

Final Progress Report

**Graduate Industrial Hygiene Training Project
Mel and Enid Zuckerman College of Public Health
University of Arizona
Tucson, Arizona 85724**

Sponsored by:

The National Institute for Occupational Safety and Health

Project Period: 7/01/00 – 6/30/06

Program Director: Jefferey Burgess, MD, MPH

Prepared by: T. Renée Anthony, PhD, CIH, CSP

Grant No: T01/CCT910446-11

September 28, 2006
Rev. Oct. 25, 2006

Table of Contents

Abstract	1
Significant Findings	2
Description of Training Program	3
Rationale	3
Program History.....	3
Program Leadership and Faculty	4
MPH/EOH Curriculum	4
Program Evaluation and Advisory Board	7
Training Candidates	8
Recruitment and Admissions.....	8
Training Record During 2000-06	9
Conclusions	14
Attachment A: List of Publications	A-1

List of Tables

Table I: Industrial Hygiene Faculty	4
Table II: Course Sequence for MPH/EOH Students	6
Table III: MPH/EOH Applicant, Admission, Enrollment Information.....	8
Table IV: Academic Training Report (Summary)	9
Table V: NIOSH TPG Support Levels	10
Table VI: Internships Completed Between 7/00 – 6/06	12

ABSTRACT

Industrial hygiene has been offered as an educational program at the University of Arizona since 1978. It was originally offered as an undergraduate program. Since 1985, graduate industrial hygiene training at the University has been designed to meet a strong demand for well-trained occupational health professionals in a region that still experiences high growth rate coupled with an extremely limited number of occupational health and safety educational programs. Over the years, the home of the industrial hygiene program has included the Department of Family and Community Medicine (DFCM) within the College of Medicine and the Arizona Prevention Center (APC), also within the College of Medicine. In January 2000, the Arizona Board of Regents approved what is now known as the Mel and Enid Zuckerman College of Public Health (MEZCOPH), where the Master of Public Health (MPH) program in industrial hygiene is administered today.

Industrial hygiene graduate students are enrolled in the Environmental and Occupational Health (EOH) concentration area within the MPH program. From the period covered by this grant (7/1/00 – 6/30/06), EOH-MPH students had no option of study other than an industrial hygiene focus area, requiring coursework to include monitoring methods, ventilation, physical exposures, exposure assessment techniques, and occupational and environmental health. Because of needs addressed by professionals in Arizona and diversified student interests, the curriculum requirements will be changing in Fall 2006, but industrial hygiene courses and techniques remain at the core of the updated program.

During this period, there were significant changes to the faculty, as Drs Mark Van Ert and Cliff Crutchfield retired in 2003 and 2004. Due to hiring freezes at The University and delayed timelines in filling these positions, student recruiting efforts were reduced as the remaining faculty arranged for coverage of teaching and advising responsibilities. In July 2005, Dr. Renée Anthony joined the faculty, with years of industrial experience and both industrial hygiene and safety certification (*i.e.*, CIH and CSP). In July 2006, Dr. Kelly Reynolds was hired to the EOH faculty; although not an industrial hygienist, her research expertise in water disinfection combined with risk assessment skills hope to address gaps in the environmental aspects to the changing program. One other search for an assistant professor is underway, and ability to contribute to the industrial hygiene teaching responsibilities features dominantly in the selection criteria.

Also during this period, a new home to the College was completed. Drachman hall, a new teaching and faculty, staff, and administration office building was completed in January of 2006. While laboratory space is still located at the Health Science Professionals building, this new space has state-of-the-art teaching facilities and allows for interdisciplinary interactions between EOH and epidemiology, biostatistics, and other MPH students.

Finally, 22 students have earned their MPH. The diversity of employment decisions for these graduates includes the traditional industry and consulting hygiene jobs, but also includes medical residency, doctoral studies in toxicology and pharmacy, and research positions. The program currently has 4 continuing students that are at part-time status, 2 students returning in the fall to complete their technical report, and 4 newly admitted industrial hygiene students attending their first courses in Fall 2006 (3 full-time, 1 part-time).

SIGNIFICANT FINDINGS

- Twenty nine students have been enrolled in the MPH/EOH program studying industrial hygiene during this grant period. A total of 22 industrial hygiene students have earned their MPH over this reporting period. Fifteen students have received some level of NIOSH TPG support during their MPH-EOH/IH studies.
- Graduates are now employed in the following sectors, working to improve health and safety of workforces or other populations around the world:
 - Industry (1)
 - Government/Research (6)
 - Consulting (6)
 - Continued Education (4)
 - Medicine/Residency (2)
- Graduate students made 9 scientific presentations at state or national professional conferences and authored or co-authored 5 publications in peer reviewed journals.
- All graduates completed the mandatory internships, requiring both report preparation and presentation during one of the 3 internship seminars scheduled each year. This provided students an opportunity to explain industrial hygiene and their roles in it to others typically unfamiliar with the profession.
- All graduates also completed required technical reports, similar to a thesis in format and content. The content ranged from comprehensive literature review to scientific research contributing to the field of industrial hygiene science. Currently, 5 students have completed all degree requirements except the technical report, and we anticipate awarding 4 more MPH degrees by December 2006.
- The loss of 2 of the 5 primary faculty members during this reporting period provided challenges to maintaining a functioning program. However, with the help of adjunct faculty and the commitment of the remaining EOH faculty and College Dean, enrolled students received a well-rounded education in industrial hygiene fundamentals. With the arrival of new faculty, students who matriculated without Drs. Crutchfield or VanErt were interviewed and educational gaps were addressed in their remaining coursework. A more lasting consequence of faculty retirement has been the sustained decrease in student enrollment: faculty and student services are addressing this during the 2006-7 academic year.

DESCRIPTION OF TRAINING PROGRAM

Rationale for Program

NIOSH support has played an extremely important role in the development of Industrial Hygiene training programs at the University of Arizona. The programs that have been developed could not have survived without such support. The regional impact of the Arizona programs is evidenced by the fact that more than 25% of the 151 national members of American Industrial Hygiene Association from Arizona are program graduates.

Graduate industrial hygiene training at the University of Arizona is designed to meet a strong demand for well-trained occupational health professionals in a region that is experiencing a high growth rate coupled with an extremely limited number of occupational health and safety educational programs.

Currently, an MPH Degree in Environmental and Occupational Health (EOH) is offered. The division and college are preparing packages for the Regents for approval to offer both MS and PhD degrees in environmental and occupational health, but we anticipate approval is two years away.

The purpose of the MPH/EOH degree is to prepare students for careers involving professional practice and/or research. All graduates from this reporting period have completed the industrial hygiene focus area. They received specialized training in the anticipation, recognition, evaluation, and control of occupational health hazards. This is emphasized in the core EOH course required of all MPH students as well as in all required EOH courses. Students and advisors work together to customize an academic program to suit the students' desired career path, and a full program of industrial hygiene selective courses are available for students wishing to pursue an industrial hygiene concentration. All MPH students in EOH are required to complete a summer internship, and unique to this division within this college, EOH MPH students are required to complete a technical report to ensure that students have mastered technical aspects of industrial hygiene, either applied or theoretical.

Program History

Industrial hygiene has been offered as an educational program at the University of Arizona since 1978. It has evolved from a Bachelor of Science in Health Science program to a graduate-level industrial hygiene training in 1985 (MS Tox). In 1993, the Arizona Board of Regents approved a Master of Public Health (MPH) degree, which is now administered by the Mel and Enid Zuckerman College of Public Health (MEZCOPH). The MEZCOPH now has full academic responsibility for several degree programs, including the MPH program. The Environmental and Occupational Health (MPH/EOH) track is one of six approved concentration areas within the MPH Program. The MPH/EOH track allows industrial hygiene students to develop a stronger appreciation for and competence in addressing public health concerns in the occupational and environmental arenas.

Program Leadership and Faculty

The primary EOH faculty members currently include Renée Anthony, Jeff Burgess, Mary Kay O'Rourke, Wayne Peate, and Kelly Reynolds. We are currently conducting a search for an additional assistant/associate professor with expertise in a *core industrial hygiene function*.

Over the first half of the grant period, from 7/00 to 6/04, Cliff Crutchfield administered the industrial hygiene program, and Mark Van Ert was the associate director. After their retirement, they both remain in the Tucson area and have continued to contribute to the program through guest lecturing as adjunct faculty. All faculty in EOH devote their time to teaching the core industrial hygiene/EOH courses, advising IH students, guiding research for student technical reports, coordinating student internships, and conducting research and service. Table I provides a list of primary and support faculty members who have contributed substantially to IH training during the project period.

MPH/EOH Curriculum

EOH MPH students have been required to complete 5 core MPH courses, including fundamentals in epidemiology, biostatistics, EOH, public health policy and management, and sociocultural and behavioral aspects of public health. In addition, three units of internship were required, culminating in an internship report and a 20-minute presentation in an internship seminar held three times each year. In the 2005-6 academic year, an additional one unit internship seminar course was added to the list of required courses, where students received formal training on the ethical conduct of research and IRB requirements at the University of Arizona. These core courses total to 19 credit hours.

EOH students have been required to complete 27 additional units of required concentration courses, including: *Fundamentals of Industrial and Environmental Health, Environmental Monitoring and Analysis, Physical Exposures, Toxicology and Chemical Exposures, Industrial Ventilation, Advanced Industrial and Environmental Health, Occupational Diseases, and EOH Seminar*. The culminating experience unique to EOH MPH students within this College of Public Health is the 3-credit research course, requiring the generation and defense of a technical report.

The schedule of courses, based on even or odd year admission cycles, are provided in Tables II(a) and II(b), respectively.

Table I. Industrial Hygiene Faculty

Name/Dept.	Specialty Area	IH Program Role
Core Faculty		
Cliff Crutchfield PhD, CIH MEZCOPH/CEP/EOH	Industrial Hygiene, Engineering Control, Respiratory Protection; <i>Retired 2004</i>	Directed IH Program until retirement; taught <i>Industrial Ventilation, IH Instrumentation, Physical Exposures, Env&Occup. Health</i> (team); Advised students; directed technical report research. Currently lectures: <i>Fundamentals of Occup. and Env. Health</i>
Mark van Ert PhD, CIH MEZCOPH/CEP/EOH	Industrial Hygiene, Toxicology, Indoor Air; <i>Retired 2003</i>	Co-directed IH Program; taught <i>Fundamentals of IH, Advanced IH</i> , co-taught <i>Indus. Tox. & Chem. Exp., Env&Occup. Health</i> (team). Advised students; directed technical report research. Currently lectures: <i>Fundamentals of Occup. and Env. Health</i>

Table I. Industrial Hygiene Faculty, continued

Name/Dept.	Specialty Area	IH Program Role
T. Renée Anthony PhD, CIH, CSP MEZCOPH/CEP/EOH	Industrial Hygiene, Engineering Control, Aerosols, Deterministic Modeling	Teaches <i>Industrial Ventilation, Monitoring Methods</i> (primary), <i>Physical Exposures, Applied Exposure Assessment, Envr. & Occup. Health</i> (team). Advises students; directs technical report research and internships; serves on IH student committees.
Jeffrey L. Burgess MD, MS, MPH MEZCOPH/CEP/EOH	Occupational Medicine, Toxicology, Hazardous Chemical Response	Chair Community, Environment, Policy Division. Teaches <i>Fundamentals of Occup. and Env. Health</i> (primary), <i>Envr. Toxicology</i> . Co-teaches <i>Occupational Diseases, Envr. & Occup. Health</i> (team). Advises students; directs technical report research and internships; serves on IH student committees.
Mary Kay O'Rourke PhD MEZCOPH/CEP/EOH	Exposure Assessment, Bioaerosols, Environmental Monitoring, Air Pollution,	EOH Program Director. Teaches <i>Envr. & Occup. Health</i> (primary); <i>Envr. Epidemiology, Risk Assessment</i> . Co-teaches <i>Monitoring Methods</i> . Advises students; directs technical report research and internships; serves on IH student committees.
Wayne F. Peate MD, MPH MEZCOPH/CEP/EOH	Occupational Medicine, Ergonomics, Preventive Medicine	Teaches <i>Occupational Diseases, Envr. & Occup. Health</i> (team); provides ergonomics lectures in <i>Physical Exposures</i> course. Advises students; directs technical report research; serves on IH student committees.
Kelly Reynolds PhD, MS Public Health MEZCOPH/CEP/EOH	Risk Assessment, Water Quality	Teaches <i>Human Health Risk Assessment (SWES 518)</i> ; Preparing to co-teaches <i>Monitoring Methods</i> and <i>Fundamentals of Industrial and Occupational Health</i>
Support Faculty		
Tom Muller, Speech and Hearing Science	Speech and Hearing	Teaches SPH 580: Community and Industrial Audiology; this course makes up 50% of Physical Hazards course
James Ranger-Moore MEZCOPH, EPI/BIOS	Biostatistics, Research Methods	Teaches <i>Bios. in Public Health</i> ; statistical consultant for IH student research
Duane C. Sherrill, PhD MEZCOPH, EPI/BIOS	Biostatistics, Research Methods	Statistical expert participating on student committees
Robin C. Harris, PhD MEZCOPH, EPI/BIOS	Epidemiology	Teaches <i>Basic Principles of Epidemiology</i> ; served on EOH/IH committees
Anabell Hill, PhD MEZCOPH, EPI/BIOS	Epidemiology	Teaches <i>Basic Principles of Epidemiology</i>
Adjunct Faculty		
Ros Hill NIOSH	Mining Health and Safety	Teaches: <i>Mine Health and Safety</i> ; mentors students; liaison between Mining and Geological Engineering masters students and EOH
Julia Rosen CIH, MPH UA Risk Management	Practicing CIH on campus	Lectures: <i>Fundamentals of Occup. and Env. Health</i> ; mentors student internships on campus; field coordinator for applied exposure assessment project
Frank Demer, CIH, MS UA Risk Management	Practicing CIH on campus	Lectures: <i>Industrial Ventilation; Occupational Diseases</i> ; mentors student internships on campus
Jeff Christensen, UA Risk Management	Hazardous waste, HAZWOPER	Lectures: <i>Fundamentals of Occup. and Env. Health</i> ; provides HAZWOPER training to students
Steve Black, CIH Arizona Division of Occupational Safety and Health (ADOSH)	Safety specialist	Lectures: <i>Fundamentals of Occup. and Env. Health</i>

Table II. Course Sequence for MPH/EOH Students through Spring 2006

(a) Even Year Admission

<i>FALL – FIRST YEAR (e)</i>			Units
CPH	584	Fundamentals of Industrial and Environmental Health ^b	3
CPH	502	Environmental Monitoring and Analysis ^b	4
CPH	574 / 577	Health Admin/Policy –or- Sociocultural & Behavioral Aspects ^a	3
CPH	696r	EOH Seminar ^b	1
<i>SPRING – FIRST YEAR (o)</i>			
CPH	573a	Basic Principles of Epidemiology ^a	3
CPH	576a	Biostatistics for Public Health ^a	3
CPH	585	Industrial Ventilation ^b	3
CPH	596n	Internship Seminar ^a	1
<i>SUMMER (o)</i>			
CPH	593a	Internship ^b	3
<i>FALL – SECOND YEAR (o)</i>			
CPH	575	Env. & Occupational Health ^a	3
CPH	553	Toxicology and Chemical Exposures ^b	3
CPH	510	Physical Hazards ^b	3
CPH	574 / 577	Health Admin/Policy –or- Sociocultural & Behavioral Aspects ^a	3
CPH	696r	EOH Seminar ^b	1
<i>SPRING – SECOND YEAR (e)</i>			
CPH	583	Occupational and Environmental Diseases ^b	3
CPH	587	Advanced Industrial and Environmental Health ^b	3
CPH	900	Research /Technical Report ^b	3
REQUIRED CREDIT HOURS			46

(b) Odd Year Admission

<i>FALL – FIRST YEAR (e)</i>			Units
CPH	584	Fundamentals of Industrial and Environmental Health ^b	3
CPH	502	Environmental Monitoring and Analysis ^b	4
CPH	553	Industrial Toxicology and Chemical Exposures ^b	3
CPH	510	Physical Hazards ^b	3
CPH	696r	EOH Seminar ^b	1
<i>SPRING – FIRST YEAR (e)</i>			
CPH	583	Occupational and Environmental Diseases ^b	3
CPH	582	Advanced Industrial and Environmental Health ^b	3
CPH	576a	Biostatistics for Public Health ^a	3
CPH	596n	Internship Seminar ^a	1
<i>SUMMER (e)</i>			
CPH	593a	Internship ^b	3
<i>FALL – SECOND YEAR (e)</i>			
CPH	573a	Basic Principles of Epidemiology ^a	3
CPH	574 / 577	Health Admin/Policy –or- Sociocultural & Behavioral Aspects ^a	3
CPH	574 / 577	Health Admin/Policy –or- Sociocultural & Behavioral Aspects ^a	3
CPH	696r	EOH Seminar ^b	1
<i>SPRING – SECOND YEAR (o)</i>			
CPH	575	Env. & Occupational Health – MPH Core ^a	3
CPH	582	Industrial Ventilation ^b	3
CPH	900	Technical Report/Research ^b	3
REQUIRED CREDIT HOURS			46

^a Required MPH core course (19 units)

^b Required EOH track course (27 units)

Program Evaluation and Advisory Board

In October 2005, the CEPH accreditation recommended that the College evaluate why the EOH curriculum requirements required significantly more credit hours than other MPH programs and to examine why there was no room for electives within the program. In August of 2005, the faculty agreed that the program had been established to meet the industrial hygiene student needs but had not been adapted to reflect the increased environmental health interests of prospective students, Arizona, and the nation. In the upcoming academic year, 2006-7, we have received approval of a revised curriculum that allows students *more flexibility* in selecting coursework, allowing students to continue with a focus on traditional industrial hygiene coursework, similar to the course plan, above, or to devise other study plans to fit their career goals, allowing the flexibility to take courses such as risk assessment, emergency preparedness I and/or II, or biomarker courses. This allows the program to remain competitive with other public health institutions and serves the need to address student interest in environmental health without requiring occupationally-focused courses such as ventilation. However, students with industrial hygiene interests, and those that may receive future NIOSH funding, will commit to a specific curriculum to ensure fundamental knowledge needed to attempt the certification exam. The curriculum will require the following EOH courses core to all EOH MPH degrees: *Fundamentals of Industrial and Environmental Health, Environmental Monitoring Methods, Applied Exposure Assessment* (a revision of the former *Advanced Industrial and Environmental Health* course), and 3 credits of research with technical report and defense. All MPH/EOH students will be required to select 9 units of selective credit; future NIOSH TPG funded students will be required to complete an *additional* 6 credits to cover the major ABIH certification rubrics.

In addition to CEPH accreditation, extramural advice to program faculty was provided on an on-going basis by the Board of Directors of the Arizona Section of the American Industrial Hygiene Association. Frequent meetings allowed interaction between faculty, students, and practitioners across the state. During this reporting period, the board initiated Industrial Hygiene Student Research Meetings, hosted in the spring. This meeting provided a forum for IH students to present their research projects and to receive feedback on their work. The Arizona Section also donated funds to support student research.

Near the end of this grant cycle, a Health and Safety Needs Assessment Survey was submitted to the AZ AIHA and ASSE membership. Twenty seven members responded, providing guidance to areas of state-wide educational health and safety needs. This feedback will be incorporated into course curriculum to ensure that the needs of professionals within Arizona will be met with new graduates. The top two priorities for continued educational needs were identified as *bioaerosols/biohazards* and hearing conservation (30% of respondents). Twenty six percent of respondents listed the following as top priorities: *confined space, emergency preparedness, environmental, medical monitoring, respiratory protection, and safety fundamentals*. With the arrival of new faculty in 2005 and now in 2006, revisions to course syllabi are ongoing, and these responses are being incorporated into curriculum revisions. Many of these concerns have already been addressed in the 2005-6 curriculum review of the EOH program: faculty have revised the content of many courses that should address these needs voiced by Arizona professionals. Changes to the program that will impact graduates with these state-wide needs include:

- Expansion of bioaerosol work and confined space measurements in the *Environmental Monitoring and Analysis* course (CPH 502)

- Continuation of audiology section, taught by faculty in Speech and Hearing department, in *Physical Exposures* course (CPH 510)
- Inclusion of advanced discussions of respiratory protection in the revision to the “ventilation” course, now changed to *Control of Occupational Exposures* (CPH 585)
- Even though discussions of safety fundamentals were incorporated into the *Fundamentals of Industrial and Environmental Health* course, we will develop of a new, web-based safety fundamentals course, to roll out in 2007/8 academic year.
- Inclusion of medical surveillance in Dr. Peate’s *Occupational and Environmental Diseases* course (CPH 583) and lesson on biomarkers in *Environmental Monitoring Methods* (CPH 502).
- Development of a two-course series on emergency preparedness, in conjunction with Arizona Center for Public Health Preparedness activities.

These and other program improvements will provide students with both theoretical and hands-on application of skills specifically addressed by professionals within the state.

Training Candidates

Recruitment and Admissions

A decline in recruitment efforts necessarily occurred during faculty transition during this grant period, as shown in Table III. Historically, the program has used the *Fundamentals of Environmental and Industrial Health* course, offered as both a graduate and undergraduate course, to attract many students into the program. In addition, health and safety courses in the Mining Engineering program have brought students into the MPH program. These courses, along with alumni taking a key role of educating interested students about the EOH program, had been successful while Drs. Crutchfield and Van Ert were at the University. However, after their retirements, alumni were uncertain about the future of the program. With new faculty arriving in 2005 and becoming involved in the local AIHA, alumni have been reassured that the program is still alive. Alumni are contacting Faculty looking for interns and graduates to hire into industrial hygiene positions, indicating continued interest in the program with state-wide professionals. EOH faculty are developing a strategy to recruit in Fall 2006, with support from the College, to once again educate student and industries that the EOH program has a premiere industrial hygiene program, focused on developing educated practitioners.

Table III. MPH/EOH Applicant, Admission, Enrollment Information

MPH, by Year Admitted	# Students Applied	# Students Offered Admission	# Students Entering Training	# Who Left Program	# Currently in Training	# Completed Training
2000-1	14	11	7	1	1	5
2001-2	19	7	4	0	2	2
2002-3	14	10	4	0	0	4
2003-4	8	7	7	1	1	5
2004-5	2	1	1	0	1	0
2005-6	2	2	1	0	1	-
2000-6 totals	59	38	24	2	6	16
(2006-7)	(9)	(7)	(4)	-	(4)	-

Training Record During 2000-06

Table IV provides a summary of the academic training from July 2000 through June 2006. Five students admitted during the last reporting cycle ending June 2000 graduated during *this* reporting period: four of these 5 had received NIOSH TPG funding through a portion of their education. Twenty four students were admitted to the program during this reporting period. One student who received NIOSH funding during her first semester changed to the Epidemiology (2003-4) program where she has earned her MPH; she has been counted as enrolled but not graduated. Another student who received funding had completed everything except preparing his final technical report and, therefore, has not received his degree (2000-1). Two additional students have completed everything except technical reports (2001-2) but have been working in the profession since 2004: They have been in contact with faculty and are currently making progress toward completing the degree requirements by December 2006. Additionally, we currently have two part-time students making reasonable progress toward the degree, one formerly full-time student who is now part-time while completing his MPH technical report and his thesis for his master in mining engineering degree. The number of "other students" in Table 6 includes MPH students completing the core EOH course (CPH 575, required for graduation) and graduate and undergraduate Soils, Water and Environment Sciences (SWES) students completing *Fundamentals of Industrial and Environmental Health*, a traditional feeder course for our program.

Table IV: Academic Training Report (Summary)

Program Year	How Does Degree Read?	# Full-Time Students Enrolled	# Full-Time NIOSH-Supported Students	# Part-Time Students Enrolled	# Part-Time NIOSH-Supported Students	# Other Students Taking OS&H Courses*	# Students Graduated	# transferred to other program
2000-1	Master of Public Health	8	6	3	0	102	3	
2001-2	Master of Public Health	6	5	0	0	58	2	
2002-3	Master of Public Health	4	2	0	0	77	3	
2003-4	Master of Public Health	9	5	0	0	67	6	1
2004-5	Master of Public Health	7	4	0	0	77	3	
2005-6	Master of Public Health	1	1	1	1	61	5	
Total IH Students		35	23	2	1	442	22	1

* Includes students in MPH core course (CPH 575) and *Fundamentals* (CPH 584)

Table V provides information on the level of support provided to students from the Training Program Grant. NIOSH funding levels are provided in the last two columns, illustrating that funding could not support full stipend for IH students at the NIH funding level of \$1255/month. As such, the program director at the time used the funds to pay for the tuition and fees for all eligible NIOSH TPG students and evenly distributed the remaining funds as stipend to all eligible full-time students.

Table V: NIOSH TPG Support Levels

Academic Year	Total # Positions Awarded	# Pre-Doc Trainees Appointed	Pre-Doc degrees/level	# Months of Support	Amount of Stipend Available	Amount of Tuition Available
2000-1	6	6	MPH	9.56	\$10,000	\$14,000
2001-2	5	5	MPH	5.98	\$15,000	\$12,000
2002-3	2	2	MPH	7.97	\$14,400	\$19,200
2003-4	5	5	MPH	14.98	\$14,400	\$18,020
2004-5	4	4	MPH	19.12	\$16,500	\$12,800
2005-6	2	2	MPH	3.09	\$3,626	\$6,422

Over this reporting period, 29 students have been enrolled in the MPH/EOH industrial hygiene program. Of these, one switched to the epidemiology degree (began in 2003), one left the program without completing his technical report (2000, although is working as an industrial hygiene consultant), and two have left the program without completing their technical reports (2001) but are currently on track for a defense in December 2006. We have four students who are still in the program at the time of this report: two are actively completing their technical report, having completed experimental work. The other two are part-time students and are advancing through the program at a reasonable pace. The breakdown by sector served by our 21 graduates is:

- Industry (1)
- Government/Research (6)
- Consulting (6)
- Continued Education (4)
- Medicine/Residency (2)

Of the 21 industrial hygiene graduates, one international student is taking additional courses; another graduate is self employed with expertise in water/wastewater systems and is seeking additional education outside the OH&S field.

At the end of Spring 2006, four industrial hygiene students were still enrolled in the program. Two were actively completing their technical report and were scheduled to complete their work over the summer/fall semesters; the other two are part-time making reasonable progress toward their degrees. In addition, two students initially enrolled in 2001-2 have returned to complete their technical report to complete their graduate requirements. Four additional students have decided to enter the MPH/EOH program in industrial hygiene in Fall 2006, two part-time and two full-time.

Table VI provides information on where these students completed their internship experience, illustrating the impact of internships on the health and safety of workers throughout Arizona.

Graduate students made 9 scientific presentations at state or national professional conferences and authored or co-authored 5 publications in peer reviewed journals. Attachment A provides information on presentations and publications from students and faculty during this reporting period. Item A lists the professional presentations made by students during this grant period. Item B lists publications where students were authors or co-authors on peer-reviewed research. Items C – E illustrate faculty publications in peer reviewed journals, presentations at technical conferences, and non-journal publications during this reporting period.

Table VI: Internships Completed Between 7/00 – 6/06

Student	Internship Report	Internship Location	Internship advisor
Kristen Wennerstrom Guilonard	<i>Operationally-Related Ergonomic Risk Factors</i>	Risk Management, University of Arizona, Tucson, AZ	Peate
Dale Goss*	<i>Morenci: Zero and Beyond</i>	Phelps-Dodge Corp., Morenci, AZ	Crutchfield
Christina Collins*	<i>Environmental Fungal Exposures: Monitoring and Analysis in Southern Arizona</i>	SA&B Environmental and Chemical Consultants	Van Ert
Joseph A. Tabor	<i>Ecological Study of Canine Valley Fever to Assess Environmental Antecedents of Disease</i>	Valley Fever Center for Excellence, Tucson, AZ	O'Rourke
Joy Fleming*	<i>An Evaluation of Occupational Exposures to Metalworking Fluids</i>	Sargent Controls, Tucson, AZ	Van Ert
Katherine Koehler*	<i>An Evaluation of Mold Concentrations: Comparing Schools and Homes in Southern Arizona</i>	Health Effects Group, Tucson, AZ	Van Ert
Shannon M. Conley*	<i>Implementing a Comprehensive Safety and Industrial Hygiene Program at a Mirror Casting Facility</i>	Optical Sciences Mirror Lab, University of Arizona, Tucson AZ	Crutchfield
Nazilla Afshari*	<i>Bloodborne Pathogen Exposure Plan for Ventana Medical Systems</i>	Ventana Medical Systems, Inc., Tucson, AZ	Crutchfield
Maria A. Fierro	<i>Preliminary Analysis of Toxic Materials Used and Stored in Homes: A Binational Study</i>	Western Arizona Area Health Council, San Luis, AZ	O'Rourke
Zenen Salazar	<i>Implementing Comprehensive Health & Safety Practices at a Pharmaceutical Facility</i>	Selectide Pharmaceuticals, Tucson, AZ	Crutchfield
Aaron Baldwin*	<i>Noise Survey and Assessment: Quaker Oats Inc. Processing Plant</i>	Hutzel and Associates, Phoenix AZ	Crutchfield
Arun B. Josyula	<i>Community Based Prevention and Intervention Research</i>	ECH Department, University of Arizona, Tucson, AZ	Burgess
Eric Nelson	<i>Training Program: Soil Characterization and Treatment Processes Used for Subsurface Sewage Disposal</i>	Pinal County Environmental Health, Florence, AZ	O'Rourke
Jack Gyger	<i>The Assessment and Remediation of Physical and Psychological Barriers to Employment in Arizona</i>	Disability Assessment Research Clinic, UMC, Tucson, AZ	O'Rourke
John Murphy	<i>Development and Implementation of Lead Hazard Control Program at the University of Arizona</i>	Risk Management, University of Arizona, Tucson, AZ	O'Rourke
Adeniyi Alo	<i>Nuestra Comunidad Nuestra Salud: Interdisciplinary Training for Health Care, Students in a Rural Border Community</i>	Nuestra Community, Nogales, AZ	Burgess
Nobuyuki (Don) Mochida	<i>Ergonomic Assessment at the Steward Observatory Mirror Lab</i>	Optical Sciences Mirror Lab, University of Arizona, Tucson AZ	Crutchfield
Emmanuel Mulenga	<i>Increasing Incidence of Silicosis in Zambia</i>	Mines and Safety Department of Zambia	Burgess
Juanita Hyde*	<i>Assessment of Toxic/Corrosive Gas Use in Research Laboratories at the University of Arizona</i>	Risk Management, University of Arizona, Tucson, AZ	Crutchfield

Table VI: Internships Completed Between 7/00 – 6/06, continued

Student	Internship Report	Internship Location	Internship advisor
Neelamkavie Smitha Francis	<i>Reduction of exposures to formaldehyde and other volatile organic compounds in a veterinary pathology lab</i>	Risk Management, University of Arizona	O'Rourke
Shannon Newton*	<i>Development and Revision of the Santa Cruz County Emergency Response and Recover Plan</i>	Santa Cruz Department of Emergency Management, AZ	Burgess
Monique Kasel*	<i>Development and Implementation of an Internal Site Safety Plan for Lab Technicians and Field Personnel</i>	TCI, Tucson AZ	O'Rourke
Tomo Taniuchi	<i>Fire Drill Noise Exposure at University Buildings and Residence Halls</i>	Steward Observatory, University of Arizona	Burgess
Pamela Hill*	<i>Effects of Wheeze and Atopy on Lung Function in Adolescence</i>	El Rio Santa Cruz Clinic, AZ	O'Rourke
Kristen Bellamy*	<i>Assessing Fluids Management at the Steward Observatory Mirror Lab</i>	Optical Sciences Mirror Lab, University of Arizona, Tucson AZ	Burgess
Phillip Joggerst	<i>Fragmentation Methods and Ground Control Safety – A Blast Quality Measurement Trial</i>	NIOSH Spokane Research Lab	Burgess
Leonard James*	<i>Development and Implementation of a Hazard Communication Program at the Steward Observatory Mirror Lab</i>	Steward Observatory, University of Arizona	Burgess

CONCLUSIONS

This six year period covered by this grant included the departure of two key hygiene instructors. However, the commitment of the College to replace faculty, the dedication of local hygienists to contribute to student education, and the commitment of the students to continue with the program during this turnover were all revealed during this cycle. The region is committed to the industrial hygiene program, with numerous offers to hire interns over the summer and offers to hire graduates upon completion of degree requirements. Support for the program continues, and new faculty have reenergized and refocused the program to meet modern demands of hygienists.

Since July 2000, the EOH program has graduated 21 MPH students, trained in both theory and practical skills useful for the diverse opportunities available to graduates. Alumni involvement in the Arizona Section AIHA, both at the board and member levels, illustrates the commitment of graduates to the profession. The synergistic relationship between the educational program at The University of Arizona and the professionals in the field makes the program at The University of Arizona unique to other hygiene programs.

Attachment A: List of Publications
IH Presentations and Publications From 7/00 through 6/06

A. Student Presentations – External to The University of Arizona

- Afshari, N:** *Feedback Based Respirator Fit Testing*. Presented at Southern California Education and Research Center Research Day, September 2001.
- Fierro, MA:** *Interleukin-10 Single Nucleotide Polymorphisms and Longitudinal Decline in Lung Function*. Presented at Southern California Education and Research Center Research Day, September 2001.
- Fleming, JE:** *Semiconductor Industry Usage of Dimethyl Sulfoxide as a Photoresist Stripping Solvent – A Risk Assessment*. Presented at Semiconductor Environmental, Safety, and Health Association National Conference, Palm Springs, April 2002.
- Koehler, KA:** *The Arsine TLV: Changing Exposure Levels in a Changing Legal Environment* Presented at Semiconductor Environmental, Safety, and Health Association National Conference, Palm Springs, April 2002. **(1st Place Paper)**
- Fleming, JE:** *An Evaluation of Occupational Exposures to Metalworking Fluids*. Presented to Arizona Section, American Industrial Hygiene Association, Casa Grande, AZ, April 2002.
- Koehler, KA:** *An Evaluation of Mold Concentrations – Comparing Schools and Homes in Southern Arizona*. Presented to Arizona Section, American Industrial Hygiene Association, Casa Grande, AZ, April 2002.
- Alo, AA:** *Possible Links Between Currently Used Semiconductor Solvents and Reproductive Effects*. Presented at Semiconductor Environmental, Safety and Health Association National Conference, San Antonio, April 2003.
- Mulenga, EM:** *Assessment of Methods Used to Measure Fume Hood Performance*. Presented at Semiconductor Environmental, Safety and Health Association National Conference, San Antonio, April 2003.
- James, L, P Joggerst, and TR Anthony.** *Development of a Chamber System to Evaluate CBRN Respirators for Firefighting Operations*. Presented at American Industrial Hygiene Conference and Exposition, Chicago, IL, May 17, 2006, Graduate Student Posters.

B. Student (underlined) and Industrial Hygiene Faculty Papers

Bolstad-Johnson DM, Burgess JL, Crutchfield CD, Storment SB, Gerkin RD. Characterization of firefighter exposures during fire overhaul. *American Industrial Hygiene Association Journal* 2000;61:636-641.

Burgess JL, CJ Nanson, DM Bolstad-Johnson, R Gerkin, TA Hysong, RC Lantz, DL Sherrill, CD Crutchfield, SF Quan, AM Bernard, and JW Chang: Adverse Respiratory Effects Following Overhaul in Firefighters. *JOEM* 43(5):467-473, 2001.

Nanson CJ, Burgess JL, Robin M, Bernard AM. Exercise alters serum pneumoprotein concentrations. *Respiration Physiology* 2001;127:259-265.

Nanson CJ, Burgess JL, Robin M, Bernard AM. Exercise alters serum pneumoprotein concentrations. *Respiration Physiology* 2001;127:259-265.

Mulenga EM, Miller HB, Sinkala T, Hysong TA, **Burgess JL. Silicosis and tuberculosis in Zambian miners. *International Journal of Occupational and Environmental Health* 2005;11:259-262.**

C. Industrial Hygiene Faculty Authored Papers – Peer Reviewed

- Burgess JL**, Kovalchick D, Harter L, Kyes K, Thompson J. Hazardous materials events: an industrial comparison. *Journal of Occupational and Environmental Medicine* 2000;42:546-553.
- Burgess JL**, Morrissey B, Keifer MC, Robertson WO. Fumigant related illnesses: Washington state's five year experience. *Journal of Toxicology Clinical Toxicology* 2000;38:7-14.
- Lebowitz MD, **O'Rourke, M.K.**, Rogan S, Reses J, Van de Water P, Blackwell A. Indoor and outdoor PM10 and associated metals and pesticides in Arizona. *Inhalation Toxicol.* 12(S1):139-144, 2000.
- O'Rourke, M.K.**, Sánchez Lizardi, P., Rogan S.P., Freman, N.G., Aguirre, A. and Saint, C.G. Pesticide exposure and creatinine variation among young children. *Journal of Exposure Analysis and Environmental Epidemiology.* 10:672-681, 2000.
- Burgess JL**, Kovalchick D, Harter L, Kyes KB, Lymp JF, Brodtkin CA. Hazardous materials events: Evaluation of transport to health care and evacuation and decisions. *American Journal of Emergency Medicine* 2001;19:99-105.
- Burgess JL**. Phosphine exposure from a methamphetamine lab investigation. *Journal of Toxicology Clinical Toxicology* 2001;39:165-168.
- Burgess JL**, Kovalchick D, Lymp JF, Kyes KB, Robertson WO, Brodtkin CA. Risk factors for adverse health effects following hazardous materials incidents. *Journal of Occupational and Environmental Medicine* 2001;43:558-566.
- Moschandreas, DJ, Kim, Y, Karuchit, S, Ari, H, Lebowitz, MD, **O'Rourke, MK**, Gordon, S, Robertson, G: In residence, multiple route exposures to chlorpyrifos and diazinon estimated by direct and indirect method models. *JEAE* 2001.
- Moschandreas, D., Ari, H, Karuchit, S, Kim, Y, Lebowitz, MD, **O'Rourke, MK**, Gordon, S, Robertson, G: Exposures to pesticides by medium and route: the 90th percentile and related uncertainties. *JEAE* 2001.
- Moschandreas, D, Karuchit, S, Kim, Y, Lebowitz, MD, **O'Rourke, MK**, Gordon, S, Robertson, G: On predicting multi-route and multimedia residential exposure to chlorpyrifos and diazinon. *JEAE* 11:56-65, 2001.
- Burgess JL**, Kovalchick D, Harter L, Kyes KB, Lymp JF, Brodtkin CA. Hazardous materials events: Evaluation of transport to health care and evacuation and decisions. *American Journal of Emergency Medicine* 2001;19:99-105.

C. Industrial Hygiene Faculty Authored Papers – Peer Reviewed, continued

- Burgess JL.** Phosphine exposure from a methamphetamine lab investigation. *Journal of Toxicology Clinical Toxicology* 2001;39:165-168.
- Burgess JL,** Kovalchick D, Lymp JF, Kyes KB, Robertson WO, Brodtkin CA. Risk factors for adverse health effects following hazardous materials incidents. *Journal of Occupational and Environmental Medicine* 2001;43:558-566.
- Moschandreas, DJ,** Kim, Y, Karuchit, S, Ari, H, Lebowitz, MD, **O'Rourke, MK,** Gordon, S, Robertson, G: In residence, multiple route exposures to chlorpyrifos and diazinon estimated by direct and indirect method models. *JEAE* 2001.
- Moschandreas, D.,** Ari, H, Karuchit, S, Kim, Y, Lebowitz, MD, **O'Rourke, MK,** Gordon, S, Robertson, G: Exposures to pesticides by medium and route: the 90th percentile and related uncertainties. *JEAE* 2001.
- Moschandreas, D,** Karuchit, S, Kim, Y, Lebowitz, MD, **O'Rourke, MK,** Gordon, S, Robertson, G: On predicting multi-route and multimedia residential exposure to chlorpyrifos and diazinon. *JEAE* 11:56-65, 2001.
- Peate WF.** Prevention of needlesticks in EMS workers. *Journal of Occupational and Environmental Medicine* 2001; 43 (6): 544-557
- Burgess JL, Nanson CJ,** Gerkin R, Witten ML, Hysong TA, Lantz RC. Rapid decline in sputum IL-10 concentration following occupational smoke exposure. *Inhalation Toxicology* 14:133-140, 2002.
- Burgess JL,** Kovalchick DF, Siegel EM, Hysong TA, McCurdy SA: Medical surveillance of clandestine drug lab investigators. *Journal of Occupational and Environmental Medicine* 44:184-189, 2002.
- Kovalchick D, Burgess JL,** Kyes KB, Lymp JF, Russo JE, Roy-Byrne PP, Brodtkin CA. Psychological effects of hazardous materials exposures. *Psychosomatic Medicine* 2002;64:841-846.
- Moschandreas DJ,** Karuchit MR, Berry, **O'Rourke MK,** Lo D, Lebowitz MD: Exposure apportionment: Ranking food items by their contribution to dietary exposure. *JEAE* 12:233-243, 2002.
- Kovalchick D, Burgess JL,** Lymp JF, Kyes KB, Russo JE, Roy-Byrne PP, Brodtkin CA: Psychological effects of hazardous materials exposures. *Psychosomatic Medicine* 64:841-846, 2002.
- Peate WF.** Occupational skin disease. *American Family Physician* 2002 Sep 15;66(6):1025-32.
- Peate WF,** Johnson JJ, Lundergan L. Fitness self-perception and VO₂max in firefighters. *Journal of Occ. & Envir. Med.* Journal 2002; 44 (6): 546-550.

C. Industrial Hygiene Faculty Authored Papers – Peer Reviewed, continued

- Hysong TA, **Burgess JL**, Cebrian ME, O'Rourke MK. House dust and inorganic urinary arsenic in two Arizona mining towns. *Journal of Exposure Analysis and Environmental Epidemiology* 2003;13:211-218.
- Sofuoglu, S.C., Lebowitz, M.D., O'Rourke, M.K., Robinson, G.L and Dellarco, M., Moschandreas, D.J. Exposure and Risk Estimates Associated with Drinking Water in Arizona. *JAMWA* 95(7):67-79, 2003
- Burgess JL**, Witten ML, Nanson CJ, Hysong TA, Sherrill DL, Quan SF, Gerkin R, Bernard AM. Serum pneumoproteins: a cross-sectional comparison of firefighters and police. *American Journal of Industrial Medicine* 2003;44:246-253.
- Meza MM, Kopplin MJ, **Burgess JL**, Gandolfi J. Arsenic drinking water exposure and urinary excretion among adults in the Yaqui Valley, Sonora, Mexico. *Environmental Research* 2004;96:119-126.
- Burgess JL**, Fierro MA, Lantz RC, Hysong TA, Fleming JE, Gerkin R, Hnizdo E, Conley SM, Klimecki W. Longitudinal decline in lung function: evaluation of interleukin-10 genetic polymorphisms in firefighters. *Journal of Occupational and Environmental Medicine* 2004;46:1013-1022.
- Anthony, T.R.**; Flynn M.R., Eisner A. Evaluation of facial features on particle inhalation. *Ann. occup. Hyg.* 49(2): 179-193 (2005)
- Derby MP, McNally J, Ranger-Moore J. Hulette L. Villar RG, Lebowitz MD, Hysong TA, MacNeil E, **Burgess JL**. Poison control center based foodborne illness surveillance. *Morbidity and Mortality Weekly Report* 2005;54 Suppl (Aug 26):35-40.
- Needham, L.J., Özkaynak, H., Whyatt, R.M., Barr, D.B. Wang, R.Y., Naeher, L., Akland, G., Bahadori, T., Bradman, A. Fortmann, R., Liu, L-J, S., Morandi, M., O'Rourke, M.K., Thomas, K. Quackenboss, J., Ryan, P.B., and Zartarian, V. 2005. Exposure Assessment in the National Children's Study: Introduction. *Environmental Health Perspectives.* 113:1076-1082, 2005
- Anthony, T.R.**; Flynn, M.R. CFD model for a 3-D inhaling mannequin: Verification and validation of fluid flow. *Ann. occup. Hygiene*, 50(2):149-156 (2006)
- Anthony, T.R.**; Flynn, M.R. Computational fluid dynamics investigation of particle inhalability *J. Aerosol Sci.*, 36:750-765 (2006)
- Josyula AB, McClellan H, Hysong, Kurzius-Spencer M, Poplin GS, Sturup S, **Burgess JL**. Reduction in urinary arsenic with provision of bottled water. *Journal of Health, Population and Nutrition* (in press).
- Josyula AB, Poplin S, Kurzius-Spencer M, McClellan H, Kopplin M, Sturup S, Lantz RC, **Burgess JL**. Environmental arsenic exposure and sputum metalloproteinase concentrations. *Environmental Research* (in press).

C. Industrial Hygiene Faculty Authored Papers – Peer Reviewed, continued

Burgess JL, Fleming JE, Mulenga EM, Josyula A, Hysong TA, Kurzius Spencer M, Joggerst PJ, Miller HB. Acute changes in sputum IL-10 following underground exposure to diesel exhaust. *Clinical Toxicology* (in press).

Poplin GS, Miller HD, Hintz PJ, Martini L, Burgess JL. Dermatitis in the Mining Industry: Incidence, Sources and Time Loss. *Archives of Environmental and Occupational Health* (in press).

Andrew AS, Burgess JL, Meza MM, Demidenko E, Waugh M, Hamilton JW, Karagas MR. Arsenic Exposure is Associated with Decreased DNA Repair In Vitro and in Individuals Exposed to Drinking Water Arsenic. *Environmental Health Perspectives* (available on-line <http://www.ehponline.org/docs/2006/9008/abstract.html>).

D. Industrial Hygiene Faculty Professional Presentations

Crutchfield C, Kautz DW, and Peate WF: *A Faster, More Rigorous Protocol For Fit Testing Respirators.* Presented at International Society for Respiratory Protection International Conference, Edinburgh, October 2002.

Crutchfield C: *Controlled Negative Pressure (CNP) Quantitative Fit Testing.* Presented at Department of Energy Respirator Managers Conference, Amarillo, June 2003.

Gecosala R, Peate WF. Prevalence rate of hepatitis C among firefighters in a municipal department. AM. Ind. Hygiene Conf., 2000.

Anthony, T.R.; Flynn, M.R. *CFD investigation of particle inhalability,* Poster (1PF16), AAAR, Austin, Tx, Oct. 18, 2005

Anthony, T.R. *Modeling aerosol inhalation: evaluating the ACGIH inhalability curve,* ISEA Conference, Session 2C, October 31, 2005, Tucson, AZ

E: Industrial Hygiene Faculty Non-Journal Publications

- O'Rourke, M.K.** and Lebowitz, M.D. Indoor bioaerosol contaminants. In: M. Lippmann, Ed. *Environmental Toxicants: Human Exposures and their Health Effects*. pp. 449-480, 2000.
- Burgess JL**, Lever P, Schumacher R. Toxic Hazards of Mining and Smelting. in: Sullivan JB, Krieger GR (eds.) *Clinical Environmental Health and Toxic Exposures* 2nd edition, Lippincott Williams & Wilkins, Philadelphia, PA. 2001:530-538.
- Brooks B, Krieger G, Peterson M, Sullivan JB, and **Van Ert M** Indoor Environmental Quality and Health, Small Animal Toxicology. Peterson, M, Talcott, P, Saunders & Co., Chapt. 13, pp.168-195, 2001.
- Burgess JL**, Lever P, Schumacher R. Toxic Hazards of Mining and Smelting. in: Sullivan JB, Krieger GR (eds.) *Clinical Environmental Health and Toxic Exposures* 2nd edition, Lippincott Williams & Wilkins, Philadelphia, PA. 2001:530-538.
- Van Ert, M., Crutchfield, C.D.**, Sullivan, J.B. Jr.: Principles of environmental & occupational assessment: chemicals, biologicals & particulates, Clinical Principles of Environmental Health & Toxic Exposures. Sullivan, J.B. Jr., Krieger, G.R., eds., Williams & Wilkins, Chpt. 4, 2001
- Sullivan, J.B. Jr., **Van Ert, M.**, Stewart, Valenzuela, T.: Emergency medical preparation for hazardous materials releases particulates, Clinical Environmental Health & Toxic Exposures. Sullivan, J.B. Jr., Krieger, G.R., eds., Williams & Wilkins, Chpt. 4, 2001.
- Sullivan, J.B. Jr., **Van Ert, M.** and Lewis, R.: Tire & rubber manufacturing industry, Clinical Environmental Health & Toxic Exposures. Sullivan, J.B. Jr., Krieger, G.R., eds., Williams & Wilkins, Chpt. 55, 2001.
- Sullivan, J.B. Jr., **Van Ert, M.**, Krieger, G.R., & Brooks, B.: Indoor air quality & health, Clinical Environmental Health & Toxic Exposures. Sullivan, J.B. Jr., Krieger, G.R., eds., Williams & Wilkins, Chpt. 76, 2001.
- Van Ert, M.**, and Sullivan, J.B. Jr.: Organochlorine pesticides, Environmental Health & Toxic Exposures. Sullivan, J.B. Jr., Krieger, G.R., eds., Williams & Wilkins, Chpt. 129, 2001.
- Sullivan, J.B. Jr., and **Van Ert, M.**: Alkylbenzene solvents & aromatic compounds, Clinical Environmental Health & Toxic Exposures. Sullivan, J.B. Jr., Krieger, G.R., eds., Williams & Wilkins, Chpt. 135, 2001.
- Brooks, B., Krieger, G., Peterson, M., Sullivan, J.B. Jr., **Van Ert, M.** Indoor Environmental Quality and Health, Small Animal Toxicology. Peterson, M., Talcott, P. Saunders & Co., Chapt. 13, pp.168-195, 2001.
- Van Ert M, Crutchfield CD**, Sullivan JB: Principles of environmental & occupational assessment: chemicals, biologicals & particulates, Clinical Principles of Environmental Health & Toxic Exposures. Sullivan JB, Krieger GR, eds., Williams & Wilkins, Chpt. 4, 2001.
- Sullivan, JB, **Van Ert, M**, Stewart, Valenzuela, T.: Emergency medical preparation for hazardous materials releases particulates, Clinical Environmental Health & Toxic Exposures. Sullivan JB, Krieger GR, eds., Williams & Wilkins, Chpt. 4, 2001.
- Sullivan JB, **Van Ert M** and Lewis R: Tire & rubber manufacturing industry, Clinical Environmental Health & Toxic Exposures. Sullivan JB, Krieger GR, eds., Williams & Wilkins, Chpt. 55, 2001.

E. Industrial Hygiene Faculty Non-Journal Publications, continued

Sullivan JB, Van Ert M, Krieger GR, & Brooks B: Indoor air quality & health, Clinical Environmental Health & Toxic Exposures. Sullivan JB, Krieger GR, eds., Williams & Wilkins, Chpt. 76, 2001.

Van Ert M and Sullivan JB: Organochlorine pesticides, Environmental Health & Toxic Exposures. Sullivan JB, Krieger GR, eds., Williams & Wilkins, Chpt. 129, 2001.

Sullivan JB and Van Ert M: Alkylbenzene solvents & aromatic compounds, Clinical Environmental Health & Toxic Exposures. Sullivan JB, Krieger GR, eds., Williams & Wilkins, Chpt. 135, 2001

Sánchez Lizardi, P., Morris, R. and O'Rourke, M.K. 2005. Cognitive and Behavioral Effects of Children's Exposure to Pesticides: Critical issues and Research Trends. In (Morris, R. ed.) *Disability Research and Policy: Current Perspectives*. Lawrence Erlbaum Associates Publishers, London. pp. 125-140, 2005