Grafft, MS, has been assisting with 63:192 since 1995.
- Lois Etre, Ph.D., has been assisting with 63:231 and 233 since 1995.

Faculty Reputation/Strength

- Stephen J. Reynolds, Associate Professor, is past President of the Iowa/Illinois section of the American Industrial Hygiene Association (AIHA) and he is a peer reviewer for the *AIHA Journal*, *Environmental Science and Technology*, and *Indoor Air*. He serves on the AIHA International Subcommittee for Eastern Europe and the ACGIH Agricultural Health and Safety Committee. He is the PI on a SERCA award from NIOSH on lead exposures among construction workers, was selected to the National Academy of Sciences Young Investigator Program for Central Asia, and was elected to membership in Delta Omega the National Public Health Honor Society. Dr. Reynolds's research interests include exposure assessment strategies and methods, indoor air quality, bioaerosols and environmental microbiology, rural health and safety, international environmental and occupational health (primarily the Former Soviet Union), and lead. He is Deputy Director of the Great Plains Center for Agricultural Health and is PI on an EPA funded study of indoor air quality of large office buildings.
- Peter Thorne, Associate Professor, has recently served the Society of Toxicology on the Immunotoxicology Program, Membership and Awards Committees. He has been a consultant to private industry and government regulatory agencies, including work as an advisor to the State of Iowa Department of Natural Resources. He frequently reviews grants for ATSDR and other agencies as well as manuscripts for journals including *Fundamental and Applied Toxicology*, *AIHAJ*, and *Archives of Environmental Contamination and Toxicology*. His principal research interests include occupational immunologic sensitization and hypersensitivity, evaluation and control of microbiological toxicants in agricultural and industrial environments, surveillance, remediation and control of facilities exhibiting sick building syndrome, and aerosol science.
- Kelley J. Donham, Professor, is an internationally recognized expert in agricultural health. He has lectured throughout the U.S. and reviewed grants and manuscripts in his field. He is a member of the International Commission on Occupational Health, co-founder of the National Coalition for Agricultural Safety and Health, and current director of the statewide Iowa Center for Agricultural Safety and Health. He is the author or co-author of more than 60 journal articles on agricultural health issues. His research interests are in respiratory disease and in the development of innovative programs to bring improved preventive medicine and medical services to rural communities.
- Mustafa Selim, Assistant Professor, is a consultant for the Egyptian Environmental Affairs Agency and is collaborating with Egyptian researchers to study the effects of pesticides and natural food toxins on rural farmers' health in Egypt. He has served as a reviewer for grants for the Agency for Toxic Substances and Disease Registry. His research interests currently focus on the analytic surveys of mycotoxin and pesticide exposure among agricultural workers and residents.
- Thomas Cook, Professor, has served nationally as a consultant in occupational biomechanics for NASA, the National Arthritis Foundation, and private industry. He has reviewed grants for the National

Institute for Disability and Rehabilitation Research. He received the American Physical Therapy Association Award for excellence in orthopedic physical therapy research in 1989.

- Burton Kross, Associate Professor, Director of CIREH, is PI for the Fogarty Grant for the international, rural, and environmental health center in Central and Eastern Europe. His research interests include pesticide exposure assessment, radon, and environmental policy.
- Nancy Lynch, Associate, co-developed a new course in Environmental Health to be taught beginning in 1994. Her research involves bioremediation and environmental microbiology.

Faculty and Staff Areas of Competence:

Faculty	Areas of Competence
Stephen J. Reynolds, PhD, CIH	Industrial Hygiene
Peter S. Thorne, PhD	Inhalation Toxicology
Kelley J. Donham, DVM, MS	Agricultural Health and Safety
Mustafa I. Selim, PhD	Environmental Analytical Toxicology
Thomas M. Cook, PhD, PT	Ergonomics
Burton Kross, Ph.D	Environmental Health
Nancy Lynch, Ph.D.	Environmental Health
Industrial Hygiene Staff	Position/Title
Mark Safarik, MS	WORKSAFE IOWA Industrial Hygienist
Stephanie Leonard, MS	WORKSAFE IOWA Industrial Hygienist
L. Fred Wagner, MS	Adjunct Instructor, Industrial Hygiene
Martin Jones, MS, CIH	Staff Industrial Hygienist and PhD Candidate
Lois Etre, PhD	Staff Industrial Hygienist
Peter Waldron, MS, MPH	Staff Industrial Hygienist
Pele Subramanian, PhD	Staff Chemist
Lamar Graft, MS	PhD Candidate, Agricultural Safety
John Rosecrance, PhD	Staff Ergonomist, WORKSAFE IOWA
Chris Zimmerman, PhD	Staff Ergonomist, WORKSAFE IOWA

2. Program Plan

The Division of Occupational and Environmental Health provides outstanding opportunities for graduate students to participate in research activities, and research funds provide support for most of the M.S. and Ph.D. level students. Because of the strong research environment, there is an emphasis on training of doctorate students. Although much research activity is focused on agriculture, industrial hygiene research activities encompass a variety of industries including automotive, electrical power, construction, asbestos and lead abatement. There is also a strong component of international occupational and environmental health.

While there remains a strong commitment to training of researchers, there has also been much more emphasis on developing a curriculum and program that will produce practicing industrial hygienists capable of contributing to the control of occupational disease from the front lines. In this regard, the role of WORKSAFE IOWA must be noted. As it relates to industrial hygiene, WORKSAFE IOWA has two goals: provision of affordable fee-for-service regional consultation on occupational safety and health; and involvement of students in applied aspects of industrial hygiene on an early and regular basis. WORKSAFE IOWA employs three industrial hygienists (Mark Safarik, Stephanie Leonard, and Lois Etre), an ergonomist (John Rosecrance), and is supervised by Dr. Reynolds. Students participate on actual industrial hygiene consultations in a progressive fashion, initially observing, then assisting with walk-

throughs and collection of industrial hygiene samples, and in the case of some Ph.D. students contributing significant technical expertise to selected projects.

a. National/Regional Need for Program

There are no other graduate IH training programs in Nebraska, Kansas, Missouri, and Iowa. Therefore, this program serves an important regional role. The need for training in IH in general, as well as that with an emphasis on agricultural exposures, in this part of the midwest reflects the limited number of other graduate training programs in the region and the nature of the region's major occupation.

Many predominantly rural industries are small to mid-sized industries employing fewer than 300. These industries rarely have a trained health and safety professional yet often have significant occupational health exposures. Recognition of this need has resulted in the development of the WORKSAFE IOWA IH consultation service and the WORKSAFE IOWA OM Associate Network, a group of community hospital-based OM clinics serving local industries with the help of IH and OM consultation from WORKSAFE IOWA. These clinics are creating a further need for trained OM physicians, nurses, physical therapists (ergonomics), and industrial hygienists within the region. In addition to the known hazards of farming as an occupation, several agriculturally related industries such as meat packing and farm implement manufacturing are associated with increased risks, including repetitive trauma, noise, and inhalation hazards.

The University of Iowa is increasingly playing a regional IH consulting and educational role. The Institute has provided IH consultation services to community hospitals, businesses, and workers in the region through WORKSAFE IOWA. It has worked cooperatively with the University Labor Center in providing health and safety training directly to employees. It has also provided continuing education to regional nurses, safety officers and others through WORKSAFE IOWA education programs.

b. Distinctive Program Contributions to the Field

One unique contribution to teaching is the involvement of students in the outreach portion of WORKSAFE IOWA. WORKSAFE IOWA is now self-supporting. WORKSAFE IOWA has two roles. One is to provide an affordable fee-for-service regional consultation resource for occupational safety and health. The second (and innovative role of this program) is to involve IH students and OM residents early and regularly in applied aspects of occupational safety and health that in other similar training programs (and heretofore in ours) is either lacking or occurs late into the student's first year.

The WORKSAFE staff includes three experienced industrial hygienists (M. Safarik, formerly director of Nebraska's OSHA Consultation Division, S. Leonard, and L. Etre). Safarik and Leonard have Master's degrees and Etre has a PhD, and all three have several years of industrial hygiene experience. Mark Safarik is a certified industrial hygienist. IH or other students in 63:191 Occupational Health are encouraged to visit with and accompany WORKSAFE hygienists providing service to Iowa industries. A formal policy describing IH student involvement in a progressive pattern of observation, assistance, and participation has been adopted. Each of the IH trainees participated in this program at least once during their first year in the program.

In addition to the main focus on training general industry IH practitioners, two specialty subtracks are available for industrial hygiene students with a particular interest in agricultural hygiene or ergonomics. Despite the striking incidence of farm related deaths, injuries, and disease, there is a dearth of trained professional hygienists in this country who have expertise in agricultural health hazards, what may be called "agricultural hygienists." As there are special considerations in agriculture that make it different than other employment, an agricultural hygienist needs both to understand industrial hygiene and to *know* agriculture. Some of the unique features that make a special knowledge of farming and understanding of farmers necessary for agricultural hygiene include the following:

- Family farms are primarily small self-employed businesses that have no traditional external financial incentives to institute safety and health such as workers compensation, OSHA regulations, or union or labor organizations.

- Farmers are independent, prone toward an egalitarian society, and are apprehensive of government regulations.
- Credible and adoptable control recommendations must be adaptable to agricultural production modes, amenable to rural community resources, and compatible with a very inelastic market structure.

While a definable agricultural hygiene subtrack is available, agricultural hygiene at The University of Iowa is an option not an emphasis within the IH training program.

Also established from support provided by a grant from the Kellogg Foundation in 1987, The University of Iowa Physical Therapy Program graduate Ergonomics specialist track is the first of its kind in this country. The Ergonomics specialist track is intended to train interested Physical Therapists to become more knowledgeable about the economic, psychological, and engineering aspects of various occupational environments. The therapist completing this track is expected to be in a unique position to apply his or her knowledge and skills to the solution of ergonomic problems, to prevent a wide variety of occupationally related musculoskeletal disabilities, and to serve as educators at other institutions, facilities, and industry. About two therapists per year have completed this program and are now working in various industrial and occupational medicine settings.

In order to encourage therapists with an occupational interest to broaden their training in other preventive aspects of industrial hygiene, support of qualified physical therapy students to pursue a modified industrial hygiene curriculum is proposed. In the established curriculum of the Physical Therapy Ergonomics Specialist Track these students already take three semester hours of the Preventive Medicine and Environmental Health core courses and six semester hours of industrial hygiene specific courses. To be eligible for a NIOSH traineeship they would take essentially all their electives in industrial hygiene and add Epidemiology and Environmental Toxicology as additional requirements. Their thesis would be within the field of ergonomics and their degree in Physical Therapy.

A more recent emphasis has been placed on health and safety in the construction industry. Many of the conditions typifying agriculture are also applicable to construction, and there is cross-over in methods for evaluating and controlling hazardous exposures in both of these industries. Especially in the smaller firms common in the midwest construction workers seldom have the benefit of structured safety programs, are exposed to a wide variety of hazards under changing environmental conditions, and have a unique professional culture. Drs. Reynolds, Cook, Zwerling, and Kross are all actively engaged in research and outreach involving the construction industry in the midwest. This focus has both supported students working on these research grants and impacted teaching in the industrial hygiene courses.

c. Interdisciplinary Experiences

The interaction between IH and OM has been described previously. As described, the new aspects to improve student interaction include the revised joint Occupational and Environmental Health Seminar/Journal Club, pairing of IH and OM students for field observation projects during Occupational Health (63:191), and IH student participation in the OMC. In 63:191 Occupational Health and 63:192 Occupational Safety enrollment of occupational medicine physicians, engineers, safety, physical therapists, lawyers, and other disciplines has increased and improved the opportunity for interdisciplinary interactions in the classroom. In both of these courses students are required to perform a site visit at a local industry and prepare a report as a multidisciplinary team. Dr. Sprince now participates as a lecturer in 63:232 IH II: Evaluation to provide training on medical history taking as an exposure assessment complement to industrial hygiene sampling. Students are then required to spend at least one morning in the Occupational Medicine Clinic observing interactions with patients, physicians, and nurses. This class exercise was so well received that students have returned to participate more than once under their own initiative. In addition, IH students have many opportunities to interact with members of the occupational health team during WORKSAFE IOWA projects and on research projects, an activity that fosters interaction. Both occupational medicine physicians and industrial hygiene students have spent time with Mark Safarik, Stephanie Leonard, Lois Etre, and Dr. Reynolds at the University and on worksites observing actual consulting activities. Several MS student and PhD. students have worked as an IH technician for WORKSAFE and it is anticipated that this will continue to be an option both for training and support. Several PhD students, most notably Lois Etre, Marty Jones, Sean Mahar, Russell Scott and Chad Roy have participated to a significant extent on specific WORKSAFE projects including peer review

of reports, provision of IH services to a hospital, evaluation and design of ventilation, and completion of industrial emissions reports. In addition to PhD students, almost all MS students are now also participating as part of multidisciplinary teams on research projects and use these projects as a basis for an MS thesis. Working with physicians, engineers, chemists, microbiologists, and other disciplines students have been intimately involved in the planning, data collection, and data analysis phases of a wide variety of research topics.

Interactions between students and practitioners in industry, government, and private practice have also been enhanced through: participation in local and national professional societies (AIHA, ASSE); preceptorships; guest lecturers in classes and seminars. Participation in local sections of professional societies is strongly supported, and travel to national meetings has also supported in part by funds from this training grant and other Department funds. Through the professional societies students have the opportunity to meet practicing professionals, and become aware of the technical, ethical, and business issues faced by practicing industrial hygienists. Students are now exploring forming a student chapter of the IA-IL Section AIHA. Local and regional Industrial Hygienists have been active in providing preceptorships and participating as guest lecturers, with very favorable responses from students. In addition to the education experience, these relationships have resulted in employment opportunities.

3. Training Candidates

The MS curriculum is intended to prepare individuals both technically and philosophically to practice the science and art of Industrial Hygiene. Full accreditation from ABET-ABIH was received in 1995. The PhD prepares individuals to conduct and supervise research or to manage advanced applied programs in academic, governmental, or private IH settings. The IH program strives to maintain a unique balance between its historical emphasis on a small number of individually trained students and the required breadth of the interdisciplinary training implicit in the profession. For IH students at Iowa, agriculture is an opportunity not an emphasis.

The philosophy underlying the curriculum for each IH student is that the organizational and planning skills of a hygienist are equally as important as their technical skills. Secondly, that to be of maximum service and value either to small employers (typical of the region) or as program managers, knowledge of the broad aspects of occupational safety, environmental pollution, and basic management skills is needed to supplement the technical aspects of industrial hygiene.

The course offerings within the Institute, the Department, and the University are quite compatible with this philosophic approach. Because of the structure of a medical school, we are not obliged to pass a large number of students through a narrowly defined curriculum. Thus, the small size and the compatibility of the campus course offerings makes the IH program at Iowa highly attractive.

Specialization in industrial hygiene via either the MS or PhD degree programs is administered by the Graduate College as a subtract within the Department of Preventive Medicine and Environmental Health. Appendix AA contains the current University of Iowa catalogue descriptions of the MS and PhD programs. Admissions to degree programs within the Department is governed by the rules and regulations established by the Graduate College. General admission criteria include:

- a baccalaureate degree in a science or engineering area
- a cumulative GPA of 2.7 for the MS and 3.0 for the PhD
- a combined score on the verbal and quantitative portions of the Graduate Record Exam (GRE) of 1050.

Applicants are then evaluated by the faculty on the basis of their general academic background, science background, previous work experience, clarity of focus, and promise.

The industrial hygiene curriculum is built around *five* components:

1. Departmental core courses covering the biology of health, environmental factors affecting health, and the biostatistical and epidemiological approaches to assess health and its hazards (12 semester hours for MS; 18 for PhD).
2. Divisional core courses covering toxicology, and a student seminar presentation (4 hours for MS; 11 for PhD).

3. Specialty courses in occupational health, industrial hygiene, and occupational safety (18 hours for MS and PhD).
4. Campus-wide breadth electives from the humanities and both pure and applied sciences (9 semester hours). While individual electives are not dictated, it is suggested that the student develop breadth in each of the following areas:
 - a) Other Occupational Services **such as** ergonomics, health physics, or labor law.
 - b) Other Environmental Issues **such as** analytical toxicology, air or water pollution engineering, environmental microbiology, or hazardous waste.
 - c) Industrial Management **such as** writing, industrial relations, psychology, sociology, or economics.

A list of over 60 candidate elective courses from outside the department has been compiled to suggest the breadth of relevant courses available at this University. (Appendix BB)

5. Competence demonstrated either through research and a thesis (required for PhD students but optional for MS students) or a major project and comprehensive examination (optional only for MS).

INDUSTRIAL HYGIENE CURRICULUM SUMMARY:

	Course number	Semester hours "Required" for	
		MS	PhD
1. Departmental Core Course Topics:			
Pathology of Diseases	69:133 or 96:120	3	3
Epidemiology	63:158	3	3
Biostatistics	63:161	3	3
Environmental Health	63:202	3	3
Advanced Biostatistics elective	e.g. 63:162		3
Specialized Epidemiology elective	e.g. 63:259		3
2. Divisional Core Course Topics:			
Environmental Toxicology	63:260	3	3
Rural Health and Ag Medicine	63:209		3
Environmental Health Policy	63:252		3
Occupational & Environmental Health Seminar	63:280	1	2
3. Occupational Health Course Topics:			
Occupational Health	63:191	3	3
Occupational Safety	63:192	3	3
Industrial Hygiene I (stressing recognition)	63:231	3	3
Industrial Hygiene II (stressing evaluation)	63:232	3	3
Industrial Hygiene III (stressing control)	63:233	3	3
Preceptorship (or MS thesis)	63:203	3	3
4. Electives Outside the Department			
Other Occupational Services Topics:	- -	3	3
Ergonomics, health physics, labor law	e.g. 101:270		
Other Environmental Topics:	- -	3	3
Air/Water/Waste Disposal	e.g. 53158		
Industrial Management Topics:	- -	3	3
Writing, psychology, economics	e.g. 8W:113		
5. Research / Thesis	63:201 or/and 63:300		<u>6</u>
		<u>43</u>	<u>62</u>

G. Current and Past Training Record - Industrial Hygiene

Since June 1993, the following have graduated from the Industrial Hygiene training program (graduation date in parenthesis):

- Alex Juchems did both a preceptorship for Weyerhaeuser Co. (NC) and a thesis on the concentration and size "Distribution of Aflatoxin B₁ in Aerosolized Grain Dust" during bin clean out. He is now working as an IH for Delta Environmental Consultants in St. Paul, MN. (5/93)

- Don Hevel did a thesis on "Survey and Analysis of Firefighter Noise Exposures in the Iowa City Fire Department." He is currently working for the consulting firm of Fluor Daniel in Des Moines, IA, on health hazards for FAA workers. (8/93)
- Jeff Lange did his thesis on "Bioaerosol Sampling in Field Studies: Can Samples be Express Mailed?" He is now continuing his studies on bioaerosols pursuing a PhD. (8/93)
- Day-Yu Chao did her thesis on "Investigation of Vapor/Particle Phase Distribution of Ammonia in Barns" and is now working for the Dept. of Health, Taipei, Taiwan. (12/93).
- Peggy Bloebaum did her thesis on "Field Evaluation of Endotoxin Collection, Extraction, and Assay Methods" and is now working for Genentech Corp. in San Francisco, CA. (8/94)
- Binny Padanilum did a thesis on "Evaluation of a Sampling Strategy for Formaldehyde using Dinitrophenylhydrazine-coated Glass Fiber Filters in both Laboratory and Industrial Settings". She is working in the Consultation Division of Iowa OSHA. (12/94)
- Leslie Cronkite did a thesis on "Enhancement of BTX Degradation by Addition of Benzoate". She is working as a research assistant in the Department of Civil and Environmental Engineering. (5/96)
- Susan Sebille did a thesis on "A Descriptive Epidemiological Study of Agricultural Injuries in Children of Iowa. She is seeking an environmental health specialist position. (12/95)
- Gregory Kullman did a dissertation on "Exposure to Organic Dusts from Dairy Farming and Respiratory Symptoms Among Farmers" and is currently working at NIOSH directing an agriculture program in Morgantown. (8/95)
- Lois Etre did a dissertation on "Evaluation of the Safety and Effectiveness of Lead Paint Hazard Reduction When Conducted by Homeowners and Landlords" and is employed as an Industrial Hygienist at the Institute for Rural and Environmental Health. (5/96)

Candidates for the MS degree in IH 9/1/95 - 3/31/96 included the following graduate students:

- Craig Taylor
- Matt Stein
- Jason Stookesbury
- Jon Taylor
- Chris Conrad
- Bruce Michael
- Leslie Cronkite
- Susan Sebille

Candidates for the PhD degree in IH 9/1/95 - 8/31/96 included the following graduate students:

- Sean Mahar, MS
- Jeff Lange, MS
- Martin Jones, MS
- Eric Bauer, MS
- John Johnson, MS
- Lois Etre, MS
- Russel Scott, MS (left the program spring 96 and hopes to return)

Lois Etre successfully completed the PhD in 1996, and is employed with WORKSAFE IOWA. Jeff Lange and Sean Maher successfully defended their dissertations and are expected to graduate in the fall of 1996. Sean Mahar is currently employed as an Assistant Professor at Ohio University. Craig Taylor, Matt Stein, and Jason Stookesbury are expected to graduate with their MS degrees in fall semester, 1996.

Our student cohort for the 1995-96 school year totaled 8 MS students and 7 PhD students. Two new MS students, Craig Hooper and Brock Wilson have joined the program fall semester 1996.

Other Progress: The present grant period began on July 1, 1993 and continued through June 30, 1996. During the academic year 1992-1993, the plan for curriculum re-organization detailed in the

competitive renewal application was approved and instituted. Each of the three core IH courses in this curriculum (63:231, 63:232, and 63:233, respectively) was designed to focus on one of the components of the traditional IH paradigm of recognition, evaluation, and control. Course 63:231 (Industrial Hygiene I) covers the recognition of both chemical and physical hazards and continues through evaluation and control of the physical agents. Course 63:232 (Industrial Hygiene II) covers chemical air sampling concepts and methods and their application to IH hazard evaluation. In addition microbiological sampling, dermal sampling, radiation assessment, and biological sampling are also covered. Course 63:233 (Industrial Hygiene III) covers engineering ventilation controls, non-ventilation chemical controls, and program management.

In an on-going process of curriculum review, the survey course also required for IH graduate students 63:191 (Occupational Health) was restructured during 1993-4 with the intent of interesting a wider variety of students than those who have already expressed a focused interest in an occupational safety and health specialty area like industrial hygiene. The re-structured 63:191 was introduced for the first time in the fall of 1994. Because the technical and programmatic IH material presented in the previous version of 63:191 was closely integrated with and used as an introduction to the more detailed coverage of same topics in 63:231, the re-structuring changes in the former 63:191 have lead to further changes in 63:231 to ensure full coverage of IH topics for IH graduate students. These latter changes are also being implemented this fall as the course is progressing. The content and philosophy of 63:192 Occupational Safety was drastically revised and has resulted in increased enrollment of engineering students and others contributing to the interdisciplinary experience of IH students, and providing a more comprehensive foundation in safety principles and practice.

Because of funding received from this training grant in 1992, equipment purchased was used to teach several laboratory sessions in 63:232 (Industrial Hygiene II: Evaluation), to improve equipment availability in 63:233 (Industrial Hygiene III: Control), and to teach relevant portions of other courses such as Environmental Health (63:202), Occupational Health (63:191), and Occupational Safety (63:192). This equipment includes a phase contrast microscope (Olympus), a self-contained breathing apparatus, an AIM gas detector, IOM inspirable samplers, and a variety of rotameters and magnahelix differential pressure gauges. With the training grant support, an organic vapor analyzer with portable gas chromatograph capabilities which was donated by Iowa OSHA for classroom use was repaired.

An institutional commitment was made to support ABET accreditation of the IH program. The necessary application package was prepared during the summer of 1994, and a site visit was made in the Fall of 1994. The M.S. program was fully accredited in 1995. This endeavor is important because of its impact on revitalizing the program and because it was the impetus for clarifying and organizing various aspects of the program. This review process is also important because it provides a mechanism for outside review and validation of IH training programs. As a result of the IH accreditation process the IH program has now been officially recognized as a distinct subtrack within the Department of Preventive Medicine, and additional laboratory space has been allocated for IH research and teaching.

Two people associated with the IH program received ABIH certification in Industrial Hygiene during the grant period as follows: Martin Jones, a PhD candidate and staff research IH, and David Rosenau, formerly a staff industrial hygienist for WORKSAFE IOWA. Dr. Reynolds was also promoted from assistant professor to associate professor effective July 1, 1996.

Appendix A

**Centers and Projects
Occupational, Environmental & Agricultural Health
The University of Iowa
Department of Preventive Medicine and Environmental Health
Division of Occupational and Environmental Health**

<u>Director</u>	<u>Title</u>	<u>Source</u>
Donham	Iowa Center for Agricultural Safety and Health (ICASH) Includes Iowa Health & Safety Services Project (IA-HASSP)	Iowa State Legislature
Zwerling	Injury Prevention Research Center	CDC
Merchant	Great Plains Center for Agricultural Health	CDC/NIOSH
Merchant	Environmental Health Sciences Research Ctr. (EHSRC)	NIEHS/NIH
Kross	Center for International Rural and Environmental Health (CIREH)	Pioneer Intl., Pan American Health Org. U. of Iowa
Merchant	WORKSAFE IOWA	Self-supporting from fees
Sprince	Academic Award in Environmental and Occupational Medicine	NIEHS
Sprince	Iowa Occupational Safety & Health Training Program	NIOSH

Appendix B

Research Projects
Occupational, Environmental & Agricultural Health
The University of Iowa
Department of Preventive Medicine and Environmental Health
Division of Occupational and Environmental Health

Title: Tractor Risk Abatement and Control Project (TRAC)
Project Director: Kelley Donham
Other Key Investigators: Carol Lehtola
Funding Source/Agency: National Center for Injury Prevention and Control - IPRC project
Funding Amount/Period: \$129,131; 9/28/90 - 08/30/96

Title: Rural Rehabilitation and Secondary Injury Project
Project Director: James Merchant
Other Key Investigators: Tom Cook, Craig Zwerling, Chrystal Stanley, David Johnson
Funding Source/Agency: National Center for Injury Prevention and Control - IPRC Project
Funding Amount/Period: \$115,060; 9/1/93 - 8/30/96

Title: The Keokuk County Rural Health Study: Epidemiological Assessment of Respiratory Disease and Injury among Farm and Non-Farm Rural Families
Project Director: James Merchant
Other Key Investigators: Craig Zwerling, Steve Reynolds, Leon Burmeister, Ann Stromquist
Funding Source/Agency: National Institute for Occupational Safety and Health (NIOSH/CDC)
Funding Amount/Period: \$705,476; 10/1/90 - 9/30/96

Title: Iowa Farm Family Health and Hazard Surveillance Project
Project Director: Craig Zwerling
Other Key Investigators: Steve Reynolds
Funding Source/Agency: National Institute for Occupational Safety and Health
Funding Amount/Period: \$383,107; 9/28/95 - 9/27/97

Title: Rural Injury Surveillance System
Project Director: Craig Zwerling
Other Key Investigators: James Merchant, Charles Lynch, John Powell, Lar Fuortes, James Torner
Funding Source/Agency: Centers for Disease Control (NCIP)
Funding Amount/Period: \$321,000; 9/28/90 - 8/30/96

Title: Health Care Worker Compliance with Hepatitis B Vaccination
Project Director: Bradley Doebbeling
Other Key Investigators: David Schwartz, James Rohrer, Richard Wenzel, Frank Kohout, Jerry Suls
Funding Source/Agency: NIOSH Special Emphasis Research Career Award
Funding Amount/Period: \$147,500; 4/1/93 - 3/31/96

Title: Elevated Blood Leads in the Iowa Construction Industry
Project Director: Steve Reynolds
Other Key Investigators: Lar Fuortes, Nancy Sprince, Bill Clarke
Funding Source/Agency: National Institute for Occupational Safety and Health
Funding Amount/Period: \$162,000; 10/1/93 - 9/30/96

Title: Air Quality Studies and Health Assessments of Individuals Living in the Vicinity of Swine-Confinement Operations
Project Director: Kelley Donham
Other Key Investigators: Kendall Thu, Peter Thorne, Steve Reynolds
Funding Source/Agency: Center for Health Effects of Environmental Contamination
Funding Amount/Period: \$14,972; 1/15/94 - 1/14/95

Title: A Community-University Partnership in Rural Health Care and Prevention
Project Director: James Merchant
Other Key Investigators: Jim Rohrer, Bob Wallace, Laurie Walkner
Funding Source/Agency: Pew Charitable Trusts & Robert Wood Johnson Foundation
Funding Amount/Period: \$250,000; 10/1/93 - 9/30/96

Title: Child and Adolescent Rural Respiratory Disease Study
Project Director: Michael Kramer
Other Key Investigators: James Merchant, Miles Weinberger
Funding Source/Agency: National Heart, Lung and Blood Institute (NSRA)
Funding Amount/Period: \$36,000; 2/4/93 - 6/30/95

Title: Occupational Injuries Among Older Workers
Project Director: Craig Zwierling
Funding Source/Agency: NIOSH Special Emphasis Research Career Award
Funding Amount/Period: \$50,000; 10/1/94 - 9/30/97

Title: Assessment of Occupational Exposure to Aflatoxin
Project Director: Mustafa Selim
Other Key Investigators: William Pependorf, Leon Burmeister
Funding Source/Agency: CDC/NIOSH
Funding Amount/Period: \$406,358; 1/1/95 - 12/31/96

Title: Cumulative Trauma Disorder
Project Director: Thomas Cook
Funding Source/Agency: Newspaper Association of America
Funding Amount/Period: \$80,601; 7/1/94 - 6/30/95

Title: Reducing Work-Related Musculoskeletal Disorders Among Carpenters or Related Construction Workers
Project Director: Thomas Cook
Other Key Investigators: Craig Zwierling, Burt Kross
Funding Source/Agency: The Center to Protect Workers' Rights
Funding Amount/Period: \$516,511; 10/1/92- 9/29/95

Title: Epidemiological and Environmental Study of Bioaerosol Exposures in the Refuse-Derived Fuel Industry: Phase II
Project Director: Steve Reynolds
Other Key Investigators: Nancy Sprince, Sean Mahar
Funding Source/Agency: Northern States Power Company
Funding Amount/Period: \$40,352; 1/1/95 - 7/31/95

Title: Central European Student Internships
Project Director: Burt Kross
Other Key Investigators: Steve Reynolds, Lar Fuortes
Funding Source/Agency: Pioneer Hybrid Seed Corp.
Funding Amount/Period: est. \$20,000; 6/1/95 - 9/1/98

Title: Water Resources in Uzbekistan/Turkmenistan
Project Director: Steve Reynolds
Funding Source/Agency: National Academy of Science
Funding Amount/Period: \$10,000; 6/1/94 - 9/1/96

Title: Great Plains Center - Industrial Hygiene Core
Project Director: Steve Reynolds
Funding Source/Agency: US PHS/Centers for Disease Control
Funding Amount/Period: \$24,818; 9/30/94 - 9/29/96

Title: Environmental Health Science Research Center - Environmental Measurement Facility
Project Director: Steve Reynolds
Funding Source/Agency: US PHS/National Institute of Environmental Health Sciences
Funding Amount/Period: \$88,581; 4/1/95 - 3/31/96

Title: Indoor Air Quality in Large Office Buildings in the Midwest
Project Director: Steve Reynolds
Funding Source/Agency: U.S. EPA
Funding Amount/Period: \$635,257; 10/1/95 - 9/30/98

Title: Great Plains Center - Design of Pesticide Control Technologies
Project Director: B. Kross
Other Key Investigators: Steve Reynolds
Funding Source/Agency: NIOSH
Funding Amount/Period: \$29,873; 9/30/95 - 9/29/96

Title: Great Plains Center - Interlaboratory Comparison of Endotoxin Assays
Project Director: Steve Reynolds
Funding Source/Agency: NIOSH
Funding Amount/Period: \$20,548; 9/30/95 - 9/29/96

Title: Great Plains Center - Assessment of Ammonia Vapor/Particles in Agricultural Aerosols
Project Director: Steve Reynolds
Funding Source/Agency: NIOSH
Funding Amount/Period: \$13,699; 9/30/95 - 9/29/96

Title: Farm Flood Response Workshop
Project Director: Steve Reynolds
Funding Source/Agency: NIOSH
Funding Amount/Period: \$50,000; 11/8/93 - 11/7/94

Title: International Training Program for Rural and Environmental Health
Project Director: B. Kross
Other Key Investigators: S. Reynolds, J. Merchant, P. Thorne, L. Fuortes
Funding Source/Agency: Fogarty International Foundation
Funding Amount/Period: \$811,756; 10/1/95 - 9/30/00

Title: Comparison of Sampling Methods for Lead in Dust
Project Director: Steve Reynolds
Other Faculty: P. Thorne, M. Selim
Funding Source/Agency: CHEEC
Funding Amount/Period: \$14,386; 8/1/92 - 7/31/93

Title: Household Radon Exposure Assessment Methods Study
Project Director: B. Kross
Other Investigators: S. Reynolds
Funding Source/Agency: Iowa Department of Public Health/EPA
Funding Amount/Period: \$73,730; 3/1/92 - 2/28/93

Title: Evaluation of the Safety and Effectiveness of Lead Abatement When Conducted by the Homeowners and Landlords
Project Director: Steve Reynolds
Other Faculty: L. Fuortes, M. Selim
Funding Source/Agency: Iowa Department of Public Health/CDC
Funding Amount/Period: \$60,000; 11/1/93 - 6/30/95

Title: Farm Family Health and Hazard Surveillance Project
Project Director: C. Zwerling
Other Investigators: S. Reynolds
Funding Source/Agency: NIOSH
Funding Amount/Period: \$383,107; 9/28/95 - 9/27/97

Title: Phase I - Epidemiological and Environmental Study of Bioaerosol Exposures in the Refuse-Derived Fuel Industry
Project Director: Steve Reynolds
Other Faculty: N. Sprince
Funding Source/Agency: Northern States Power Company

Funding Amount/Period: \$3136; 9/1/93 - 11/30/93

Title: Pesticide Use and Rural Health in Taiwan
Project Director: D. Chao and S. Reynolds
Funding Source/Agency: Center for International Rural and Environmental Health
Funding Amount/Period: \$3,350; 3/1/93 - 2/28/94

Title: Environmental Health Sciences Research Center
Project Director: J Merchant, Center Director; S Reynolds, Facility Director
Other Faculty: N. Sprince, P. Thorne
Funding Source/Agency: NIEHS
Funding Amount/Period: \$5,173,055; 4/1/96 - 3/31/01

Appendix C

Occupational Medicine and Industrial Hygiene Graduates 7/1/93 - 6/30/96

<u>Occupational Medicine Calendar Year</u>	<u>Received MS</u>	<u>Completed Residency</u>
1993	Raad Yaldo	
1994	Rick Garrels	Raad Yaldo
1995		Rick Garrels
1996	Steve Olsen Ellen Ballard	

<u>Industrial Hygiene Calendar Year</u>	<u>Received MS</u>	<u>Received PhD</u>
1993	Don Hevel Alex Juchems Day-Yu Chao Jeff Lange	
1994	Peggy Bloebaum Binny Padanilum	
1995	Susan Sebille	Gregory Kullman
1996	Leslie Cronkite	Lois Etre

