THE UNIVERSITY OF MICHIGAN CENTER FOR OCCUPATIONAL HEALTH & SAFETY ENGINEERING: A NIOSH EDUCATION AND RESEARCH CENTER

ANNUAL REPORT

July 1, 2005 – June 30, 2006

SUBMITTED BY:
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UNIVERSITY OF MICHIGAN
ANN ARBOR, MICHIGAN 48109

(November 1, 2006)

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II. Introduction and Executive Summary

July, 2005 through June 2006 was a highly productive year for our ERC. In the sections below we list the major accomplishments and significant changes during the year. We also provide information about our ERC website, which we are now in the process of updating.

II.A. Major Accomplishments

Enrolled students

- From July 1, 2005 to June 30, 2006, 81 students were enrolled in ERC related programs, including 44 full-time Masters level students, 7 part-time Masters level students, and 30 Ph.D. students.
- 37 of the 81 enrolled students were NIOSH supported trainees, including 32 full-time Masters students, 1 part-time Masters student, and 4 Ph.D. students.

Graduated students

- A total of 39 students graduated from ERC academic program areas, including 25 MPH students, 2 Ph.D. students in Industrial Hygiene, 2 MS Nursing students, 5 MS Engineering students, 4 Ph.D. students in Industrial and Operations Engineering (IOE), and 1 Ph.D. in IOE and Mechanical Engineering.

Publications and presentations involving trainees

- NIOSH supported trainees produced or collaborated on a total of 39 publications, 64 presentations and 1 patent during the reporting period.

New faculty hires/faculty augmentation of specific programs

- 7 new ERC related faculty members were hired during the reporting period, including 1 Professor/Department Chair, 2 Associate Professors, 3 Assistant Professors, and 1 Adjunct Associate Professor.
- Our faculty in occupational epidemiology has been dramatically augmented by 3 new faculty, and a high degree of integration with the department of epidemiology has been achieved

Faculty promotions

- One Program Director (Dr. Hong in OHN) was promoted from Assistant Professor to Associate Professor with Tenure

Retooled programs

- The non-residential On Job/On Campus (OJ/OC) Executive Masters program, intended for mid-career professionals in industrial hygiene, occupational health nursing, occupational medicine, and occupational safety engineering, was reformulated into a mixed modality (half of face-to-face and half distance learning) program to (successfully) increase enrollment while maintaining rigorous quality. Twenty-four new students will start the program in November 2006.

New or retooled courses

- During the reporting period, 3 new courses, 1 revised course, 1 new required course, 3 courses in development, and new minor concentrations for one program (IH) were developed in the ERC related academic program areas.

II.B. Significant Changes since July 1, 2004-June 30, 2005

[note: Those Significant Changes that also represent Major Accomplishments are repeated in this section]

One significant factor of note is the *absence* of significant change in the leadership of the ERC: the Program Director, Associate Program Director and Directors of each of the core and allied programs have remained the same for several years.

New faculty hires/faculty augmentation of specific programs

- 7 new ERC related faculty members were hired during the reporting period, including 1 Professor/Department Chair, 2 Associate Professors, 3 Assistant Professors, and 1 Adjunct Associate Professor. Four additional faculty searches are underway in the Department of Environmental Health Sciences (EHS).
- Our faculty in occupational epidemiology has been dramatically augmented by the hiring of 3 new tenure-track faculty in EHS, and a high degree of integration with the Department of Epidemiology has been achieved

Faculty promotions

- One Program Director (Dr. Hong in OHN) was promoted from Assistant Professor to Associate Professor with Tenure

Retooled programs

- The non-residential On Job/On Campus (OJ/OC) Executive Masters program, intended for mid-career professionals in industrial hygiene, occupational health nursing, occupational medicine, and occupational safety engineering, was reformulated into a mixed modality (half of face-to-face and half distance learning) program to (successfully) increase enrollment while maintaining rigorous quality. Twenty-four new students will start the program in November 2006.

New or retooled courses

- During the reporting period, 3 new courses, 1 revised course, 1 new required course, 3 courses in development, and new minor concentrations for one program (IH) were developed in the ERC related academic program areas.

Pilot projects

- Five new pilot projects in NORA research areas were funded during July 2005 through June 2006
- Since the programs inception:
    - Seven pilot project trainees have accepted new positions as faculty members in academic institutions.
    - Two pilot project trainees have accepted new research positions in private sector laboratories.
    - One patent disclosure has been filed.

Trainee awards and honors

- A total of 16 awards and honors were bestowed upon ERC trainees since July 2005, including 4 of the 12 nationally awarded ASPH/EPA Fellowships, 1 National Science Foundation Graduate Fellowship, 2 AIHF Awards, 1 Tichauer Award for best student presentation at the AIHCE, and multiple University of Michigan School of Public Health scholarships

Faculty awards and honors

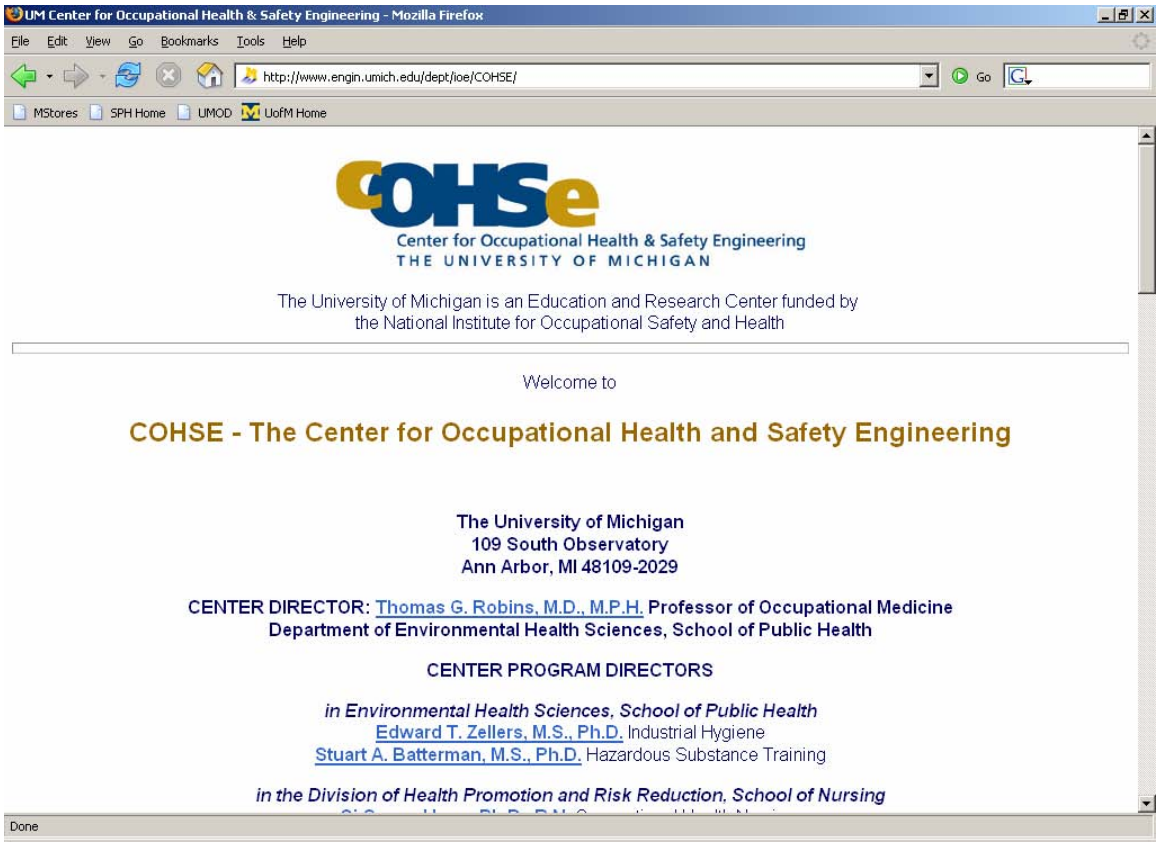
- Numerous ERC related faculty were recognized for their outstanding teaching and research in the field with awards, including the Jon R. and Beverly S. Holt Award for Excellence in Teaching, the Blue Cross Blue Shield of Michigan Foundation Excellence in Research Award in the category of Health Policy or Health Services Research, the Excellence in Research Award from the University of Michigan School of Public Health, and the Young Clinic Investigator Award.
- ERC related faculty were honored for their achievements in the field through serving on National Research Council Committees, receiving a joint appointment as Professor of Civil and Environmental Engineering in the College of Engineering, being selected as an AAOHN Fellow, serving as President of Midwestern Nursing Research Society, and presenting the keynote address at the Eurosensors XIX conference.

Continuing Education and Outreach activities

- 18 courses were conducted through Continuing Education and Outreach (CEO) during the reporting period, including 5 IH courses, 8 OHN courses, 20 OMR courses, and 3 OSE courses, with a total of 1031 persons trained.
- During the reporting period, CEO exhibited at 7 professional conferences, including the Human Factors and Ergonomics Society, American Industrial Hygiene Association, American Society of Biomechanics, Applied Ergonomics Conference, International Ergonomics Association and the American Association of Occupational Health Nursing conferences.

II. C. ERC Web site

Representative pages from the University of Michigan ERC Web site and key links to other related sites are shown below. Related links include those to faculty members associated with the Center, Center academic program areas, the Center's continuing education program, faculty interests, Ph.D. thesis topics. These links connect the Center to the major contributors at the University and to the collaborating University departments and programs. We are launching a plan to update the entire UM ERC site. This will include an updated research section, a student and alumni section, photos and slideshow of trainees and faculty, and the inclusion of the external advisory board members.



Home page: http://www.engin.umich.edu/dept/ioe/COHSE/

Links to faculty:
Center Director: http://www.sph.umich.edu/iscr/faculty/profile.cfm?uniqname=trobins

IH Program Director:
http://www.sph.umich.edu/iscr/faculty/profile.cfm?uniqname=ezellers

HSAT Program Director:
http://www.sph.umich.edu/iscr/faculty/profile.cfm?uniqname=stuartb

OHN Director: http://www.nursing.umich.edu/faculty/hong_oisaeng.html

OSE Director: http://ioe.engin.umich.edu/people/fac/wmkeyser.php

COHSE Academic Degree Programs:
http://www.engin.umich.edu/dept/ioe/COHSE/#CAD

IH Program: http://www.sph.umich.edu/ehs/ih/
HSAT Program: http://www.sph.umich.edu/hsat/
OHN Program: http://www.nursing.umich.edu/academics/masters/ohn.html
OSE Program: http://www.engin.umich.edu/dept/ioe/COHSE/OSE.html

COHSE Continuing Education Program:
http://www.engin.umich.edu/dept/ioe/COHSE/#CEP

Current Schedule of Course Offerings:
http://www.engin.umich.edu/dept/ioe/COHSE/pro_ed_calendar.html

Ergonomics Training and Service for Small and Medium Sized Michigan Companies: http://www.engin.umich.edu/dept/ioe/C4E/erg_training.html

Needs Assessment Survey: http://www.zoomerang.com/recipient/survey-intro.zgi?p=WEB223UYHWQP96

Faculty and Their Major Interests:
Center faculty page: http://www.engin.umich.edu/dept/ioe/COHSE/fac.html
EHS faculty page: http://www.sph.umich.edu/iscr/faculty/dept.cfm?deptID=2
OHN faculty page: http://www.nursing.umich.edu/faculty/index.html
OSE faculty page: http://ioe.engin.umich.edu/people/fac/Areas.pdf

Ph.D. Thesis Topics: http://www.engin.umich.edu/dept/ioe/COHSE/phd.html

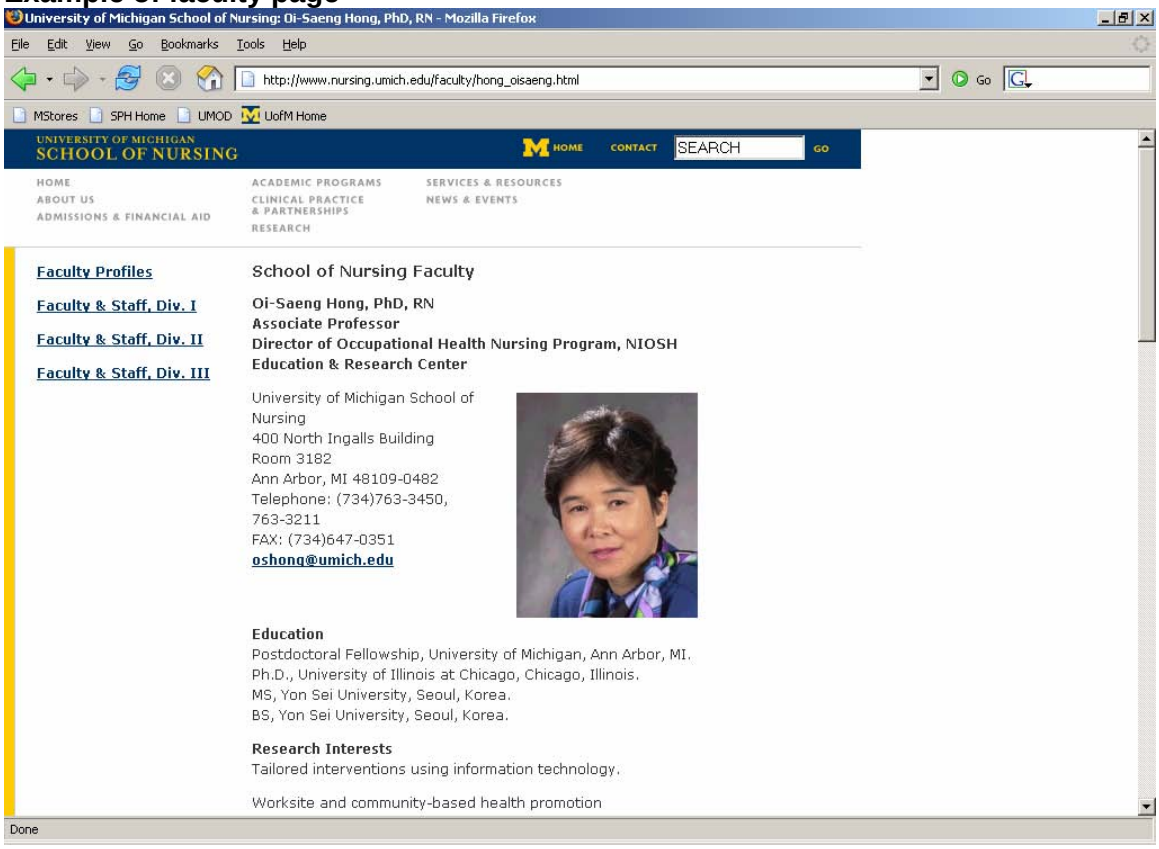
Related Links:
University of Michigan Rehabilitation Engineering Research Center:
http://umrerc.engin.umich.edu/

University of Michigan Center for Ergonomics: http://www.engin.umich.edu/dept/ioe/C4E/

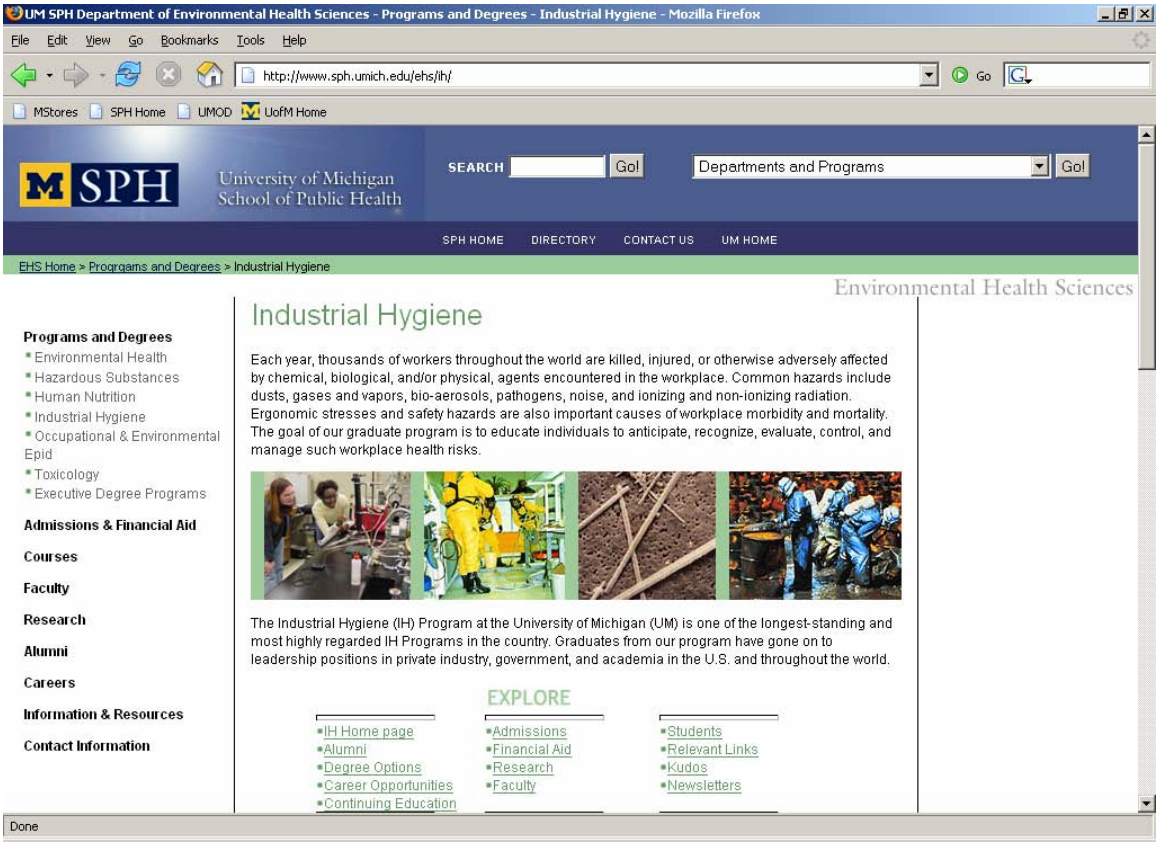
NIOSH: http://www.cdc.gov/niosh/homepage.html

OSHA: http://www.osha.gov/

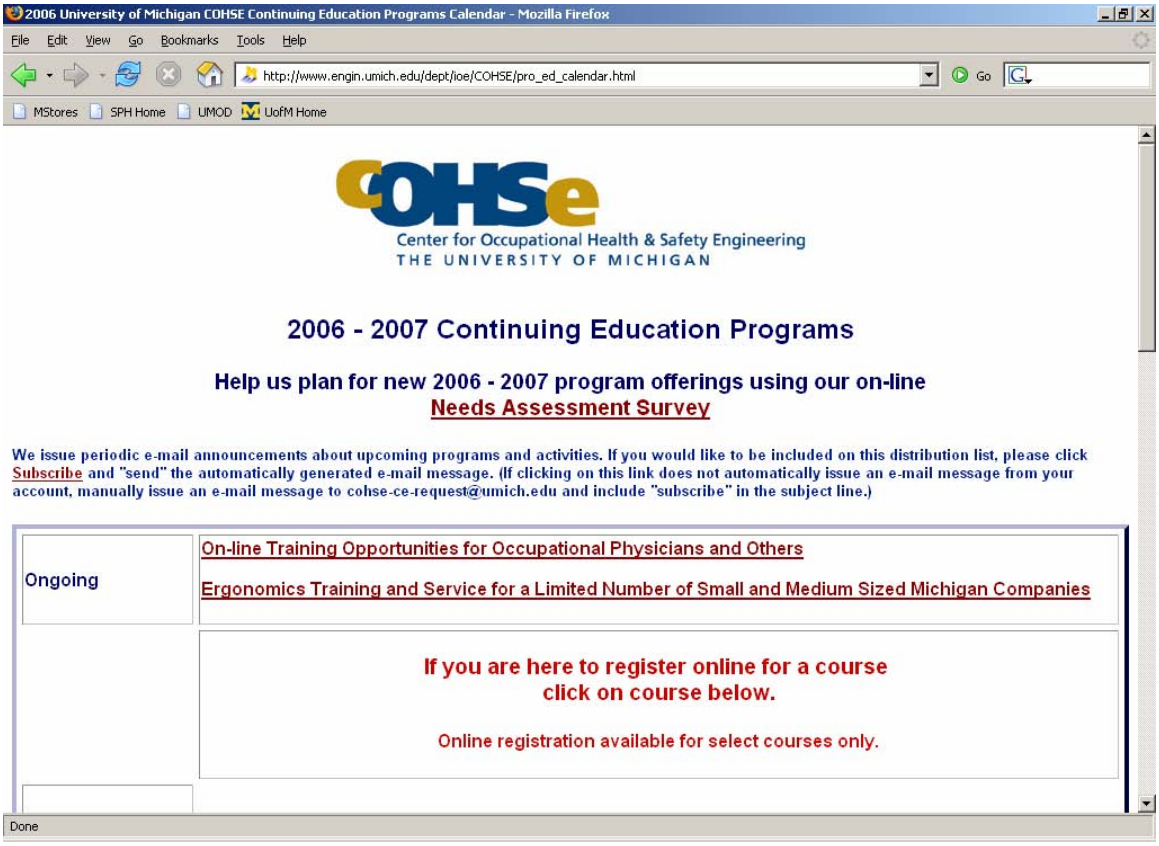
Example of faculty page



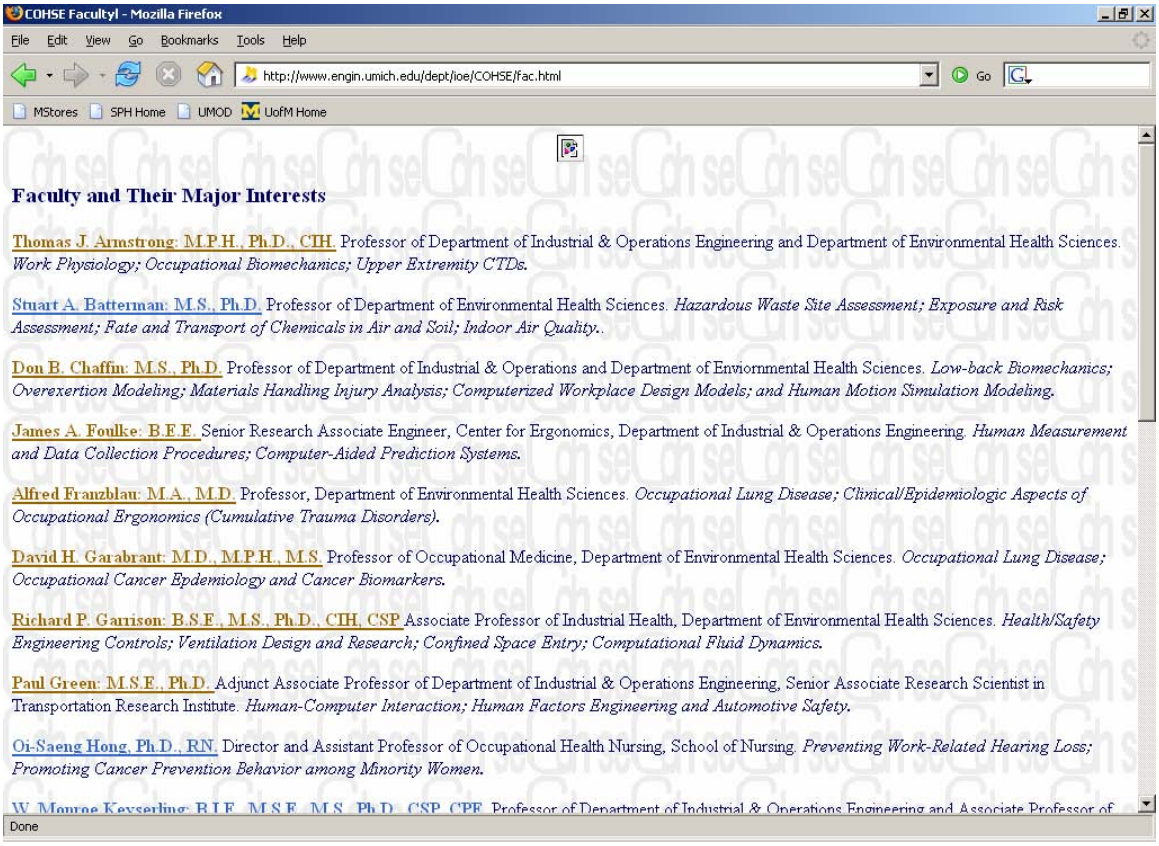
Example of academic program page



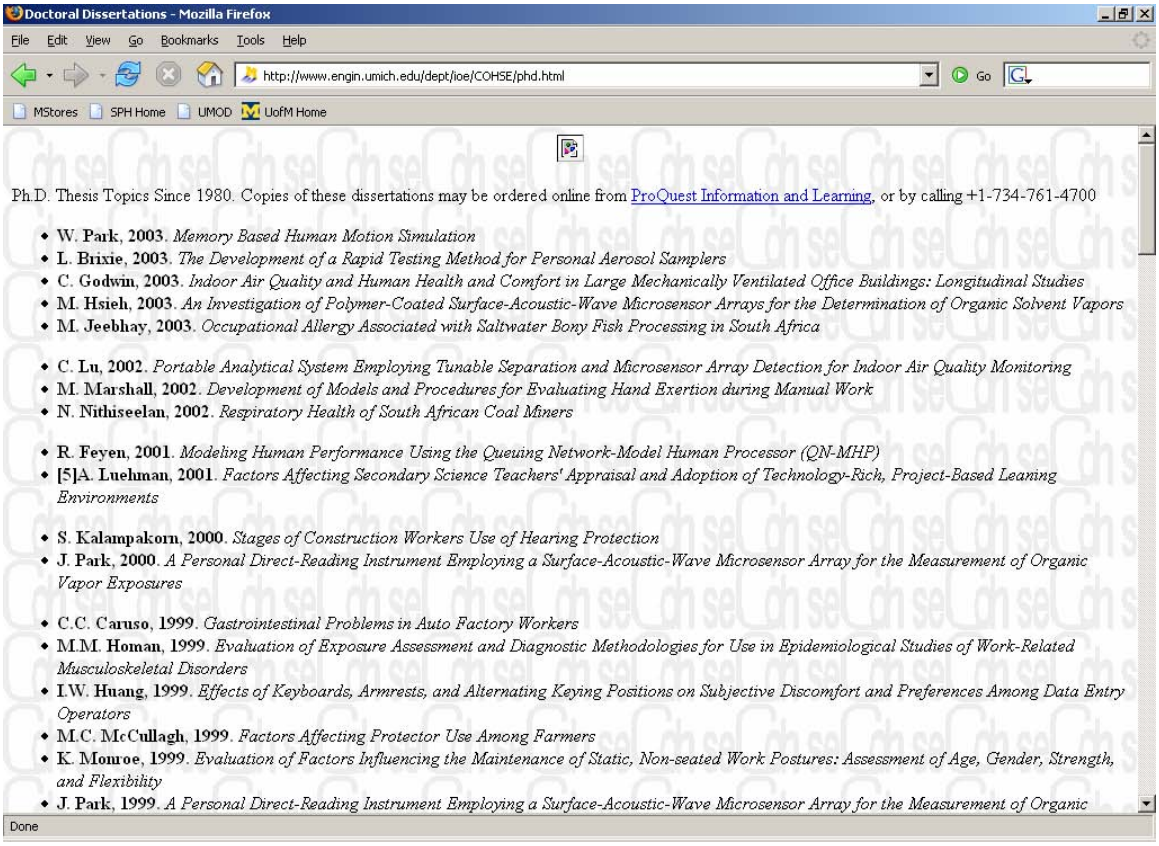
Example of Continuing Education



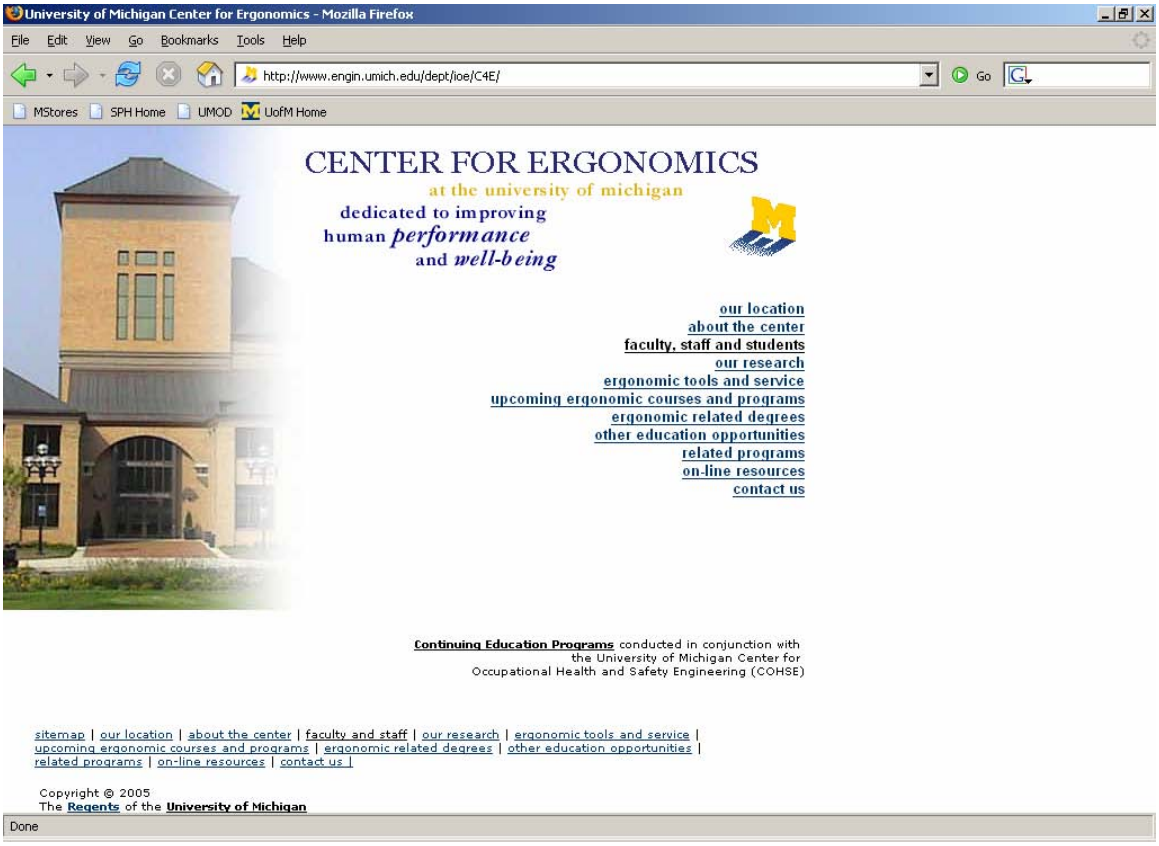
Example of Faculty Interests



Example of Ph.D. Thesis topics



Example of related link


University of Michigan Center for Ergonomics - Mozilla Firefox
File Edit View Go Bookmarks Tools Help
http://www.engin.umich.edu/dept/ioe/C4E/
Go
MStores SPH Home UMOD UofM Home
CENTER FOR ERGONOMICS
at the university of michigan
dedicated to improving
human performance
and well-being
our location
about the center
faculty, staff and students
our research
ergonomic tools and service
upcoming ergonomic courses and programs
ergonomic related degrees
other education opportunities
related programs
on-line resources
contact us
Continuing Education Programs conducted in conjunction with
the University of Michigan Center for
Occupational Health and Safety Engineering (COHSE)
sitemap | our location | about the center | faculty and staff | our research | ergonomic tools and service |
upcoming ergonomic courses and programs | ergonomic related degrees | other education opportunities |
related programs | on-line resources | contact us |
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A. Program Title

Center Administration

B. Program Director

Thomas G. Robins, M.D., MPH
Professor of Occupational and Environmental Medicine

C. Program Description

C.1 Brief History and Goals

The University of Michigan Center for Occupational Health and Safety Engineering (COHSE) was established as a NIOSH Education and Research Center (ERC) in 1982, and has been continuously funded since that time. As a NIOSH ERC, we currently provide professional (Masters) and research (Doctoral and post-Doctoral) training in Industrial Hygiene (IH), Occupational Health Nursing (OHN), and Occupational Safety Engineering and Ergonomics (OSE), Occupational Epidemiology (OE), and Hazardous Substances Academic Training (HSAT). Other components include a Pilot Project Research Training Program (PPRT), NORA Research Support Program (NORA), and Continuing Education and Outreach (CEO) programs. All programs are based at the Ann Arbor campus in our School of Public Health, School of Nursing, and College of Engineering, facilitating interdisciplinary activities for faculty and students.

> *Mission Statement:* Our mission is to serve the region, nation, and world as a center of excellence for research and graduate education in Occupational Health and Safety. We will maintain outstanding academic and research programs in the disciplines of Industrial Hygiene, Occupational Health Nursing, and Occupational Safety Engineering and Ergonomics, and in Hazardous Substances Academic Training, and in Occupational Epidemiology. We will provide broad-based, interdisciplinary academic training in occupational health to ensure that graduates are qualified to pursue careers and assume leadership roles in the practice of occupational health and safety. We will offer a variety of continuing education programs and outreach activities to transfer state-of-the-art knowledge to professionals and practitioners in OH&S and allied disciplines.

As a NIOSH Education and Research Center, we serve a number of constituencies, including: 1) NIOSH, 2) industry, labor, and professional interests in our region, 3) academic units within the University of Michigan that provide critical teaching and research resources (including tenured faculty positions) necessary for Center success, and 4) our students. The broad goals of the Center are to:

- Increase the financial resources needed to improve the number, quality, and diversity of graduate students in each core area
- Promote excellence in our academic training and research training programs in each program area
- Enhance the quality of our Continuing Education courses and other service/outreach activities
- Increase external research funding in order to improve our research infrastructure and expand opportunities for research training
- Provide an organizational structure to coordinate and promote multidisciplinary educational activities for all core programs

- Promote OH&S education in undergraduate and graduate courses in other departments and other regional schools
- Assist Center programs and affiliated academic units in recruiting and promoting faculty associated with the Center.

C.2. Center Management

Our Center is managed by an Executive Committee comprised of the Center Director, Associate Director, the five Academic Program Directors, and the Director of Continuing Education. This committee meets formally six or more times per year. Between formal meetings, there is regular communication through electronic mail, telephone calls, and personal interaction at seminars and other interdisciplinary activities.

Since July, 2001, Dr. Thomas Robins has served, as Center Director, and Dr. Monroe Keyserling has served as Associate Center Director. The directorships of the programs include Dr. Edward Zellers (IH), Dr. Monroe Keyserling (OSE & PPRT), Dr. Oisaeng Hong (OHN), Dr. David Garabrant (OE), Dr. Stuart Batterman (HSAT), Mr. Randy Rabourn (CEO), and Dr. Thomas Robins (NORA). The directorships have been highly stable, with no changes in the past 3 years.

All activities of the Center are discussed routinely during the frequent Executive Committee meetings. In these meetings there is a strong emphasis on maximizing input of the Program Directors and striving for consensus to assure that the best decisions are taken. Important areas of Center management which the Executive Committee addresses include:

- Fiscal: preparation in the fall of budget requests for the Annual Progress Report and Non-competing Continuation Application; preparation in the spring of final budgets for the next fiscal year based on the NIOSH "Award Statement"; review of encumbrances and planned expenditures for the current fiscal year, and coordination of the request to NIOSH for "carry forward" funds (if any) from the previous fiscal year
- Grant applications: review of progress and setting of goals for the coming year including common themes and approaches
- Interdisciplinary interactions: interdisciplinary activities are planned for the new academic year (e.g., courses, seminars, clinics, field investigations, and social activities). Areas where interactions can be improved are identified and plans are made to enhance student and faculty interactions. Progress is reviewed at all meetings of the Executive Committee.
- Academic planning constitutes a major activity which includes: a) review of course offerings and time schedules to insure that students can register for courses taught outside of their own school; b) review of progress of students from all cores in multidisciplinary courses; c) plan our interdisciplinary seminar series; d) discussion and coordination of student recruiting activities; e) discussion of faculty recruiting in disciplines essential to the function of the ERC; f) development of plans for new and revised interdisciplinary courses; g) discussion of strategies for promotion of research in NORA priority areas and the best use of NORA research support funds; h) review of progress of the Pilot Project Research Training; i) discussion of Continuing Education/Outreach activities and goals to assure participation of faculty from all core disciplines; j) identification of research opportunities that promote interdisciplinary interactions among faculty and students.
- Setting future directions: we utilize each meeting of the Executive Committee to: a) monitor progress in achieving Center goals and meeting benchmark measures of effectiveness; b) discuss new directions in the occupational health and safety professions that need to be addressed in our training programs;, c) plan responses to research funding opportunities that

cut across the core disciplines; d) discuss changes at NIOSH, OSHA, and other federal and state agencies that may influence our training, research, and continuing education activities.

In addition to meetings of the Executive Committee, there are other activities that bring together Program Directors and faculty from all academic cores. The Center-supported weekly Seminar in Occupational Health and Safety Engineering (Winter Term) provides opportunities for all faculty to meet informally. Cross-departmental faculty appointments also provide opportunities for individual faculty members to promote and coordinate interdisciplinary OH&S teaching and research. Four such appointments exist for Profs. Armstrong, Chaffin, Franzblau, and Keyserling, who hold positions in both the EHS Department in the School of Public Health and the IOE Department in the College of Engineering.

The Center also benefits greatly from guidance by an External Advisory Board composed of representatives from five core disciplines. Members of the committee (see Figure) come from industry, labor and government. Meetings of the Advisory Board are held annually in the late fall. During the past grant cycle, two changes were made in the structure of these meetings which have substantially increased the specificity and usefulness of input from the Advisory Board: a) critical issues facing the Center (recent examples: student recruitment strategies, response to bioterrorism and the attacks of September 11, integration of distance learning modalities into curricula, response to expected trends in the occupational health and safety over the next five years) are discussed in small breakout groups mixing Board members and Center faculty followed by report back sessions to the full group; b) Board members go into closed executive session at the end of each meeting and then report recommendations back to the faculty. In addition to formal meetings, individual faculty are in regular contact with committee members to discuss specific issues of mutual interest.

FIGURE. ERC ADVISORY BOARD

PAUL S ADAMS PhD, CSP, CPE *(OSE)*
Manager, Safety Engineering & Ergonomics
EnSafe, Inc

DOUGLAS KALINOWSKI *(IH, OSE)*
Director, Bureau of Safety and Regulation
Consumer and Industry Services
Michigan Department of Labor

JEANNIE HANNA, RN, MSN, COHN-S *(OHN)*
Manager, Health Resources
Visteon Corporation

HENRY B. LICK, PhD, CIH, CSP *(IH)*
Consultant
(Formerly Head of Industrial Hygiene at Ford Motor Company)

RICHARD KOWALSKI, RN, MSA,COHN-S *(OHN)*
General Supervisor, Medical Dept
Delphi Saginaw Steering Systems

DAVID K. MARTIN, CIH *(IH, OSE, CE)*
EHS Manager
Xpedx

FRANKLIN MIRER, PhD, CIH *(OM, IH, OSE)*
Director, Health and Safety
United Auto Workers

JUDY MORRIS, RN, MS, COHN-S/CM *(OHN, CE)*
Manager, EH&S
Attwood Corp

PAUL D MOSS, CIH, ROH *(IH)*
Director, Corporate Health, Safety &Env.
Dade Behring, Inc

HENRY PAYNE, PhD, CIH *(IH, CEO)*
Director
OSHA Training Institute

GORDON REEVE, PhD *(OM)*
Manager, Epidemiology
Ford Motor Company

MARYJEAN SCHENK, MD, MPH, MS *(OEE)*
Associate Professor & Chair
Dept of Family Medicine
Wayne State University

FREDERICK M. TOCA, PhD, CIH, CSP*(IH)*
Industrial Hygienist
Atlantic Environmental Inc

RODNEY D. TURPIN *(HSAT)*
Senior Environmental Specialist
Environmental Protection Agency

FLINT WATT, PE *(IH)*
Chief, Drinking Water & Rad Protection
Dept of Environmental Quality
Michigan Dept of Public Health

D. Program Activities and Accomplishments

Over the past year, the ERC has made excellent progress towards its goals and objectives. Major accomplishments in the areas of trainee honors, awards, scholarships; faculty honors, awards, appointments; trainee theses and dissertation; new faculty positions; new and modified courses; and trainee recruitment including diversity efforts are presented in section II.A. Major Accomplishments. Significant changes in the ERC are described in section II.B. Significant Changes since July 1, 2004-June 30, 2005. In Section IV Specific Improvements in Occupational Safety and Health Resulting From ERC Programs, we report on further accomplishments involving the translation of research and training activities into improved OHS practice.

E. Program Products

Key products of the ERC are listed in Section II.A. together with Section IV.

F. Future Plans

Key elements of our future plans include:

- Improve strategic planning:
    - Making increase use of our talented and interested external advisory board to assist with detailed strategic planning for the ERC. To accomplish this we will increase our meeting schedule from annually to semiannually, and include a half day retreat jointly between ERC faculty and External Advisory Board members to help plan future directions and initiatives.
    - Within the next 6 months we will conduct a new needs assessment survey among our alumni and other selected target populations
- We will continue to recruit, enroll, and graduate the most talented students and future leaders of the field in our Masters and doctoral programs. We will pursue several strategies to further increase our success with recruitment including:
    - Upgrading and invigorating the ERC's website;
    - Launching a substantially modified On Job/On Campus Executive Masters program for industrial hygiene, safety, nursing, and occupational medicine mid-career professionals. While maintaining the same very high quality, we will use mixed modalities of teaching (both distance learning and face-to-face formats) to decrease by 50% the amount of time which these students, drawn from all of the country, need spend in Ann Arbor;
    - We will develop and offer a new 4+1 degree track jointly with the Department of Chemistry to enable students to complete a BA in Chemistry and an MPH in industrial hygiene in a 5-year period (rather than 6 years required as separate, sequential programs).
    - We have created and will widely advertised a new NORA Fellowship to attract and support the most talented doctoral students wishing to carry out research in NORA related areas
- Continue to make improvements our curricular offerings, and in the interdisciplinarity of the of training of our students. These improvements will include:
    - The above-described revised OJ/OC program – we expect to be able to expand the program to include career professionals practicing Occupational Epidemiology in the next cohort that will begin in 2008;
    - Encourage and assist our 4 new faculty in EHS in the development of new courses relevant to the mission of the ERC;
    - Launch a new interdisciplinary management course;
    - Launch a new interdisciplinary team-based course organized around the conduct of OHS research and practical projects
- Enhance research training through a combination of:
    - Continued funding of pilot projects;
    - Direct funding of NORA-related research projects in which students are involved
    - Having faculty continue to aggressively pursue competitive research funding in which students will participate;
- Recruit and involve new faculty in our ERC programs:
    - In addition to the 4 new faculty in EHS who are been increasingly integrated into our ERC activities, active searches are underway for 4 additional faculty in EHS who should also contribute to a critical mass of faculty in our OHS disciplines;
    - We have begun the process of markedly increasing the involvement of faculty with primary appointments in the Department of Epidemiology in our occupational epidemiology training programs
- Continue to aggressively pursue the scheduling of continuing education programs and outreach activities

A. Program Title

Interdisciplinary Coordination

B. Program Director

Thomas G. Robins, M.D., MPH
Professor of Occupational and Environmental Medicine

C., D., and E. Program Description, Program Activities and Accomplishments, Program Products

C.1. Student Interaction in Scheduled Classes and Seminars

The Center is strongly committed to interdisciplinary education. As part of this commitment, we believe that students from different disciplines should share classroom experiences, and we have designed our curricula accordingly. Students from the different ERC programs take five common didactic courses (also attended by students outside of the ERC): 1) EHS 550: *Industrial Hygiene*, 2) IOE 539: *Occupational Safety Engineering*, 3) EPID 503: *Strategies and Uses of Epidemiology*, 4) EHS 658: *Physical Hazards in the Work Environment*, and 5) IOE 837/EHS 668: *Occupational Health and Safety Seminar*.

With the addition of two new interdisciplinary courses to the curriculum (see Future Directions section below), this will bring us to 7 courses taken by all students for 14 credit hours. This schedule assures that on-campus, full-time students from all cores will be together in at least two classes every semester. On Job/On Campus (OJ/OC) students in IH, OM, OSE, thisand OHN also take these courses together during their weekends on campus. Finally, we are able to bring all OJ/OC students and on-campus students together during the Winter Term for the Seminar in Occupational Health and Safety Engineering.

In addition to the above courses that are common to all four cores, students from two or more cores routinely take the following courses: Biostat 503 Introduction to Biostatistics (IH, OE, OHN, HSAT), EHS 501 Occupational Diseases (IH, OE, OHN, HSAT), EHS507 Exposure Assessment (IH, OE, HSAT), EHS 508 Risk Assessment (IH, OE, HSAT), EHS 654 Ventilation for Contaminant Control (IH, EH, OSE), EHS 757 Occupational Health Aspects of Industrial Processes (IH, OSE), Epid 501 (Principles of Epidemiology (IH, HSAT, OE, OHN), IOE 433 Ergonomics (IH, OSE), IOE 439 Safety Management (IH, OSE), IOE 534 Occupational Biomechanics (OSE, IH), IOE 634 Work-related Upper Limb Disorders (OSE, IH).

C.2. Interdisciplinary Interaction in Student Research and Projects

There are many opportunities for students from different cores to work together outside of the classroom. In the Occupational Health Aspects of Industrial Processes course (EHS 757), students conduct plant walk-throughs together as members of an interdisciplinary team. In Occupational Diseases (EHS 501), Exposure Assessment (EHS 507), and Risk Assessment (EHS 508) students work together on team projects and formal presentations that require integration of knowledge from across the cores.

Students also have an opportunity to interact with students and faculty from outside their core discipline when performing research projects. Some examples include contributions of Drs. Tom

Armstrong in Occupational Safety Engineering, and Al Franzblau in Occupational Epidemiology to research activities for three of the OHN doctoral students by serving on the preliminary exam and dissertation committee; service on the doctoral committees of SPH students by Occupational Safety Engineering faculty (Drs. Armstrong and Keyserling), and service by Dr. Franzblau in SPH on doctoral committees of students in Industrial and Operations Engineering. This coordination also helps to maximize participation of faculty from outside of Center core programs with the research of doctoral students in core programs. Examples include participation of faculty in the Department of Epidemiology and in the Medical School on doctoral research of Occupational Epidemiology students, and faculty in Electrical and Mechanical Engineering, Chemistry, and Physics interacting with Industrial Hygiene doctoral students.

The NORA Research Support Program and the Pilot Project Research Training Program provides additional opportunities for student involvement in interdisciplinary research through support of several research projects which bring together students and faculty from different programs.

Students in the On Job/On Campus program have a unique opportunity for interactions outside their core disciplines, which include industrial hygiene, occupational health nursing, occupational safety engineering, and occupational medicine. Not only do these students participate together in classes once every two months over almost 2 years during the “on-campus” weekend; they also interact regularly with professionals from other occupational health and safety disciplines during their regular work assignments. These “on-the-job” experiences are shared in the classroom and informally during the on-campus weekends.

C.3. Opportunities for Dual Degrees

The University of Michigan provides a special opportunity for interdisciplinary education through the dual-Masters degree program. This program allows students to simultaneously pursue two Masters degrees. Because students are allowed to “double count” up to 1/6 of their coursework toward both degrees, it is possible for the student to complete two degrees in only two calendar years. The dual degree option in OSE and IH has been completed by several students. The dual degree option is also available for students who wish to specialize in both Industrial Hygiene and Environmental Health (HSAT). In fact, most of the students in the full-time IH program are also enrolled in the HSAT program, which is a reflection of the expanded role of assessment of environmental exposures and hazardous substances in industrial hygiene. Enrollment in such a dual degree program necessarily enhances interactions of students and faculty across core disciplines.

Finally, the dual degree option allows students to combine training in a traditional OH&S core with training in a related non-ERC program. For example, one student completed a dual Masters degree program between OSE and Construction Engineering.

C.4. Interdisciplinary Interactions beyond the ERC Cores

Faculty from the ERC core programs also interact on a regular basis with other groups on campus by presenting guest lectures and seminars, participating in clinics, committee service, and as co-investigators on research projects. Students from the ERC cores are frequently active participants in these endeavors. Departments, centers, institutes and clinics involved in

interdisciplinary research include: The School of Architecture, The School of Natural Resources, The Department of Aerospace Engineering, The Department of Biomedical Engineering, The Department of Electrical Engineering and Computer Science, The Department of Mechanical Engineering and Applied Mechanics, The Department of Chemistry, The Department of Neurology, The Department of Neuropsychology, The Department of Physical Medicine and Rehabilitation, The Department of Endocrinology, The Program in Kinesiology, The Institute of Gerontology, The Kresge Hearing Institute, The Institute for Social Research, The University of Michigan Cancer Center, The Center for Integrated Sensor Circuits, The University of Michigan Hospitals Health Program Advisory Committee, The University of Michigan Advisory Committee on Health Affairs, The University of Michigan Advisory Committee on Laboratory Safety.

F. Future Plans

Beginning in January 2007, we will add a new course NUR 606 *Management for Occupational & Environmental Health and Safety Professionals* that will be led by the OHN faculty. The course will be offered by OHN faculty Drs. Hong and Strasser along with guest speakers in various fields (IH, occupational safety engineering, business, etc) starting in Jan. 2007. This will be the first course taught by OHN faculty for students in other OHS programs. This course will be required for IH, HSAT, OSE, OHN, and OM (in OJ/OC) students.

In September 2007, we will launch a completely restructured version of a course, EHS 600, currently titled Professional Perspectives in Environmental Health. In its new format, this 2-credit course will span the entire academic year. It will be required of all students in all ERC-associated programs, both residential and OJ/OC, including IH, OHN, OSE, HSAT, OE, and OM (in OJ/OC). Students form working teams from multiple disciplines on the project that draw upon their disciplinary perspectives to characterize or solve a practical research or other type of problem. The leaders of the Employee Health and Evaluation and Control of Occupational and Environmental Hazards units in the University of Michigan Health System have agreed to work with ERC faculty and the student groups to define, provide resources to address, and co-supervise the solution of important OHS issues they face. Groups will work under the supervision of ERC faculty members whose interests are matched to the type of problem selected by the group. We consider this new course to be a key mechanism for increasing high quality interdisciplinary interaction across students from all of the disciplines represented in the ERC, as well as between residential and OJ/OC students. These interdisciplinary team projects may be particularly illuminating for residential students, as they will be teamed with OJ/OC students who are mid-career professionals with substantial levels of practical knowledge and experience in the solution of real-life OHS problems.

Pilot Project Research Training Progress Report:

A. Program Title

The University of Michigan Center for Occupational Health and Safety Engineering,
Pilot Project Research Training Program

B. Program Director

W. Monroe Keyserling, Ph.D.
Professor of Industrial and Operations Engineering and Environmental Health Science

C. Program Description

C.1 Goals

The goal of Pilot Project Research Training Program (PPRT) is to strengthen the future occupational health and safety research capacity of the United States by increasing the number and quality of scientists who pursue research careers in occupational health and safety (OH&S) disciplines. This is accomplished by enhancing opportunities for research training at The University of Michigan's Center for Occupational Health and Safety Engineering (UM-COHSE) and at other colleges and universities in our region. Specifically, this project provides short-term seed funds to support innovative pilot research projects in priority areas defined by the National Occupational Research Agenda (NORA) and for projects that address special OH&S needs in HHS Region V, the manufacturing heartland of the United States.

This project supports the following types of University of Michigan research trainees:

1. Ph.D. students enrolled in ERC core and component programs,
2. Junior faculty and post-doctoral research fellows and affiliated with ERC core and component programs, and
3. Ph.D. students, post-doctoral fellows, and/or junior faculty in non-core programs who wish to develop or enhance their OH&S research capabilities.

In addition, support is provided for pilot research projects and collaborative research with faculty and students from NIOSH Training Project Grants (TPGs) and other colleges and universities in HHS Region V. At these institutions, support is provided to the following types of research trainees:

1. Ph.D. students enrolled in TPG programs,
2. Junior faculty and post-doctoral research fellows affiliated with TPG programs, and
3. Ph.D. students, post-doctoral fellows, and/or junior faculty at institutions without NIOSH TPG training grants who wish to develop or enhance their OH&S research capabilities. (For example, our pilot project grant has supported students and faculty in the Mechanical, Biomedical, and Industrial Engineering Departments at The University of Wisconsin at Madison.)

C.2 Responsible Conduct of Science Training

The University of Michigan is committed to the responsible conduct of faculty, staff, and students in all aspects of research. As part of this commitment, the university has established a web-based system for training and certifying faculty, staff, and students on responsible research practices. Faculty, staff and students who serve as investigators or research assistants must complete modules on: 1) Foundations of Responsible Research Conduct (e.g., ethics and legal requirements related to publication/authorship,

intellectual property, conflict of interest, plagiarism, misconduct reporting, etc.), and 2) Human Research (e.g., why human subjects research is regulated, regulatory and ethical responsibilities of the PI, IRB and University, etc.). Each module includes a test which must be successfully passed in order to achieve certification. The website for the training program can be accessed at the following URL:

http://www.research.umich.edu/training/peerrs.html

In addition to the formal certification process, students work with faculty mentors to develop research protocols, write informed consent documents, prepare IRB applications and collect data on human subjects. Most Masters-level trainees and all Doctoral-level trainees play a significant role in submitting at least one complete IRB application in conjunction with the research projects required for their degree.

All projects that involve the participation of human subjects must be reviewed and approved by a University of Michigan Institutional Review Board (IRB) or by the IRB of the applicant's institution. To comply with NIOSH pilot project guidelines for protection of human subjects, IRB approval documents for each project are submitted to NIOSH with the request to release funds.

Should any project involve the use of vertebrate animals, recombinant DNA, radioisotopes, and/or radioactive materials, approval is required from the appropriate committee(s) at the applicant's institution before funds are released to the investigators.

C.3 Program Faculty

The University of Michigan Center for Occupational Health and Safety Engineering is fortunate to have a large faculty with strong research records that cover a broad spectrum of OH&S issues. These faculty serve as advisors and sponsors for internal pilot research projects and as liaison representatives for collaborative projects with regional institutions. Faculty sponsors and their areas of research expertise are shown in Table PPRT–1.

D. Program Activities and Accomplishments

D.1 Announcing the Competition for Funding

To provide research trainees and faculty advisors adequate time to prepare proposals, the formal announcement of the Pilot Project Research Training Program (PPRTP) is distributed each spring for the pending budget year. These announcements are sent to faculty and students in all University of Michigan ERC programs, to NIOSH TPG Project Directors in HHS Region V, and to other regional colleges and universities with OH&S research activities. A copy of the announcement distributed for the 2006-07 budget year is presented as Appendix PPRT–2.

D.2 Scientific Review Process

Proposals are evaluated by the Pilot Research Project Scientific Review Committee. Current committee members include:

- W. Monroe Keyserling, Ph.D., PPRTP Director, Occupational Safety/Ergonomics Academic Program
- Oisaeng Hong , Ph.D., Occupational Health Nursing Academic Program
- Alfred Franzblau, M.D., Occupational Medicine/Occupational Epidemiology Academic Programs
- Edward Zellers, Ph.D., Industrial Hygiene/Hazardous Substances Academic Programs
- John Graff, Ph.D., Regional Academic Representative, Wayne State University (Epidemiology)
- Lida Orta-Anes, Ph.D., Public Representative, United Auto Workers and The University of Puerto Rico (Ergonomics and OHS programs)
- Paul S. Adams, Ph.D., External Advisory Board Representative, Applied Safety and Ergonomics Inc. (Safety Engineering and Management)

Proposals are distributed to members of the Scientific Review Committee for a mail-ballot review. Each proposal is scored on a 100-point quality scale using the scoring sheet shown in Appendix PPRT–3

D.3 Progress During Reporting Year

For the reporting year (July 2005 – June 2006), seven proposals were submitted and five were funded. Applicants for the two unfunded proposals were invited to resubmit for the 2006-07 funding cycle.

Titles, NORA areas and performance sites for the five funded projects are summarized below:

1. A Microfabricated Diffusional Vapor Sampler with Integrated Thermal Desorption Heater
   NORA Areas: Indoor environments, Emerging technologies, Exposure assessment methods
   Performance Site: University of Michigan (Industrial Hygiene)
2. Investigating the Effect of Parallax on Upper Limb Posture Analysis
   NORA Areas: Musculoskeletal disorders, Exposure assessment methods
   Performance Site: University of Michigan (Occupational Safety and Ergonomics)
3. Development of a Biomechanical Hand Model for Study of Hand Posture, Strength, and Musculoskeletal Disorders
   NORA Areas: Musculoskeletal disorders, Exposure assessment methods
   Performance Site: University of Michigan (Occupational Safety and Ergonomics)
4. Occupational Exposure, Knowledge and Protective Behaviors Among Korean Dry Cleaners
   NORA Areas: Special Populations at risk, Mixed Exposures
   Performance Site: University of Michigan (Occupational Health Nursing)
5. Gait Adaptations: Role of Visual Information and Repeated Exposures in Risk Assessment of Tripping for Construction Workers
   NORA Areas: Traumatic Injuries, Risk assessment methods
   Performance Site: Purdue University (Health and Physiology)

Additional information on these projects, including abstracts and budgets is given in Appendix PPRT-4.

D.4 Progress in Regional Collaboration

During the seven years (July 1999 – June 2006) of the NIOSH pilot project initiative, we have had excellent participation from regional institutions, with one-third of all projects (9 out of 27) awarded to collaborating schools, including: The University of Wisconsin (six projects); Purdue University (two projects); and Wayne State University (one project). Within the University of Michigan, three pilot projects have been performed outside the core academic programs of our ERC, including: two projects in Physical Medicine and Rehabilitation and one project in Emergency Medicine.

D.5 Program Evaluation

The ERC Executive Committee reviews the program annually. Our review includes the following topics:

- Number of internal and external proposals submitted. For the past two years (2005-06 reporting year and current year), we had ten internal and two external proposals submitted. (Note: One of the internal proposals was the re-submission of an unfunded project.
- Number of funded proposals and funding “success” rate. For the past two years, we funded nine of 12 proposals (75 percent success rate).
- Amount and source of matching funds to support pilot research projects. This amount is typically 50-60% of the total project cost and includes items such as cost sharing of equipment purchases and payment of trainee tuition.
- Publications and presentations from funded projects. 39 new publications were produced or reported during the 2005-06 cycle. See Appendices PPRT-4 and PPRT-5.
- New proposals generated based on pilot project findings. 16 new proposals were generated since our last progress report. See Appendices PPRT-4 and PPRT-5.

- Placement of research trainees in academic, public sector and private section research positions. Several promotions and new appointments occurred during the reporting year:
    - Dr. Oisaeng Hong, a former PPRTP grant recipient was promoted to Associate Professor and received tenure at The University of Michigan's School of Nursing.
    - Mr. Chris Grieshaber was appointed Assistant Professor in the Department of Health Sciences at Illinois State University.
    - Dr. Mary Sesto has been promoted to Associate Scientist in the Department of Biomedical Engineering at The University of Wisconsin.
    - Dr. Janis Miller was appointed as Assistant Research Scientist in the School of Nursing and a Research Assistant Professor in the School of Medicine at The University of Michigan.
    - Dr. Jennifer Change D'Souza was appointed to the research staff of the Institute of Gerontology at The University of Michigan.

E. Program Products

The major products resulting from the Pilot Project Research Training Program can be grouped into three major categories: 1) Publications (includes publications in archival journals, publications in conference proceedings, and oral presentations at professional/research meetings, 2) Proposals developed as a result of Pilot Project research activities, and 3) Placement of Pilot Project trainees in research positions in academia, government and the private sector. Since the inception of the Pilot Project Research Training Project in 1999, our grant has been quite successful, producing the following outputs:

- Pilot project research projects have resulted in a total of 73 publications and/or oral papers.
- 13 proposals that were seeded by pilot project research have been funded.
- An additional eight proposals seeded by pilot project research have been prepared; seven were not funded and two are awaiting a funding decision.
- Seven pilot project trainees have accepted new positions as faculty members in academic institutions.
- Two pilot project trainees have accepted new research positions in private sector laboratories.
- One patent disclosure has been filed.

F. Future Plans

Four pilot projects have been approved for the 2006-07 budget year:

1. Microbial Characterization of Metal Removal Fluids and Associated Biofilms Using Molecular Approaches
   NORA Areas: Infectious Diseases, Indoor Environments, Exposure Assessment Methods, Asthma and Chronic Obstructive Pulmonary Disease
   Performance Site: University of Michigan (Industrial Hygiene)
2. Post-doctoral Training in Exposure Assessment of Emerging Contaminants in the Indoor Environment
   NORA Areas: Indoor Environments, Exposure Assessment Methods
   Performance Site: University of Michigan (Industrial Hygiene)
3. Development of a Biomechanical Model for Torque and Thrust Strength on Cylindrical Handles
   NORA Areas: Musculoskeletal Disorders of the Upper Extremity, Traumatic Injuries
   Performance Site: University of Michigan (Occupational Safety and Ergonomics)

4. Modeling the Relationship between Work-related Musculoskeletal Disorder Risk Exposure and Lean Manufacturing
   NORA Areas: Musculoskeletal Disorders of the Upper Extremity, Organization of Work
   Performance Site: University of Michigan (Occupational Safety and Ergonomics)

Additional information on these projects, including abstracts and budgets is given in Appendix PPRT-6.

A. Program Title

Nora Research Support

B. Program Director

Thomas G. Robins, M.D., MPH
Professor of Occupational and Environmental Medicine

C. Program Description

C.1 Goals and Objectives

The overarching goal of the NORA Research Support program is to enhance the ERC's research training mission in an integrated fashion across the disciplines represented in the Center. Our ERC research training programs are designed to promote high quality research in the NORA research priority areas. We emphasize the development of the interdisciplinary research skills among students needed to become future leaders in occupational health and safety research. This interdisciplinary focus allows the complex issues raised by several of the NORA priority areas to be addressed effectively by graduates of our programs. Some of the elements which are emphasized in the NORA Research Support program include: 1) the development and delivery of research-related courses and continuing education using distance learning modalities, 2) funding of guest speakers with expertise in NORA-related research areas to give presentations and collaborate with University of Michigan faculty and students, 3) the sponsorship of conferences and symposia to assess regional needs for research and research training, 4) support of pilot research training projects on NORA related topics, 5) direct support of doctoral students conducting research in NORA priority areas, and 6) leveraged support of new research faculty and major research equipment playing a critical role in technical research support and training of graduate students with a NORA focus.

D. and E. Program Activities, Accomplishments, and Products

D.1. Assessing and meeting regional research needs.

The NORA Research Support program contributes in several ways to the ERC's effort to assess and meet regional research needs.

The sponsorship of conferences and symposia to assess regional needs for research and research training. A new program addressing long-standing and emerging NORA-related research issues and needs addressing ultrafine particle hazards, Aerosol Characterization: Hard Rock Mining to Nanotechnology, was conducted at the Michigan Safety Conference during the July 2005-June 2006 cycle and was well-attended.

Periodic survey of the rich pool of ERC alumni holding professional positions in occupational health and safety. The ERC used NORA support funds to analyze results of a previous comprehensive survey of alumni during the past 20 years using a combination of mailings and a dedicated internet site. Questions were included concerning the adequacy of specific courses addressing research issues, as well as the extent to which degree programs offered under the ERC enable practicing occupational safety and health professionals to translate research findings into interventions to prevent illness and injury and the workplace. NORA funds were used to design a new set of discipline-specific alumni survey instruments including an additional direct focus on NORA-related research needs, and to pilot the new survey instrument among

the industrial hygiene alumni. An ERC-wide alumni survey redesigned on the basis of this pilot is being conducted in the current fiscal year.

D.2. Provision of administrative and technical research support.

Administrative research support. The Center Director, Dr. Thomas Robins, the Associate Center Director, Dr. W. Monroe Keyserling, and the Center Administrative Assistant, Ms. Emily MacGuire, receive salary funding under the NORA research support program to provide administrative research support for the Center. Their activities include 1) working with the individual program directors and other ERC faculty to develop goals and long range plans for NORA-related research funding, 2) fiscal planning, reviewing and coordinating budgets, and overseeing accounting functions, 3) organizing Executive Committee Meetings for oversight of these NORA-related activities, with an emphasis on ensuring interdisciplinary research approaches involving faculty and students across the Center.

Technical research support. A critical addition to our Center's ability to provide technical research support has been leveraging funds to hire a research scientist in the School of Public Health, Dr. Sergei Chernyak. Dr. Chernyak has broad experience in laboratory and field methods for the collection and analysis of organic compounds in both biological and abiological samples. Dr. Chernyak plays a central role in two activities. First, he is directing the laboratory analysis of samples, primarily organic compounds, for several funded research projects. Other responsibilities include supervision of students and technicians, data analysis, quality assurance, and report and manuscript generation. Second, he is helping to increase the research and research training capacities of the Center in the NORA priority areas, such as developing exposure monitoring field methods, which are very complementary to the strengths of other ERC faculty.

We had used NORA research support funds in the previous fiscal cycle for a state-of-the-art GC – MS system. This GC-MS substantially increases capacity for the analysis of organic compounds critical to research in several NORA priority areas. With respect to specific teaching and training applications, the instrument is used to familiarize students with advanced GC-MS analyses and applications in exposure assessment and exposure management. Funds in this cycle were used for maintenance of this and other major laboratory equipment used for the-related research. Selected students were trained on the equipment in order to permit them to complete MS research or MPH field experience activities that involve advanced chemical analysis in a NORA area.

We leveraged NORA research support funds to buy a fluoresence microplate reader/analyzer used by new assistant professor Chuanwu Xi, an expert in microbial exposure assessment through DNA analysis of environmental samples. Dr. Xi is using the instrument both for Nora-related research projects and for microbial exposure assessment exercises in the lab classes.

In addition, the NORA funding was used to provide technical and biostatistical support of research in NORA priority areas being conducted by ERC faculty that includes direct involvement of Ph.D. and other students in core ERC programs. Support has included technical advice, research-related durable supplies, data entry and cleaning, and data management and analysis. Examples of studies which have benefited from this sort of support include a study of contact dermatitis among automotive assembly workers which constitutes the Ph.D. thesis topic of Mr. Aaron Sussell under the supervision of Dr. Robins, and a study of environmental and occupational risk factors for pancreatic cancer conducted by Dr. Garabrant.

D.3. Coordination of interdisciplinary research

The coordination of interdisciplinary research across the many programs, disciplines, and schools represented within the Center requires substantial thought and planning. The NORA research support is used in a number of ways to assist with the coordination of interdisciplinary research. Firstly, Drs. Robins and Keyserling receive NORA research salary support to help them play their key coordinating roles as the Center's Director and Associate Director. Promotion of interdisciplinary research is a frequent topic of discussion at the bimonthly executive committee meetings at which all program directors are present. Attention to this issue has resulted in a large number of cross-disciplinary research projects in which students are involved. Some examples include contributions of Drs. Tom Armstrong in Occupational Safety Engineering, Al Franzblau in Occupational Epidemiology; service on the doctoral committees of SPH students by Occupational Safety Engineering faculty (Drs. Armstrong and Keyserling), and service by Dr. Franzblau in SPH on doctoral committees of students in Industrial and Operations Engineering.

Secondly, NORA funds are used to bring distinguished guest speakers to discuss interdisciplinary research topics of direct interest to ERC core faculty. The resulting interactive collaborations during seminars attended jointly by students from all of the Center programs and subsequent formal meetings lead to substantially improve coordination of such projects among faculty. These visits are made especially cost-effective as possible by having the visiting faculty member both give presentations in seminar series widely attended by an interdisciplinary array of University of Michigan faculty and students, as well as participate in informal discussions with faculty in graduate students involved in NORA related research.

D.4. Training graduate students with NORA focus

Recruitment of students for research training. NORA research support is being used to attract graduate students with a NORA focus by paying for fees and staffing of booths at two key conferences at which the Center recruits students interested in research: the American Occupational Health Conference and the American Industrial Health Association Conference.

Direct support of doctoral students conducting research in NORA priority areas. Tuition and stipend support of doctoral students conducting research in NORA priority areas allows us to increase our total research training capacities. Funding during this past fiscal cycle was provided to one doctoral student in Occupational Epidemiology program: Ms. Jennifer Chang, who has received support to work with Dr. Franzblau on an externally funded study investigating the natural history of occupational musculoskeletal disorders, and one student in HSAT, Mr. Hien Le, who is working with Dr. Stuart Batterman to address statistical problems of missing exposure data in occupational and environmental epidemiologic studies.

Support of research projects in NORA priority areas in which students are participating. Examples of studies which have benefited from this sort of support include a study of contact dermatitis among automotive assembly workers which constitutes the Ph.D. thesis topic of Mr. Aaron Sussell under the supervision of Dr. Robins, and a study of environmental and occupational risk factors for pancreatic cancer conducted by Dr. Garabrant, in which doctoral candidate Ms. Gina Kolata participated.

Assistance with laboratory based courses teaching research principles. The NORA Research Support funding was used to provide general equipment, supplies, and laboratory assistance to enhance lab-based courses.

D.5. Training students who become occupational safety and health professionals to implement NORA findings in evidence-based practice.

The development and delivery of research related coursework, and continuing education, using distance learning modalities. NORA funds were used to help transform our long-standing and historically highly successful nonresidential executive Masters degree program known as On Job/On Campus (OJ/OC) from a fully face-to-face program with 22 monthly 4-day sessions in Ann Arbor to a mixed modality program using distance learning technologies to maintain the same quality while reducing the number of sessions in Ann Arbor to 11. This change has substantially improved our enrollment figures: 24 students in industrial hygiene, safety engineering, occupational health nursing, and occupational medicine will be commencing the newly designed program November, 2006.

D.6. Administration of Pilot Project Research Training Program

Support of pilot research training projects on NORA related topics. The NORA research support program provides assistance and administrative support to the PPRT through salary funding of both Dr. Keyserling who serves as Director of The University of Michigan Pilot Project Research Training Program, and Ms. Shelley Withem who serves as the Administrative Assistant. This enables us to increase the amount of funds that can be used to directly support pilot projects.

F. Future Plans

During the next budget period we intend to use these NORA funds to:

- Conduct an updated regional needs assessment;
- Provide technical support of research and research training through partial funding of research scientists, purchase of state-of-the-art research equipment, durable research supplies, and data entry, cleaning, management and analysis;
- Train graduate students in research principles through updated student recruitment activities, direct support of doctoral students conducting research on NORA priority areas, direct support of research projects which includes student participation, and assistance with laboratory-based courses teaching research principles;
    - Planned new directions within this category include:
        - Creation and widespread advertising of competitive NORA Fellowships offering full tuition and stipend support to help attract the strongest doctoral students
        - Direct support of the restructured course EHS 600 that will involve students across all the ERC programs working together on interdisciplinary OHS research projects under supervision of ERC faculty and the employee health and evaluation and control of occupational and environmental hazards units in the University of Michigan Health Systems. Support will include direct funding of the research projects and some support of faculty time.
- Train students who are or will become occupational safety and health professionals to implement NORA findings in evidence-based practice through the development and delivery of research related coursework and continuing education using distance learning modalities;
- Provide administrative and technical support of pilot research training projects on NORA related topics

Program Progress Report

A. Industrial Hygiene

B. Program Director: Edward T. Zellers, Ph. D., Professor

C. Program Description

Faculty participation. The IH Program has a long tradition of strong faculty leadership, productivity, and commitment to academic training, scholarly research, and service to the profession. Over this past year, the core IH Program faculty comprised Professor Zellers, Professor James Vincent, and Assistant Professor John Meeker. Documentation of their original research is found in the list of archival papers and published conference proceedings in Appendix C. Prof. Zellers has been IH Program Director since 1999. His work in the development of chemical sensor arrays and associated micro-analytical systems is at the cutting edge of the field and seeks to bring the revolutionary advances occurring in new technologies to bear directly on IH problems related to personal exposure monitoring, indoor air quality assessments, breath analysis, ambient-air monitoring, biomarker analysis, etc. Over this past year he has supported and been primary mentor for 7 PhD students (5 in Chemistry and 2 in EHS). He taught lecture and laboratory courses on the evaluation of chemical hazards (EHS 652, EHS 653) and part of a graduate-level course in the Chemistry Department on modern analytical methods (CHEM 545). He teaches in, and is co-director of, the continuing education course entitled "Comprehensive Review of IH" offered twice annually. He is a member of the Editorial Boards for the journals *Sensors and Actuators B* and the *Journal of Occupational & Environmental Hygiene*. Prof. Vincent continues his world-renowned work in aerosol studies, including the development and optimization of new samplers, and he has also continued his contributions in the policy arena focusing on obtaining consensus on reconciling standards among multiple countries throughout the world. He teaches courses on environmental and occupational health sciences (EHS 550), ventilation for contaminant control (657) (in both residential and OJOC modes) and a course on occupational health practices (EHS 757) (residential course) and assists in the administration of the IH Program in numerous substantive ways. Profs. Vincent and Zellers both had R01 research grants under the NIOSH NORA program during this reporting period. Their work is addressing several NORA research priorities. Professor Meeker was hired in September, 2005 and represents a welcome addition to the IH faculty in the area of exposure assessment. He already has an active extramurally funded research program focused on reproductive health effects arising from exposures to pesticides and other chemical agents, and will be increasing his teaching and advising contributions in the coming year (taking over EHS 658, Physical Hazards, and developing a new course, EHS 657, Advanced Exposure Assessment).

Numerous additional faculty contribute to the IH Program by teaching courses, mentoring students, and providing input to the nature and quality of the curriculum. The most prominent of these are T. Robins (ERC Director, EHS 507), A. Franzblau (EHS 501), D. Garabrant (EHS 508, Risk Science Center Director, OE Program Director), M. Keyserling (IOE 539, OSE Program Director, ERC Deputy Director), S. Batterman (EHS 574, HSAT Program Director), O. Hong (NURS 606, OHN Program Director), J. Miklos (EHS 581), and B. Joseph (EHS 656).

Mission, Goals, Objectives: The mission of the IH Program is to provide broad-based academic training in occupational health, ensure that graduates are qualified to pursue careers and assume leadership roles in the practice of industrial hygiene, and mentor those pursuing doctoral level training in research at the cutting edge of the IH field to prepare them for careers

in academia or research and development. As part of this mission, Program faculty recruit highly qualified students to the Program, engage in independent research projects to advance the state of knowledge in IH, and perform service activities regionally, nationally, and internationally. The overarching goals developed to support the mission of the IH MPH Program are:

1. Enroll and graduate top-quality students in sufficient numbers to help assure an outstanding graduate-level educational experience, continued strength and recognition for the IH program, and a significant contribution to the pool of qualified IH professionals to serve regional and national needs.
2. Establish and maintain an outstanding faculty committed to providing exceptional educational experiences for the students, innovative IH scientific research, and professional service to the broader IH community.
3. Provide financial aid to IH students to enable them to matriculate and graduate.
4. Maintain a comprehensive curriculum to prepare students for professional practice and certification.
5. Develop and maintain excellent facilities for training students and conducting cutting-edge IH research.
6. Secure external funding for supporting students and faculty research in areas of critical need.
7. Conduct effective and successful continuing educational activities to meet needs of IH practitioners and provide additional revenue for the IH program.
8. Inspire students to foster the highest standards of integrity, ethical conduct, and professionalism in their careers.
9. Engage and motivate IH program alumni to support students (e.g., via advising, internships, and full time employment) and the IH program (e.g., via advising, scholarships, and monetary donations)

Responsible Conduct of Science. The University of Michigan is firmly committed to the highest standards of ethical conduct in education and research. All IH students are required to complete a series of awareness training modules through the University Program for Education and Evaluation in Responsible Research and Scholarship (www.research.umich.edu/training/peerrs.html), which address (1) foundations for responsible research conduct; (2) institutional review board (IRB) procedures related to human subjects research; (3) conflicts of interest; (4) animal research; and (4) the Health Insurance Portability and Accountability Act of 1996 (HIPAA) related to privacy of personal data. This training is done on-line and includes examinations and certificates that are awarded to document successful completion. Lectures and reading materials on ethics included in classes such as EHS 550 and EHS 600, and a code of conduct outlining expected elements of academic integrity is circulated and discussed in every course in the IH curriculum.

Curriculum. We pride ourselves on the comprehensiveness of our Master's IH curricula, and feedback received from our constituencies consistently indicates that we should continue to impart solid training in classical IH skills, knowledge, and concepts. There is no undergraduate program. Students pursuing careers as practitioners elect the 60-credit-hour MPH degree option, with core courses in biostatistics, epidemiology, exposure assessment, risk assessment, air sampling and analytical methods (lecture and lab), management, toxicology, occupational diseases, ventilation, safety, radiation, occupational law and policy, ergonomics, noise and other physical hazards, in addition to electives in related areas. The 48-credit-hour MS degree

program focuses more on research/technical skills and serves as a doctoral-preparative training program. The MS degree option requires a formal thesis. MPH and MS degree requirements are completed in four academic terms. The residential MPH includes a formal summer internship, which serves for most students as a capstone project that requires integration of skills learned in coursework and documentation of mastery in the form of a report and presentation. For our On Job/On Campus (OJOC) students, the integrated work project (IWP) serves as the capstone research project. All MPH students are required to take two SPH "breadth" courses (one in health behavior and health education and one in health management and policy). Appendix A provides required courses and sample curricula for the IH MPH degree (residential and OJ/OC), IH MS degree, and IH PhD degree.

D. Program Activities and Accomplishments

Meeting goals and objectives: We were successful in recruiting 8 new MS/MPH students and 1 PhD students in the Fall of 2005. The average GPA was 3.3 and average GRE score (Q and V combined) was > 50%ile, reflecting the strong academic preparation of the incoming students. Ten of these students were supported by the NIOSH ERC. Total enrollment in the IH Program is currently (Fall, 2006) 20 students (includes HSAT students). A total of 12 students graduated from the program during the reporting period, all of which took positions in occupational and environmental health and 7 of which stayed in the region (IL and MI). We placed all of our continuing students in IH-relevant internships during the summer of 2005. With regard to gender and racial diversity, the split of male/female students was 60/40 and 12% of the students were African American or Hispanic. The curriculum remained strong as indicated by high evaluation scores (> 4 out of 5 in most courses), high overall satisfaction by students as reflected in exit survey results, and successful placement of graduates in IH/HSAT-relevant jobs. We hired a new core IH faculty member. All core IH faculty have active, extramurally-funded research programs, they collectively published 20 papers, and have served the IH community in a number of substantive ways.

Trainee honors, awards, scholarships. Our students have received a number of awards over the past year, including: AIHF George and Florence Clayton Award, Michael Cooper; AIHF Ralph Smith Award, Matt Johnson and Ryann Fisher; MIHS Award, Gerald Houvener; 2005 EHS MPH Poster Competition, 1st Place - Michael Cooper, 2nd Place - Gerald Houvener; Warren Cook Award, Judy Zhong; UM SPH Scholarships, Josh Bennett, Gerald Houvener, Hollie Quissenberry.

Faculty honors and awards. Professor Meeker received the Young Clinic Investigator Award in September, 2005 and Professor Zellers was invited to give the keynote address at Eurosensors XIX, Barcelona, Spain, September 12th- 14th, 2005.

New faculty positions. There have been four faculty hired into the EHS Department over the past year that will have important positive impacts on the IH program. As mentioned above, Professor Meeker was hired as a core IH faculty member (Assistant Professor, started in September, 2005) with interests in exposure assessment. Prof. Howard Hu assumed the position of Chair of the EHS Department in September, 2006. He is a leading occupational and environmental epidemiologist with active research interests in heavy metal exposures and health effects. Prof. Olivier Joliet (Assoc. Prof., started in September, 2005) brings expertise in life cycle analysis and risk science. Prof. Chuanwu Xi (Asst. Prof., started in September, 2005) brings expertise in environmental microbiology. A fifth faculty member, Professor Marie O'Neill (Asst. Prof., 50% appt., started in September, 2006) brings expertise in environmental exposure assessment and epidemiology. Each of these faculty has or will contribute to the IH Program through teaching, mentorship, and/or by expanding the scope of research accessible to

students. For example, Dr. Xi taught a new lab (with Zellers in EHS 653) this past year on endotoxin sampling and analysis.

New courses. In response to NIOSH suggestions for integrating the OHN faculty more completely into the ERC curricula, we will be launching a new course, NURS 606 (Management for Occupational & Environmental Health and Safety Professionals) that will be taken by IH students and students from the other ERC Programs. Dr. Meeker has just received approval to teach EHS 657, Advanced Exposure Assessment. Dr. Joliet will be bringing a new course on line entitled Life Cycle Assessment: Human Health and Environmental Impacts, which will be an elective for IH students. Another initiative launched this past year is the development of eight "IH Minors" in areas of Environmental Microbiology, Public Health Genetics, Occupational Epidemiology, Ergonomics, Global Health, Management, and Reproductive Health. These informal minor concentrations provide students structured options for their 10-13 credit-hours of electives.

E. Program Products

Publications and Presentations: The core IH Program faculty had 20 peer-reviewed papers and conference proceedings published or submitted over the past year, of which 10 involved student co-authors (Appendix C). Approximately 10 presentations were delivered at professional conferences and other formal venues by IH faculty and their students this past year. Among the papers published was one for which Prof. Zellers was lead author that reported the first microfabricated gas chromatograph capable of multi-vapor determinations. This landmark publication was the result of a team effort spanning several departments at Michigan, funded primarily through the Center for Wireless Integrated Microsystems, with additional support provided by a NISOH R01 and by this training grant. Prof. Zellers was awarded a patent this year as co-inventor of a microfabricated preconcentrator-focuser device for use in a micro gas chromatogaph.

As stated above, Prof. Zellers co-directs and teaches in the continuing education course entitled "Comprehensive Review of Industrial Hygiene", which was offered twice last year and has been extremely successful in attracting enrollment. Other ERC faculty that participate in this course include Profs. Franzblau, Batterman. IH faculty research funding has been quite healthy this year, with extramural funding from the National Science Foundation, NIOSH (2 R-01 grants and 2 NIOSH-Pilot Project grants), the Michigan Tobacco Research Network (American Legacy Foundation, prime), and the Flight Attendants Medical Research Institute (FAMRI). All of these projects involved support of, and participation by students. The program assembled and submitted a Self Study Report as part of its effort to receive re-accreditation by the American Board of Engineering and Technology (ABET). The site visit was held in October, 2006 and went extremely well. Re-accreditation is expected when formal decisions are rendered in July, 2007.

F. Future Plans

Planned initiatives. Several activities and initiatives are planned for this next year. Foremost among these is our launching of a newly formatted OJOC MPH program which incorporates distance learning elements (in the past, all instruction has been residential). We will be implementing several changes to the way in which the IH curriculum is assessed and managed. For example, we are incorporating a new course evaluation mechanism that addresses the extent to which intended goals and competencies have been met. We will also be bolstering the way we solicit and use feedback on the program from our constituencies in order to improve the

program. We have already been shifting some content of the IH laboratory course (EHS 653) to encompass several issues relevant to ambient environmental health, and will now be having IH students take this class alongside students majoring in Environmental Health. Another initiative that expands our interdisciplinary training is to morph our current capstone course, EHS 600, in a way that teams students from multiple disciplines on a project that draws upon their disciplinary perspectives to characterize or solve a practical problem. We will also be offering a 1-cr-hr laboratory class in the OJOC program for the first time, and we plan to launch a 4+1 BA-MPH program (with Chemistry undergrads) as a means of increasing enrollment/interest in the IH Program. The IH faculty will also participate in developing another ERC-wide alumni survey (follow up to our 2004 survey) as part of our on-going Center assessment process. A new ERC-wide EH&S management course (NURS 606) will also be offered this year.

A. Program Title-Occupational Health Nursing (OHN)

B. Program Director: Dr. Oi-Saeng Hong, Associate Professor

C. Program Description

The OHN graduate program prepares graduates for leadership roles in health protection and health promotion for employees in work settings. The Master's (MS) Degree Program prepares occupational health nurse managers and administrators; and the Ph.D. program prepares nurse scientists and leaders in health care.

Goals and Objectives**:** The goals of the OHN MS Program are to: (a) prepare well-trained professional level nurse managers and administrators; (b) offer high quality Continuing Education (CE) courses to upgrade skills for professional practice in OHN; (c) increase the number of well qualified OHN graduate students; (d) promote OHN education in undergraduate and graduate courses in other departments and other schools in the region; and (e) maintain a high level of interdisciplinary collaboration within the ERC. The goals of the PhD program are to prepare skilled researchers and educators with specializations in OHN.

Curricula: OHN MS program requires a total of 47 credit hours (10 for nursing core courses required of all nursing MS students + 17 for nursing specialty community/OHN courses + 12 for interdisciplinary Occupational & Environmental Health, and Safety (OEHS) courses + 8 for public health core courses). The curriculum for OHN MS degree program and course descriptions for each course is included in Appendix A.

New interdisciplinary management course (N606, *Management for OEHS Professional, 2credits*) was developed by Drs. Hong and Strasser and approved by the School of Nursing (SON) Curriculum Committee. As this new course will replace the 2 credit theory portion of N687 Managing Community Based System (2 credits for theory, 2 credits for practicum), OHN students will complete 2-credit practicum portion of N687. Therefore this new course will not affect overall total credit allocation (47 credit hours). The course will be offered by Drs. Hong and Strasser along with guest speakers in various fields (IH, occupational safety engineering, business, etc) in Jan. 2007. This will be the first course taught by OHN faculty for students in programs of OHN, Industrial Hygiene (IH), Occupational Epidemiology, and Safety Engineering program.

OHN MS program has been offered in On Job On Campus (OJOC) format, which is a flexible option for nurses interested in pursuing advanced degrees in OHN who may not be able to participate in traditional programs while holding down a full-time job. Although the OJ/OC format is popular and attracts students from across the US, all OHN programs are challenged with the recruitment of students who are primarily employed full-time and live at a distance from the University. During the past year, we have restructured the OJOC format with the inclusion of 50% web-based distance learning to attract a steady number of well-qualified students to the OHN program. The revised OJOC format, a unique combination of on-campus and distance learning, will be implemented in Fall 2006.

Responsible Conduct of Science**:** All OHN students learn basic foundations in responsible research conduct through the required courses (N536 *Utilization of Nursing Research in Advanced Practice* for MS; N830 & N831 *Design, Methods & Analysis I & II* for PhD students). All OHN students involved in sponsored projects must be certified in the Program for Education and Evaluation in Responsible Research and Scholarship that fulfills the NIH requirement.

D. Program Activities & Accomplishment: During the reporting period, we made a good progress toward meeting previously listed goals and objectives except that the number of MS students recruited to the program were small (2 non-OJOC students) due to restructure of OJOC program. It is expected to have 6-7 MS students in the new cohort in the Fall 2006. Highlights of accomplishments are summarized as follow:

Program Leadership and Faculty: During the reporting period, the program director, Dr. Hong, was promoted to Associate Professor with tenure that will contribute to the stability in the program leadership. Dr. Hong provided leadership in curriculum development and renovation of OJOC format with 50% on-campus and 50% distance learning modality. She also participated in an interdisciplinary team with faculty (from Medicine, Public Health, Labor Relations, and Industry) to develop occupational health and safety certification curriculum for occupational health professionals in Shanghai, China. Dr. Hong has been involved in various levels of student research projects, including minority high school students' summer research apprenticeships, Undergraduate Research Opportunity Program, Master's scholarly projects (N699), and doctoral committees and postdoctoral research training. In addition to mentoring OHN students at the University of Michigan, Dr. Hong serves on the preliminary examination and dissertation committees for an OHN doctoral student at the University of Illinois at Chicago, which is an exemplar of collaboration between the NIOSH ERCs.

Dr. Hong continued to provide leadership in creating and strengthening international collaborations in OHN education and research. International visibility has been increased by Dr. Hong's active participations in consultation in curriculum development for OHN graduate program and research training and conducting collaborative research in other countries (Brazil, Korea). She was appointed as a consultant in OHN program and a co-advisor of an OHN doctoral student at the University of São Paulo at Ribeirão Preto College of Nursing in Brazil. Dr. Hong and her collaborator in Brazil (Dr. Marziale) established research training agreement to provide Brazilian government sponsored OHN doctoral students with the opportunity for research training at the University of Michigan School of Nursing. The first Brazilian OHN doctoral student (Fernanda Rocha) selected by Brazilian government will start research training under Dr. Hong's mentorship in 2006 Fall.

Dr. Hong served on the Board of Directors for the Global Korean Nursing Foundation and as Co-chair of Postdoctoral Fellow Selection Committee of the Foundation. She continues to serve as a research mentor for postdoctoral fellows selected by the Foundation. Last year, Dr. Hong was appointed as a research mentor by the National Coalition of Ethnic Minority Nurse Associations, Inc for development of ethnic nurse scientists. She provided research mentorship for a junior faculty and a doctoral student whose research focus on worksite health promotion. Hong's other professional leadership performance includes activities as Guest Editor for the American Association of Occupational Health Nurses (AAOHN) Journal, editorial board for Korean Nursing Science Journal (English issues), manuscript reviewers for Journal of Nursing Scholarship, Journal of Korean Academy of Nursing (English issues), and Japan Journal of Nursing Science (English issues), and abstract reviewer for American Public Health Association. With the recognition of her excellent research and professional performance, during the reporting year, Dr. Hong received several awards: *Blue Cross Blue Shield of Michigan Foundation Excellence in Research Award* in the category of Health Policy or Health Services Research; *Outstanding Faculty Member Award*, Ginsberg Center Award for Community Service & Social Action, University of Michigan; *Faculty Teaching Fellow* in the Program of Global Intercultural Experience for Undergraduates, University of Michigan; and *Mentor Award*, National Coalition of Ethnic Minority Nurse Associations, Inc.

Other core faculty members (Barkauskas, Morris, Strasser) and former director (Lusk) for the OHN program made contributions to and played significant leadership roles in the field. During the past year, Dr. Barkauskas continued to work with the courses in the graduate courses taken by the OHN students and students in Public Health/Community Health and Home Care Nursing. In conjunction with the plan to develop a heavily web-supported, part-distance learning option for the OJOC program, she developed web-supported versions of the courses N563 Community Health Nursing and Population Assessment and N686 Interventions with Aggregates and Communities. In addition, she taught N563 to part-time students in the transitional year from regular OJOC to the part distance learning OJOC. Dr. Barkauskas continues to lead the evaluation of a major Kellogg Foundation funded grant to develop a national database for nurse-managed centers, and has published several articles related to this effort.

Dr. Strasser continued teaching N572 (Current and emerging issues in OHN), supervising student clinical practicum, and providing research advisement for MS students. As a member of the AAOHN Journal Editorial Board, she is particularly skilled in assisting students with manuscript preparation. She participated in developing a new interdisciplinary course (N606) and will co-teach the course with Dr. Hong in January, 2007. Dr. Strasser served as the Chair of the Research Committee, American Board of Occupational Health Nurses (ABOHN). With recognition of her outstanding contribution to the field of OHN, and she was selected as an AAOHN Fellow.

Ms. Morris assisted in the recruitment of OHN students at the AAOHN conference, determining CE program needs, and coordination of CE program development. She continued teaching CE courses for OHNs at both regional and national levels and provided consultation on the development of N606.

A new faculty member, Dr. Sonia Duffy (Associate Professor), was hired to join the OJOC faculty. Dr. Duffy has an outstanding record of research in smoking cessation and cancer prevention. She will teach and co-teach nursing specialty courses in OJOC. Dr. Duffy will serve on OHN PhD students' program planning, preliminary exam, and dissertation committees. She will also actively participate in recruitment of high quality OHN students, program development, and trainee evaluation. Dr. Duffy's external funding from various agencies will strengthen an outstanding environment for research training in the OHN program.

Dr. Lusk served as an expert consultant in preparation of Hong's R01 grant proposal to develop an expert system intervention to prevent noise-induced hearing loss in fire fighters. She continued to serve as the President of Midwestern Nursing Research Society.

Trainees: Due to the restructuring of the OJOC format, recruitment of a new cohort was deferred until Fall 2006 but two MS students were admitted to a non-OJOC program during the reporting period. Two students (P. Zinner & T. Clark) obtained their MS degrees. Zinner's scholarly project was accepted for publication in a peer-reviewed nursing journal. All doctoral program graduates had demonstrated good record of research and publication productivity in the past year. Drs. Kerr at the University of Minnesota and McCullough at the University of North Dakota have ongoing research projects in prevention of noise-induced hearing loss among Latino construction workers (funded by NIDCD) and farmers (funded by NIOSH), respectively. Dr. Kalampakorn made a presentation at the International Congress on Occupational Health Centennial meeting in Milan, Italy and has been serving as co-chair for the international OHN conference in Thailand. A recent graduate (Dr. Raymond at the Wayne University) published three papers from his preliminary examination and dissertation work.

A new OHN doctoral student (Melinda Chee) who accepted the admission to the program in Spring 2006 deferred her enrollment until Fall 2007 due to unforeseen personal circumstance. Two new international students from China (Siying Huang) and Taiwan (Yun-Ping Lin) were admitted to the doctoral program with the research focus in OHN. The Global Korean Nursing Foundation sponsored OHN postdoctoral fellow (Dr. Jeong) completed her research training under Dr. Hong's guidance and returned to Korea to assume a research faculty position at the Yonsei University-Won Ju. With Dr. Hong's mentorship, Dr. Jeong had completed a NIOSH funded pilot project that investigated occupational health and safety issues among Korean-American drycleaners and made several presentations during her postdoctoral fellowship.

Trainee Recruitment**:** Recruitment of highly qualified and motivated students remains a priority for the program. Enhanced recruitment efforts are being implemented to increase enrollment in both MS and PhD programs. Such efforts include open houses, career days, recruitment booths at the American Public Health Association and AAOHN meetings, reaching out to potential students through our OHN alumni, advertising about the program in AAOHN Journal, extensive phone calls, e-mails, web sites and personal contacts. We are committed to diversity and aggressively recruit ethnic minority students. The SON has a number of programs established to accomplish this goal. Collaborative partnerships have been set up between our school and several institutions (Howard, Univ. of Texas Health Science Center at San Antonio [UTHSCSA]) that serve predominantly students of color. Working with the UTHSCSA, an institution that serves a primarily Hispanic population, the SON obtained a funding from the National Institute of Nursing Research to develop a program that will accelerate the entry of ethnically diverse nurses into careers in nursing science. We expect this program to serve as a potential source of future applicants of diverse ethnicity. In 2006, Dr. Hong was selected as a faculty mentor by a National Coalition of Ethnic Minority Nurse Associations (NCEMNA), Inc for development of ethnic nurse scientists. Through her NCEMNA mentor role for ethnic minority nurses, Dr. Hong will be able to promote attention to occupational health issues and concerns and attract an increased number of ethnic minority students to the program.

E. Program Products. During the reporting period, OHN faculty and trainees were productive with completion of 2 funded research projects, conducting 8 ongoing studies including 2 international collaborative projects, and 19 publications and 30 presentations. A list of funded projects, publications and presentations is included in Appendix C.

Dr. Hong demonstrated an excellent record of funding and research productivity. She has submitted a R01 application to develop and implement an expert system intervention to prevent noise-induced hearing loss in fire fighters. Two NIOSH funded research projects, *Worksite intervention to promote physical activity* and *Occupational exposure, knowledge, and protective behaviors among Korean drycleaner* have been completed. Four undergraduate and two graduate students including one IH MS student (A. Giotto) have become part of the research team for Dr. Hong's projects and gained valuable research experience as part of their program. During the past year, Dr. Hong obtained a funding from the NINR for her pilot study, *NIHL-Expert (NIHL-e) System Intervention: Developmental Stage I*. She initiated two international collaboration research projects with OHN researchers in Brazil and Korea: *Job delineation research with occupational health nurses in Brazil: A part of international comparative study* funded by ABOHN and *Web-based survey of hearing protection behavior in workers of six power plants in Korea* funded by Pusan National University. Her research projects funded by NIOSH, NINR, and ABOHN substantially strengthens the environment for research training for undergraduate and graduate students in OHN program as well as other fields. Dr. Hong has contributed to enhancing interdisciplinary collaboration in research and education through her

multidisciplinary research teamwork with a wide range of individuals, including workers, labor unions, national organizations, and multidisciplinary experts in the areas of industrial hygiene, occupational medicine, computer engineering, audiology and hearing science, information technology, and hearing conservation.

F. Future Plans

There are no anticipated changes in faculty, space, and facilities. Future plans for the MS degree program are to continue to progress toward meeting previously listed objectives. For the doctoral program, we will continue to recruit well-qualified students and prepare them to develop rewarding careers, primarily as researchers or faculty in OHN.

Occupational Safety Engineering and Ergonomics Progress Report:

A. Program Title

The University of Michigan Center for Occupational Health and Safety Engineering,
Program in Occupational Safety Engineering and Ergonomics

B. Program Director

W. Monroe Keyserling, Ph.D.
Professor of Industrial and Operations Engineering

C. Program Description

C.1 Brief History and Goals

Graduate training in Occupational Safety Engineering and Ergonomics (OSE) has been offered by The University of Michigan's Department of Industrial and Operations Engineering (IOE) since 1971. This program was incorporated into the Michigan ERC in 1982 and renewed during site visits in 1984, 1989, 1994, 1999 and 2004.

Our goal is to be an internationally-recognized center of excellence for research and graduate education in the design, analysis, implementation and improvement of facilities, equipment and processes to assure the safety and well-being of human resources in the workplace. Our educational programs include:

1. Professional training (Masters degrees). Intended for students who wish to pursue careers as full-time safety and ergonomics professionals. Students complete a curriculum that covers technical and managerial topics, learn basic research methods and complete an independent research project. To view a sample curriculum and list of elective courses, please see Appendix A.
2. Research training (Ph.D. degrees). Intended for students who wish to pursue careers in academic, government and industrial research settings. Following extensive coursework, students conduct research in either a laboratory or field setting.
3. Continuing education. Short courses are provided for occupational health professionals, managers, engineers, and labor representatives who desire specialized training in safety and ergonomics.
4. Cognate courses for students in other disciplines. Courses in safety and ergonomics are taken for elective credit by undergraduate and graduate students from a variety of non-core academic programs (e.g., mechanical engineering, construction engineering, manufacturing engineering, naval architecture and business administration).

Since 1971, we have graduated 246 Masters and 76 Ph.D. students who completed the OSE degree option. For the reporting year (July 2005-June 2006), we had 5 Masters and 5 Ph.D. graduates.

C.2 Responsible Conduct of Science Training

The University of Michigan is committed to the responsible conduct of faculty, staff, and students in all aspects of research. As part of this commitment, the university has established a web-based system for training and certifying faculty, staff, and students on responsible research practices. Faculty, staff and students who serve as investigators or research assistants must complete modules on: 1) Foundations of Responsible Research Conduct (e.g., ethics and legal requirements related to publication/authorship, intellectual property, conflict of interest, plagiarism, misconduct reporting, etc.), and 2) Human Research (e.g., why human subjects research is regulated, regulatory and ethical responsibilities of the PI, IRB and

University, etc.). Each module includes a test which must be successfully passed in order to achieve certification. The PEERRS website can be accessed at the following URL:

http://www.research.umich.edu/training/peerrs.html

In addition to the formal certification process, students work with faculty mentors to develop research protocols, write informed consent documents, prepare IRB applications and collect data on human subjects. Most Masters-level trainees and all Doctoral-level trainees play a significant role in submitting at least one complete IRB application in conjunction with the research projects required for their degree.

C.3 Program Faculty

The OSE program at The University of Michigan is fortunate to have a large, stable, and highly-productive faculty. Eighteen faculty and staff members (see Table OSE--1) teach OSE courses and advise student research. The eight tenured IOE faculty listed in Table OSE--1 have special roles (e.g., curriculum planning and evaluation, student counseling, student recruitment, administration of doctoral exams, etc.) in addition to teaching and research. Ten additional members of the faculty and staff are involved in teaching OSE classes, advising student research and/or providing laboratory support. Finally, faculty from other university units (not listed in the table) contribute to the program by teaching courses in industrial hygiene, epidemiology, construction safety, systems reliability, management, and program administration.

Table OSE--1. Contributions of OSE Faculty and Staff

Name	Specialization/Interests	Rank/Title
Tenured Faculty		
Dr. W.M. Keyserling, (OSE Program Director)	Safety Engineering, Ergonomics, Trucking/Warehousing	Professor
Dr. T.J. Armstrong	Biomechanics (Upper Ext.), Office Ergonomics, Rehab.	Professor
Dr. D.B. Chaffin	Biomechanics (Low Back), Manual Mat. Handling	Professor
Dr. G.D. Herrin	Applied Statistics, Experimental Design	Professor, Assist. Dean
Dr. B. Kantowitz	Cognitive Ergonomics, Transportation Safety	Professor
Dr. Y. Liu	Cognitive Ergonomics, Human/Computer Interaction	Associate Professor
Dr. B.J. Martin	Work Physiology, Occupational Vibration	Associate Professor
Dr. N. Sarter	Cognitive Ergonomics/Transportation Safety	Associate Professor
Supporting Faculty and Staff		
Dr. P. Adams	Safety Engineering, Safety Management	Adjunct Assistant Prof.
Dr. P. Frantz	Warning Systems, Product Safety, Safety Management	Adjunct Assistant Prof.
Dr. A. Franzblau	Musculoskeletal Disorders, Epidemiology	Research Scientist
Dr. P. Green	Human Factors (Controls/Displays)	Research Professor
Dr. M. Reed	Anthropometry, Biomechanics, Human Motion	Assoc. Research Prof.
Dr. T. Rhoades	Product Safety, Safety Management, Transportation Safety	Adjunct Assistant Prof.
Dr. S. Ulin	Participatory Ergonomics/Plant-based Programs	Sr. Research Associate
Dr. R. Werner	Musculoskeletal Disorders, Epidemiology	Research Scientist
Mr. C. Woolley	Research Instrumentation, Ergonomic Software	Research Engineer
Mr. E. Claxton	Technical Support, Instrumentation Shop and Labs	Engineering Technician

There have been several changes to faculty and staff since our last report. Mr. James Foulke retired in June 2006 after a career of almost 50 years with The University of Michigan's Center for Ergonomics. Mr. Foulke played a key role in supporting faculty and student research through the development of specialized equipment and instrumentation for laboratory and field studies. He also developed our instrumentation course (IOE 432). These responsibilities will be assumed by Mr. Charles Woolley, a

Research Engineer with more than 20 years experience on our staff. Among non-tenure-track faculty, Dr. Paul Adams was hired to teach our Safety Management Course (IOE 438). Dr. Adams holds a Ph.D. from Michigan in Industrial and Operations Engineering (OSE Option) previously served on the Safety faculty at Illinois State University. More recently, Dr. Adams has worked as a safety engineer in industry and as a safety/ergonomics consultant. We will have one faculty retirement during the 2006-07 academic year. After a distinguished career of nearly 40 years, Dr. Don Chaffin will retire from active faculty status in December 2006.

C.4 Curriculum

During the 2004 site visit, a new Masters curriculum was approved. The base of this curriculum is 18 credits of required coursework and seminars in core areas of safety engineering, OHS management, industrial hygiene, epidemiology, and statistical methods. Core courses are taken with students from other disciplines in our ERC. In addition, all NIOSH trainees must complete a 3-4 credit research project. Students are then free to choose electives from almost 50 graduate courses in order to specialize in one or more of the following areas: physical ergonomics, cognitive ergonomics, safety engineering, or OHS management. The Masters degree can usually be completed within a calendar year. Please refer to Appendix A for additional information.

The Ph.D. degree typically requires 4-5 years to complete. Students build on the Masters degree and develop research skills by taking additional upper-level graduate courses in statistics/experimental design, epidemiology, safety, biomechanics, physiology, psychology, and laboratory/field research methods. To assure an early research experience, each Ph.D. student must identify a research advisor and write a brief research proposal during the fall term of the first year. In the winter term, the student works closely with his/her advisor to complete a small project and write a final report. During the second year, the student continues working with the advisor, performing additional research and writing a formal dissertation proposal. Doctoral examinations are given at the end of the first year (the Qualifying Exam) and early in the third year (the Preliminary Exam) to assess progress. The Qualifying Exam focuses on performance in coursework and the first-year research project. The Preliminary is a comprehensive evaluation of the research proposal and the student's preparation to perform the proposed work. After passing the Preliminary Exam, the Dissertation Committee is responsible for advising the student and assuring the quality of the doctoral research. Advanced Ph.D. students are also expected to publish and present their findings at scientific meetings.

D. Program Activities and Accomplishments

The 2005-06 reporting year was highly successful, with many accomplishments and achievements. We enrolled a total of 26 full-time (20 Ph.D., 6 M.S.) and 2 part-time students (both M.S.). Looking at program outputs, we had 5 Ph.D. and 5 M.S. students graduate during the reporting year. Additional details, including placement information, are provided in Table 4a.

Major accomplishments of students and faculty, and major program developments are highlighted below.

D.1 Trainee Honors, Awards, and Scholarships

Our students won several prestigious awards during the reporting year:

- Mr. Marc Berman (2nd year Ph.D. student) received a National Science Foundation Graduate Fellowship. Marc joins three other Ph.D. students (Mike Bauerly, Tom Ferris, and Kristi Schmidt) who are NSF Fellows.
- Ms. Sarah Womack received the Tichauer Award for best student presentation at the AIHCE in Chicago.

- Mr. David Wagner won a College of Engineering Outstanding Graduate Mentor Award for excellence in supervision of undergraduate research.

D.2 Faculty Honors, Awards, and Appointments

Significant faculty accomplishments include:

- Prof. Thomas Armstrong served on the ACGIH Physical Agents Committee.
- Profs. Don Chaffin, Monroe Keyserling, and Nadine Sarter served on National Research Council Committees.
- Prof. Yili Liu received the Jon R. and Beverly S. Holt Award for Excellence in Teaching.
- Adjunct Prof. Paul Adams served as Director of the Board of Certified Safety Professionals.

D.3 Trainee Dissertations and Theses

Dissertation titles and advisors for our 5 Ph.D. graduates are listed in Appendix C. In addition, our M.S. and Ph.D. students were sole authors on 3 technical reports and co-authors on 3 technical reports. (Note: Our Masters program does not have a formal thesis requirement; however, all NIOSH trainees must complete a directed research project that culminates in a technical report.)

D.4 New Courses

The following new courses were developed during the reporting year:

- Prof. Tom Armstrong made significant changes to IOE 463 (Work Measurement and Prediction), increasing the course from 2 to 3 credits and increasing the emphasis on lean manufacturing methods and musculoskeletal disorders.
- Prof. Nadine Sarter developed two new courses, IOE 434 (Human Error and Complex System Failure and IOE 491 (Multimodal Displays: Conceptual Basis and Design)
- Prof. Paul Green developed a new course on Automotive Human Factors (IOE 491)

D.5 Trainee Recruitment and Diversity

For the 2005-06 reporting year, OSE enrollment was 28 students (7 Masters and 21 Ph.D.) Of this total, 10 were females (36%) and 3 were underrepresented minorities (11%). Among our 10 graduates, 5 were female (50%) and 2 were underrepresented minorities (20%). For the Fall 2006 term (next reporting year), OSE enrollment stands at 27 students (7 Masters and 20 Ph.D.) with 12 females (44%) and 3 underrepresented minorities (11%). As part of our recruiting efforts to increase enrollment of underrepresented students, we participate in the College of Engineering's PREVIEW and IMPACT programs. The PREVIEW program sponsors campus visits for potential M.S. and Ph.D. students during the Fall term (including GEM, LSAMP, McNair, and Meyerhoff scholars), allowing students to visit laboratories and meet with current faculty and students. (Note: Travel expenses are covered by the University). The IMPACT program focuses on the recruitment of Ph.D. students. A campus visit is provided to tour facilities, meet with potential dissertation advisors, and discuss possible dissertation topics. Finally, the College of Engineering sponsors faculty visits to HBCUs and universities in Puerto Rico to meet with potential students and discuss opportunities for graduate school.

E. Program Products

E.1 Publications

2005-06 was a highly productive year for publications. Our faculty and students produced a total of 120 publications and presentations with students serving as sole author or co-author on 76 publications. A

complete list with bibliography citations appears in Appendix C. It was a particularly productive year for the publication of books (3) and book chapters (11). We consider this to be an important part of our Research-to-Practice (R2P) mission as books and book chapters are one of the most effective ways of transferring recent research developments to current and future OHS practitioners.

E.2 Research-to-Practice (R2P) Activities

We consider technology transfer to be an important part of our ERC mission. A few of our R2P activities for the reporting year are highlighted below:

- The U of M Center for Ergonomics, in cooperation with the State of Michigan, provides ergonomics consulting and training services to small and medium-sized companies. In a typical year, we are able to respond to approximately 12-15 requests for in-plant assistance. During the 2005-06 reporting year, we started a new initiative by involving our Ph.D. students in this program. We believe that this type of service delivery activity greatly enriches the education of our students while providing additional services to clients.
- Professors Barry Kantowitz and Paul Green, in conjunction with The University of Michigan Transportation Institute are involved with multiple studies to improve the safety performance of both commercial and passenger vehicles. Because highway crashes continue to be the leading cause of occupational fatalities in the United States (BLS, 2006), this research has important benefits to the safety of the American workforce.
- Professors Don Chaffin and Bernard Martin are working with a consortium of private sector and federal sponsors (including the Dept. of Defense) in the development and implementation of computer aided tools for the high fidelity modeling of human motions and activities. These models can be used pro-actively in job design, providing a safer workplace for American workers and military personnel.
- Professors Yili Liu and Nadine Sarter are involved in several projects on the topic of multi-task cognitive modeling. A major goal of this research is to reduce errors and improve human performance and systems safety on jobs that require complex human-machine interactions.
- Adjunct Professor Paul Adams is working with the American Water Works Association Research Foundation and the Environmental Protection Agency to improve safety performance in the water utilities industry.

F. Future Plans

We had successful recruiting for the 2006-07 academic year, and our current enrollment stands at 27 students (7 Masters, and 20 Ph.D.). We are particularly pleased with the fact that five new Ph.D. students started their programs this fall. We will continue to recruit Masters students for the Winter 2007 term, and hope to enroll 1-3 additional students in January.

We look forward to another productive year for Ph.D. graduates. Dr. Kevin Rider has already completed all of his dissertation requirements and will formally receive his degree in December. Dr. Rider is employed as an Assistant Professor at The University of West Virginia. Mr. Chris Grieshaber is writing his dissertation and expects to defend during the first half of 2007. He is currently employed as an Assistant Professor at Illinois State University.

With the impending retirement of Professor Don Chaffin, we are working with the IOE Department and the College of Engineering to establish a search for a new faculty position in ergonomics and safety. Due to a tight budget year, it is unlikely that this position will be filled during the 2006-07 hiring cycle. However, we anticipate that new faculty positions will be established for the 2007-08 cycle and that this will be a priority hiring target.

Progress Report: Occupational Epidemiology (reporting period July 1, 2005 – June 30, 2006)

A. Program Title: Occupational Epidemiology Training Program
B. Program Director: David H. Garabrant, MD, MPH

C. Program Description
Goals and Objectives
The program in occupational epidemiology has been in existence for 4 years and received NIOSH funding for the first time in July 2004. Thus, we completed our second year of funded training in June 2006 and we are currently in our third year of funding. Our training objectives are

- To more fully integrate the curricula, faculty, and trainees in the Departments of Environmental Health Sciences and Epidemiology for the purpose of strengthening the curriculum and the educational experience of students.
- To strengthen the training in occupational epidemiology methods, as recommended by our site visitors in 2005.
- To recruit a class of masters level students of outstanding quality and to train them for professional careers in occupational epidemiology through didactic instruction, field experiences, and interdisciplinary interaction.
- To recruit outstanding doctoral students in occupational epidemiology, give them outstanding didactic instruction, mentor them in the conduct of original research, and prepare them for research careers in occupational epidemiology.
- To recruit trainees from underrepresented racial and ethnic groups

D. Program Activities, Accomplishments, and Program Products
Faculty Development
In the past academic year we undertook a substantial expansion and re-alignment of our faculty in response to the pink sheet we received after our program review in 2005. In that critique, the reviewers urged that the OE program recruit additional faculty with strength in methodologic issues in occupational epidemiology and that we achieve greater integration between the Departments of Environmental Health Sciences and Epidemiology. In response to that recommendation, we have recruited a new Chair of our department, Howard Hu, MD, PhD. Professor Hu holds a doctoral degree in epidemiology from the Harvard School of Public Health and has spent his career in the field of occupational epidemiology. He holds appointments as Professor of Epidemiology in the Department of Epidemiology and as Professor of Environmental Health Sciences in the Department of Environmental Health Sciences. He is an important to both departments, due to his substantial expertise in occupational epidemiology methods and field experience. In addition, we recruited a new junior faculty member, Marie O'Neill, PhD, as Assistant Professor of Environmental Health Sciences and Assistant Professor of Epidemiology. Dr. O'Neill holds a doctoral degree in epidemiology and recently completed a post-doctoral fellowship as a Robert Wood Johnson Fellow at the University of Michigan School of Public Health. She is currently developing coursework in advanced methods in occupational epidemiology.

In addition to these critical additions to our faculty, we have been working closely with the Chair of Epidemiology, Hal Morgenstern, PhD, to integrate more closely the epidemiology and environmental health science students who have interests in occupational epidemiology. Professor Morgenstern has a long career in occupational epidemiology and is a renowned authority in epidemiology methods. We are currently pursuing faculty appointments in

Epidemiology for Professors Robins and Franzblau and an appointment in Environmental Health Sciences for Professor Morgenstern to more fully integrate the two departments. Overall, we have dramatically augmented our faculty in occupational epidemiology and have achieved a high degree of integration with the Department of Epidemiology, as was recommended by the site visitors in our recent review.

Honors and Awards

Professor Garabrant received the Excellence in Research Award from the University of Michigan School of Public Health in April 2006. This award is made annually to a single faculty member in recognition of outstanding research accomplishments. In recognition of the outstanding training and ability of our trainees, four of them were awarded ASPH/EPA fellowships in environmental epidemiology to work at the EPA this year. Nationwide, only 12 of these fellowships were awarded. We believe that securing fully one third of these prestigious national fellowships is a strong statement about the strength and reputation of our training program.

Enrollment, Student Research, and Curriculum

In the past year we enrolled a total of 12 students (11 masters and 1 doctoral) in occupational epidemiology (OE). In addition to these students, we are in the process of enrolling a new class of students in the Executive Masters Degree in Environmental Health Sciences, which will include additional students with interests in occupational epidemiology. We expect that as a result, our enrollment in OE will be larger as this class forms. During the past academic year, we graduated 3 doctoral students and 8 masters students. Our research program achieved outstanding productivity, with 31 publications, abstracts, and presentations at scientific meetings by occupational epidemiology trainees. These are listed in Appendix D.

The curriculum in OE has now achieved strength in field training, as we have built the program over the past four years. Our masters trainees are required to complete a field experience during the summer between their first and second years. Examples of field experiences this past year include a research investigation of cancer risks among meat cutters, completed at the International Agency for Research on Cancer (IARC) in Lyon, France; a cohort follow-up study of the Michigan polybrominated biphenyl cohort, conducted at the Michigan Department of Community Health; and follow-up of the Triana, Alabama cohort exposed to PCBs, conducted at the National Cancer Institute in Rockville, Maryland.

We continue to revise and improve the occupational epidemiology curriculum in response to site visitors' comments. We have increased the amount of methodologic content, by requiring students to take EPID 600 Introduction to Epidemiology, followed by a new course EPID 601 Principles and Methods in Epidemiology. EPID 600 is now the introductory course, which is followed by EPID 601 which is an in-depth course in epidemiology methods. In addition, OE students participate in the joint Departments of Environmental Health Sciences and Epidemiology poster session, which provides increased interaction with IH, HSAT, and Epidemiology students. The poster session is one of the highlights of the students' experience, bringing students together to discuss their research and to learn research approaches in other disciplines. The consequence of these curriculum changes is to strengthen the training in epidemiology methods and to give the students practical experience in the conduct of occupational epidemiology, which reinforces their didactic training.

Training in the Responsible Conduct of Research

All OE trainees are required to complete the Program for Education and Evaluation in Responsible Research and Scholarship (PEERRS), which is a web-based instruction and

certification program for all members of the University of Michigan community engaged in or associated with research. There are five modules, each of which consists of 20-30 web pages containing the core material, short case studies with questions, and pop-ups with additional information to provide greater depth and elaboration. The modules are: 1) *Foundations of Responsible Research Conduct* (publication/authorship, intellectual property, conflict of interest, signatures, plagiarism, misconduct reporting); 2) *Research Administration* (UM procedures/forms, PI responsibilities, pre- and post-award activities, federal regulations, important contacts); 3) *Conflict of Interest* (definitions and recognizing potential conflicts, responsibilities toward students/colleagues, consulting and conflict of commitment, sponsored project and technology transfer issues); 4) *Human Research* (basic module provided in three versions -- clinical research, health sciences and social/behavioral sciences. It covers definition of human subjects research, why human subjects research is regulated, regulatory and ethical responsibilities of the PI, IRB, and University); 5) *Animal Research* (principles and regulations for animal care and use, regulatory and ethical obligations of researchers, reporting requirements, obtaining approval). After completing each module the trainee must achieve PEERRS certification (valid for three years), which is based on passing a short test (5-10 questions) associated with each topic with a score of 80% or better. The Human Subjects modules require a score of 100% to pass. The tests are generated randomly from a bank of questions developed for each module.

Trainee Recruitment

The OE program continues to evolve in its approach to recruitment, focusing increasingly on web-based approaches. We continue to develop the OE website within the UM School of Public Health website and link it to many related sites within the University of Michigan, including the ERC, IH, HSAT, OHN, HSE, the Center for Risk Science and Communication, Toxicology, Environmental Science, and Epidemiology websites. We believe that our website is now the principal portal through which applicants learn about our training program. In addition, we maintain traditional recruiting approaches including advertising in professional journals; printed materials sent to undergraduate colleges, universities, alumni, business, and contacts; and listing our program in traditional graduate school directories such as Peterson's Guide to Graduate schools. We actively recruit racial and ethnic minority students and our recruiting materials emphasize this commitment by the University of Michigan. Our website provides links to student organizations at the SPH that play critical roles in recruiting and retaining minority graduate students including La Salud (a resource for leadership and professional development for Latino/a students) and Public Health Students of African Descent (PHSAD) (a resource for African American students).

F. Future Plans

We plan to continue development of the OE curriculum as the new faculty develop new courses and modify existing courses in response to changing needs of trainees in OE. Drs. O'Neill and Hu will play critical roles in defining new areas of instruction and research. Drs. Franzblau, Hu, O'Neill, Robins, and Garabrant will continue with their ongoing funded research programs, which include:

Case-Control Study Of Leukemia And Lymphomas In An Automobile Transmission Manufacturing Plant. Principal Investigator: Garabrant, David. Sponsor: United Auto Workers/Ford Motor Company National Joint Committee for Health and Safety.

Case-Control Study Of Lung Cancer In Automobile Assembly Plants. Principal Investigator: Garabrant, David. Sponsor: United Auto Workers/Ford Motor Company National Joint Committee for Health and Safety.

Case-Control Study Of Pancreas Cancer Examining The Roles Of DDT And Other Chlorinated Pesticides. Principal Investigator: Garabrant, David. Sponsor: NCI/NIEHS

Cohort Mortality Study Of Automotive Manufacturing Workers in Transmission and Chassis and Stamping Plants. Principal Investigator: Garabrant, David. Sponsor: United Auto Workers/Ford Motor Company National Joint Committee for Health and Safety.

DEARS Recruitment Study. Principal Investigator: Robins, T. Sponsor: EPA

Dioxin Exposure Study Examining Exposure Pathways By Which Environmental Sources Of Dioxins Contribute To Serum Dioxin Levels. Principal Investigator: Garabrant, David. Sponsor: Dow Chemical Company.

Evaluation of Digital Chest Radiographs for Pneumoconioses. Principal Investigator: Franzblau, A. Sponsor: American Schools of Public Health

FAMU and Harvard Center for Health and Health Care Disparities. Principal Investigator: Hu, Howard (of the Center's Research Project). Sponsor: NIH/NCMHD.

Gene-Metal Interactions and Parkinson's Disease. Principal Investigator: Hu, Howard. Sponsor: NIH/NIEHS.

Lead Biomarkers, Aging, and Chronic Disease. Principal Investigator: Hu, Howard. Sponsor: NIH/NIEHS.

Metals Mixtures and Children's Health (Center for Children's Environmental Health and Disease Prevention Research). Principal Investigator: Hu, Howard. Sponsor: NIH/NIEHS.

Michigan Center for the Environmental and Children's Health - Exposure Core. Principal Investigator: Israel, B/Robins TG. Sponsor: NIH/EPA

Post-Offer Screening and Risk Factors for CTS. Principal Investigator: Franzblau, A. Sponsor: Washington University/NIH.

Prospective Cohort Study Of Chlorpyrifos Manufacturing Workers. Principal Investigator: Garabrant, David. Sponsor: Dow Chemical Company.

Research Training in Environmental and Occupational Health in Southern Africa. Principal Investigator: Robins, T. Sponsor: NIH/Fogarty Center.

Study of Lead Exposure & Outcomes Amongst Children in Chennai, India. Principal Investigator: Hu, Howard. Sponsor: NIH/FIC.

United Automobile Workers Hazardous Materials Worker Health and Safety Training
Principal Investigator: Robins, T. Sponsor: International Union, UAW

Additional research proposals are in various stags of planning and seeking funding. We will continue to integrate the departments of Environmental Health Sciences and Epidemiology in research, teaching, faculty interactions, and student interactions. Additional efforts are in

progress to augment our recruitment activities, including website development, outreach at undergraduate campuses, and advertising of our program. We also are developing a network of alumni and mechanisms for career development for our graduates to insure that they have outstanding opportunities upon graduation.

Program Progress Report

A. Hazardous Substance Academic Training Program Area (HSAT)

B. Program Director

Director. Brief highlights of the HSAT Program Director, Prof. S. Batterman, are provided below (please see appendices for more information).

Dr. Batterman is an environmental scientist/engineer with extensive experience in the hazardous substances area, including RCRA and CERCLA applications, through service for Michigan's Site Review Board for its Hazardous Waste Management Act 64, as Advisory Board Member for the Great Lakes Environmental Justice Program, as Technical Advisor for Superfund cleanups and incinerator permitting, and as expert witness and consultant regarding cleanups, CERCLA activities, and risk assessments in both national and international settings. From 2002-5 he served as Associate Editor for ASCE *Journal of Environmental Engineering.* In 2004 he consulted for the World Health Organization on the development of medical waste disposal policies. In 2005-6 he conducted an assessment of hazardous/medical waste incineration in South Africa, and a risk assessment was completed for Durban in 2006. Dr. Batterman regularly provides continuing education courses both nationally and internationally in air sampling, air pollution control, exposure assessment, risk management, and other topics. His expertise includes methods for measuring hazardous substances in air, water, and soil; the transport and fate of volatile organic compounds in air and soils; air toxics; indoor air quality; and exposure and risk assessment. He holds appointments as Professor of Environmental Health Sciences in the School of Public Health and also Professor of Civil and Environmental Engineering in the College of Engineering, both at the University of Michigan.

As HSAT Program Director since program inception in 1993, Dr. Batterman provides program management and participates in all aspects of the program including needs assessment; review, modification and approval of course and program changes; coordination of course schedules; expansion of student recruitment efforts; cross-listing of courses; student advising and assistance in internships; supervision of post-doctoral scientists including those supported under NORA Pilot Projects, and outreach to government, industry, and other organizations. He has substantial interaction with all faculty participating in the HSAT Program. Dr. Batterman is responsible for student advising, recruitment and other academic affairs, and for complying with NIOSH administrative requirements regarding student obligations, progress reports, etc. As former EHS Associate Chair and Curriculum Committee Head, Dr. Batterman is well positioned to facilitate HSAT curriculum initiatives within the Department and school. He teaches courses on "Environmental Management of Hazardous Substances" and "Environmental Impact Assessment" in both the residential and On Job/On Campus offerings.

Faculty. The HSAT Program benefits from the diversity and excellence of participating faculty who are drawn from multiple units at the University. These faculty teach HSAT specialty courses, advise students regarding courses, and provide supervision for field experiences and research. They have shown exceptional commitment to excellence in research, teaching and service, and all have achieved professional recognition for their activities, including tenure. Participating faculty actively publish peer-reviewed papers, technical reports, books and book chapters (sometimes co-authored with HSAT students), and they have extensive national and international service.

C. Program Description

Goals. The overall goal of the UM HSAT Program is to maintain and enhance the specialized

academic program that emphasizes hazardous substance health and safety training for occupational safety and health professionals. The program responds to the well-recognized need for qualified industrial hygiene (IH) graduates specializing in hazardous substances area in the region served by the Michigan ERC. The HSAT Program curriculum provides a comprehensive and solid grounding in the principles and practices of occupational safety and health for professionals in or entering the hazardous substance work force. It complements and extends the IH program by providing training in hazardous substances, including environmental chemistry, impact assessment, exposure and risk assessment, emergency response, 40-hour HAZWOPER training, hazardous substances management, other environmental science and health topics related to hazardous substances and hazardous waste current practice, and research in the IH, environmental health, and hazardous substances area. Program electives can be tailored to the trainee's background and interests. The HSAT Program is devoted to master's level training. Qualified program graduates can pursue doctoral work in IH or elsewhere in the Department of Environmental Health Sciences.

Objectives. Specific objectives of the HSAT Program are to develop both technical and non-technical skills of trainees; integrate concepts and problem-solving approaches from industrial hygiene, engineering and other public health disciplines; provide for trainee recruiting and trainee support (including HAZWOPER training); foster course and program development; and to implement program evaluation.

The curriculum is designed to provide a comprehensive and solid grounding in the principles and practices of occupational safety and health for professionals in or entering the hazardous substance work force. The HSAT Program is designed to: meet industrial hygiene certification requirements; provide measurement and analysis skills (including statistics, epidemiology); provide training and knowledge in management areas (embedded in many courses since program graduates perform management functions such as supervising technical staff, budgeting and allocating resources, developing training, and complying with environmental regulations); and to foster interdisciplinary training. Students also have interdisciplinary and applied experiences, including the mandatory summer Field Experience.

Faculty participation. Contributions to the HSAT program are made by the following faculty: Dr. Edward Zellers, the ERC IH Director who holds appointments in EHS and Chemistry; Dr. Jerome O. Nriagu, an environmental chemist who is Professor in Environmental Health Sciences, Research Scientist in the Center for Human Growth & Development, and Faculty Associate of the Center for African and African American Studies; Dr. James Vincent, former EHS Chair, who is a physicist and hygienist with numerous publications and patents, most in the area of aerosol science. Dr. David Garabrant, who holds joint appointments in EHS and the Department of Medicine and is director of new Risk Science and Communication Center; Dr. Thomas Robins, the ERC director, who has major interests in neurotoxic and nephrotoxic effects of organic solvents, environmental epidemiology, evaluation of H&S training programs, and international health; Dr. Jonathan Bulkley, the Peter M. Wege Professor of Sustainable Systems; Professor of Natural Resources, and Professor of Civil & Environmental Engineering; Dr. Gregory A. Keoleian, Associate Professor in the School of Natural Resources and the Environment and the co-director of the Center for Sustainable Systems. Newly-recruited faculty expected to participate in HSAT program offerings include Drs. John Meeker and Chuanwu Xi, both Assistant Professors of Environmental Health Sciences, and Dr. Olivier Jolliet, Associate Professor of Environmental Health Sciences.

The HSAT Program maintains representation on the external ERC Advisory Committee with members that have outstanding knowledge of HSAT related issues, expertise in chemical emergencies, hazardous waste sites, air monitoring, contaminant containment and clean-up, and occupational health and safety and evaluation. In addition to their generous donation of

time, EAC members such as EPA's Rod Turpin have given lectures/seminars in HSAT courses, employed HSAT trainees as interns, and provided other input to program faculty.

Curriculum. The HSAT curriculum is designed to meet competencies aimed at ensuring that individuals in or entering the hazardous substance work force can contribute to the field at a professional level, and to meet academic accreditation requirements for IH certification. The full-time residential curriculum provides a solid foundation in site remediation, worker protection, hazardous substances management, hazardous waste law, environmental chemistry, environmental impact and risk assessment, and HAZWOPER training. To address these goals, the HSAT curriculum modifies the IH Program curriculum by providing additional course work to provide knowledge, skills and expertise in hazardous substances management, control, regulations, on site response, risk assessment issues, and in-depth treatment of environmental sampling, analysis, monitoring and assessment activities. (The ABET-accredited IH program includes biostatistics, epidemiology, ergonomics, occupational disease, sampling and analysis, toxicology, safety, legal aspects, etc., as described elsewhere in this report.

The HSAT curriculum is shown in Appendix A. This curriculum features a set of core courses, a number of modular sequences, strict sequencing or tracking, a directed field experience, a minimum of 12 credit hours interdisciplinary training shared with other ERC trainees, common seminars, and a number of other features. The specified courses must be taken unless equivalency is demonstrated. Some trainees will be able to waive BIOSTAT 503 and possibly other courses. Modifications to the curriculum may be made based on a student's preparation and goals, subject to approval of the student's advisor and the Program Director. Several requirements have alternatives, permitting flexibility in meeting the special needs of the student, especially for students with existing background. While curriculum demands are high, feedback received from each graduating cohort, input from our Advisory Committee, course evaluations, and other program evaluation activity all indicate the success of this program.

The program includes several courses that provide regional coverage, e.g., field visits to local facilities involved in hazardous waste management. Other courses include advanced computer applications, e.g., CAMEO, ALOHA, RMP*COMP, IEUBK, and SAS. Many courses require PowerPoint presentations, and several require web-based presentations. Students complete off-site Hazardous Materials Incident Response Operations (HAZWOPER) training that meets the requirements of 29 CFR 1910.120. This is arranged at US EPA facilities in Cincinnati, OH, Edison, NJ or elsewhere. The HSAT Program assists trainees with transportation and subsistence expenses to these intensive and high quality courses. All students are also required to complete a Field Experience that provides valuable hands-on experience, typically from May to August at the end of the first year of study. Depending on a student's interest and background, the Field Experience may be in a corporate, government or research setting. The Field Experience represents a directed study activity: agreements are developed and signed by the student, field experience supervisor, and faculty advisor; students complete a proposal, abstract, report and poster, which must be approved; a minimum of 320 hours must be worked, and students and supervisor complete evaluation forms which are reviewed by the student and faculty advisor. No academic credit is given for the Field Experience or HAZOPER training. Finally, a limited number of electives can be added to the curriculum, particularly in the final term for the HSAT-IH program, and students have benefited from courses in engineering, management, industrial ecology, environmental health sciences, and other areas, all drawn from the very large list of offerings at the University of Michigan.

Responsible Conduct of Science. Because of the importance and sensitivity of ethical issues in science, all HSAT trainees (and other EHS students) are required to satisfactorily complete and on-line awareness training modules (and obtain certificates) that address (1) institutional review board procedures (IRB, addressing the use of human subjects in research) and the Health

Insurance Portability and Accountability Act of 1996 (HIPAA, addressing privacy concerns). These and other topics regarding the responsible conduct of science are also discussed in seminar and lecture.

D. Program Activities and Accomplishments

The HSAT Program has demonstrated many successes and accomplishments in the past year. These include recruitment of excellent students; successful and relevant placement in internships and permanent positions in the hazardous substance field for program graduates; attainment of CIH credential for most graduates with sufficient experience; continuation of strong working relationships among participating faculty in multiple schools and colleges at the university; procurement of support and recognition for trainees; sponsorship of visiting faculty and guest lecturers in core HSAT courses; development of distance based learning course/modules; and hiring and mentoring of new faculty who are engaged with the HSAT program;

Trainee honors, awards, scholarships. In the past year, our students have received a number of scholarships and awards, including the following: Second-year student C. Hassinger received a UM Graduate Student Instructor appointment. First-year students P. Dopart and C. Work received scholarships from the School of Public Health.

Faculty honors and awards. In the past year Program Director S. Batterman received a joint appointment as Professor of Civil and Environmental Engineering in the College of Engineering.

New faculty positions. The EHS Department successfully completed four new searches, hiring the following outstanding individuals: Professor H. Hu as Department Chair with interests in epidemiology and metals toxicity; Associate Professor O. Jolliet with interests in exposure and risk modeling; Assistant Professor J. Meeker with interests in exposure assessment including occupational and environmental exposure assessment; and Assistant Professor C. Xi with interests in microbiology and water-borne contaminants. Each of these faculty is contributing to the HSAT curriculum through courses that are either EHS-wide requirements or electives. The HSAT Program Director worked especially intensively with Professors Jolliet and Wu to integrate subject matter into the HSAT curriculum.

The EHS Department also has three additional faculty searches ongoing for the 2006-7 academic year.

New courses. While the HSAT curriculum is rather packed, we have initiated several curriculum initiatives in the past year. These include development of an ERC-wide multidisciplinary course, Management for Occupational & Environmental Health and Safety Professionals; an Advanced Exposure Assessment Course; and an Advanced Risk Assessment Course which may become integrated into the HSAT curriculum. Also, we have continued the evolution of several computer-based courses, including EHS 507 Principles of Exposure Assessment, and EHS 572 Environmental Impact Assessment.

Trainee recruitment and diversity. The current HSAT cohort partially supported by NIOSH funds has five 2nd year students and four 1st year students. This is the largest group of HSAT students we have had at one time. We are proud of the quality and diversity of the HSAT trainees. As mentioned, due to their outstanding academic credentials, several HSAT students have received UM and SPH scholarships. We are committed to diversity and aggressively recruit women and minority students. The current group includes five women. Recruitment objectives, which include student diversity, have benefited from SPH funds that provide tuition support to academically qualified minorities; this is often complemented with HSAT funds to provide a more attractive and competitive package.

E. Program Products

HSAT faculty have had numerous presentations and publications over the project period (See Appendix C for publications and presentations of program faculty and trainees).

HSAT faculty were involved in two continuing education courses, the well-regarded UM CIH refresher course.

HSAT faculty research include externally-funded studies that addressing a number of environmental and occupational contaminants (see faculty biosketches). Of particular note are studies measuring exposures to polybrominated biphenyl ethers, newly recognized contaminants (supported by EPA and the Great Lakes Commission), and studies examining tracers useful for air exchange and passive tobacco smoke exposure (supported by the NIOSH Pilot Project funds).

F. Future Plans

Overall, activities in the next budget period will be similar to those in 2006-7 with most HSAT activity aimed at recruiting and supporting trainees, developing and integrating courses, and procuring external support. Some revisions of HSAT curriculum are anticipated with the new offerings from the newly hired faculty, and the offering of new ERC-wide management course.

In addition, the newly revised On-Job/On-Campus (OJ/OC) program for part-time students starts in October 2006. This program is being offered in ~50% distance-based modality. While no HSAT option is currently planned for the OJ/OC program, it does involve HSAT faculty and it may allow the development of computer-based modules that can enhance the residential HSAT program.

In addition, three new faculty searches are underway that may in the next few years enhance HSAT offerings. We are also further integrating MPH and doctoral program (the latter will not affect HSAT since there is no HSAT doctoral program.)

Finally, the IH Program is undergoing ABET accreditation in 2006-7, with involvement from HSAT faculty.

IIIA. Program Title: Continuing Education and Outreach

This is the annual report for the Continuing Education and Outreach (CE&O) program, addressing July 1, 2005 through June 30, 2006. The Michigan ERC has one funded program covering both Continuing Education (CE) and Outreach, so this annual report section will correspondingly cover both CE and Outreach. There is one centralized CE and Outreach department to serve all Michigan ERC academic areas. This report will integrate the activities for all academic areas.

III.B. Program Director

The Michigan ERC CE&O Program is directed by Mr. Randall Rabourn, who has a strong academic and professional background in occupational health and safety and has directed the Michigan ERC's CE&O program since 1985. He is a Certified Safety Professional and a Certified Professional Ergonomist.

III.C. Program Description

The general goal for Continuing Education and Outreach is to provide current occupational health and safety information to those who can affect workplace health and safety. This audience includes occupational health physicians and nurses, industrial hygienists, safety personnel, managers, supervisory personnel, workers, labor representatives, and various occupational healthcare-related professionals. Specific CE annual goals are to: conduct at least 15 courses annually with at least 2 programs attributable to each of the ERC's core disciplines; train more than 400 people; have 10 ERC faculty and staff participate; and assess continuing education needs via open website surveys or other methods. Specific annual outreach goals include: involve at least 10 ERC faculty and staff in outreach activities by providing academic support, lectures and consults to benefit non-ERC individuals and organizations; exhibit at 1 or more professional conferences; maintain an ERC website to advertise our academic and continuing education activities; and issue email announcements about our programs and activities.

The CE&O program is partially funded by the NIOSH ERC grant, with other support derived from course registration fees. The NIOSH grant provides a base of support (although fractional) for the program director, a conference coordinator and program logistics support personnel. This base is important since it allows us to attract support from other sources, effectively leveraging the NIOSH funding. Our current NIOSH grant does not provide separate budgets for CE and Outreach activities. Most of the CE&O budget is assigned to CE activities and outreach activities are largely conducted by individual faculty and staff with little direct NIOSH financial support.

Further Information about Continuing Education: A dedicated and committed program faculty and support staff conducts the CE programs. These individuals have demonstrated this commitment over many years of active participation in Michigan CE programs. This past year we continued to have strong participation by our ERC faculty as planners, directors and lecturers in our programs. Faculty support is a major strength of our CE activities. Our faculty members have high academic credentials and are nationally and internationally recognized for work performed in their individual areas of expertise. The School of Public Health, the College of Engineering and the School of Nursing which house these individuals, have consistently been ranked among the best in their fields. Detailed biographical and professional information attesting to the excellent reputation and strength of these individuals is included in report sections devoted to the academic disciplines or in the last competing renewal application submitted in 2004. Generalized statements about our faculty include: most are tenured, senior-level faculty members; they are active professionally and are leaders and fellows in national professional organizations; some are involved in regional and

national occupational health and safety standards activities; some are involved in setting up occupational health and safety programs for other nations; and even emeritus faculty continue to participate in our activities.

Our strong and respected ERC faculty allows us to identify, attract and utilize complimentary national and international experts (typically 60-80 annually) for guest lectures and presentations. This expands our ability to cover a broad range of topics in high quality continuing education programs that the Center is proud to sponsor. In the minority of our programs where ERC faculty members are not delivering the course, programs and program faculty are carefully selected, utilizing referrals from reputable sources, such as ERC faculty, colleagues, professional organizations and other ERCs. A further testament to the strength of our faculty comes from course evaluations and surveys where many program attendees indicate that faculty quality is a major reason for attending our programs.

Several of our programs are aimed at multiple core disciplines. This results in fractional counting (and multiple listing) of courses in Tables 12a and 12b, but in no event is a course counted more than once. Even though our ERC has no OM program, physicians are targeted by our multidisciplinary programs and we also direct them to on-line training opportunities offered at other ERCs via our website.

We find it effective to enlist the support of professional groups and universities via program co-sponsorship. This allows us to reach a larger audience by pooling mailing lists and personal contacts and is an important mechanism to leverage NIOSH funding. We secure continuing education credits and issue certificates of attendance to program attendees.

Many different mechanisms of needs assessment are utilized to help shape the courses we offer. We continue to use the results of the large CE survey we conducted and compiled near the end of 2004. We participate in needs assessment surveys administered by the ERC Continuing Education Directors at national occupational health and safety conferences. We also conduct an on-going electronic needs assessment survey on our Michigan ERC website. (A copy is not included here, but can be accessed at www.umcohse.org.) We also participate in the NIOSH ERC website (www.niosh-erc.org) needs assessment survey.

Other needs assessment methods are also important. We have an on-going continuing education and outreach advisory group comprised of regional representatives from occupational health and safety professions. We maintain close ties to national professional organizations to better understand their members' needs and work with those organizations to offer timely programs. At the conclusion of our continuing education programs we request a program evaluation from all program attendees. Attendees indicate areas of interest or need that they or their associates have which could be addressed in future continuing education programs. This feedback also helps us revise on-going programs. We also gather needs information by less formal methods such as interviews with program attendees. Our active and visible faculty gather valuable information through their professional contacts, which is used in program development.

It is improbable that we will be able to offer programs to address the needs of everyone. In cases where individuals have specific needs that we do not address by our programs, we make efforts to align them with other regional ERCs or organizations that can assist them.

Further Information about Outreach: Limited NIOSH funding was available to conduct large scale, organized outreach projects, yet significant activities occurred, many undertaken on an individual faculty and staff member basis. We engage in diversified outreach activities, including: providing educational development support to assist other academic institutions and units with curriculum or research issues; providing lectures and presentations for numerous organizations and agencies on occupational health and safety topics; providing consultations to organizations to assist them in addressing a multitude of safety and health issues; and providing support to individuals and organizations in many non-categorical ways.

III.D. Program Activities and Accomplishments

Continuing Education: The Center provided courses aimed at the four academic core areas of industrial hygiene (IH), occupational medicine (OM), safety engineering (OSE) and occupational health nursing (OHN). 1031 people attended the 18 programs we conducted, resulting in 2910 person days of training. Three of these courses were attributable to OS, 2 to OM, 5 to IH and 8 to OHN. Thirteen ERC faculty and staff participated in these programs. We assessed continuing education needs of our target audience via an open survey on our website and by other means. In short, the Center met or exceeded our annual CE goals stated above. (See tables 12a and 12b for a statistical report on the CE programs conducted, Attachment CE-1 for information about each program, and section III.E for more information about the CE "products.")

Outreach: Twenty ERC faculty and staff provided a mid-year listing of their outreach activities, documenting their participation. We exhibited at 7 professional conferences. We maintained an ERC website. We issued monthly announcements via email to 5500 people about our continuing education and academic programs. These results exceeded our annual outreach goals. A summary of selected accomplishments follow. Detailed listings of individual faculty and staff activities are provided as Attachment CE-2 to this report.

Educational Development: OM and IH faculty are the foundation for the Michigan Fogarty International Center Programme in Environmental Health Sciences. This large-scale, non-ERC funded project's purpose is to develop the occupational and environmental health infrastructure and expertise in Southern Africa and involves: 1) financial and intellectual support for candidates from the Southern African Development Community (SADC) for MPH and PhD programs at the University of Michigan, 2) short-term focused training for SADC researchers and health professionals, 3) sponsoring SADC candidates for postgraduate programs at partner institutions in Southern Africa, 4) sponsoring mid-level researchers at SADC institutions, 5) developing web-based learning programs and 6) organizing and funding short-term training courses and conferences in Africa.

Individual faculty representing all core disciplines assisted non-occupational health and safety departments within the University of Michigan by supplying lectures, advice and mentoring of students related to occupational health and safety issues. Of particular note is the IH faculty's support of the Chemistry Department in these areas plus student recruitment. Other institutions and organizations benefited from ERC support for curriculum development (academic or continuing education) or research support. These would include: University of Cincinnati, Northwest Ohio Association of Occupational Health Nurses, Tulane (recent disruption due to Katrina), Marquette University, Virginia Tech, Colorado State University, University of Alabama Birmingham and others.

Presentations/Lectures/Awareness Seminars: Numerous presentations and lectures were delivered by faculty and staff from all core disciplines on a variety of occupational health and safety topics. A partial list of recipients include: Michigan Occupational and Environmental Medicine Association, NIEHS/EPA, Michigan Society of Toxicology, Michigan Department of Community Health, Wayne State University, Washington University, Army Automotive Research Center, Society of Automotive Engineers, the United Auto Workers Union, construction trades union, Optimizing Global Health through Nursing Science conference, International Council of Nursing 23rd Quadrennial Congress, Midwest Nursing Research Society, American Psychological Association and five small companies in Michigan.

Consultations: Many organizations received consultation support from individual faculty and staff members from all core disciplines. A partial list of activities include: workplace or work system analysis and design support; assist panels, companies, organizations and governments in developing occupational health and safety policies or evaluating impact studies; research support; and legal and management support. Recipients of these consults were both regional and national/international in scope and impacted thousands of workers. Examples of regional recipients

include: University of Michigan employee health and safety departments; Michigan OSHA; Michigan-based automakers; United Auto Workers union; Society of Automotive Engineers; Korean Drycleaners Association in Michigan; numerous large companies and more than 10 small Michigan companies. Examples of national or international recipients include: NIOSH; NIDCD; OSHA; National Research Council; United Steel Workers union; US Army; World Health Organization; US National Academies; University of Capetown; University of KwaZulu-Natal; University of Sao Paulo College of Nursing; Pusan National University; EulJi University School of Nursing; and several large companies.

Other Outreach Activities: The University of Michigan conducts a sizable training and service project for small businesses in Michigan. This project, funded by a Consultation, Education and Training (CET) grant from the state of Michigan is led by Michigan ERC faculty and staff from the College of Engineering. This outreach activity assists a state agency, Michigan OSHA, by providing on-site ergonomics training to approximately 200 people annually (not included in Tables 12a and 12b). This project also provides state employers with professional service to identify high-risk workplaces and to assist in developing systems to improve working conditions to lessen the risk of musculoskeletal injuries. This project is a valuable resource to Michigan OSHA consultants who provide support to regional companies beyond our direct contact. This on-going project has reached more than 2400 people in on-site seminars and over 6000 people via CD-ROM training. NIOSH budget is not used directly for these activities, but the infrastructure provided by the ERC grant is instrumental in obtaining the CET grant.

We maintain a 5500+ member email listserv system to reach large numbers of individuals via e-mail quickly and inexpensively. We use this outreach tool to inform many people about our ERC activities via a monthly announcement. We also maintain a Michigan ERC website to provide visitors with academic and continuing education information and we field website-related telephone and internet inquiries, providing ad-hoc service to individuals in a wide variety of organizations. It is difficult to make an estimate of the actual number of these inquiries, but the number is large.

We cosponsor the Applied Ergonomics Conference with the Institute of Industrial Engineers, bringing an academic perspective to a conference devoted to 600 ergonomics practitioners. We also cosponsor the Digital Human Motion conference with the Society of Automotive Engineers, providing an occupational health perspective to a traditional engineering audience. We staffed exhibits at the national conferences of the Human Factors and Ergonomics Society, American Industrial Hygiene Association, American Society of Biomechanics, Applied Ergonomics Conference, International Ergonomics Association and the American Association of Occupational Health Nursing to promote academic and continuing education opportunities. We also exhibited regionally at the Michigan Safety Conference. We develop and maintain two computer software programs for evaluating workplace musculoskeletal requirements which have over 4000 licensees, and discount this software to academic institutions. An IH faculty member received a patent for a “microelectromechanical heating apparatus,” moving research information into practice.

The Center entertains visitors and conducts occupational health and safety awareness programs and tours of our facilities. Several OSE faculty and staff arranged tours and presentations for over 300 high school students and parents exploring career opportunities, several with a focus on attracting minority groups and women to engineering. Individuals in the OSE and IH disciplines wrote articles or were interviewed for the general public.

Individuals from all ERC core disciplines served in advisory roles to professional organizations and national research organizations and served on editorial boards. This past year, an ERC individual associated with the OSE core co-chaired the Michigan OSHA ergonomics standard Advisory Board and an OM faculty member helped plan and presented at the NORA town hall meeting in Chicago.

III.E Program Products

The products of the CE&O program are the courses and programs we conduct. This past year we conducted 18 courses or programs. Space does not permit a detailed description of each product here, but a summary of each is provided in Attachment CE-1.

There are several programs (products) or program issues deserving special mention. A new program addressing ultrafine particle hazards, Aerosol Characterization: Hard Rock Mining to Nanotechnology, was conducted at the Michigan Safety Conference. This program was made possible by special NIOSH funding for NORA activities. Another new program, Preventing and Managing Workplace Musculoskeletal Disorders, was conducted in conjunction with the ERC at UCLA in June. This initial collaborative effort was successful and plans are underway to expand this effort to address issues affecting low-wage workers. This past year we offered an unusually large number of nursing programs, due in part to the new Principles of Workers Compensation and Disability Case Management offering and a series of 4 courses conducted at the national occupational health nursing conference. In addition to registration fee-paying attendees, we were able to offer 30 scholarships to Michigan small businesses to attend our Ergonomics Principles for Workplace Assessment and Design course. Scholarship funding came from the State of Michigan CET grant (described earlier). The CE infrastructure provided by the ERC grant is important in obtaining this state funding to further serve regional needs.

III.E Future Plans

The annual goals for CE and Outreach developed as a part of our last competing renewal (and summarized in III.C of this report) will remain in effect for the upcoming reporting year, July 1, 2006 through June 30, 2007.

Continuing Education: Several of the CE programs offered in the past year and described in Attachment CE-1 will be offered again in the upcoming year. Some of these programs will have completely new content, such as the Industrial Hygiene Discussional, the Ergonomic Inverventions and Research program, the NORA Symposium, and the Preventing and Managing Workplace Musculoskeletal Disorders program. In addition, new programs in name and content are planned for the upcoming year, including: Biomechanical Job Analysis, Physical Assessment for the Occupational Health Nurse, Occupational Biomechanics Symposium: Celebrating 35 Years of Progress and Looking Toward the Future, and Developing Accommodations for Employees with Physical Impairments.

This aggressive slate of new programs or program content is typical for our ERC. We will use our current CE&O administrative staff to manage these programs and will collaborate with other organizations to leverage our resources. ERC faculty and staff will take active roles in directing and teaching these programs.

Outreach: A wide variety of outreach activities will be accomplished by ERC faculty and staff on an individual performance basis, similar to those described in this report and listed in Attachment CE-2. We will assist universities and other organizations with educational and consultative support and will provide presentations to promote occupational health and safety. We will exhibit at multiple occupational health and safety conferences over the next year to recruit academic and continuing education students. We plan to update our ERC website. We will continue our monthly email correspondence with the growing number of people on our listserv system. We have recently been awarded a renewal of our State of Michigan CET grant to provide ergonomics training and service to small Michigan companies. This will allow us to continue our outreach work with these companies throughout the upcoming reporting year.

IV. Report on Specific Improvements in OS&H Resulting from ERC Programs

Overview. ERC faculty have carried out a wide array of research studies, consultations, technology transfers, and training programs regionally, nationally, and internationally, that have had direct beneficial impacts on practices leading to improved worker health and safety. A majority of these can be characterized as Research-to-Practice (R2P) activities.

U.S. Based Projects:

- The U of M Center for Ergonomics, in cooperation with the State of Michigan, provides ergonomics consulting and training services to small and medium-sized companies. In a typical year, we are able to respond to approximately 12-15 requests for in-plant assistance. During the 2005-06 reporting year, we started a new initiative by involving our Ph.D. students in this program.
- Professors Barry Kantowitz and Paul Green, in conjunction with The University of Michigan Transportation Institute are involved with multiple studies to improve the safety performance of both commercial and passenger vehicles. Because highway crashes continue to be the leading cause of occupational fatalities in the United States, this research has important benefits to the safety of the American workforce.
- Professors Don Chaffin and Bernard Martin are working with a consortium of private sector and federal sponsors (including the Dept. of Defense) in the development and implementation of computer aided tools for the high fidelity modeling of human motions and activities. These models can be used pro-actively in job design, providing a safer workplace for American workers and military personnel.
- Professors Yili Liu and Nadine Sarter are involved in several projects on the topic of multi-task cognitive modeling. A major goal of this research is to reduce errors and improve human performance and systems safety on jobs that require complex human-machine interactions.
- Professor Thomas Robins and doctoral student Mr. Aaron Sussell have worked closely with Adjunct Associate Professor Gordon Reeve, Chief of Epidemiology for the Ford Motor Company, to develop and implement recommendations for the prevention of contact dermatitis among the automotive assembly workers. These recommendations, based on findings of Mr. Sussell's doctoral dissertation "Incidence and Risk Factors for Occupational Contact Dermatitis among Automobile Assembly Workers", have been presented to management and union representatives leading to implementation of improved products selection, improved work practices and improved use of personal protective equipment (gloves and sleeves).
- Dr. Batterman regularly provides continuing education courses both nationally and internationally in air sampling, air pollution control, exposure assessment, risk management, and other topics.
- Dr. Hong received funding of an RO1 Grant proposal to develop an expert system intervention to prevent noise-induced hearing loss in firefighters.

Notable impacts on International OHS. Professor Robins is the Director of the University of Michigan/Fogarty International Center Southern African Program in Training and Research in Environmental and Occupational Health (ITREOH). This large-scale, non-ERC funded project's purpose is to develop the occupational and

environmental health infrastructure and expertise in Southern Africa. Methods include, among several others, financial and intellectual support for candidates from the Southern African Development Community (SADC) for MPH and PhD programs at the University of Michigan, and direct funding of research by junior to mid-level researchers at SADC institutions. Fogarty trainees coming to the University of Michigan benefit enormously from the strong research and training environment that the ERC grant funds play a major role in creating and maintaining. This ITREOH grant has a solid track record of translating the results of research into public health practice including influencing the development and implementation of health policies. For example, the research conducted by Dr. Mohamed Jeebhay as a Fogarty UM doctoral student under the direction of Professor Robins on occupational seafood allergies and asthma has contributed directly to the content of the regulations on Hazardous Biological agents promulgated under the Occupational Health and Safety Act in South Africa. His research on baker's asthma has contributed toward a downward revision of the current exposure standards for flour dust. The first study of air pollution and health effects in the South Durban Industrial Basin (South Africa), which formed the basis for the Masters theses of two Fogarty funded students, found that children with persistent asthma were experiencing increased symptoms and decreased lung function with the elevations of SO2, PM10 and NO2 at levels well within international standards. These findings played a significant role in decisions by the two major oil refinery in the basin to take steps to substantially reduce emissions to improve air quality in the area. A third example is the study of mercury contamination from a large industrial facility outside of Durban conducted by one of the Fogarty trainees (Jacques Oosthuizen). The findings of this study, that mercury levels were relatively low in fish being consumed downriver from the plant but very high in water immediately adjacent to the plant, drove related remediation and lifestyle recommendations.

Professor Batterman conducted an assessment of hazardous/medical waste incineration in South Africa, and a risk assessment was completed for Durban in 2006, both leading to specific recommendations which are currently under implementation.

Outreach and consultation. Many organizations received consultation support from individual faculty and staff members across all core disciplines. A partial list of activities include: workplace or work system analysis and design support; assistance to panels, companies, organizations and governments in developing occupational health and safety policies or evaluating impact studies; research support; and legal and management support. Beneficiaries of these consults were both regional and national/international in scope resulting in positive impacts on thousands of workers. Examples of regional recipients of consultations include: University of Michigan employee health and safety departments; Michigan OSHA; Michigan-based automakers; United Auto Workers Union; Society of Automotive Engineers; Korean Drycleaners Association in Michigan; numerous other large companies and more than 10 small Michigan companies lacking in the in-house expertise to address OHS issues. Examples of national or international recipients include: NIOSH; NIDCD; OSHA; National Research Council; United Steel Workers Union; US Army; World Health Organization; US National Academies; University of Cape Town; University of KwaZulu-Natal; University of Sao Paulo College of Nursing; Pusan National University; EulJi University School of Nursing; and several large companies.

Required Curricula: Industrial Hygiene MPH

School of Public Health Core Requirements

Select one of the following

BIOSTAT 503	(4)	Introduction to Biostatistics
BIOSTAT 553	(4)	Applied Biostatistics
STAT 400	(4)	Applied Statistical Methods

Select one of the following

EPID 503	(3)	Strategies and Uses of Epidemiology
EPID 601	(5)	Principles and Methods in Epidemiology

MPH School of Public Health Requirements*

Competency in Biostatistics, Epidemiology, Environmental Health Sciences, Health Behavior and Health Education and Health Management and Policy

Environmental Health Sciences Departmental Core Requirements

BIOSTAT 523	(3)	Biostatistical Analysis for Health-Related Studies
EHS 501	(2)	Occupational and Environmental Disease
EHS 506	(2)	Principles of Toxicology
EHS 507	(2)	Principles of Exposure Assessment
EHS 508	(2)	Principles of Risk Assessment
EHS 600	(1)	Professional Perspectives in Environmental Health
EHS 688	(1)	Topics in Environmental Health Sciences

Field Experience (see EHS field experience guidelines)

Industrial Hygiene Core Requirements

EHS 550	(3)	Principles of Industrial Hygiene
EHS 581	(1)	Principles of Radiological Health
EHS 652	(3)	Evaluation of Chemical Hazards
EHS 653	(3)	Environmental Sampling and Analysis Laboratory
EHS 654	(3)	Ventilation for Contaminant Control
EHS 658	(1)	Physical Hazards
EHS 668	(1)	Professional Seminars in Occupational Health
EHS 757	(2)	Occupational Health Aspects of Industrial Processes
IOE 539	(3)	Occupational Safety Engineering
EHS 556	(3)	Occupational Ergonomics

Sample Schedule: Industrial Hygiene MPH

Year 1, Term I (Fall)		
Select one (1) of the following		4
BIOSTAT 503	Introduction to Biostatistics	
BIOSTAT 553	Applied Biostatistics	
EHS 506	Principles of Toxicology	2
EHS 507	Principles of Exposure Assessment	2
EHS 550	Principles of Industrial Hygiene	3
EHS 652	Evaluation of Chemical Hazards	3
EHS 688	Topics in Environmental Health Sciences	1
EHS 757	Occupational Health Aspects of Industrial Processes	2
	Credits	**17**
Year 1, Term II (Winterl)		
BIOSTAT 523	Analytical Health Related Studies	3
EHS 654	Ventilation Contaminant Control	3
EPID 503	Strategies and Uses in Epidemiology	3
EHS 688	Topics in Environmental Health Sciences	
EHS 653	Environmental Sampling and Analysis Laboratory	3
EHS 556	Occupational Ergonomics	2
EHS 581	Radiological Health	1
	Credits	**15**
Year 1, Spring/Summer		
FIELD EXPERIENCE		
HAZWOPER TRAINING		
Year 1, Term I (Fall)		
EHS 508	Principles of Risk Assessment	2
EHS 600	Professional Perspectives in Environmental Health	1
EHS 658	Physical Hazards	1
IOE 539	Occupational Safety Engineering	3
HBHE 600	BIC Requirement (HBHE)	3
	Electives	4
	Credits	**14**
Year 1, Term I (Winter)		
EHS 501	Occupational and Environmental Disease	2
EHS 668	Occupational Health Seminar	1
HMP XXX	BIC Requirement (HMP)	3
	Electives	8
	Credits	**14**
	GRAND TOTAL	**60**

Required Curricula: Industrial Hygiene MS

School of Public Health Core Requirements

Select one of the following

BIOSTAT 503	(4)	Introduction to Biostatistics
BIOSTAT 553	(4)	Applied Biostatistics
STAT 400	(4)	Applied Statistical Methods

Select one of the following

EPID 503	(3)	Strategies and Uses of Epidemiology
EPID 601	(5)	Principles and Methods in Epidemiology

Environmental Health Sciences Departmental Core Requirements

BIOSTAT 523	(3)	Biostatistical Analysis for Health-Related Studies
EHS 501	(2)	Occupational and Environmental Disease
EHS 506	(2)	Principles of Toxicology
EHS 688	(1)	Topics in Environmental Health Sciences*
EHS 698	(3)	Research
EHS 699	(1)	Masters Thesis

Industrial Hygiene Core Requirements

EHS 550	(3)	Principles of Industrial Hygiene
EHS 556	(2)	Occupational Ergonomics
EHS 652	(3)	Evaluation of Chemical Hazards
EHS 653	(3)	Environmental Sampling and Analysis Laboratory
EHS 654	(3)	Ventilation for Contaminant Control
EHS 658	(1)	Physical Hazards
EHS 668	(1)	Professional Seminars in Occupational Health
EHS 698	(4)	Research
IOE 539	(3)	Occupational Safety Engineering

Sample Schedule: Industrial Hygiene MS

Year 1, Term I (Fall)		
Select one (1) of the following		4
BIOSTAT 503	Introduction to Biostatistics	
BIOSTAT 553	Applied Biostatistics	
EHS 506	Principles of Toxicology	2
EHS 550	Principles of Industrial Hygiene	3
EHS 652	Evaluation of Chemical Hazards	3
EHS 688	Topics in Environmental Health Sciences	1
	Credits	**13**
Year 1, Term II (Winter)		
BIOSTAT 523	Analytical Health Related Studies	3
EHS 654	Control of Airborne Contaminants	3
EHS 501	Occupational and Environmental Disease	2
EHS 688	Topics in Environmental Health Sciences	
EHS 653	Environmental Sampling and Analysis Laboratory	3
EHS 698	Research	2
	Credits	**13**
Year 1, Term I (Fall)		
EHS 658	Physical Hazards	1
IOE 539	Occupational Safety Engineering	3
	Elective	3
EHS 698	Research	3
	Credits	**10**
Year 1, Term I (Winter)		
EHS 556	Occupational Ergonomics	2
EHS 668	Occupational Health Seminar	1
EPID 503	Strategies and Uses in Epidemiology	3
	Cognate	3
EHS 698	Research	2
EHS 699	Masters Thesis	1
	Credits	**12**
	GRAND TOTAL	**48**

DOCTOR OF PHILOSOPHY (Ph.D.)
(Industrial Health – Industrial Hygiene)

Departmental Course Requirements

Select one of the following		
BIOSTAT 503	(4)	Introduction to Biostatistics
BIOSTAT 553	(4)	Applied Biostatistics
STAT 400	(4)	Applied Statistical Methods
Select one of the following		
EPID 503	(3)	Strategies and Uses of Epidemiology
EPID 601	(4)	Principles and Methods in Epidemiology
BIOSTAT 523	(3)	Biostatistical Analysis for Health-Related Studies
EHS 688	(1)	Topics in Environmental Health Sciences[1]
EHS 899	(6)	Advanced Research
EHS 869	(1)	Doctoral Seminar in Environmental Health Sciences[2]

[1]EHS 688 is a departmental seminar that students register each Fall Term until they have passed their DQE. It is expected that they will attend seminars throughout their doctoral program but they do not have to officially register.

[2]EHS 869 is a doctoral seminar that students register for until they have passed their DQE. Upon completion of their DQE, they will present a seminar once a year until completion of their doctoral program. It is expected that they will attend the seminars throughout their doctoral program but do not need to register after successfully passing the DQE.

Major Area Course Requirements

Industrial Health

EHS 501	(2)	Occupational and Environmental Disease
EHS 507	(2)	Principles of Exposure Assessment
Must select two of the following		
EHS 550	(3)	Principles of Industrial Hygiene
EHS 652	(3)	Evaluation of Chemical Hazards
EHS 654	(3)	Ventilation of Contaminant Controls
EHS 556	(3)	Occupational Ergonomics

Minor Area Course Requirements

No formal course requirements for a minor area are required. However the student should have the equivalent of 5 credit hours of coursework. The student and academic advisor will submit to the Student Services office a plan stating the minor and how the student will meet course requirements whether by previous or current coursework. The Doctoral Committee will review and approve the plan. This should be done within the first term of enrollment.

Required courses in the residential and OJOC MPH curricula (beginning in Fall, 2006).

Course		Year, Semester		Breadth	Industrial Hygiene	
		Residential	OJOC		Core	Related
BIOST 503	Introduction to Biostatistics	Fall Term – Year 1	Year 1	4		
EHS 506	Principles of Toxicology	Fall Term – Year 1	Year 1			2
EHS 507	Principles of Exposure Assessment	Fall Term – Year 1	Year 1		1	1
EHS 550	Intro to Occup. and Environ. Health	Fall Term – Year 1	Year 1		3	
EHS 652	Evaluation of Chemical Hazards	Fall Term – Year 1	Year 2		3	
EHS 658	Physical Hazards	Fall Term – Year 1	Year 2		1	
EHS 688	Topics in Environ Health Sciences	Fall Term – Year 1	Year 1 & 2			1
BIOST 513	Appl Regression Anal.: Public Hlth Studies	Winter Term – Year 1	Year 1 & 2	4		
EHS 501	Occupational and Environmental Disease	Winter Term – Year 1	Year 2		1	1
EHS 508	Principles of Risk Assessment	Winter Term – Year 1	Year 1		1	1
EHS 654	Control of Exposure to Airborne Contaminants	Winter Term – Year 1	Year 2		3	
EPID 503	Strategies and Uses in Epidemiology	Winter Term – Year 1	Year 1	3		
EHS 668	Occupational Health Seminar	Winter Term – Year 1	Year 1 & 2		1	
EHS 653	Environ. Sampling and Analysis Lab (OJOC students will take for 1 credit)	Winter Term – Year 1	Year 2		3 (1)	
	Field Experience	Spr/Sum – Year 1			3	
EHS 698	Research/Integrated Work Project		Year 1 & 2		4	
EHS 600	Professional Perspectives in Environ. Health	Fall Term – Year 2	Year 2		1	
EHS 688	Topics in Environ Health Sciences	Fall Term – Year 2				1
IOE 539	Occupational Safety Engineering	Fall Term – Year 2		3		
EHS 552	Occupational Safety		Year 2			
HBHE 600	Psychosocial Factors in Health Behavior	Fall Term – Year 2	Year 1	3		
EHS 757	Occ. Health Aspects of Industrial Processes	Fall Term – Year 2			2	
HMP 653	Law and Public Health	Winter Term – Year 2		3		
HMP 617	Understanding Health Care Organizations		Year 2			
EHS 556	Occupational Ergonomics	Winter Term – Year 2	Year 2			2
EHS 581	Radiological Health	Winter Term – Year 2	Year 2		1	
NURS 606	Management of OEHS Professionals	Winter Term – Year 2	Year 1 & 2		2	
EHS 570	Water Quality Management		Year 2			3
EHS 572	Environmental Impact Assessment		Year 2			2
EHS 574	Environmental Chemistry		Year 1			3

Sample schedule for the OJOC IH MPH degree program (starting in Fall, 2006).

				Year	2006			2007														2008							
				Month	Nov	Dec		Feb		Apr		Jun		Jul		Sep		Dec		Feb		Apr		June	Total	Total	Total
				Days	8-12	7-10	DL	8-11	DL	12-15	DL	7-10	DL	26-29	DL	27-30	DL	6-9	DL	7-10	DL	3-6	DL	5-8	OC	DL	
Course	Cr.	Title	Instructor																										
BIO 503	4	Biostatistics	Staff		6	6	6	6	6	2															20	12	**32**
EPID 503	3	Epidemiology	Johnson		4	4	4	4	4	4	4	4	2												20	14	**34**
EHS 507	2	Principles Exposure Assessment	Robins		6	4	4	4	4																14	8	**22**
EHS 506	2	Principles Toxicology	Richardson		6	6	6	2	2																14	8	**22**
EHS 574	3	Environmental Chemistry	Nriagu		4	6	6	4	6	4	2														18	14	**32**
EHS 550	3	Occupational & Environ Health	Vincent		4	4	4	4	4	4	2	4	2												20	12	**32**
HBHE 600	3	Principles of Health Behavior	Sonnega					4	2	4	2	4	2	2											14	6	**20**
EHS 508	2	Risk Assessment	Garabrant					1	2	4	6	4	2	2											11	10	**21**
NURS 606	2	Management for OSEH Professionals	Brush							2	6	3	4	2	4										7	14	**21**
BIO 523	3	Health Related Studies Biostatistics	Staff							3	6	4	6	6	6	2									15	18	**33**
EHS 570	3	Water Quality Assessment& Management	Xi							2	2	4	6	4	6	4	2								14	16	**30**
HMP 617	3	Understanding Health Care Organizations	Banasak Holl									2	6	4	4	4	4	2							12	14	**26**
EHS 501	2	Occupational and Environmental Diseases	Franzblau											4	4	4	4	4	2						12	10	**22**
EHS 652	3	Evaluation of Chemical Hazards	Zellers											2	4	4	6	4	6	6	**2**				16	18	**34**
EHS 653	1	Environmental Sampling & Analysis Lab	Staff													6	2	4	2	4	2	4			18	6	**24**
EHS 658	1	Physical Hazards	Meeker													2	2	2	2	2	2	2			8	6	**14**
EHS 654	3	Control Occ & Env Contaminants	Vincent													3	4	4	4	4	4	6	2		17	14	**31**
EHS 681	1	Radiological Health	Miklos															2	2	2	2	2	2		6	6	**12**
EHS 572	2	Environmental Impact Assessment	Batterman															1	4	2	4	4	4	4	11	12	**23**
EHS 556	2	Occupational Ergonomics	Joseph															1	2	4	4	6	2	4	15	8	**23**
EHS 552	3	Occupational Safety	Staff															1	4	4	6	5	6	6	16	16	**32**
EHS 698/600	5	IWP Project	Staff																					8	8	0	**8**
EHS 688	1	Topics in Environmental Health Sciences	Staff					1		1		1		1		1		1		1		1		8	16	0	**16**
	57	-Credit hours in program	Hours in Month		30	30	30	30	30	30	30	30	30	27	28	30	24	26	28	29	26	30	16	30			
			Courses in Month		6	6	6	8	8	9	8	8	8	8	6	8	7	10	9	8	8	8	5	5			

APPENDIX A

OHN PROGRAM PLAN/CURRICULUM

Nursing Core Courses (total: 10 credits)

N532 (3 credits)	Theoretical Base for Advanced Nursing Practice
N535 (3 credits)	Strategy for Nursing and Health Care
N536 (2 credits)	Utilization of Nursing Research in Advanced Practice
N699 (2 credits)	Synthesis Project

Nursing Specialty Courses (total: 17 credits)

N537 (3 credits)	Health Promotion and Risk Reduction Across the Life Span
•N563 (4 credits)	Community Health Nursing and Population Assessment
*N572 (2 credits)	Current and Emerging Issues in Occupational Health Nursing
•N686 (4 credits)	Intervention for Aggregates and Populations
•N687 (2 credits)	Managing Community/Worksite Based Systems - Practicum
**N606 (2 credits)	Management for Occupational and Environmental Health and Safety Professionals

Required Occupational Health Specialty Cognates (total: 20 credits)

BIOS 503 (4 credits)	Introduction to Biostatistics
EHS 501 (2 credits)	Occupational and Environmental Diseases
EHS 510 (2 credits)	Occupational Toxicology
EHS 550 (2 credits)	Principles of Environmental and Occupational Health
EHS 552 (3 credits)	Occupational Safety
EHS 556 (3 credits)	Occupational Ergonomics
EHS 668 (1 credit)	Occupational Safety and Health Seminar
EPID 503 (3 credits)	Strategies and Uses of Epidemiology

Total Credits: 47

OHN COURSE DESCRIPTIONS

Nursing Core Courses

N532 (3 cr.) Theoretical Base for Advanced Nursing Practice. (Instructor: E. Beattie)

This course focuses on critical analysis of theory and the utilization of various levels of nursing theory as a base for nursing practice. It further examines the inter-relationship of theory, research and practice in the development of the scientific body of nursing knowledge. The process of theory analysis and evaluation is utilized to design theory-based practice and to develop a theoretical perspective to formulate potential research questions.

N535 (3 cr.) Strategies for Nursing and Health Care. (Instructor: P. Kalisch)

This course is designed to provide students as present and future leaders with a political, economic, and financial understanding of the health care industry. In addition, fundamentals of strategic planning are introduced to facilitate the merging of the financial side of patient care with the clinical dimension. Fundamental changes in industry structure brought about by the growth of alternate health care delivery models and other aspects of health care reform will also be stressed.

N536 (2 cr.) Utilization of Nursing Research in Advanced Practice. (Instructor: O. Hong)

The goal of this course is to promote research-based nursing practice. The course focuses on the critical analysis of scientific knowledge related to clinical problems. An understanding of the research process, applicable theories, organizational dynamics, and leadership functions are applied to design and plan a process of implementing research in health care settings.

N699 (2 cr.) Synthesis Project. (Instructors: V. Barkauskas/S. Clemen-Stone/O. Hong/ J. Morris/P. Strasser)

All master's degree students are required to engage in a culminating experience which synthesizes relevant domains of knowledge and makes a contribution to generation or application of knowledge to enhance practice, education, theory, or policy. A choice of subject and approach facilitates relevance to students' career goals. A final scholarly product must be generated as a result of the experience. Students may choose among projects that focus on research, practice or health policy. This course is required for all master's students. Although students may need to register for additional credits to complete the project, no more than 2 credit hours may be used for the graduation requirement.

Nursing Specialty Courses

N537 (3 cr.) Health Promotion and Risk Reduction Across the Life Span. (Instructor: V. Barkauskas)

This course is required for all students in the Division of Health Promotion and Risk Reduction. It focuses on developing a framework for advanced nursing practice

considering theoretical perspectives, environments which influence health, and various intervention strategies for health problems identified in the Health Objectives.

N563 (4 cr.) Community Health Nursing and Population Assessment. (Instructors: S. Clemen-Stone/O. Hong)

Students examine the field of community health nursing and their selected subspecialty roles and standards of practice, e.g., occupational health nursing, home health care, or public health nursing, within the context of community-and aggregate-directed health services. A major focus is on the assessment and analysis of the health of population groups and their environments using community assessment and needs assessment perspectives. Methods of obtaining health and environmental assessment data from multiple sources, including mechanisms of obtaining information from populations served, and methods of data analysis and presentation are applied.

Community is considered in its broadest sense and includes geopolitical jurisdictions, worksites, schools, and distinct cultural neighborhoods. Students apply community and needs and assets assessment techniques to community health nursing and occupational health nursing practice.

N572 (2 cr.) Current and Emerging Issues in Occupational Health Nursing (Seminar). (Instructors: O. Hong/P. Strasser)

These seminars focus on the current and emerging issues in occupational health nursing practice. Factors affecting occupational health services to worker populations are explored, and students analyze the history and current and future practice of occupational health nursing.

N686 (4 cr.) Intervention for Aggregates and Populations (Lecture/Clinical). (Instructors: V. Barkauskas/O. Hong)

This course builds on the community assessment theories and skills obtained in N563, and focuses on program planning, implementation, and evaluation for community-based groups. The course provide students with an opportunity to collaboratively design, implement, and evaluate a community-based, health-oriented intervention that targets a selected objective for a specific population. In collaboration with faculty and providers in the target population, such as a geopolitical jurisdiction, a worksite, a school, or a distinct cultural neighborhood, students will tailor their interventions to be culture- and gender-sensitive and developmentally appropriate. Students will implement their interventions in the context of their subspecialties (e.g., community care, occupational health, and home health care). Students will complete a practicum and use other forms of experiential learning and dialectical seminars to accomplish course objectives.

N687 (2 cr.) Managing Community/Worksite Based Systems - Practicum (Clinical). (Instructors: J. Morris/P. Strasser)

This clinical course provides students with the opportunity to critically examine the specific functions of nurse managers in occupational health. Particular focus will be placed on helping students to understand and respond to factors in rapidly changing environments which affect occupational health services delivery and related

organizational and managerial strategies. Principles and practices of human resource management, resource allocation, and services management will be emphasized. Clinical practice in community/worksite based systems enhances the students' ability to critically analyze role responsibilities of nurse managers and personal leadership style.

N606 (2 cr.) Management for Occupational and Environmental Health and Safety (OEHS) Professionals (Seminar). (Instructors: J. Morris/P. Strasser)

This seminar course provides students with the opportunity to critically examine the specific functions of OEHS managers in a variety of worksites. Particular focus will be placed on helping students to understand and respond to factors in rapidly changing environments, which affect OEHS services delivery and related organizational and managerial strategies. Application of fundamental management principles and practices of human resource management, financial management and resource allocation, and services management will be emphasized. Case studies will enhance the students' ability to critically understand and analyze role responsibilities of OEHS managers and personal leadership styles.

Required Occupational Health Specialty Cognates

BIOS503 (4 cr.) Introduction to Biostatistics.

Fundamental statistical concepts related to the practice of public health: descriptive statistics; probability; sampling; statistical distributions; estimation; hypothesis testing; chi-square tests; simple and multiple linear regression; one-way ANOVA. Use of the computer in statistical analysis.

EHS501 (2 cr.) Occupational and Environmental Diseases.

Selected topics in the diagnosis, treatment and prevention of environmental and occupational disease, including coverage of toxins, exposures, organ systems, and disease. Lectures and case studies address exposures to solvents, radon, lead and other metals, asbestos and other pneumoconiotic dusts, outdoor air pollution, indoor air quality, and noise. Major health effects and disease categories covered include cancer, respiratory disease, and reproductive health.

EHS510 (2 cr.) Occupational Toxicology.

Dose response relationship; uptake, distribution, metabolism and excretion of toxic substances in the body; toxicokinetics; biotransformation; selected examples or organ toxicity or concern to occupational physicians; chemical carcinogenesis; chemical mutiagensis; short and long-term assays; and evaluation of toxicity.

EHS550 (2 cr.) Principles of Environmental and Occupational Health.

Basic concepts of industrial hygiene and occupational health hazards. Physical, chemical and radiological health stresses of the industrial environment; sources, effects, measurement, evaluation and control of exposure. The course is also offered as a three credit course in both the regular term and in the OJ/OC format.

EHS552 (3 cr.) Occupational Safety.

Design/modification of machinery/products to eliminate or control hazards arising out of mechanical, electrical, thermal, chemical, and motion energy sources. Application of retrospective and prospective hazard analysis, systems safety, expert systems and accident reconstruction methodologies. Case examples: industrial machinery and trucks, construction and agriculture equipment, automated manufacturing systems/processes.

EHS556 (3 cr.) Occupational Ergonomics.

Principles, concepts and procedures concerned with worker performance, health and safety. Topics include: biomechanics, work physiology, psychophysics, work stations, tools, work procedures, work standards, musculoskeletal disorders, noise, vibration, heat stress and the analysis and design of work.

EHS668 (1 cr.) Occupational Safety and Health Seminar.

Seminars in contemporary occupational health topics and issues. Presentations by noted authorities from industry, labor organization, governments, and academia.

EPID503 (3 cr.) Strategies and Uses of Epidemiology.

Basic epidemiology for the public health professional, with review of fundamental principles and concepts, and application to selected examples of chronic, non-infectious diseases and infectious disease. Designed for students without a doctoral degree.

EHS668 (1 cr.) Occupational Safety and Health Seminar.

Seminars in contemporary occupational health topics and issues. Presentations by noted authorities from industry, labor organization, governments, and academia.

EPID503 (3 cr.) Strategies and Uses of Epidemiology.

Basic epidemiology for the public health professional, with review of fundamental principles and concepts, and application to selected examples of chronic, non-infectious diseases and infectious disease. Designed for students without a doctoral degree.

Masters Degree in Industrial and Operations Engineering
Occupational Safety Engineering and Ergonomics (OSE) Option

For more than 50 years, The University of Michigan's Department of Industrial and Operations Engineering (IOE) has offered graduate education in ergonomics. After the passage of the federal Occupational Safety and Health Act in 1970, an occupational safety option was created. Since then, approximately 240 Masters and 70 Ph.D. degrees have been awarded to students specializing in ergonomics and safety.

The IOE Masters degree is intended for students who hold a bachelor's degree in engineering or physical science. Most students can complete the safety/ergonomics option in 10-16 months. Students have flexibility in selecting course work to match specific interests. A list of commonly-elected classes is available on the following pages. Those wishing to pursue a Ph.D. degree will find that the M.S. program provides excellent preparation.

A limited number of traineeships are available from the National Institute for Occupational Safety and Health (NIOSH). NIOSH trainees are expected to pursue careers in the field of occupational safety and health. Therefore, all NIOSH trainees are required to take the following core courses in safety, ergonomics, and public health.

Safety/Occupational Health Core - 10 credits

IOE 438: Safety Management (2 credits)
NUR 606: OHS Program Management (2 credits)
IOE 539: Safety Engineering (3 credits)
EHS 550: Industrial Hygiene (2 credits)
EHS 658: Physical Hazards (1 credit)

Epidemiology and Statistics Core - 6 credits

IOE 465: Design of Experiments (3 credits)
EPI 503: Strategies and Uses of Epidemiology (3 credits)

Seminars and Research - 5-6 credits

IOE 836: Ergonomics Seminars (1 credit)
IOE 837: Occupational Health and Safety Engineering Seminar (1 credit)
IOE 590: Directed Research (3-4 credits)

All NIOSH trainees must complete a Master's research project (IOE 590) and must complete a minimum of 33 credit hours to receive financial assistance through the NIOSH grant.

Students who do not receive NIOSH funding can complete the degree with 30 credit hours and have more flexibility in course selection. Base requirements for the non-NIOSH degree include a minimum of 14 credits at the 500-level or above, with at least 8 credits from IOE 500-level or above classes. At least two courses (not less than 4.5 credits) must be taken outside IOE. Specific requirements for the IOE M.S. degree can be found at:

http://ioe.engin.umich.edu/degrees/grad/gpai_docs/0804_MS_req_forbid.rtf

Many non-NIOSH students elect additional courses beyond the 30-credit minimum in order to enhance the breadth and depth of their education.

Sample Curriculum
Master of Science in Industrial and Operations Engineering
(Occupational Safety Engineering and Ergonomics Option)

Fall Term (16 credits)

IOE 539: Safety Engineering (3 credits)
IOE 836: Ergonomics Seminars (1 credit)
EHS 550: Industrial Hygiene (2 credits)
EHS 658: Physical Hazards (1 credit)

Electives (9 credits, see next page for suggested courses)

Winter Term (14 credits)

IOE 438: Safety Management (2 credits)
IOE 465: Design of Experiments (3 credits)
IOE 837: Occupational Health and Safety Engineering Seminar (1 credit)
EPI 503: Strategies and Uses of Epidemiology (3 credits)
NUR 606: OHS Program Management (2 credits)

Elective (3 credits)

Spring Half-term (3-4 credits)

IOE 590: Directed Research* (3-4 credits)

* Students may elect IOE 593 “Ergonomics Professional Project” instead of IOE 590.

Suggested and Elective Courses for
Master of Science in Industrial and Operations Engineering
(Occupational Safety Engineering and Ergonomics Option)

Note: Departmental codes can be bound at the bottom of the next page.

Occupational Safety and Health

CEE 533 -- Advanced Construction Systems (3 cr.), Lecturer John Everett
EHS 550 -- Industrial Hygiene (2 cr.), Prof. James Vincent,
EHS 655 – Occupational Injury Prevention: Policy Control (3 cr.), Prof. Ronald Maio
EHS 658 – Physical Hazards in the Work Environment (1 cr.), Prof. Edward Zellers
EPI 503 – Strategies and Uses of Epidemiology (3 cr.), EPID Staff
EPI 651 -- Epidemiology and Public Health Management of Disasters (2 cr.) Prof. Sienko Dean
HBHE667 -- Bioterrorism: Community Preparation and Response (3 cr.), Prof. Greg Button
IOE 438 -- Occupational Safety Management (2 cr.) Adjunct Profs. Paul Frantz and Tim Rhoades
IOE 539 -- Occupational Safety Engineering (3 cr.), Prof. Monroe Keyserling
NAME 582 -- Systems Reliability and Safety (3 cr.), Prof. Tassios Perakis
NERS 484 -- Radiological Health Engineering Fundamentals (4 cr.), Prof. Kimberlee Kearfott
NUR 606 – Management for OEHS Professionals (2 cr.), Prof. Oiseang Hong

Physical Ergonomics (Biomechanics, Anthropometry, Physiology, Work Measurement)

IOE 463 -- Work Measurement and Prediction (3 cr.), Prof. Tom Armstrong
IOE 491--Applied Physical Ergonomics (2 cr.), Prof. Tom Armstrong
IOE 533 – Human Motor Behavior and Engineering Systems (3 cr.), Prof. Bernard Martin
IOE 534-- Occupational Biomechanics (3 cr.), Prof. Bernard Martin
IOE 567 -- Work-related Musculoskeletal Disorders (3 cr.), Profs. Keyserling and Armstrong
IOE 635 – Biomechanics Lab (2 cr.), Instructor Charles Woolley
IOE 636 – Human Performance Lab (2 cr.), Prof. Bernard Martin

Cognitive Ergonomics (Human Factors Engineering, HCI):

EECS 493 -- User Interface Design and Analysis (3 cr.), Prof. David Kieras
IOE 434 -- Human Error & Complex System Failures (3 cr.), Prof. Nadine Sarter
IOE 436 -- Human Factors in Computer Systems (3 cr.), Adjunct Prof. Paul Green
IOE 491-- Engineering Aesthetics (2 cr.), Prof. Yili Liu
IOE 491 – Multi-modal Display Systems (3 cr.), Prof. Nadine Sarter
IOE 491 – Automotive Human Factors (3 cr.), Adjunct Prof. Paul Green
IOE 491 – Intelligent Transportation (3 cr.), Prof. Barry Kantowitz
IOE 536 – Cognitive Ergonomics (3 cr.), Prof. Nadine Sarter
IOE 591 – Transportation Human Factors (2 cr.), Prof. Barry Kantowitz
IOE 691 – Computational Cognitive Ergonomics (3 cr.), Prof. Yili Liu
Psych 449 – Decision Processes (3 cr)
Psych 689 – Culture and Cognition (2 cr)
Psych 643/EECS 643 – Theory of Neural Computation (2-4 cr)
Psych 746 – Human Performance (3 cr)
Psych 749 – Cognitive Functioning (3 cr)
Psych 948 – Seminar in Psychological Processes: Learning, Thinking, and Problem Solving (3 cr)
SI 649 – Information Visualization (3 cr)
SI 682 – User-Interface Design (3 cr)

SI 688 – Fundamentals of Human Behavior (3 cr)
SI 689 – Computer-Supported Cooperative Work (3 cr)

Engineering Breadth

AERO 729 – Spec. Top. in Gas Dynamics: Explosions, Explosives (3 cr.) Prof. Wm. Kauffman
BME 456 – Tissue Biomechanics (3 cr.), Prof. Scott Hollister
BME 458 -- Biomedical Instrumentation and Design (3 cr.), Profs. Anderson or Kipke
IOE 425 – Manufacturing Strategies (2 cr.), IOE Staff
IOE 432 – Instrumentation (3 cr.), Instructor Charles Woolley
IOE 465 -- Design and Analysis of Industrial Experiments (3 cr.), IOE Staff
IOE 466 -- Statistical Quality Control (3 cr.), IOE Staff
IOE 562 -- Reliability (3 cr.), Prof. Vijay Nair
MEAM 452 -- Design for Manufacturability (3 cr.) MEAM Staff

Management/Legal/Finance Breadth

CEE 501 -- Legal Aspects of Engineering (3 cr.), CEE Staff
EHS 508 – Principals of Risk Assessment (2 cr.), Prof. Arthur Oleinick
IOE 421 -- Work Organizations (3 cr.), Prof. Jeffrey Liker
IOE 452 – Corporate Finance (3 cr.), Prof. Jussi Keppo
IOE 522 – Theories of Administration (3 cr.), Prof. Jeffrey Liker
IOE 523 – Comparative Technology Management Seminar (3 cr.), Prof. Sebastian Fixson

Projects, Research, and Seminars:

IOE 590 – Directed Research (2-4 cr.), IOE Faculty
IOE 593 -- Ergonomics Professional Project (2-4 cr.), IOE Faculty
IOE 836 -- Seminar in Human Performance (1 cr.), Prof. Don Chaffin
IOE 837 -- Seminar in Occ. Health and Safety Engineering (1 cr.), IOE Staff

Department Codes:
BME – Biomedical Engineering
CEE -- Civil and Environmental Engineering
EECS -- Electrical Engineering and Computer Science
EHS -- Environmental Health Science (Public Health)
EPI -- Epidemiology (Public Health)
IOE -- Industrial and Operations Engineering
MEAM -- Mechanical Engineering and Applied Mechanics
NAME-- Naval Architecture and Marine Engineering
NERS -- Nuclear Engineering and Radiological Science
NUR – Nursing
PSYCH – Psychology
SI – School of Information

Required Curricula: Occupational & Environmental Epidemiology MPH

School of Public Health Core Requirements

Select one of the following

BIOSTAT 503	(4)	Introduction to Biostatistics
BIOSTAT 553	(4)	Applied Biostatistics
STAT 400	(4)	Applied Statistical Methods

Select one of the following

EPID 503	(3)	Strategies and Uses of Epidemiology
EPID 601	(5)	Principles and Methods in Epidemiology

MPH School of Public Health Requirements*

Competency in Biostatistics, Epidemiology, Environmental Health Sciences, Health Behavior and Health Education and Health Management and Policy

Environmental Health Sciences Departmental Core Requirements

BIOSTAT 523	(3)	Biostatistical Analysis for Health-Related Studies
EHS 501	(2)	Occupational and Environmental Disease
EHS 506	(2)	Principles of Toxicology
EHS 507	(2)	Principles of Exposure Assessment
EHS 508	(2)	Principles of Risk Assessment
EHS 600	(1)	Professional Perspectives in Environmental Health
EHS 688	(1)	Topics in Environmental Health Sciences

Field Experience (see EHS field experience guidelines)

Occupational and Environmental Epidemiology Core Requirements

BIOSTAT 510	(3)	Statistical Computer Program Packages
BIOSTAT 560	(4)	Statistical Methods in Epidemiology/
EHS 656	(3)	Research Methods in Occupational and Environmental Health
EHS 659	(1)	Occupational Injury Prevention Seminar
EHS 670	(3)	Applications in Environmental Epidemiology
EPID 655	(5)	Field Studies in Epidemiology

Sample Curricula: Occupational & Environmental Epidemiology

Year 1 (Fall Term)		
Select one (1) of the following		
BIOSTAT 503	Introduction to Biostatistics	4
BIOSTAT 553	Applied Biostatistics	
EHS 506	Principles of Toxicology	2
EHS 507	Principles of Exposure Assessment	2
EHS 688	Topics in Environmental Health Sciences	1
EPID 601	Principles and Methods of Epidemiology	5
	Credits	**14**
Year 1 (Winter Term)		
BIOSTAT 510	Statistical Computer Program Packages	3
BIOSTAT 523	Biostatistical Analysis for Health Related Studies	3
EHS 501	Occupational and Environmental Disease	2
EHS 659	Occupational Injury Prevention Seminar	1
EHS 688	Topics in Environmental Health Sciences	
EPID 655	Field Studies in Epidemiology	5
	Electives	2
	Credits	**16**
Year 1, Spring/Summer		
FIELD EXPERIENCE		
Year 2 (Fall Term)		
BIOSTAT 560	Statistical Methods in Epidemiology	4
EHS 508	Principles of Risk Assessment	2
EHS 600	Professional Perspectives in Environmental Health	1
EHS 656	Research Methods in Occupational Epidemiology	3
EHS 668	Occupational Health Seminar	1
EHS 688	Topics in Environmental Health Sciences	1
HBHE 600	BIC Requirement (HBHE)	3
	Credits	**15**
Year 2 (Winter Term)		
EHS 670	Applications in Environmental Epidemiology	3
EHS 668	Professor Seminars in Occupational Health	1
EHS 688	Topics in Environmental Health Sciences	
HMP XXX	BIC Requirement (HMP)	3
	Electives	8
	Credits	**15**
	GRAND TOTAL	**60**

DOCTOR OF PHILOSOPHY (Ph.D.)
(Industrial Health—Occupational & Environmental Epidemiology)

Departmental Course Requirements

Select one of the following		
BIOSTAT 503	(4)	Introduction to Biostatistics
BIOSTAT 553	(4)	Applied Biostatistics
STAT 400	(4)	Applied Statistical Methods
Select one of the following		
EPID 503	(3)	Strategies and Uses of Epidemiology
EPID 601	(4)	Principles and Methods in Epidemiology
BIOSTAT 523	(3)	Biostatistical Analysis for Health-Related Studies
EHS 688	(1)	Topics in Environmental Health Sciences[1]
EHS 899	(6)	Advanced Research
EHS 869	(1)	Doctoral Seminar in Environmental Health Sciences[2]

[1]EHS 688 is a departmental seminar that students register each Fall Term until they have passed their DQE. It is expected that they will attend seminars throughout their doctoral program but they do not have to officially register.

[2]EHS 869 is a doctoral seminar that students register for until they have passed their DQE. Upon completion of their DQE, they will present a seminar once a year until completion of their doctoral program. It is expected that they will attend the seminars throughout their doctoral program but do not need to register after successfully passing the DQE.

Major Area Course Requirements

Industrial Health

EHS 501	(2)	Occupational and Environmental Disease
EHS 507	(2)	Principles of Exposure Assessment
Must select one (1) of the following		
EHS 550	(3)	Principles of Industrial Hygiene
EHS 652	(3)	Evaluation of Chemical Hazards
EHS 654	(3)	Ventilation of Contaminant Controls
EHS 556	(3)	Occupational Ergonomics

Minor Area Course Requirements

No formal course requirements for a minor area are required. However the student should have the equivalent of 5 credit hours of coursework. The student and academic advisor will submit to the Student Services office a plan stating the minor and how the student will meet course requirements whether by previous or current coursework. The Doctoral Committee will review and approve the plan. This should be done within the first term of enrollment.

Required Curricula: Hazardous Substances Academic Training

School of Public Health Core Requirements

Select one of the following

BIOSTAT 503	(4)	Introduction to Biostatistics
BIOSTAT 553	(4)	Applied Biostatistics
STAT 400	(4)	Applied Statistical Methods

Select one of the following

EPID 503	(3)	Strategies and Uses of Epidemiology
EPID 601	(5)	Principles and Methods in Epidemiology

MPH School of Public Health Requirements*

Competency in Biostatistics, Epidemiology, Environmental Health Sciences, Health Behavior and Health Education and Health Management and Policy

Environmental Health Sciences Departmental Core Requirements

BIOSTAT 523	(3)	Biostatistical Analysis for Health-Related Studies
EHS 501	(2)	Occupational and Environmental Disease
EHS 506	(2)	Principles of Toxicology
EHS 507	(2)	Principles of Exposure Assessment
EHS 508	(2)	Principles of Risk Assessment
EHS 600	(1)	Professional Perspectives in Environmental Health
EHS 688	(1)	Topics in Environmental Health Sciences

Field Experience (see EHS field experience guidelines)

Hazardous Substances Academic Training Core Requirements

EHS 550	(3)	Principles of Industrial Hygiene
EHS 581	(1)	Principles of Radiological Health
EHS 574	(3)	Environmental Chemistry
EHS 570	(3)	Water Quality Management
EHS 572	(2)	Environmental Impact Assessment
EHS 652	(3)	Evaluation of Chemical Hazards
EHS 653	(3)	Environmental Sampling and Analysis Laboratory
EHS 654	(3)	Ventilation for Contaminant Control
EHS 658	(1)	Physical Hazards
EHS 668	(1)	Professional Seminars in Occupational Health
EHS 757	(2)	Occupational Health Aspects of Industrial Processes
IOE 539	(3)	Occupational Safety Engineering

Must select one of the following

EHS 556	(3)	Occupational Ergonomics
IOE 491	(2)	Applied Physical Ergonomics
IOE 567	(3)	Work Related Musculoskeletal Disorders

Must select two (2) of the following

EHS 680	(3)	Environmental Management Hazardous Substances
ENSCEN 686	(2)	Environmental Sustainability
NRE 537	(3)	Industrial Ecology
NRE 595	(3)	Risk Benefit Analysis

Sample Schedule: Hazardous Substances Academic Training

Year 1, Term I (Fall)		
Select one (1) of the following		4
BIOSTAT 503	Introduction to Biostatistics	
BIOSTAT 553	Applied Biostatistics	
EHS 506	Principles of Toxicology	2
EHS 507	Principles of Exposure Assessment	2
EHS 550	Principles of Industrial Hygiene	3
EHS 652	Evaluation of Chemical Hazards	3
EHS 688	Topics in Environmental Health Sciences	1
EHS 757	Occupational Health Aspects of Industrial Processes	2
	Credits	**17**
Year 1, Term II (Winterl)		
BIOSTAT 523	Analytical Health Related Studies	3
EHS 654	Ventilation Contaminant Control	3
EPID 503	Strategies and Uses in Epidemiology	3
EHS 688	Topics in Environmental Health Sciences	
EHS 653	Environmental Sampling and Analysis Laboratory	3
EHS 556	Occupational Ergonomics	3
EHS 581	Radiological Health	1
	Credits	**16**
Year 1, Spring/Summer		
FIELD EXPERIENCE		
HAZWOPER TRAINING		
Year 1, Term I (Fall)		
EHS 508	Principles of Risk Assessment	2
EHS 570	Water Quality Management	3
EHS 574	Environmental Chemistry	3
EHS 600	Professional Perspectives in Environmental Health	1
IOE 539	Occupational Safety Engineering	3
HBHE 600	BIC Requirement (HBHE)	3
	Credits	**16**
Year 1, Term I (Fall)		
EHS 501	Occupational and Environmental Disease	2
EHS 572	Environmental Impact Assessment	2
EHS 658	Physical Hazards	1
EHS 668	Occupational Health Seminar	1
Select two (2) of the following		6
ENSCEN 686	Environmental Sustainability (2 credits)	
NRE 537	Industrial Ecology (3 credits)	
NRE 595	Risk Benefit Analysis (3 credits)	
HMP XXX	BIC Requirement (HMP)	3
	Credits	**15**
	GRAND TOTAL	**64**

ATTACHMENT CE-1
Descriptive Summary of Continuing Education Courses Offered
July 2005 through February 2006

Program: July 10-29, 2005
41st Annual Graduate Summer Session on Epidemiology
Ann Arbor, MI

Attendees: 279
Person days of training: 1618.2 (Weighted Avg. 5.8 days/person)

Program Description:

The summer program offers instruction in the principles, methods and applications of epidemiology. Distinguished faculty from academic centers and governmental agencies throughout the United States and other countries will be responsible for introductory and advanced courses in epidemiology, biostatistics and data management. Curriculum options include one-week, three-week and weekend courses. Special evening lectures by guest speakers, and weekly social events, complement the classroom sessions. Following is a list of courses that were offered:

- Fundamentals of Biostatistics
- Principles and Applications of Epi Info
- Topics in Infectious Disease
- Epidemiology and Health Policy
- Fundamentals of Epidemiology
- Clinical Epidemiology and Evidence-Based Decision Making
- Design and Conduct of Clinical Trials
- Analysis of Clinical Trials
- Community Based Interventions for Behavioral and Social Change
- Pharmacoepidemiology and Risk Management
- Evaluation of Occupational and Environmental Hazards
- Reproductive and Perinatal Epidemiology
- Epidemiology in Public Health Practice
- Introduction to the Logistic and Poisson Model
- Analysis of Epidemiologic Data: An Applied Approach
- Successful Scientific Writing
- Applied Computing in Epidemiologic Research
- Cancer Epidemiology: Assigning Priorities in Cancer Prevention
- Ethics, Law and Epidemiology
- Introduction to Systematic Reviews and Meta-Analysis
- Introduction to SAS
- Social Epidemiology
- Complex Sample Survey Data Analysis with SUDAAN
- Probability Sampling Techniques in Epidemiology
- Analysis of Longitudinal Data from Epidemiologic Studies
- Global Health Issues, Crises and Solutions
- Environmental Determinants of Infectious Diseases
- Introduction to Genetics in Epidemiology
- Geographic Information Systems for Epidemiology
- Causal Interference and Causal Regression Models
- Molecular Epidemiology of Cancer

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
93	23	26	30	107	118	15	20	10	55	46	15

Program: September 19-23, 2005
Comprehensive Industrial Hygiene Review
Ann Arbor, MI

Attendees: 49
Person days of training: 220.5

Program Description:

This 4.5 day course is an intensive, high-level review of a wide range of industrial hygiene topics to help those preparing for certification exams. It provides attendees with comprehensive and contemporary information delivered by more than a dozen experts from the University of Michigan and from the private sector. The course benefits individuals needing to broaden or refresh their industrial hygiene knowledge base and will assist them in focusing their efforts to pursue professional certification.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	0	45	0	4	35	6	1	0	6	1	0

Program: November 3-4, 2005
42nd Annual Warren Cook Discussional on Industrial Hygiene
Ann Arbor, MI

Attendees: 23

Person days of training: 34.5

Program Description:

This program consists of one and one half days of discussion by prominent leaders in the field of Industrial Hygiene. Discussion sessions are directed by University of Michigan faculty. The Discussional offers a unique opportunity to share information about issues of contemporary interest to industrial hygienists.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	0	23	0	0	22	0	0	0	0	1	0

Program: December 8-9, 2005
Ergonomic Interventions and Research: Preventing Musculoskeletal Disorders in Healthcare, Construction and Other Industries
Berkeley, CA

Attendees: 108
Person days of training: 216

Program Description:

Musculoskeletal disorders continue to be costly in terms of worker suffering and employer expense. This program convenes researchers and practicing ergonomists from a cross section of industries to describe how ergonomics principles can be applied to evaluate and design tools, workplaces and tasks to prevent these disorders and their associated disabilities. A large focus will be on successful ergonomic interventions and programs in healthcare, construction and other industries. This program is the latest in an annual series aimed at providing new ergonomic examples and insights to first-time and returning attendees.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
11	10	4	22	61	73	1	1	6	4	23	0

Program: February 20-23, 2006
Occupational Ergonomics: Work Evaluation and Prevention of Upper Limb and Back Disorders
Los Angeles, CA

Attendees: 32
Person days of training: 128

Program Description:

Manual labor continues to be one of our most valuable industrial resources despite strides in production automation. More than ever, it is important that jobs and equipment be designed to enable workers to achieve their full potential while preventing pain and injury. This course provides comprehensive coverage of ergonomic issues and principles associated with manual work and workplace musculoskeletal disorders. Leading ergonomic practitioners and educators provide lectures, case studies, video depictions of workplaces and discussion sessions. The focus is on ergonomic principles and concepts so that attendees can apply this information to their own work environments. Topics include: biomechanics; risk factors of upper extremity and low back disorders; fatigue; job evaluation techniques; common worker medical issues; and industrial ergonomics programs and justification to management.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	1	2	6	23	21	1	6	1	0	2	1

Program: February 24-25, 2006
Ergonomic Job Analysis
Los Angeles, CA

Attendees: 27
Person days of training: 40.5

Program Description:

Ergonomic analysis of jobs is an essential part of a comprehensive program for controlling work-related musculoskeletal disorders such as low back pain and upper extremity repetitive trauma. This program uses lectures and demonstrations to develop practical job analysis skills. Students participate in analyses and discussion of videotaped jobs selected from a variety of industries and occupations. Case studies and discussions emphasize the identification and evaluation of ergonomic stresses and the development of alternative solutions to workplace problems. This course is intended for individuals who already have a basic knowledge of occupational ergonomics.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	1	2	7	18	15	1	8	0	0	3	0

Program: March 21, 2006
Applied Ergonomics in the Healthcare Industry
Ann Arbor, MI

Attendees: 39
Person days of training: 39

Program Description:

Musculoskeletal disorders are the largest work-related injury and illness problem in the United States. Consequently, ergonomics is recognized as one of the most important factors in the occupational environment today affecting employee injury and illness. Attention to workplace ergonomic factors is important to prevent musculoskeletal disorders, including workplaces in the healthcare industry. This one-day program introduces the audience to contemporary concepts of occupational ergonomics and its application to jobs in the healthcare industry. The program format will be lectures, panel discussions, interspersed with case studies and application examples.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	9	4	11	15	30	2	1	1	0	2	3

Program: March 27-31, 2006
Comprehensive Industrial Hygiene Review
Ann Arbor, MI

Attendees: 40
Person days of training: 180

Program Description:

This 4.5 day course is an intensive, high-level review of a wide range of industrial hygiene topics to help those preparing for certification exams. It provides attendees with comprehensive and contemporary information delivered by more than a dozen experts from the University of Michigan and from the private sector. The course benefits individuals needing to broaden or refresh their industrial hygiene knowledge base and will assist them in focusing their efforts to pursue professional certification.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	0	21	9	10	30	4	1	0	1	3	1

Program: March 29-31, 2006
Occupational Health and Safety Principles and Nursing Certification Review
Ann Arbor, MI

Attendees: 19
Person days of training: 47.5

Program Description:

This two and one-half day course provides an intensive overview of the principles of occupational health nursing practice. It is designed for nurses managing occupational health and safety programs, services and staff and performing OHN clinical functions such as counseling and client advocacy. This program will be of particular interest to nurses preparing for the COHN and COHN-S examinations.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	19	0	0	0	17	0	0	0	0	2	0

Program: April 1-2, 2006
Principles of Workers' Compensation and Disability Case Management Certification Review
Ann Arbor, MI

Attendees: 11
Person days of training: 22

Program Description:

This intensive two-day course will discuss the principles of disability and workers' compensation case management and help attendees prepare for case management practice in a variety of settings. Insurance and payment systems for case management will be addressed, including: employer benefit and carve out programs, managed care concepts, workers compensation, Medicare, Medicaid, SSI, and SSD. Attendees will learn strategies and skills to design, implement and measure outcomes of Disability Management and Workers' Compensation systems to ensure the success of case management initiatives. This program will assist attendees prepare for various case management, occupational health and other certification examinations.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	8	0	0	3	11	0	0	0	0	0	0

Program: April 18, 2006
NORA Symposium at the Michigan Safety Conference: "Aerosol Characterization: Hard Rock Mining to Nanotechnology
Lansing, MI

Attendees: 100
Person days of training: 50

Program Description:

Concerns about the potential adverse health effects related to inhalation exposure to fine and ultrafine particles have been prominent for many years, usually in the general environment. More recently, attention has been directed toward potential hazards of fine and ultrafine particles in the workplace, particularly those that might be associated with emerging nanotechnologies. This session will focus on characterization of exposures of fine and ultrafine particles in the occupational setting and state-of-the-art exposure measurement.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
10	15	25	50	0	70	0	15	0	0	5	10

Program: May 4-5, 2006
Using the 3D Static Strength Prediction Program
Ann Arbor, MI

Attendees: 20
Person days of training: 30

Program Description:

Manual materials handling activities present significant ergonomic challenges for workers and are associated with many musculoskeletal disorders such as strains, sprains and low back pain. The 3D Static Strength Prediction Program™ (3D SSPP™) is an ergonomics job analysis and design tool developed by the University of Michigan Center for Ergonomics to quantify biomechanical requirements during manual materials handling tasks. This 1-1/2 day workshop is devoted to training individuals with an ergonomics background how to use the computer software and interpret its output. This workshop will include lectures with numerous reinforcing hands-on computer workshop activities supervised by course instructors. Biomechanics principles will be reviewed, but this should be refresher information for attendees. Enrollment will be limited to ensure that all attendees will have access to a computer throughout the course.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	0	1	9	10	18	0	0	1	0	1	0

Programs: May 5-12, 2006
Safety Series at the AAOHN 2006 Symposium and Expo
Albuquerque, NM

Program Description:

(Four half-day programs are presented. Separate registration is required.)

Module 1: Fundamental OSHA Hazard Communication

Attendees: 52
Person days of training: 26

The roles of OHNs are being expanded to include greater responsibility for company safety programs and OSHA compliance. This workshop introduces OSHA standards and the compliance inspection process. The components of an effective safety and health program are discussed, and an update of OSHA's recordkeeping standard is provided. The essential components of an effective and OSHA-compliant Hazard Communication program are discussed.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	52	0	0	0	52	0	0	0	0	0	0

Module 2: Selected Outcome & Performance Standards

Attendees: 47
Person days of training: 23.5

Slips, trips and falls are the major cause of general industry accidents and incidents. This workshop will provide an overview of OSHA standards pertaining to walking-working surfaces, exit routes, emergency response and fire prevention plans. Information will also be provided on how to conduct a hazard assessment to prescribe appropriate types of personal protective equipment (PPE).

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	47	0	0	0	47	0	0	0	0	0	0

Module 3: Electrical & Confined Space Hazard Control

Attendees: 52
Person days of training: 26

OSHA statistical data confirm the hazards of worker death or serious injury from electrical current; failure to properly perform lock out/tag out (LOTO); and entry into confined spaces with hazardous atmospheres. This workshop will examine hazardous conditions involving energized equipment and confined space environments. Participants will be provided with examples of written program tools, which can be adapted for individual work settings.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	52	0	0	0	52	0	0	0	0	0	0

Module 4: Machine Guarding & Evaluation of Safety and Health Programs

Attendees: 47
Person days of training: 23.5

Machine safeguarding is the primary way to control amputation and crush hazards from mechanical components of stationary machinery. This session will identify hazardous motions, safeguarding principles and options for a variety of common workplace machines. In addition, attendees will participate in hazard identification using tools such as Job Hazard Analysis and accident investigation. Risk management concepts will then be utilized to assess the identified hazards.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
0	47	0	0	0	47	0	0	0	0	0	0

Program: May 23-24, 2006
Ergonomics Principles for Workplace Assessment and Design
Lansing, MI

Attendees: 32
Person days of training: 64

Program Description:

Ergonomics is recognized as one of the most important factors in the occupational environment today affecting employee injury and illness. Attention to ergonomic workplace design is important to prevent musculoskeletal disorders and to promote productive workplaces. Many companies, as well as state and federal regulatory agencies, view ergonomics as a means to reduce injuries and illnesses such as cumulative trauma disorders of the upper extremities (tendinitis, carpal tunnel syndrome, etc.) and low back disorders. This two day program introduces the audience to contemporary concepts of occupational ergonomics. The program format is lectures, interspersed with problem solving examples and case studies.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
1	3	4	7	17	29	0	2	1	0	0	0

Program: June 21-22, 2006
Preventing and Managing Workplace Musculoskeletal Disorders: Current Research and Ergonomics Programs that Work
Los Angeles, CA

Attendees: 54
Person days of training: 108

Program Description:

Workplace musculoskeletal disorders (MSDs) are costly in terms of worker health and employers' "bottom line." Applying ergonomics principles to the design of work environments can help prevent or manage these disorders and the adverse impact on workers and companies. A multi-disciplinary group of speakers will describe current ergonomics knowledge and methods to address MSDs, including interventions and strategies to prevent them. A large focus of this program will be practicing ergonomists describing ergonomics programs and approaches that have proved successful in a variety and industries and companies.

Occupation Category					Employer Category						
MD	RN	IH	SAF	OTH	PRI	FED	STA	LOC	FOR	ACAD	OTH
3	0	1	18	32	36	1	2	3	0	11	1

NAME OF RECIPIENT GROUP	*# (1)*	*I/E (2)*	*DESCRIPTION OF ACTIVITY*	*DATE*
Department: ENVIRONMENTAL HEALTH SCIENCES				
School: SCHOOL OF PUBLIC HEALTH			**Institution: THE UNIVERSITY OF MICHIGAN**	
EDUCATIONAL DEVELOPMENT				
Steven P. Levine - Industrial Hygiene				
Tulane			Curriculum consultation	ongoing
Thomas G. Robins - Occupational Medicine				
University of Cape Town, South Africa	1000	E	Assisted in development of web-based, distance learning Diploma in Occupational Health	7/05-current
Multiple Southern African international institutions addressing occupational health	10000	E	organized and ran regional meeting on Occupational Health in Southern Africa	9/15/05
James H. Vincent – Industrial Hygiene				
Industrial Hygiene Program, University of Michigan			EHS757: Worked with local industrial hygienists to arrange field trips of current industrial hygiene students	Fall 2005/Winter 2006
Industrial Hygiene Program:, University of Michigan			Liaised with domestic and overseas industrial hygiene and occupational health professionals to organize internships for Summer 2006	Fall 2005/Winter 2006
Edward T. Zellers – Industrial Hygiene				
Chemistry Dept., University of Michigan			Provided lectures, recruiting poster, individual presentations on Occupational Health to grad students and applicants.	
Electrical Engineering Dept., University of Michigan			Provided input on OH applications of sensor technology for large Center focusing on Wireless Integrated Microsystems	annually, 2001-current
PRESENTATIONS-LECTURES-SEMINARS				
Stuart Batterman - Industrial Hygiene				
Insituto Nacional de Saude, Porto, Portugal	100	E	Lectures	Dec. 05

(1) Number of people impacted
(2) Intramural or Extramural activity: Intramural activity is defined as within the program supported by the grant.

Alfred Franzblau - Occupational Medicine				
MI Dept. of Community Health	15		Pre-employment Screening	Jan 2005
Wayne State University, School of Med, Occ. Med Program	10		B-reading: An Overview and Future Challenges for Occupational Physicians	July 2005
MI Occupational and Environmental Medicine Assoc.	125		Preplacement Screening Exams and Carpal Tunnel Syndrome	Sept 2005
Washington University	40		Pre-placement screening: Is it Effective? Examination of Pre-placement Nerve Testing to Prevent CTS	Oct 2005
David Garabrant - Occupational Medicine				
MI Occupational and Environmental Medicine Assoc.	125		Mesothelioma Risk Among Auto Mechanics	Sept 2005
MI Society of Toxicology			Biomonitoring in Epidemiology Studies	Nov 2005
NUATRC	200		First Annual Air Toxics Workshop, Session Moderator	Nov 2005
MI Premier Public Health Conference			UofM's Dioxin Exposure Study	Oct 2005
John Meeker – Industrial Hygiene				
Labor Representatives as part of the NIOSH/CPWR Engineering Controls Work Group in Orlando, FL	40	E	Presented data on several ongoing research projects assessing engineering methods to control hazardous exposures in the construction trades	11/17-11/18/2005
Thomas G. Robins - Occupational Medicine				
Meeting Of NIEHS/EPA Environmental Health Children's Centers	100	E	Presentation on involvement of community in environmental exposure assessment	5/28/03

Meeting of International society for environmental epidemiology, Johannesburg, South Africa	500	E	Presentation on the University of Michigan Fogarty initiative on occupational health in Southern Africa	9/15-16/2005
NORA Town Hall Meeting, Chicago, IL	150	E	Co-sponsored and gave presentation on future NORA priorities	12/19/05
James H. Vincent – Industrial Hygiene				
British Occupational Hygiene Society: Annual Conference			The Warner Lecture: Graduate Education in Occupational Hygiene, A Rational Framework	April 2005
Air Monitoring Symposium 2005, Loen, Norway			Invited paper: Testing personal inhalable aerosol samplers: a suggested improved protocol based on new scientific knowledge	June 2005
Edward T. Zellers – Industrial Hygiene				
Eurosensors, XIX			Au-Thiolate Nanoparticles as Interfacial Layers on Microsensor Arrays for Micro Gas Chromatography	Sept 2005
6th East Asia Conference on Chemical Sensors			Meso-Scale VOC-Mixture Analyzer with Tunable Separation and Microsensor Array Detection	Nov 2005
WIMS Center			6 posters twice annually at WIMS site visits and IAB meetings on research and IH implications of microsystems for complex-vapor monitoring	
CONSULTATIONS				
Stuart Batterman - Industrial Hygiene				
South Camden Citizens	5	E	Discussion regarding air quality and Superfund	Sept. 05
CHASS Community Group	15	E	Community advisory panel	Bimonthly
Alfred Franzblau - Occupational Medicine				
Washington Garner Middle School	10		Update on the Michigan Dioxin Exposure Study – Community Advisory Meeting	Sept 2005
Freeland Elementary School	50		Update on the Michigan Dioxin Exposure Study – Community Advisory Meeting	Oct 2005

David Garabrant - Occupational Medicine				
ABA Litigation Section			Environmental, Products Liability and Mass Torts Litigation Committees Joint CLE Seminar	Jan 2006
Steven P. Levine - Industrial Hygiene				
			Legal Consultation	ongoing

Thomas G. Robins - Occupational Medicine				
WHO Collaborating Centers in occupational health	10^9	E	Participated in five-year planning meeting setting goals for addressing global occupational health issues	9/17/06 were
U.S. National Academies	700,000	E	Charter member of task force addressing illness sequelae of exposures during the 1991 Persian Gulf war	7/05-current
AUPOHS-NIOSH task force on resource allocation	10,000	E	Co-chair of task force addressing resource allocation for the overall ERC programs	11/05-current
Konkola and Mopani copper mines, Zambia	20,000	E	Consulted on study of respiratory health of copper miners in Zambia	7/05-current
University of Cape Town, South Africa	30,000	E	Consulted on study of health effects in community secondary to massive, outdoor elemental sulfur fire	7/05-current
University of KwaZulu-Natal, Durban, South Africa	$2*10^6$	E	consulted on large-scale study of health effects of the ambient air pollution in Durban, South Africa	7/05-current
BP Petroleum and the United Steelworkers Union	80,000	E	Consulted on methods to prevent industrial fires and explosions	10-12/2005
Workers in Southern Africa	10^7	E	consulted with the Swedish National Institute for Work and Life and WHO on new initiative to assist in development of occupational health in Southern Africa	7/05-current
OTHER				
Stuart Batterman - Industrial Hygiene				
State of Michigan		E	Review of environmental impact statements	July 05
Houston Chronicle Newspaper		E	Review of environmental series	March 05
Center of Occup and Environ Health, University of KwaZulu Natal	30	E	Advisory Board Member	Bimonthly
Thomas G. Robins - Occupational Medicine				
United Automobile Workers	500,000	E	Play a leading role in evaluation of a peer training program in occupational health & safety	7/05-current

James H. Vincent – Industrial Hygiene				
Royal Society of Chemistry			Chairman of Editorial Board, *Journal of Environmental Monitoring*	Calendar Year 2005
Edward T. Zellers – Industrial Hygiene				
Journal of Microelectromechanical Systems			Microfabricated multi-stage preconcentrator-focuser for a micro gas chromatograph	2005
Lab on a Chip			First generation hybrid MEMS gas chromatograph	2005
Journal of Environmental Monitoring			Chamber evaluation of a portable GC with tunable retention and micro-sensor array detection for indoor air quality monitoring	2006
Journal of Microelectromechanical Systems			Microfabricated preconcentrator for quantitative analysis of trace organic compounds	In review
US Patent			"Microelectromechanical Heating Apparatus and Fluid Preconcentrator Device Utilizing Same"	July 2005
University of Michigan Tobacco Research Network			Final report: Rapid determination of airborne ETS markers with a novel field instrument	Nov 2005

Department: INDUSTRIAL AND OPERATIONS ENGINEERING

School: COLLEGE OF ENGINEERING **Institution: THE UNIVERSITY OF MICHIGAN**

EDUCATIONAL DEVELOPMENT				
Thomas J. Armstrong - Safety Science				
Marquette University		E	Research support; provided advice for the RERC activities	Oct., 2005
Don B. Chaffin- Safety Science				
Biomedical Eng. Exec. Comm.	3	3	Member curriculum committee	Present
Provide Workplace Design Software		E	CAD Software used in Education of Engineers	Present
NRC-HF Committee			Advisor on Human Factors Education for Engineers	2-7-06
Univ of Cincinnati			Supervisor Sub-contract for modeling human motion data	1-05 to 12-05
W. Monroe Keyserling - Safety Science				
College of Engineering Curriculum Committee		I	Review curricula and courses related of OH&S within UM College of Engineering	Jan.-May 2006
Randall Rabourn - Continuing Education				
Michigan Safety conference			Assisted Industrial Hygiene Division to develop training program for conference attendees	Fall, 2005
Colorado State University			Met with John Rosecrance in Engineering to discuss potential UM – CSU collaborative training project	August, 2005
Charles B. Woolley				
Virginia Tech, Blackburg			Research Equipment Support	

PRESENTATIONS-LECTURES-SEMINARS				
Thomas J. Armstrong - Safety Science				
UAW-DaimlerChrysler Health and Safety	100	E	Presentations to health and safety personnel re: hand activity level and hand force analysis	Oct, 2005
UAW	40	E	Presentations on job analysis tools	March, 2006
Don B. Chaffin - Safety Science				
Automotive Research Center (Army)	50	E	Speaker	Nov 05
Intern. Soc of Biomechanics	1100	E	Keynote Plenary Speaker	Aug, 05
Human Factors and Ergo Soc	110	E	Invited Keynote Speaker	Sept 05
Soc. Automotive Engineers - DHM Conf.	200	E	Speaker and session arranger	July 05
W. Monroe Keyserling - Safety Science				
University of Michigan – Department of Physical Medicine and Rehabilitation (PMR)	20	I	Lecture on work-related overexertion disorders to PMR residents	
Yili Liu - Safety Science				
High school visitors and parents	300		Gave two presentations to these visitors as part of UM College of Engineering Tech Days & Minority Engineering Program Office activities	Nov 2005
Bernard Martin – Safety Science				
Society for Neuroscience			4 presented projects -Degradation of exocentric reference in visually-occulded three dimensional reaching tasks -Adapted movement strategies in torso-hand coordination for spinal cord injury and low back pain patients -Feedback control of in-vehicle pointing tasks perturbed by ride motion -Postural goal of unconstrained head movement strategies	Oct 2005

University of Alabama Birmingham			Invited presentation: Human motion simulation and whole body vibration	Summer 2005
Nadine Sarter – Safety Science				
American Psychological Association			Invited address APA Annual Convention (DIV 3) "Cognitive Ergonomics: The Application of Basic Research Findings to Interface Design"	August 2005
Sheryl S. Ulin - Safety Science				
City of Wyoming, MI	38	E	Introductory Ergonomics Awareness Seminar	August 17, 2005
Inergy Automotive	35	E	Introductory Ergonomics Awareness Seminar	August 19, 2005
Douglas Autotec	26	E	Introductory Ergonomics Awareness Seminar	August 24, 2005
David Brown Union Pump (2 sessions)	56	E	Introductory Ergonomics Awareness Seminar	September 13, 2005
Kalamazoo Container (3 sessions)	79	E	Introductory Ergonomics Awareness Seminar	September 16, 2005
UM E100 class	100	E	Anthropometry for Workstation Design Lecture	October 31, 2005
Charles B. Woolley - Safety Science				
High School Women-Exploration	20	E	Tour of Center for Ergonomics and Introduction	7/18/05
UAW/GM Center for HR	10	E	Lecturer of 3DSSP	10/4/05
UAW/DC	40	E	Lecturer of 3DSSPP as Advanced Tool	10/20/05
CONSULTATIONS				
Thomas J. Armstrong - Safety Science				
Rio Physical Medicine Center	6	E	Ergonomic training and workplace evaluations	August, 2005
RERC Accessible Medical Instrumentation Symposium		E	Provided advice on developing future research initiatives	Oct., 2005

US Car Group		E	Provided advice on biomechanical hand models	Nov., 2005
NUMMI motors		E	Advised regarding ergonomic job analysis and benchmarking	Oct., 2005
Don B. Chaffin - Safety Science				
Army-NAS Soldier Systems Advisor	50	E	NAS Advisory Board Meeting	On-going
Society of Automotive Engineers		E	Consultation on Digital Human Motion	On-going
Federal OSHA			Advised on evaluating health and safety conditions	Fall 2005
W. Monroe Keyserling - Safety Science				
University of Michigan Health System	1000s	I	Supervised student project involving systems system analysis of entry/emergency exit door systems	Nov.-Dec. 2005
Randall Rabourn - Continuing Education				
Industry consultation		E	Assisted in developing ergonomics training materials	Fall, 2005
Industry consultation	40	E	Conducted ergonomics training workshops	2005 - 2006
UM Epid Research Project		I	Provided technical support to classify physical requirements of 300 jobs in knee injury epid study	Fall, 2005
Nadine Sarter – Safety Science				
National Research Council			Invited member – Committee on FAA Aviation Safety Inspector Staffing Standards	Oct 2004 – May 2006
National Research Council			Invited member – Decadel Survey of Civil Aeronautics, Panel E	Sept 2005 – Oct 2006
Sheryl S. Ulin - Safety Science				
Industrial Consultation		E	Develop Ergonomics Awareness Training Module	June – October 2005
Industrial Consultation	30	E	Ergonomic Assessment Workshop	4 sessions
City of Wyoming, MI	2	E	Workstation Evaluations and Recommendations	August 2005
Inergy Automotive	3	E	Workstation Evaluations and Recommendations	August 2005

Douglas Autotec	2	E	Workstation Evaluations and Recommendations	August 2005
David Brown Union Pump	2	E	Workstation Evaluations and Recommendations	September 2005
Kalamazoo Container	3	E	Workstation Evaluations and Recommendations	September 2005
Stone Plastics	3	E	Workstation Evaluations and Recommendations	October 2005
AutoAir	3	E	Workstation Evaluations and Recommendations	October 2005
Huhtamaki Plastics	4	E	Workstation Evaluations and Recommendations	November 2005
Adaptive Materials	2	E	Workstation Evaluations and Recommendations	December 2005
Brookcrest	2	E	Workstation Evaluations and Recommendations	January 2006
Sunset Manor	2	E	Workstation Evaluations and Recommendations	January 2006
Charles B. Woolley - Safety Science				
High School Students	40	E	Tech Day 2005 – Intro to Ergonomics and tour	11/5/05
OTHER				
Thomas J. Armstrong - Safety Science				
ACGIH		E	Member of the ACGIH Physical Hazards committee and involved in establishing related TLVs	
UM College of Engineering Safety Committee			Chair	On-going
UM IOE Safety Committee			Chair	On-going
Various journals			Editorial Positions: Scandinavian Journal of Work, Environment and Health, EBM; Journal of Occupational Rehabilitation, EBM; Assistive Technology, Reviewer; Clinical Biomechanics, Reviewer; Applied Ergonomics, Reviewer	On-going
Don B. Chaffin - Safety Science				
Inst. Ind Eng.		E	Editorial Board for “IE Handbook”	Present
SAE		E	Reviewer for papers on Human Modeling	Present

SAE - Human CAD Com.		E	Member -- Advisory Gr. on Workplace Design Software	Present
Auto Res. Center		I	Thrust Area Leader in Human Modeling	Present
Taylor Francis Pub.		E	Editorial Board for "Theoretical Issues in Ergonomics"	Present
National Academy of Engineering		E	Co-chair-Membership nominating committee for Industrial Engineers	Present
Automotive News			Provided input for article on Human Motion Simulation	
Light & Medium Truck Magazine			Provided interview on ergonomics in vehicle design for article	
W. Monroe Keyserling - Safety Science				
NIOSH		E	Served as Ad Hoc member of Safety and Occupational Health Study Section for Fall meeting	Oct. 18-19, 2205

Yili Liu - Safety Science				
IEEE Transactions			Associate editor on Systems, Man, Cybernetics	2000-now
IEEE Transactions			Associate editor on Intelligent Transportation Systems	2000-now
Randall Rabourn - Continuing Education				
IIE Applied Ergo Conf		E	Co-sponsored conference and assisted with planning	2005-6
SAE DHM		E	Co-sponsored conference and assisted with planning	Winter 2006
UM Listserve Members	5000	I	Wrote monthly news-notes (12 notes)	
Small Michigan companies		E	Assisted in administration of Michigan Consulttion, Education and Training grant for ergonomics training and provided technical assistance	7/05 – 2/06
BCPE		E	Arranged for proctoring CPE exam in Michigan	Winter 2006
HFES Conference, Orlando		E	Exhibited	9/05
Sheryl S. Ulin - Safety Science				
State of Michigan		E	Committee co-chair of Ergonomics Standard Advisory Board	October 2003-Present
State of Michigan, House Commerce Committee		E	Testimony regarding HB5447; Ergonomics Standard	January 17, 2006
Publication in MIOSHA News,	Circula -tion of 20,000	E	Self-Elevating Vehicle used as an Ergonomic Intervention in Automotive Parts Distribution Operations	Summer 2005
Charles B. Woolley - Safety Science				
Conference Attendees	100	E	ISB/ASB Booth, Cleveland	August 2005
Conference Attendees		E	HFES Orlando, Demo Ergo Tools	Sept 2005

Department: DIVISION OF HEALTH PROMOTION AND RISK REDUCTION

School: SCHOOL OF NURSING **Institution: THE UNIVERSITY OF MICHIGAN**

EDUCATIONAL DEVELOPMENT				
OiSaeng Hong - Occupational Health Nursing				
Global Korean Nursing Foundation	1	E	Mentor for postdoctoral research training	2005 - present
University of Michigan	3	I	Mentors for undergraduate research opportunity program on hearing loss prevention, and Drycleaners occupational health.	2005-2006
National Coalition of Ethnic Minority Nurse Associations, Inc	3	E	Research mentoring for 3 ethnic minority doctoral nursing students.	2006
University of Michigan School of Nursing Doctoral Students	3	I	Supervising and guiding doctoral students' research activities	2005
University of Michigan School of Nursing Doctoral Students	4	I	Research training for thesis/scholarly projects	2005
University of Michigan School of Nursing Doctoral Students	4	I	Co-Mentoring research experience on worksite physical activity intervention project	2004-2005
Pat Strasser - Occupational Health Nursing				
Northwest Ohio Association of Occupational Health Nurses	50	E	Part of the planning committee for the group. Assisted in setting up occupational health continuing education offerings for the nurse members.	September, 2005 through May 2006

PRESENTATIONS – LECTURES - SEMINARS				
OiSaeng Hong - Occupational Health Nursing				
Mosby's faculty development institute. Miami, FL.	350	E	Presented: Enriching graduate education for working nurses through unique approach	Jan, 2006
The Optimizing Global Health through Nursing Science conference. Chicago, IL.	35	E	Presented: The effect of healthy life style on infant mortality in the OECD countries	2005
International Council of Nursing 23rd Quadrennial Congress. Taipei, Taiwan.	250	E	Presented: Innovative approach for advanced academic training in occupational health nursing: On Job/On Campus program.	May, 2005
Midwestern Nursing Research Society 29th Annual Research Conference. Cincinnati, OH.	40	E	Presented: Heart disease risk assessment for Asian residents in southeastern Michigan	May, 2005
Nursing Research Conference. Wayne State University.	200	E	Presented: Comparison of predictors of hearing protection use for Hispanic and Non-Hispanic white factory workers	Aug, 2005
Pat Strasser - Occupational Health Nursing				
National Workers' Compensation and Occupational Medicine Seminar, Hyannis, MA	120	E	Presentation- "Case Management for Occupational Health Professionals" to conference attendees.	July 20, 2005
CONSULTATIONS				
OiSaeng Hong - Occupational Health Nursing				
Korean Drycleaners Association in Michigan	16	E	Training in chemical exposure in the drycleaning industry	2005
EulJi University, DaeJeon, Korea School of Nursing	3	E	Consultation on International Research Collaboration Initiatives on Occupational Health	June, 2005
Pusan National University, Korea	9	E	Consultation on Development of Dissertation Research	Jan, 2006

University of Sao Paulo at Ribeirao Preto College of Nursing, Brazil	1	E	Pre-doctoral training in occupational health nursing	2006
Sally Lusk - Occupational Health Nursing				
NIOSH			Consultant to intramural grant (PI, Caruso) on effects of shift work on nurses	
NIDCD			Advisory Committee on Kerr Grant to test interventions to prevent NIHL in Latinos	
Pat Strasser - Occupational Health Nursing				
Corporate Clients	Varies	E	Ongoing occupational health consulting to several large corporations.	Ongoing
OTHER				
OiSaeng Hong - Occupational Health Nursing				
Denby High School Students	1	E	Research meeting for minority high school students in the GENESIS (Gaining Excellence in Nursing Education: Students Intensifying Scholastics)	July, 2005
Sally Lusk - Occupational Health Nursing				
Midwest Nursing Research Society			President	2005 - 2007
			Member, Council for the Advancement of Nursing Science Steering Committee	2005 – 2007

ERC Applicant Institution: University of Michigan
Program Director: Edward T. Zellers
Discipline: Industrial Hygiene

Table 4a
Academic Training Report
Previous Budget Period: July 1, 2005 to June 30, 2006

Degree Awarded	How Does Degree Read?	# Full-Time Trainees Enrolled[1]	# Full-Time NIOSH-Supported Trainees	# Part-Time Trainees Enrolled	# Part-Time NIOSH-Supported Trainees	# Other Trainees Taking OS&H Courses[2]	# Trainees Graduated
Baccalaureate/associate degree							
Master's degree							
MPH	Master of Public Health (Industrial Hygiene)	12	10	0	0	660	10
MS	Master of Sciences (Industrial Health)	0	0	0	0	0	0
Doctorate degree							
PhD	Doctoral of Philsophy (Industrial Health)	4	0	0	0	0	2
Post-doctoral (Include formally registered Occupational Medicine residents in all years of the residency.)[3]							
Other (specify, e.g., undergraduate Certificate program trainees)							

Refer to: Supplemental Instructions, page 10.

[1] Trainee counts include all students in the approved programs.

[2] Does not include trainees counted in any of the full-time or part-time categories

[3] In this case, there may be double counting between Doctorate degree and Post-doctoral categories.

ERC Applicant Institution: University of Michigan
Program Director: Edward T. Zellers
Discipline: Industrial Hygiene

Table 13
Minority Recruitment Data[1]
Previous Budget Period: July 1, 2005 to June 30, 2006

GROUP DATA			INDIVIDUAL DATA			
# of Minorities Applied	# of Minorities Offered Admission	# of Minorities Entered Program	For those who entered program: Identify by sequential #	Current Status (in training, graduated, left the program, etc.)	Sources of Support	Subsequent Career Development/ Employment
2	2	2	1	in training	U.S. Coast Guard	
			2	in training	NIOSH ERC	

Refer to: Supplemental Instructions, page 13.

[1] First three columns are a group total; last four columns refer to individual trainees.

ERC Applicant Institution: The University of Michigan Educational Resource Center

Program Director: Tom Robins

Discipline: Occupational Health Nursing

Table 4a

Academic Training Report

Current Budget Period July 1, 2005 - June 30, 2006

Degree Awarded	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
MS	Community Health Nursing - Occupational Health Nursing Focus	1	1	5	1	1	2

*does not include students counted in any of the full-time or part-time categories

* One student (Sung Hee Lee) in Epidemiology

ERC/TPG Applicant Institution: The University of Michigan Educational Resource Center

ERC/TPG Program Director: Tom Robins

Table 13

Minority Recruitment Data

Current Budget Period July 1, 2005 - June 30, 2006

Training Area	# of Minorities Applied	# of Minorities Offered Admission	# of Minorities Entered Program	For those who entered program: Anonymous id#	Current Status (in training, graduated, left the program, etc.)	Sources of Support	Subsequent Career Development/ Employment
OHN	1	1	1		in training	NIOSH	Currently Employed

ERC Applicant Institution: The University of Michigan
Program Director: W. Monroe Keyserling, Ph.D.
Discipline: Occupational Safety Engineering and Ergonomics

Table 4a
Academic Training Report
Previous Budget Period: July 1, 2005 to June 30, 2006

Degree Awarded	How Does Degree Read?	# Full-Time Trainees Enrolled[1]	# Full-Time NIOSH-Supported Trainees	# Part-Time Trainees Enrolled	# Part-Time NIOSH-Supported Trainees	# Other Trainees Taking OS&H Courses[2]	# Trainees Graduated
Baccalaureate/associate degree							
B.S.	Bachelor of Science in Industrial and Operations Engineering	0	0	0	0	300	0
Master's degree							
M.S./M.S.E.	Master of Science in Industrial and Operations Engineering	6	2	2	0	50	5
Doctorate degree							
Ph.D.	Doctor of Philosophy in Industrial and Operations Engineering	19	3	0	0	10	4
	Doctor of Philosophy in Industrial and Operations Engineering and Mechanical Engineering	1	0	0	0	0	1
Post-doctoral (Include formally registered Occupational Medicine residents in all years of the residency.)[3]							
Other (specify, e.g., undergraduate Certificate program trainees)							

Refer to: Supplemental Instructions, page 10.

[1] Trainee counts include all students in the approved programs.

[2] Does not include trainees counted in any of the full-time or part-time categories

[3] In this case, there may be double counting between Doctorate degree and Post-doctoral categories.

ERC Applicant Institution:
Program Director:
Discipline:

Table 13
Minority Recruitment Data[1]
Previous Budget Period: July 1, 2005 to June 30, 2006

GROUP DATA			INDIVIDUAL DATA			
# of Minorities Applied	**# of Minorities Offered Admission**	**# of Minorities Entered Program**	**For those who entered program: Identify by sequential #**	**Current Status (in training, graduated, left the program, etc.)**	**Sources of Support**	**Subsequent Career Development/ Employment**
3*	2*	2*	Current OSE Minority Students (matriculated Sept. 2001 or later)			
* Applications processed for Fall 2006 admission			M.S. #1	Inactive -- must complete directed research project	NIOSH (when actively enrolled)	Law School
			M.S. #2	In training	GEM Fellowship	
			M.S. #3	In training	GEM Fellowship	
			Ph.D. #1	Graduated with M.S. degree	NIOSH	Leave of absence from Ph.D. program while being treated for chronic health problem
			Ph.D. #2	Graduated	University Fellowships and Teaching Assistantships	Assistant Professor
			Ph.D. #3	Completing dissertation research, defense in early 2007	University Fellowships, Teaching Assistantships, NIOSH Pilot Project	Will start interviewing later this year

Refer to: Supplemental Instructions, page 13.

[1] First three columns are a group total; last four columns refer to individual trainees.

ERC Applicant Institution: University of Michigan
Program Director: David Garabrant
Discipline: Occupational & Environmental Epidemiology

Table 4a
Academic Training Report
Previous Budget Period: July 1, 2005 to June 30, 2006

Degree Awarded	How Does Degree Read?	# Full-Time Trainees Enrolled[1]	# Full-Time NIOSH-Supported Trainees	# Part-Time Trainees Enrolled	# Part-Time NIOSH-Supported Trainees	# Other Trainees Taking OS&H Courses[2]	# Trainees Graduated
Baccalaureate/associate degree							
Master's degree							
MPH	Master of Public Health	16	10	0	0	598	10
Doctorate degree							
PhD	Doctoral of Philosophy (Industrial Health)	6	1	0	0	0	0
Post-doctoral (Include formally registered Occupational Medicine residents in all years of the residency.)[3]							
Other (specify, e.g., undergraduate Certificate program trainees)							

Refer to: Supplemental Instructions, page 10.

[1] Trainee counts include all students in the approved programs.

[2] Does not include trainees counted in any of the full-time or part-time categories

[3] In this case, there may be double counting between Doctorate degree and Post-doctoral categories.

ERC Applicant Institution: University of Michigan
Program Director: David Garabrant
Discipline: Occupational & Environmental Epidemiology

Table 13
Minority Recruitment Data[1]
Previous Budget Period: July 1, 2005 to June 30, 2006

GROUP DATA			INDIVIDUAL DATA			
# of Minorities Applied	# of Minorities Offered Admission	# of Minorities Entered Program	For those who entered program: Identify by sequential #	Current Status (in training, graduated, left the program, etc.)	Sources of Support	Subsequent Career Development/ Employment
5	5	0				

Refer to: Supplemental Instructions, page 13.

[1] First three columns are a group total; last four columns refer to individual trainees.

ERC Applicant Institution: University of Michigan
Program Director: Stuart Batterman
Discipline: Hazardous Substances Academic Training

Table 4a
Academic Training Report
Previous Budget Period: July 1, 2005 to June 30, 2006

Degree Awarded	How Does Degree Read?	# Full-Time Trainees Enrolled[1]	# Full-Time NIOSH-Supported Trainees	# Part-Time Trainees Enrolled	# Part-Time NIOSH-Supported Trainees	# Other Trainees Taking OS&H Courses[2]	# Trainees Graduated
Baccalaureate/associate degree							
Master's degree							
MPH	Master of Public Health	9	9	0	0	792	5
Doctorate degree							
Post-doctoral (Include formally registered Occupational Medicine residents in all years of the residency.)[3]							
Other (specify, e.g., undergraduate Certificate program trainees)							

Refer to: Supplemental Instructions, page 10.

[1] Trainee counts include all students in the approved programs.

[2] Does not include trainees counted in any of the full-time or part-time categories

[3] In this case, there may be double counting between Doctorate degree and Post-doctoral categories.

ERC Applicant Institution: University of Michigan
Program Director: Stuart A. Batterman
Discipline: Hazardous Substances Academic Training

Table 13
Minority Recruitment Data[1]
Previous Budget Period: July 1, 2005 to June 30, 2006

GROUP DATA			INDIVIDUAL DATA			
# of Minorities Applied	# of Minorities Offered Admission	# of Minorities Entered Program	For those who entered program: Identify by sequential #	Current Status (in training, graduated, left the program, etc.)	Sources of Support	Subsequent Career Development/ Employment
0	0	0				

Refer to: Supplemental Instructions, page 13.

[1] First three columns are a group total; last four columns refer to individual trainees.

ERC Applicant Institution: The University of Michigan — Rev. 09/06

Program Director: Randall Rabourn

Table 12a

CE Course Offerings by Program Area

Previous Budget Period: July 1, 2005 to June 30, 2006

					# Trainees by Profession					# Trainees by Employer						
Course/Seminar Title*	**Program Area**	**Total Trainees**	**Length of Course**	**Total Pers Days**	**MD**	**NURS**	**HYG**	**SAFETY**	**OTHER**	**Private Industry**	**Fed Gov**	**State Gov**	**Local Gov**	**Foreign Country**	**Academic**	**Other**
Summer Session on Epidemiology (25%) **	IH	70	5.8	406	23	6	7	7	27	29	3	5	3	14	12	4
Industrial Hygiene Comprehensive Review (Sept)	IH	49	4.5	220.5			45		4	35	6	1		6	1	
Cook Industrial Hygiene Discussional	IH	23	1.5	34.5			23			22					1	
Preventing Musculoskeletal Disorders (Dec) (25%)**	IH	27	2	54	2	2	1	6	16	18		1	2	1	5	
Occupational Ergonomics (25%)**	IH	8	4	32		1		2	5	5	1	1			1	
Ergonomic Job Analysis (25)**	IH	7	2	14			1	2	4	4	1	2				
Applied Healthcare Ergonomics (25%)**	IH	9	1	9		2	1	3	3	7					1	1
Industrial Hygiene Comprehensive Review (Mar)	IH	40	4.5	180			21	9	10	30	4	1		1	3	1
NORA Symposium (25%)**	IH	25	0.5	12.5	2	4	6	13		17		4			1	3
Ergonomics Principles (25%)**	IH	8	2	16			1	2	5	7		1				
Preventing Musculoskeletal Disorders (Jun) (25%)**	IH	14	2	28	1			5	8	9	1	1			2	1
Subtotal IH (5 total courses)**		**280**		**1006.5**	**28**	**15**	**106**	**49**	**82**	**183**	**16**	**17**	**5**	**22**	**27**	**10**

Summer Session on Epidemiology (25%) **	OHN	70	5.8	406	23	6	7	7	27	30	4	5	2	14	11	4
Preventing Musculoskeletal Disorders (25%)**	OHN	27	2	54	3	3	1	5	15	19			1	1	6	
Occupational Ergonomics (25%)**	OHN	8	4	32			1	1	6	5		2				1
Ergonomic Job Analysis (25)**	OHN	7	2	14		1		1	5	4		2			1	
Applied Healthcare Ergonomics (25%)**	OHN	10	1	10		3	1	2	4	8	1					1
OH&S and Nursing Certification Review	OHN	19	2.5	47.5		19				17					2	
Disability Case Management	OHN	11	2	22		8			3	11						
NORA Symposium (25%)**	OHN	25	0.5	12.5	2	4	6	13		17		4			1	3
Safety Series at the AAOHN 2006, Module 1	OHN	52	0.5	26		52				52						
…. Module 2	OHN	47	0.5	23.5		47				47						
…. Module 3	OHN	52	0.5	26		52				52						
…. Module 4	OHN	47	0.5	23.5		47				47						
Ergonomics Principles (25%)**	OHN	8	2	16		1	1	2	4	7			1			
Preventing Musculoskeletal Disorders (Jun) (25%)**	OHN	14	2	28	1			5	8	9		1	1		3	
Subtotal OHN (8 total courses)**		**397**		**741**	**29**	**243**	**17**	**36**	**72**	**325**	**5**	**14**	**5**	**15**	**24**	**9**

Summer Session on Epidemiology (25%) **	OMR	70	5.8	406	24	5	6	8	27	30	4	5	2	14	12	3	
Preventing Musculoskeletal Disorders (25%)**	OMR	27	2	54	3	3	1	5	15	18	1		1	1	6		
Occupational Ergonomics (25%)**	OMR	8	4	32				2	6	5		1	1		1		
Ergonomic Job Analysis (25)**	OMR	6	2	12				2	4	3		2			1		
Applied Healthcare Ergonomics (25%)**	OMR	10	1	10		2	1	3	4	8		1				1	
NORA Symposium (25%)**	OMR	25	0.5	12.5	3	4	6	12		18		4			1	2	
Ergonomics Principles (25%)**	OMR	8	2	16	1	1	1	1	4	8							
Preventing Musculoskeletal Disorders (Jun) (25%)**	OMR	13	2	26			1	4	8	9			1		3		
Subtotal OMR (2 total courses)**		**167**		**568.5**	**31**	**15**	**16**	**37**	**68**	**99**	**5**	**13**	**5**	**15**	**24**	**6**	

Summer Session on Epidemiology (25%) **	OS	69	5.8	400.2	23	6	6	8	26	29	4	5	3	13	11	4	
Preventing Musculoskeletal Disorders (25%)**	OS	27	2	54	3	2	1	6	15	18			2	1	6		
Occupational Ergonomics (25%)**	OS	8	4	32			1	1	6	6		2					
Ergonomic Job Analysis (25)**	OS	7	2	14				2	5	4		2			1		
Applied Healthcare Ergonomics (25%)**	OS	10	1	10		2	1	3	4	7	1		1		1		
NORA Symposium (25%)**	OS	25	0.5	12.5	3	3	7	12		18		3			2	2	
Using the 3DSSP	OS	20	1.5	30			1	9	10	18			1		1		
Ergonomics Principles (25%)**	OS	8	2	16		1	1	2	4	7		1					
Preventing Musculoskeletal Disorders (Jun) (25%)**	OS	13	2	26	1			4	8	9			1		3		
Subtotal OS (3 total courses)**		**187**		**594.7**	**30**	**14**	**18**	**47**	**78**	**116**	**5**	**13**	**8**	**14**	**25**	**6**	
GRAND TOTALS (All Program Areas)		**1031**		**2910.7**	**118**	**287**	**157**	**169**	**300**	**723**	**31**	**57**	**23**	**66**	**100**	**31**	
		**If course is attributable to multiple program areas,															
*Group together by Program Area and Provide Sub-Totals for Each Program Area- You may add or delete rows as necessary		the fraction of course attributable to the program area is shown in parentheses.															
		No single program is counted more than a total of 1.0.															

ERC Applicant Institution: University of Michigan
Program Director: Randall Rabourn

Rev. 09/06

Table 12b
Summary of CE Course Offerings by Program Area
Previous Budget Period: July 1, 2005 to June 30, 2006

					# Trainees by Profession					# Trainees by Employer						
Course/Seminar Title	**Program Area**	**Total Trainees**	**Total # of Courses**	**Total Pers Days**	**MD**	**NURS**	**HYG**	**SAFETY**	**OTHER**	**Private Industry**	**Fed Gov**	**State Gov**	**Local Gov**	**Foreign Country**	**Aca-demic**	**Other**
Subtotal IH	**IH**	280	5	1006.5	28	15	106	49	82	183	16	17	5	22	27	10
Subtotal OHN	**OHN**	397	8	741	29	243	17	36	72	325	5	14	5	15	24	9
Subtotal OMR	**OMR**	167	2	568.5	31	15	16	37	68	99	5	13	5	15	24	6
Subtotal OS	**OS**	187	3	594.7	30	14	18	47	78	116	5	13	8	14	25	6
TOTAL	**0**	**1031**		**2910.7**	**118**	**287**	**157**	**169**	**300**	**723**	**31**	**57**	**23**	**66**	**100**	**31**

Appendix C. Publications

The following lists publications involving IH Core faculty and their students.

Journal Publications (student co-authors are underlined)

1. **Meeker JD**, Barr DB, Hauser R. Thyroid hormones in relation to urinary metabolites of non-persistent insecticides in men of reproductive age. Reprod Toxicol In Press.
2. Hauser R and **Meeker JD**. Epidemiologic studies on the relationship between semen quality and environmental chemicals: Historic and contemporary compounds. In: Nicolopoulou-Stamati P, Hens L, Howard CV (eds). Reproductive Health and the Environment. Springer, Berlin: In Press.
3. **Meeker JD**, Susi P, Pelligrino, A. Comparison of occupational exposures among painters using three alternative blasting abrasives. J Occup Environ Hyg; In Press.
4. **Meeker JD**, Ryan L, Barr D, Hauser R. Exposure to non-persistent insecticides and reproductive hormones in adult men. Epidemiology, 2006; 17(1): 61-66.
5. **Meeker JD**, Barr D, Bennett D, Ryan L, Herrick R, Hauser R. Temporal variability of urinary levels of nonpersistent insecticides in adult men. J Expo Anal Environ Epidemiol, 2005; 15(3):271-81.
6. **Meeker JD**, Susi P, Pelligrino A. A case study of exposure to silica and metals among painters using specular hematite abrasive. J Occup Environ Hyg, 2005; 2(8):D60-D68.
7. Brixey, L.A. and **Vincent, J. H**. (2005), Aspiration efficiency of IOM-like personal aerosol samplers from experiments with a new rapid data acquisition system, *Aerosol Sci. Tech.*, in press.
8. **Vincent, J.H.** (2006), Testing personal inhalable aerosol samplers: a suggested improved protocol based on new scientific knowledge, *J. Env. Monitor.*, 8, 53-62.
9. **Vincent, J.H.** (2005), Graduate education in occupational hygiene: a rational framework, *Ann. Occup. Hyg.*, 49, 649-659.
10. **Vincent, J.H.** (2005), Standards for health-related aerosol measurement: critical review and update, *J. Environ. Monitor.*, 7, 1037-1053.
11. Watson, R.T., Patz, J., Gubler, D.J., Parson, E.A. and **Vincent, J. H**. (2005), Environmental health implications of global climate change, *J. Environ. Monitor.*, 7, 834-843.
12. Brixey, L.A., Evans, D.E. and **Vincent, J. H**. (2005), Aspiration efficiency of a thin-walled probe at rights angles to the wind, *J. Aerosol Sci.*, 36, 1144-1145.
13. W.C. Tian, H. K. L. Chan, C. -J. Lu, S. W. Pang, and **E. T. Zellers,*** "Microfabricated Multi-stage Preconcentrator-Focuser for A Micro Gas Chromatograph", *Journal of Microelectromechanical Systems*, *JMEMS*, 2005, 14, 498-507.

14. C.-J. Lu,, W. H. Steinecker, W.-C. Tian, M. Agah, J. A. Potkay, M. C. Oborny, J. Nichols,- H. K. L. Chan, J. Driscoll, R. D. Sacks, S. W. Pang, K. D. Wise, **E. T. Zellers**,* "First Generation Hybrid MEMS Gas Chromatograph," *Lab On A Chip*, 2005, 5, 1123-1131.
15. C.-J. Lu, C. Jin, and **E. T. Zellers**,* "Chamber Evaluation of a Portable GC with Tunable Retention and Microsensor-Array Detection for Indoor Air Quality Monitoring," *J. Environmental Monitoring***,** 2006, 8, 270-278.
16. W. H. Steinecker, M. P. Rowe, and **E. T. Zellers**,* "Model of Vapor-Induced Resistivity Changes in Gold-Thiolate Monolayer-Protected Nanoparticle Sensor Films," *J. Am. Chem. Soc*., under review, 2006.
17. M. P. Rowe, W. H. Steinecker, and **E. T. Zellers**,* "Exploiting charge-transfer complexation for selective measurement of gas-phase olefins with nanoparticle-coated chemiresistors," *Anal. Chem*., under review, 2006.
18. H. K. L. Chan, M. Takei, S. W. Pang, R. A. Veeneman, and E. T. Zellers,* "Microfabricated preconcentrator for quantitative analysis of low-concentration organic compounds," *Proceedings of Transducers 05*, Seoul, Korea, June 5-9, 2005.
19. W.H. Steinecker, M.P. Rowe, H. Xu, Q. Zhong, C. Jin, L. Farina, C. Kurdak, **E.T. Zellers**,* "Au-Thiolate Nanoparticles as Interfacial Layers on Microsensor Arrays for Micro Gas Chromatography," *Proceedings of Eurosensors XIX*, Barcelona, Spain, September 12th- 14th, 2005, pp. I1-I6.
20. Q. Zhong, W. H. Steinecker, **E. T. Zellers**,* "Meso-Scale VOC-Mixture Analyzer with Tunable Separation and Microsensor Array Detection." Proceedings of the 6th East Asia Conference on Chemical Sensors, November 6-9, 2005, Guilin, China accepted for publication in *Rare Metal Matls and Engin.*

Patents

1. US Patent : "Microelectromechanical Heating Apparatus and Fluid Preconcentrator Device Utilizing Same," Patent 6,914,220; inventors: W. C. Tian, S. Pang, E. T. Zellers, issued on July 5, 2005.

Appendix B: Publications, Presentations, & Funded Projects for OHN Faculty and Students

PUBLICATIONS

Barkauskas, V., Schafer, P., Sebastian, J.G., Pohl, J. M., Benkert, R., Nagelkerk, J., Stanhope, M., Vonderheid, S.C., Tanner, C.L. (in press). Clients Served and Services Provided by Academic Nurse-Managed Centers. Journal of Professional Nursing.

Benkert, R., George, N., Tanner, C., **Barkauskas, V.**, Pohl, J.M., Marszalek, A. (in press). Satisfaction with a school based teen health center: A report card on care. Pediatric Nursing.

Brady, J. & **Hong, O.** (in press). Work climate and hearing protection behaviors in construction workers. Professional Safety

Hong, O. & Samo, D. (in press). Hazardous decibel and hearing loss in fire fighters. Association of American Occupational Health Nurses Journal

Knoblaugh, D.J., & **Strasser, P.B**.** (2006). Legal and ethical issues. In M. Salazar (ed.), AAOHN Core Curriculum for Occupational Health Nursing (3rd ed.); WB Saunders Co.

Lusk, S. L., **Raymond, D. M***, Connon, C., & Miller, M. (2006). Workers and worker populations. In Salazar, M.K. (Ed.). Core curriculum for occupational & environmental health nursing (3rd ed). Philadelphia: W.B. Saunders.

McCullagh, M.* (2006). Home modifications: Nurses can make life at home safer and more convenient as abilities change. American Journal of Nursing, 106(10), 56-65.

McCullagh, M.* (in press). Pender's health promotion model. In Peterson, S. and Bredow, T., Middle-range theories: Applications to nursing research. Philadelphia: Lippincott.

Pohl, J. M., Breer, L., Tanner, C., **Barkauskas, V.**, Bleich, M., Bomar, M., Fiandt, K., Jenkins, M., Lundeen, S., Mackey, T., Nagelkerk, J., Werner, K. (2006). National consensus on data elements for nurse managed health centers. Nursing Outlook, 54(2), 81-84.

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Vonderheid, S., **Barkauskas, V**., Pohl, J. M**.,** Sebastian, J. (2006). Codes Utilized at Nurse-Managed Centers: Results from A National Pilot Survey. Public Health/Community Health Centers Section Symposium. The 30th annual Midwest Nursing Research Society conference in Milwaukee, Wisconsin.

ONGOING FUNDED RESEARCH PROJECTS

Hong, PI, NIHL-Expert (NIHL-e) System Intervention: Developmental Stage I, P30-Michigan Center for Health Intervention (MICHIN), NINR.

Hong, Co-I, Worksite intervention to promote physical activity (Thomas, PI), NIOSH

Hong, Co-PI, Web-based survey of hearing protection behavior in workers of six power plants in Korea, Pusan National University.

Hong, Co-PI, Job delineation research with occupational health nurses in Brazil: A part of international comparative study, ABOHN

Hong, PI & faculty sponsor, Occupational exposure, knowledge, and protective behaviors among Korean drycleaners, NIOSH,

Hong, PI, Community-partnered Osteoporosis Awareness Education and Bone Density Screening among Asian Americans in Southeast Michigan, University of Michigan.

Kerr*, PI**,** Latino-based Multimedia to Prevent NIHL, NIDCD

McCullagh*, PI**,** Factors Influencing Farmers' Use of Hearing Protectors, NIOSH

Notations:

Bold – Faculty
***Trainee**
****Denotes those who were trainees and are now on OHN faculty at the UM**

Appendix C: Publications
Occupational Safety Engineering and Ergonomics
(July 2005-June 2006)

Student authors are underlined.

Students receiving NIOSH support as trainees or on PPRT-funded projects are **underlined and bolded**.

Refereed Papers

Bauerly, M., and Liu, Y. (2006). Computational modeling and experimental investigations of interface aesthetics, *International Journal of Human-Computer Studies*, 64(8):670-682.

Berman, M.G., Jonides, J., and Nee, D.E. (in-press). Studying Mind and Brain with fMRI. *Social, Cognitive and Affective Neuroscience.*

Chaffin, D.B. (2005). Improving Digital Human Modeling for Proactive Ergonomics in Design, *Ergonomics*, 48(5):478-491.

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D'Souza, J.C., Franzblau, A., Keyserling, W.M., Gillespie, B., Werner, R.A., Rabourn, R. and Ulin, S.S. (submitted). Analysis of the Third National Health and Nutrition Examination Survey (NHANES III) using Expert Ratings of Job Categories, submitted to *AJIM*.

Green, P. (2006). Parking Crashes and Parking Assistance System Design: Evidence for Crash Data Bases, The Literature, and Insurance Agent Interviews, (*SAE paper 2006-06AE-269*), Warrendale, PA, in press

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Doctoral Dissertations

Ebersole, M. L. *An Investigation of Exposure Assessment Methods for Selected Physical Demands in Hand-Intensive Work* (Advisors: T.J. Armstrong and W.M. Keyserling)

Huang, F. *Human control strategy in dynamic object manipulation tasks* (Advisor: B. Martin)

Kim, K. *Modeling of Head and Hand Coordination in Un-Constrained Three-Dimensional Movements* (Advisor: B. Martin)

Pomales-Garcia, P. *Aesthetic and Performance Aspects of Web-Based Distance Learning Technology* (Advisor: Y. Liu)

Rider, K. *Simulating Reach Trajectories Perturbed by Vehicle Ride Motion* (Advisor: D. Chaffin)

Schmidt, K. *Theoretical and Experimental Investigations in Engineering Aesthetics* (Advisor: Y. Liu)

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Sarter, N.B. (2006). Multiple Resource Theory as a Basis for Multimodal Interface Design: Success Stories and Qualifications. In Kramer, A., Wiegmann, D., and Kirlik, A. (Eds.), Attention: From Theory to Practice. In press.

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Sarter, N.B. (2006). Visual, Tactile, and Multimodal Information Processing. In W.S.Marras and W. Karwowski (Eds.), The Occupational Ergonomics Handbook - Fundamentals and Assessment Tools for Occupational Ergonomics (2nd edition; pp. 23.1 – 23.25). CRC Press/Taylor and Francis.

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Young, S.L., Frantz, J.P., Rhoades, T.P., and Hall, S.M. *(2006)*. Development and Objectives of the ANSI Z535 Series of Standards for Safety Signs and Colors: A Historical Perspective. Wogalter, M.S. (Ed.), *The Handbook of Warnings*, pp. 445-454, Lawrence Erlbaum Associates, Inc., New Jersey.

Young, S.L., Frantz, J.P., Rhoades, T.P., and Wisniewski, E.C. *(2006)*. Revisions of Labeling for Personal Watercraft: Label Development and Evaluation. Wogalter, M.S. (Ed.), *The Handbook of Warnings*, pp. 723-738, Lawrence Erlbaum Associates, Inc., New Jersey.

Oral Papers (abstracts with no written manuscript)

Adams, P.S., (2006) "The New ANSI/AIHA Z10-2005 Standard: Does Ergonomics Fit," *Institute of Industrial Engineers Web Conference*, January, 2006.

Adams, P.S., Joffe, M. (2006) "Experience Ergonomics," *9th Annual Applied Ergonomics Conference*, Orlando, March 2006.

Choi J., Armstrong T.J. (2005) 3-dimensional kinematic model for predicting hand posture during certain gripping tasks, *ISB 2005 Meeting*, Cleveland, OH, August 2005.

Ebersole, M., **M. Lau** and T. J. Armstrong. (2005) Task-based measurement of force in automobile assembly using worker self-assessment, observational analysis and electromyography. *Human Factors and Ergonomics Conference,* Orlando, FL, September 2005 – Winner of Industrial Ergonomics Technical Group Student Paper Award.

Ebersole, M., T. J. Armstrong and A. Johnson (2005) Assessment of Repetition in Automobile Assembly Jobs. *American Industrial Hygiene Conference and Exposition*, Anaheim, CA, May 2005 – Winner of Tichauer Award.

Ferris, T., Sarter, N.B., (2006) "Crossmodal Cuing of Visual Targets in Complex Data-Rich Domains", *ARL ADA CTA RMB/FY07 Planning Meeting*, Westminster, Colorado, February 2006.

Grieshaber, C. D., T. J. Armstrong and **N. Seo**. (2005) Flexor digitorum superficialis muscle activity during three hose insertion tasks as measured by surface electromyography. International Society of Biomechanics, Cleveland, Ohio, July 2005.

Rider, K., Martin, B.J., (2005) "Feedback control of in-vehicle pointing tasks perturbed by ride motion" *35th Annual Meeting of the Society for Neuroscience*, Washington, DC, 2005.

Rider, K., Martin, B.J. (2006) Ride motion effects on the accuracy of rapid pointing tasks. 1st American Conference on Human Vibration, Morgantown, WV, June 2006.

Sarter, N.B., Ferris, T., Hameed, S., and Penfold, R. (2006). Adaptive multimodal information presentation. *Advanced Decision Architectures FY07 Planning and RMB Meeting*, Westminster, Colorado, February 2006.

Sarter, N.B., Ferris, T., and Hameed, S. (2006) How to design adaptive multimodal interfaces for future combat operations: Empirical findings and guidelines. *Army Research Laboratory Collaborative Technology Alliances Conference (CTAC).* Adelphi, MD, April 2006.

Tsimhoni, O., (2005) "The future of night vision systems", *Presented at IOE 836 seminar on Human Factors, University of Michigan*, November 11, 2005.

Tsimhoni, O., Bärgman, J., Minoda, T., and Flannagan, M.J., (2005) "Detecting pedestrians using alternative night vision enhancement systems", *Society for Automotive Engineers World Congress 2005*, Detroit, MI, April 2005.

Womack, S.K., Armstrong, T.J., and Liker, J.K., (2006) Modeling the Relationship between Modern Management Systems and Musculoskeletal Disorders: Does Lean Manufacturing Lead to Poor Ergonomics?, *American Industrial Hygiene Conference 2006*, Chicago, IL.

Wu, C.**,** and Liu, Y. (2006) Queuing Network Modeling of Behavioral and Psychophysiological Measurements in Multitasking*, 2006 Annual Meeting of the Society for Mathematical Psychology*, Vancouver, BC, Canada

Technical Reports (directed study projects, research reports, etc.)

Eoh, H., Green, P.A., Yee, S., Green, P.E., Nguyen,L., and Schweitzer, J. (2005). *Development of a Driving Workload Manager Based upon the ACAS FOT Data (Technical Report UMTRI-2005-**)*, Ann Arbor, MI: University of Michigan Transportation Research Institute.

Green, P.E. Yee, S., Green, P.A., Nguyen, L.,J. and Eoh, H. (2005). *How Do Distracted and Normal Driving Differ: An Analysis of the ACAS FOT Data (Technical Report UMTRI-2005-**)*, Ann Arbor, MI: University of Michigan Transportation Research Institute.

Hoffman, S.G., Chaffin, D.B., and Reed, M.P. (2005). *Biomechanical Posture-Prediction Model for Standing Tasks*, Human Motion Simulation Laboratory Progress Report, December 2005.

Nguyen, L., Yee, S., Green, P.A., Schweitzer, J., and Eoh, H. (2005). *The Second Generation UMTRI Scheme for Coding Driver Activities in Distraction (Technical Report UMTRI-2005-**)*, Ann Arbor, MI: University of Michigan Transportation Research Institute.

Sarter, N.B., Hameed, S., Jayaraman, S. and Ferris, T. (2006). *Supporting Preattentive Reference and Interruption Management through Multimodal Notifications*. Report prepared for NASA Johnson Research Center (under ESR&T (Exploration Systems Research and Technology) SISM (Software, Intelligent Systems, and Modeling) Project "Liaison Agents for Distributed Crew Interaction with Autonomous Control" (PI: Debra Schreckenghost), June 2006.

Schweitzer, J., Green, P.A., and ** (2005). *Task Acceptability and Workload of Driving Urban Roads, Highways, and Expressway: Ratings from Video Clips (Technical Report UMTRI-2005**)*, Ann Arbor, MI: University of Michigan Transportation Research Institute.

Tsimhoni, O., Minoda, T., and Flannagan, M.J. (2005). *Pedestrian Detection with Night Vision Systems Enhanced by Automatic Warnings (Technical Report UMTRI-2005-23)*. Ann Arbor, MI: The University of Michigan Transportation Research Institute.

Wagner, D.W. (2005). *Transition-Stepping Classification for Manual Materials Handling Tasks*, Human Motion Simulation (HUMOSIM) Partners Meeting, December 2005.

Wagner, D.W. (2006). *Transition Stepping for Manual Materials Handling Tasks.* Human Motion Simulation (HUMOSIM) Partners Meeting, Ann Arbor, Michigan.

Wise, M.J. (2006) *Analysis of Runway Incursions: Literature Overview and Recommendations for the Future*, IOE 590 Masters Directed Research Final Report, June 2006.

Yee, S. , Green, P.A., Eoh, H., Nguyen, L. and Schweitzer, J. (2005). *Distracting Tasks People Do While Driving: An Analysis of the ACAS FOT Data(Technical Report UMTRI-2005-**)*, Ann Arbor, MI: University of Michigan Transportation Research Institute.

Yee, S., Green, P.A., Nguyen, L., Schweitzer, J., and Oberholtzer, J. (2006). *Second Generation UMTRI Scheme for Classifying Driver Activities in Distraction Studies and Coding ACAS Video Clips* (Technical Report UMTRI-2006-16), Ann Arbor, MI: University of Michigan Transportation Research Institute.

Newsletters and Non-refereed Publications

Chaffin, D.B. (2005) A Survey of Human Factors Courses in Engineering, The HFES Educators Newsletter, March 2005.

Ulin, S.S. and Keyserling, W.M. (2005). Self-Elevating Vehicle used as an Ergonomic Intervention in Automotive Parts Distribution Operations. MIOSHA News, Summer Issue. Circulation of 20,000.

New Courses and Substantially Revised Courses

Armstrong, Thomas
In the future, I plan to continue developing and teaching IOE 463 Work Measurement and Design. I believe that this is an excellent cornerstone course for ergonomics and management. In 2006 it will be converted from a 2 hour half term evening course to a 3 hour full term day course. Course enhancements include elimination of some of the older material on performance ratings, more emphasis on methods analysis, predetermined time systems, lean manufacturing, allowances for control of musculoskeletal disorders, work station design and layout guest lectures and field trips. The laboratories have been replaced with in-class demonstrations, filed trips and homework exercises. I have drafted a text book for the class that has been distributed as a series of handouts. I hope to have a completed draft that I can hand out at the beginning of the fall term.

Green, Paul
1. IOE 491 - Automotive Human Factors - new
2. Human Factors Engineering Short Course (substantially revised)

Sarter, Nadine
IOE 491 - "Multimodal Displays: Conceptual Basis and Design"

Honors and Awards

Thomas J. Armstrong:
2005 College of Engineering Research Excellence Award
Appointment to the CoE CPD Executive Committee

Marc G. Berman: Won a National Science Foundation Graduate Research Fellowship

Yili Liu: Jon R. and Beverly S. Holt Awards for Excellence in Teaching, 2006.

David W. Wagner: Outstanding Mentor Award presented by the Office of the Associate Dean for Graduate Education and the Graduate Student Advisory Committee (2/28/2006)

Sarah K. Womack: Tichauer Award for best student podium presentation at the American Industrial Hygiene Conference 2006, Chicago, IL.

Research Supervision

Yili Liu:

1. Cristina Pomales-Garcia, graduated in April 2006, dissertation title: "Aesthetic and performance aspects of web-based distance learning technology."
2. Kristi Schmidt, graduated in April 2006, dissertation title: "Theoretical and experimental investigations in engineering aesthetics."

Bernard Martin:

1. Felix Huang
   (co-chaired with R. B. Gillespie) PhD defense April 27, 2006
   title : *Human control strategy in dynamic object manipulation tasks*

Nadine Sarter:

1. Crossmodal Links in Attention Between Vision, Audition, and Touch: Their Implications For The Design of Adaptive Multimodal Interfaces (NSF) –Shameem Hameed (Ph.D.) and Swapnaa Jayaraman (Ph.D.)
2. Advanced Decision Architectures: Building Information Superiority in the Army through User-Centered Decision Support (U.S. Army Research Laboratory) - Thomas Ferris (Ph.D.), Shameem Hameed (Ph.D.)

Research to Practice

Paul S. Adams
"Integrating Worker Health and Safety into Water Utility Operation, Management, and Facility Design" is a multi-year project sponsored by the American Water Works Association Research Foundation (AwwaRF) and funded by AwwaRF and the U.S. EPA. This project will identify and report on various aspects of safety program management and technologies in the Water Utilities industry, including cost benefit analysis, ergonomics, and safety through design strategies. The project team includes Principle Investigators Paul Adams (Applied Safety and Ergonomics, Inc.) and John Borowski (Black & Veatch).

Thomas J. Armstrong
Armstrong's research focuses on work related musculoskeletal disorders. His new initiatives involve the design of equipment for hand work and the design of hand-held data entry devices. Other current research areas include hand coupling as a factor in

falls and recovery from falls, including ladders and the role of hand activities of daily living, particularly transfer activities for elderly populations.

Paul Green
SAVE-IT project
As a subcontractor to Delphi, using US DOT funds, we are carrying out research on a workload manager, a system to determine when drivers are overloaded. Delphi is now building a test vehicle to implement the research.
Nissan Around View Monitor
Nissan is developing a video system to assist drivers with parking and other driving tasks. We did the research to support design for the US market
IVBSS (Integrated Vehicle-Based Safety System)
We are carrying out simulator studies to support a field test of multiple in-vehicle warnings systems. The field test will take place in the fall of 2007.

Barry Kantowitz

SAFETY AND HEALTH APPLICATIONS OF KANTOWITZ RESEARCH
The goal of this research is to eliminate, or at least minimize, automobile crashes. Intelligent transportation systems offer the potential to reduce the severity of crashes and can also prevent some crashes. People who die or are injured in automobile crashes are unhealthy. So this research will improve occupant health and safety.

Sheryl S. Ulin, Ph.D., CPE
The University of Michigan Center for Ergonomics has been awarded annual Consultation, Education and Training (CET) Grants from the State of Michigan to provide ergonomics job analysis and training and conduct follow-up activities with small and medium sized Michigan companies. (Funding dates include: 10/1/91 – 9/30/01 and 10/1/03 – 9/30/07). The project provides companies written job analysis reports that include recommendations for workplace changes to reduce worker exposure to musculoskeletal disorders. In addition, the training provided on-site at companies provides knowledge to workers, engineers and managers so they can identify workplace risk factors and develop workplace interventions. This project also provides opportunities for students to apply occupational safety and health principles. One Ph.D. student, Michael Lau, is partially funded by this project. Undergraduate and graduate students visit companies involved in this grant program to provide additional service through class projects that include application of ergonomics principles.

Yili Liu:
Our research on multi-task cognitive modeling will likely to have impact on improving the safety of workers engaged in multiple tasks simultaneously as required in many jobs. Our research on engineering aesthetics will likely to have impact on the affective and aesthetic design of safety devices and warning systems to attract users attention and achieve greater safety and usability**.**

Bernard Martin:
Realistic simulation of movements is expected to significantly improve pro-active ergonomics by providing computer aided tools capable or reproducing human activities with high fidelity and thus improve the predictability of possible injuries associated with motion.

Nadine Sarter:

1. Crossmodal Links in Attention Between Vision, Audition, and Touch: Their Implications For The Design of Adaptive Multimodal Interfaces (NSF)
2. Advanced Decision Architectures: Building Information Superiority in the Army through User-Centered Decision Support (U.S. Army Research Laboratory)

The above two research projects focus on the design of multimodal interfaces (i.e., interfaces that present information in visual, auditory, and tactile form) for the domains of air traffic control, medicine (in particular, in ORs and ICUs), and military operations. By creating robust and effective multimodal displays, we hope to better support operators in the detection and processing of critical information and thus improve task performance and increase safety in these environments.

Service

Paul S. Adams:

Director, Board of Certified Safety Professionals
Director and BCSP Representative, Council of Engineering and Scientific Specialty Boards
Pre-conference Program Co-Chair and Conference Organizing Committee, Applied Ergonomics Conference
Advisor, NIOSH ERC Advisory Board for the University of Michigan Center for Occupational Health and Safety
Reviewer of competitive proposals for NIOSH Research Pilot Projects, University of Michigan Center for Occupational Health and Safety ERC

Thomas J. Armstrong:

Dept/Coll/Univ	Service Assignment	Role
IOE	IOE Safety	Chair
IOE	GAFA	Chair
IOE	Awards	Member
IOE	APM advisor	
CoE	Safety	Chair
CoE	Promotion CEE	Member
UM	Campus Safety and Security Advisory Committee	Member

Position	Publication
Member	Scandinavian J. Work Environment and Health
Member	J. Occupational Rehabilitation
Ad Hoc	Human Factors and Ergonomics
Ad Hoc	Applied Ergonomics
Ad Hoc	Ergonomics
Ad Hoc	Clinical Biomechanics
Ad Hoc	J. Biomechanics

ACGIH	TLV Physical Agents Committee	Member

Professional Outreach & Public Service:

- Advisor Committee Seminar

Marquette University RERC on Accessible Medical Instrumentation
Marquette University, seminar on computerized tools for ergonomic analysis

- Organized Conference with UC Berkeley

Ergonomic Interventions and Research: Preventing Musculoskeletal Disorders in Healthcare, Construction and Other Industries
December 8-9, 2005, San Francisco, CA

- UAW Safety Training

3/2/05 Blacklack, MI

- NUMMI

Presentation to NUMMI S&H team regarding research opportunities with UM, November 10 and 11, 2005, Freemont, CA

- Rio Physical Medicine Center

Presentation to Rio Rehab to discuss rehab research and joint conference, Harlingen, TX

- Daimler Chrysler

Lectures on"Force Assessment" and "ACGIH TLV for monotask handwork" Oct 19 & 20, 2005

- UAW GM

Analysis of Multi-task Jobs" on May 11, 17, 18 and 19

- U Puerto Rico

Presented lecture on ACGIH TLV, & Ergo-Lean, 6/10/2005, San Juan, PR

Paul Green:

Human Factors and Ergonomics Society
Chair, Publications Committee
Member, HFES Institute Task Force
Member, Resource Development Task Force

Barry Kantowitz:

Associate Editor, *Human Factors*

Yili Liu:

1. Associate Editor: IEEE Transactions on Systems, Man, and Cybernetics
2. Associate Editor: IEEE Transactions on Intelligent Transportation Systems

Bernard Martin:

Reviewer for: Ergonomics, HFES, J Biomechanics

Sheryl S. Ulin, Ph.D., CPE

Co-Chair of the Ergonomics Advisory Committee for the state of Michigan, MIOSHA

Charles B. Woolley:

Administered BCPE exam, 4/10/06.

Appendix C.
Publications and Presentations by Occupational Epidemiology Trainees.

1. Adriaens, P; Demond, A; Towey, T; Chang, Sc; Chen, Q; Franzblau, A; Garabrant, D; Gillespie, B; Gwinn, D; Hedgeman, E; Hong, B; Knutson, K; Ladronka, K; Lee, CY; Lepkowski, J; Olson, K; Sima, C; Sinibaldi, J; Ward, B; Zwica, L. Invited Presentation. Measurements of Soil Concentrations of PCDDs, PCDFs, and PCBs From a Community in Michigan, USA. Dioxin 2006 Conference, Oslo, Norway.

2. Chen, Q; Lee, S-Y; Hedgeman, E; Ghosh, D; Gillespie, BW; Lepkowski, J; Garabrant, D. Abstract. Comparison of Machine Learning Methods and Linear Regression Models in Identifying Important Predictor Variables For Serum Dioxin TEQ For a Community in Michigan, USA. Dioxin 2006 Conference, Oslo, Norway.

3. Chen, Q; Lee, S-Y; Hedgeman, E; Olson, K; Little, RJA; Elliott, MR; Gillespie, BW; Lepkowski, J; Garabrant, D; Franzblau, A. Abstract. Environmental Factors That Explain Variation in The Upper Percentiles of Serum Dioxin Concentrations in a Community in Michigan, USA. Dioxin 2006 Conference, Oslo, Norway.

4. D'Souza JC, Franzblau A, Werner RA. Review of epidemiologic studies on occupational factors and lower extremity musculoskeletal and vascular disorders and symptoms. J Occup Rehab. 2005;15(2):129-165.

5. D'Souza JC, Robert A. Werner, W. Monroe Keyserling, Brenda Gillespie, Randall Rabourn, Sheryl Ulin, Alfred Franzblau. Analysis of the Third National Health and Nutrition Examination Survey (NHANES III) using Expert Ratings of Job Categories. [submitted]

6. D'Souza JC, W. Monroe Keyserling, Robert A. Werner, Brenda Gillespie, Alfred Franzblau. Expert Consensus Ratings of Job Categories from the Third National Health and Nutrition Examination Survey (NHANES III). [submitted]

7. Franzblau A, Werner RA, Yihan J. Pre-placement nerve testing for carpal tunnel syndrome: Is it cost-effective? J Occ Environ Med. 2004;46(7):714-719.

8. Franzblau, A; Garabrant, D; Adriaens, P; Gillespie, BW; Demond, A; Olson, K; Ward, B; Hedgeman, E; Knutson, K; Zwica, L; Towey, T; Chen, Q; Ladronka, K; Sinibaldi, J; Chang, S; Lee, S; Gwinn, D; Sima, C; Swan, S; Lepkowski, J. Invited Presentation. The University of Michigan Dioxin Exposure Study: Project Overview. Dioxin 2006 Conference, Oslo, Norway.

9. Franzblau, A; Hedgeman, E; Chen, Q; Lee, SY; Adriaens, P; Demond, A; Garabrant, D; Gillespie, B; Lepkowski, J. Abstract. A Follow-Up Investigation of High Serum Outliers From The University of Michigan Dioxin Exposure Study. Dioxin 2006 Conference, Oslo, Norway.

10. Garabrant, D.H.; Franzblau, A; Lepkowski, J; Adriaens, P; Demond, A; Hedgeman, E; Knutson, K; Zwica, L; Chen, Q; Olson, K; Ward, B; Towey, T; Ladronka, K; Sinibaldi, J; Chang, S-C; Gwinn, D; Sima, C; Swan, S; Gillespie, B. Invited Presentation. Environmental Factors That Explain Variation in Serum Dioxin Concentrations in a Community in Michigan, USA. Dioxin 2006 Conference, Oslo, Norway.

11. Garabrant, D.H.; Franzblau, A; Lepkowski, J; Adriaens, P; Demond, A; Hedgeman, E; Knutson, K; Zwica, L; Chen, Q; Olson, K; Ward, B; Towey, T; Ladronka, K; Sinibaldi, J; Chang, S-C; Lee, C; Gwinn, D; Sima, C; Swan, S; Gillespie, B. Abstract. Background Levels of PCDDs, PCDFs, and PCBs in Blood, Soil, and Household Dust in The General Population of Michigan, USA. Dioxin 2006 Conference, Oslo, Norway.

12. Gillespie, B; Chen, Q; Lee, SY; Hong, B; Garabrant, D; Hedgeman, E; Sima, C; Lepkowski, J; Olson, K; Luksemburg, W. Abstract. A Comparison of Data Analysis Options When Some Values Are Below The Limit of Detection (LOD). Dioxin 2006 Conference, Oslo, Norway.

13. Gohagan JK, Marcus PM, Fagerstrom RM, Kucera G, The Lung Cancer Screening Study Research Group. Final results of the Lung Screening Study, a randomized feasibility study of spiral CT versus chest X-ray screening for lung cancer. Lung Cancer 2005;47(1):9-15.

14. Hedgeman , E; Chang , S-C; Towey , T; Demond , A; Adriaens , P; Chen , Q; Franzblau , A; Gillespie , BW; Sima , C; Garabrant , D. Abstract. Principal Components Analysis of Serum PCDDs, PCDFs, and PCBs From a Community in Michigan, USA. Dioxin 2006 Conference, Oslo, Norway.

15. Hedgeman , E; Chen , Q; Gillespie , BW; Franzblau , A; Garabrant , D. Abstract. A Comparison of Serum PCDD, PCDF, and PCB Levels From a Community in Michigan, USA With The United States Population. Dioxin 2006 Conference, Oslo, Norway.

16. Hedgeman , E; Maier , M; Luksemburg , W; Patterson , D; Knutson , K; Franzblau , A; Garabrant , D; Lee, S. Y. Abstract. Quality Assurance Methods During The Serum Analyses of PCDD, PCDF, and PCB Levels For The University of Michigan Dioxin Exposure Study. Dioxin 2006 Conference, Oslo, Norway.

17. Hedgeman, E; Chen , Q; Gillespie , BW; Franzblau , A; Knutson , K; Zwica , L; Sima , C; Lee , S-Y; Lepkowski , J; Ward , B; Ladronka , K; Olson , K; Sinibaldi , J; Towey , T; Adriaens , P; Demond , A; Chang , S-C; Gwinn , D; Swan , S; Garabrant , D. Invited Presentation. Measurements of Serum Concentrations of PCDDs, PCDFs, and PCBs From a Community in Michigan, USA Dioxin 2006 Conference, Oslo, Norway.

18. Knutson, K; Chen, Q; Gillespie, BW; Hong, B; Hedgeman, E; Ward, B; Olson, K; Franzblau, A; Garabrant, D. Abstract. Pregnancy and Breast Feeding and Their Relationship To Serum PCDD, PCDF, and PCB Levels For a Community in Michigan, USA. Dioxin 2006 Conference, Oslo, Norway.

19. LaDronka, K; Ward, B; Olson, K; Freeland, S; Sinibaldi, J; Hedgeman, E; Zwica, L; Towey, T; Demond, A; Franzblau, A; Garabrant, D; Adriaens, P; Lepkowski, J. Abstract. Cross-Organizational Training On The University of Michigan Dioxin Exposure Study: Ensuring Consistency, Confidentiality and Cooperation in Data Collection. Dioxin 2006 Conference, Oslo, Norway.

20. Le, H, Alireza Sadeghnejad, Julia J. Wirth, Mary Lee Hultin, Michael Depa, S. Batterman, Robert L. Wahl, “Association of Ozone with Low Birth Weight in

Southeast Michigan, 1990-2001," presented at the Annual Meeting of the Council of State and Territorial Epidemiologists, Albuquerque, NM, 2005.

21. Le, H.; S. Batterman; Alireza Sadeghnejad; Julia J. Wirth; Mary Lee Hultin; Michael Depa; Robert L. Wahl, "Association of ozone with low birth weight in Michigan, 1990-2001, using multiple imputation method for missing ozone values," 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 2005.

22. Le, H; S. Batterman, K. Dombkowski, R. Wahl, J. Wirth, E. Wasilevich, M. Depa, "A Comparison Of Multiple Imputation And Optimal Estimation For Missing And Uncertain Urban Air Toxics Data," presented at the International Conference on Environmental Epidemiology & Exposure, 2006, Paris, France.

23. Olson, K; Lepkowski, J; Ward, B; Ladronka, K; Sinibaldi, J; Franzblau, A; Adriaens, P; Gillespie, B; Bandyk, J; Chang, Sc; Chen, Q; Demond, A; Gwinn, D; Hedgeman, E; Knutson, K; Lee, S; Sima, C; Swan, S; Towey, T; Zwica, L; Garabrant, D. Invited Presentation. Prevalence of Exposure Routes in The University of Michigan Dioxin Exposure Study: Food Consumption, Recreational and Household Activities, Occupations and Demographics. Dioxin 2006 Conference, Oslo, Norway.

24. Rolnick S, Hensley-Alford S, Kucera GP, Fortman K, Ulcickas-Yood M, Jankowski M, Johnson C. Racial and age differences in colon examination surveillance following a diagnosis of colorectal cancer. J Natl Cancer Inst Monogr 2005; 35:96-101.

25. Sadeqnejad, A., H. Le, M.L. Hultin, S. Batterman, M. Depa, J. Wirth, D. Cornell, R. Wahl, "Adverse Birth Outcomes and Air Pollution in Michigan", Michigan Epidemiology Conference, Ann Arbor, MI, March 11, 2005.

26. Ulcickas Yood M, McCarthy BD, Kempf J, Kucera GP, Wells K, Oliveria S, Stang P. Racial differences in reaching target low density lipoprotein goal among individuals treated with prescription statin therapy. Am Heart J 2006; 152(4):777-84.

27. Ulcickas Yood M, Watkins E, Wells K, Kucera G, Johnson CC, Lydick E. The impact of NSAID or COX-2 use on the initiation of antihypertension therapy. Pharmacoepidemiol Drug Safety 2006.

28. Ward, B; LaDronka, K; Skoman, M; Olson, K; Sinibaldi, J; Lepkowski, J; Blackburn, Z; Freeland, S; Franzblau, A; Hedgeman, E; Zwica, L; Towey, T; Demond, A; Garabrant, D. Abstract. Considerations For Managing a Large, Multi-Faceted Study Involving Multiple Organizations. Dioxin 2006 Conference, Oslo, Norway.

29. Zwica, L; Chang, S-C; Towey, T; Knutson, K; Adriaens, P; Demond, A; Chen, Q; Gillespie, B; Franzblau, A; Garabrant, D. Abstract. Principal Components Analysis of Household Dust Concentrations of PCDDs, PCDFs, and PCBs From a Community in Michigan, USA. Dioxin 2006 Conference, Oslo, Norway.

30. Zwica, L; Franzblau, A; Knutson, K; Gillespie, BW; Chen, Q; Lee, S-Y; Hong, B; Garabrant, D. Abstract. Predictors of Household Dust Concentrations of PCDDs,

PCDFs, and PCBs in a Community in Michigan, USA. Dioxin 2006 Conference, Oslo, Norway.

31. Zwica, L; Knutson, K; Towey, T; Hedgeman, E; Franzblau, A; Chen, Q; Lee, S-Y; Sima, C; Gillespie, B; Adriaens, P; Demond, A; Lepkowski, J; Ward, B; Ladronka, K; Olson, K; Sinibaldi, J; Chang, S-C; Gwinn, D; Swan, S; Garabrant, D. Invited Presentation. Measurements of Household Dust Concentrations of PCDDs, PCDFs, and PCBs From a Community in Michigan, USA. Dioxin 2006 Conference, Oslo, Norway.

Appendix C. Publications

The following lists publications involving HSAT Program faculty and/or trainees that have resulted in whole or in part from ERC training grant support.

Journal Publications

1. S. Batterman, C. Godwin, C. Jia, "Long Duration Tests of Room Air Filters in Cigarette Smokers' Homes," *Environmental Science & Technology*, 39, 18, 7260 – 7268, 2005.10.1021/es048951q
2. J.P. Hickey, S. Batterman, and S.M. Chernyak, "Trends of Chlorinated Organic Contaminants in Great Lakes Trout and Walleye from 1970 to 1998," *Archives of Environmental Contamination and Toxicology*, 50, 97-110, 2006. Online Nov. 15, 2005. DOI: 10.1007/s00244-005-1007-6
3. S. Batterman, C. Jia, G. Hatzivasilis, C. Godwin, "Simultaneous Measurement of Ventilation Using Tracer Gas Techniques and VOC Concentrations in Homes, Garages and Vehicles," *Journal of Environmental Monitoring*, 8, 249-256, 2006. DOI: b601100.
4. S. Batterman, Jae Hwan Lee, Chunrong Jia, Sergei Chernyak, "Ozone Artifacts and Carbonyl Measurements using Tenax GR, Tenax TA, Carbopack B and Carbopack X Adsorbents," *J. Air & Waste Management Association*, accepted.
5. Christopher Godwin, S. Batterman, "Indoor Air Quality in Michigan Schools", *Indoor Air, accepted.*
6. Chernyak S, Batterman S, Gwynn E, Jia C, Begnoche L, "Temporal (1983-2005) and spatial trends of polybrominated diphenyl ethers in great lakes rainbow smelt and lake trout," Organohalogenated Compounds, accepted (2006).
7. S. Batterman, S. Chernyak, Y Gounden, M Matooane, "Concentrations of persistent organic pollutants in ambient air in Durban, South Africa," Organohalogenated Compounds, accepted (2006).
8. C. Jia, S. Batterman, S. Chernyak, "Development and Comparison of Methods using MS Scan and Selective Ion Monitoring Modes for a Wide Range of Airborne VOCs", submitted.

Conference Presentations

1. C Jia, S. Batterman, S Chernyak, "Development of a sensitive thermal desorption GC-MS method using selective ion monitoring for a wide range of VOCs," presented at IAQ 05, Beijing, China, Sept. 4-9, 2005.
2. S. Batterman, C Jia, C Godwin, G Hatzivasilis, "Distributions of Volatile Organic Compounds (VOCs) in Indoor and Outdoor Air among Industrial, Urban and Suburban Neighborhoods," presented at IAQ 05, Beijing, China, Sept. 4-9, 2005.
3. S. Batterman, C. Jia, S. Chernyak, Y. Gounden, "Exposure assessment for toxic air pollutants in Durban, South Africa," *Epidemiology*. 16(5): S129-S130, September 2005. Also presented at the 17th Conference of the International Society for Environmental Epidemiology, Johannesburg, South Africa, Sept. 13-17, 2005.

4. S. Batterman, C. Godwin, C. Jia., “Biological monitoring for VOCs,” presented at Workshop on the Interpretation of Biomonitoring Data and their relationship to Exposure Information, American Chemistry Council, Minneapolis, MN, July 26-27, 2006.
5. Chernyak S, Batterman S, Gwynn E, Jia C, Begnoche L, “Temporal (1983-2005) and spatial trends of polybrominated diphenyl ethers in great lakes rainbow smelt and lake trout,” presented at Dioxin 2006, Oslo, Norway, Aug. 21-5, 2006.
6. S. Batterman, S. Chernyak, Y Gounden, M Matooane, “Concentrations of persistent organic pollutants in ambient air in Durban, South Africa,” to be presented at Dioxin 2006, Oslo, Norway, Aug. 21-5, 2006.
7. S. Batterman, C. Godwin, C. Jia, “Design and Evaluation of a New Breath Monitoring System for Volatile Organic Compounds,” presented at the International Council of Chemical Association (ICC) Biomonitoring Workshop, Minneapolis, MN, July 26-7, 2006. Invited.
8. S. Charles, S. Batterman, “Quantification of 2,5-dimethylfuran in Environmental Tobacco Smoke (Quantifying and Reducing Exposures to Environmental Tobacco Smoke),” presented to the 2006 University of Michigan Tobacco Research Network Workshop, School of Public Health, University of Michigan, Ann Arbor, May 9, 2006.

PILOT PROJECT RESEARCH TRAINING PROGRAM APPENDICES:

Appendix PPRT – 1. University of Michigan PPRT Faculty Advisors

Appendix PPRT – 2. 2006-07 Program Announcement

Appendix PPRT – 3. Scoring Sheet used by Scientific Review Committee

Appendix PPRT – 4. Summary of Funded & Unfunded Pilot Projects – Reporting Year (2005-06)

Appendix PPRT – 5. Updated List of Publications, Proposals, and Placements

Appendix PPRT – 6. Summary of Funded & Unfunded Pilot Projects – Next Year (2006-07)

Appendix PPRT – 1.
University of Michigan PPRT Faculty Advisors

Faculty Member	Areas of Expertise
Thomas Armstrong, Ph.D.	Upper Extremity CTDs, Rehabilitation Ergonomics
Violet Barkauskas, Ph.D.	Evaluation of Health Promotion/Risk Reduction Programs, Outcomes of Community-based Nursing Services
Stuart Batterman, Ph.D.	Hazardous Waste, Environmental Science
Don Chaffin, Ph.D.	Low Back Pain, Manual Materials Handling, Digital Modeling
Alfred Franzblau, M.D.	Work-related MSDs, Pulmonary Disease, Biological Monitoring
David Garabrant, M.D.	Occupational and Environmental Cancer Epidemiology
Paul Green, Ph.D.	Design of Interactive Displays and Controls, Cognitive Ergonomics
Bonnie Haggerty, Ph.D.	Occupational psychosocial stress and depression
Oisaeng Hong, Ph.D.	Effects of noise exposure, evaluation of workplace intervention programs, computer-based tailored training
Howard Hu, M.D.	Occupational Medicine and Epidemiology.
Barry Kantowitz, Ph.D.	Transportation Safety, Cognitive Ergonomics
Monroe Keyserling, Ph.D.	Safety Engineering, Postural Biomechanics, Rehab. Ergonomics
Yili Liu, Ph.D.	Cognitive Ergonomics, Human/computer Interaction
Bernard Martin, Ph.D.	Vibration, Work Physiology
John Meeker, Sc.D.	Exposure Assessment
Thomas Robins, M.D.	Solvent Neurotoxicity, Occupational Nephropathy, Inhalation Toxicology, Evaluation of OH&S Training Programs
Nadine Sarter, Ph.D.	Human Error, Multi-modal display systems

Patricia Strasser, Ph.D.	Psychological Stress and Upper Extremity Disorders
James Vincent, Ph.D., Sc.D.	Aerosol Science, Exposure Assessment, Occupational Health Standards, Computational Fluid Dynamics
Reg Williams, Ph.D.	Workplace interventions for depression
Chuanwu Xi, Ph.D.	Integrated biosensors for environmental monitoring
Edward Zellers, Ph.D.	Air Sampling, Instrumentation, PPE, Exposure Assessment

Appendix PPRT – 2.

2006-07 Pilot Project Program Announcement

FINAL ANNOUNCEMENT:
Support for Pilot Research Projects in Occupational Health and Safety

The University of Michigan Center for Occupational Health and Safety Engineering (UM-COHSE), a NIOSH Education and Research Center (ERC) invites proposals for pilot research training projects in occupational safety and health for the period November 1, 2006 through June 30, 2007. It is anticipated that a single project will be funded under this initiative. This program is open to students and faculty at colleges and universities in HHS Region V (the Great Lakes Region) and nearby states. This program is open to students and faculty at The University of Michigan and other colleges and universities in HHS Region V (the Great Lakes Region) and nearby states.

Applications are invited from the following groups:

The University of Michigan

- Ph.D. students enrolled in UM-COHSE programs (Industrial Hygiene/HSAT, Occupational Health Nursing, Occupational Epidemiology, and Occupational Safety and Ergonomics)
- Junior faculty (non-tenured) affiliated with UM-COHSE programs
- University of Michigan Ph.D. students, post-doctoral fellows, and junior faculty in non- UM-COHSE programs who wish to develop or enhance their OH&S research capabilities

Other Universities in HHS Region V and Nearby States

- Ph.D. students and junior faculty who wish to develop or enhance their OH&S research capabilities.

A principal objective of this program is the support of research training, therefore all applications must demonstrate that the proposed work will increase the number and quality of scientists who pursue research careers in occupational health and safety disciplines. Consistent with this goal, an individual is eligible to receive only one grant as a pilot project research trainee over the course of his/her career. (Note: This rule does not limit the number of doctoral students that a faculty member can supervise as research trainees.) The program also focuses on pilot research, i.e., innovative studies that generate preliminary results that will lead to applications for traditional peer-reviewed research grants (e.g., NIH R01, R03, etc.) in occupational health and safety disciplines. This program is not intended to support pilot research performed by senior faculty in the absence of a strong research training purpose.

DEADLINE FOR APPLICATIONS

The deadline for applications is 5:00 PM, Friday, September 29, 2006. Submit to:

W. Monroe Keyserling, Ph.D.
Director, Pilot Project Research Training Program
IOE Building

The University of Michigan
1205 Beal Avenue
Ann Arbor, MI 48109-2117

Submitting Applications:

Electronic: Electronic submission of applications is requested. To submit electronically, the entire application package must be converted to a single pdf file. The file should be submitted as an e-mail attachment to Ms. Haack-Withem at the following address:

wmkeyser@umich.edu

Mail: Mail applications will still be accepted, provided that they are postmarked by the September 29 deadline. If you submit by mail, you must send **six** copies of the entire application.

Budget Requirements and Restrictions

Each application must provide a detailed budget and budget justification using the PHS Form 398 format. The maximum amount that will be awarded is $20,000; however the average pilot project award is only $16,980. If the awarded amount is not sufficient to support the proposed work, the applicant must demonstrate the availability of matching funds to assure that all project goals will be achieved by the June 30, 2007 deadline. Only direct costs will be supported.

Budgets may include the following cost categories: necessary equipment and supplies, subject fees, travel costs to collect data, and the cost of necessary research personnel. If support is requested for a doctoral student research trainee, the maximum stipend may not exceed $1731 per month. As a general rule, funding will not be approved for the following costs: faculty salaries, secretarial support for pilot research projects, and tuition for research trainees. Salary support for the research trainee should not exceed 50% of the total project budget.

June 30, 2007 is the absolute last day for any charges to a pilot project account. Any charges incurred after this date will not be reimbursed.

Faculty Oversight of Research Training

Proposals that support a doctoral student as the research trainee must have a faculty sponsor who will serve as the Principal Investigator and will be held responsible for the scientific and fiscal integrity of the project. The PI is also responsible for submitting all reports in a timely manner. The faculty sponsor must serve on the “graduate faculty” of the applicant institution. (A member of the “graduate faculty” has been approved by his/her institution to serve as chair of a doctoral dissertation committee.) The research trainee will serve as a co-Principal Investigator on the project.

Reporting Requirements

A brief mid-year progress report must be submitted no later than Marcy 1, 2007 and cover the following topics:

- Progress to date
- Timeline for completing research tasks
- Plans for publications
- Plans for follow-up research (including anticipated grant applications

A final report must be submitted no later than August 1, 2007. The final report must include the following sections:

- Executive Summary (1 page single-spaced)
- Final Technical Report (approximately 20-30 pages, double spaced, plus references and relevant appendices
- Abstracts of submitted or planned publications
- Plans for follow-up grant applications

Principal Investigators are responsible for submitting the mid-year and final reports by the February and August deadlines.

In addition to the above reports, copies of all publications resulting from the project must be submitted to the Pilot Research Training Program Administrator.

Research Involving Humans or Animal Subjects

All projects involving either human or animal subjects must be reviewed and approved by the appropriate Institutional Review Board. A completed copy of the IRB application must be included with the proposal as a separate document. (When submitting electronically, the IRB application must be submitted as a separate file). Please make careful note of the following requirements:

1. The project title and PI on the IRB application (and IRB approval letter) must be an exact match to the project title and PI on the pilot project proposal.
2. The letter from the IRB must give the names and roles of key research participants. If the project is performed by a Ph.D. student, the IRB letter must list the faculty member as the Principal Investigator and the student as the Research Trainee.
3. Any proposal that does not include a copy of the IRB application will be considered incomplete and will be returned without review.

Note: If the proposal is approved for funding, a copy of the IRB approval letter must be submitted to the Director of The University of Michigan Pilot Project Research Training Program before any funds will be released. **Investigators are STRONGLY ENCOURAGED to apply for IRB approval as soon as possible. NIOSH will not release funds and research may not begin until all IRB documentation is submitted.** (Note: In previous years, several projects have been delayed by several months due to slowness in IRB approvals. This has created problems in meeting the June 30 deadline for completing the pilot project research.)

Proposal Format and Evaluation Criteria

Format for Technical Proposal

All proposals submitted to the Pilot Project Research Training Program will be limited to a maximum of five single-spaced pages**, and must conform to the following format:**

- Abstract (1/2 page maximum, does not count toward page limit)
- Specific Aims (1/2 page maximum)
- Significance (1 page maximum)
- Qualifications of Investigator (includes related research/professional experience of research trainee, 1 page maximum)
- Research Plan (must include quarterly milestones and end of year deliverables, 3 pages maximum)
- Current and Future Sources of Support (1 page maximum)

Note: Any application that exceeds the five page limit will be returned without review.

Additional Required Sections

In addition to the five-page technical proposal, each application must include the following appendices:

A. Budget and Justification (submitted using PHS Form 398 budget format)
B. Curriculum vitae of Research Trainee and Faculty Sponsor
C. Letter of support from Faculty Sponsor
D. Time Line showing start/completion times of major activities
E. Documentation of other sources of support during the budget period (if applicable)
F. Letter(s) of support from regional stakeholder(s) (if applicable)
G. References cited in the proposal

H. Attached as separate file: Completed copy of Human Use IRB application (if applicable). If submitted by paper, only one copy is required.

Evaluation

Proposals will be reviewed by the Pilot Research Project Scientific Review Committee during the month of June. Proposals will be scored on a 100-point quality scale, using the following weighting factors:

Relevance to NORA priorities and regional needs (including: 1) evidence of support from employer, employee, and/or academic stakeholders, and 2) likelihood of developing effective workplace interventions)
25 points

Preparation of investigator to perform proposed work
10 points

Adequacy of resources (faculty advisors, laboratories, computers, access to work sites, etc.) required to complete the pilot project
10 points

Innovativeness and scientific merit; adequacy and feasibility of experimental plan
40 points

Building research capacity of investigator (likelihood of applicant's success in obtaining future funding from conventional sources)
15 points

NORA Priority Areas:

- Dermatitis
- Asthma and Chronic Obstructive Pulmonary Disease
- Fertility and Pregnancy Abnormalities
- Hearing Loss
- Infectious Diseases
- Low Back Disorders
- Musculoskeletal Disorders of the Upper Extremity
- Traumatic Injuries
- Emerging Technologies
- Indoor Environment
- Mixed Exposures
- Organization of Work
- Special Populations at Risk
- Cancer Research Methods
- Control Technology and PPE
- Exposure Assessment Methods
- Health Services Research
- Intervention Effectiveness Research
- Risk Assessment Methods
- Social and Economic Consequences of Workplace Illness and Injury
- Surveillance Research Methods

Appendix PPRT – 3.
Scoring Sheet used by Scientific Review Committee

Pilot Research Proposal Review Sheet
University of Michigan Education and Research Center

Project Title: _____

Investigator: _____

Reviewer: _____

Proposals are scored on a 100-point quality scale, using the following weighting factors:

1. Relevance to NORA priorities* and regional needs**:
   Maximum score = 25 points _____

2. Preparation of investigator to perform proposed work
   Maximum score = 10 points _____

3. Adequacy of resources (faculty advisors, laboratories, computers, access to work sites, etc.) required to complete the pilot project
   Maximum score = 10 points _____

4. Innovativeness and scientific merit; adequacy and feasibility of experimental plan
   Maximum score = 40 points _____

5. Building research capacity of investigator (likelihood of applicant's success in obtaining future funding from conventional sources)
   Maximum score = 15 points _____

TOTAL SCORE _____

BUDGET RECOMMENDATION:

Fund at requested level: Yes No

If requested budget is not recommended, please suggest reductions below:

Appendix PPRT – 4.
Summary of Funded and Unfunded Pilot Projects – Current Year (2005-06)

FUNDED PROJECTS

Note: Project numbers are based on the serial number of all funded pilot projects. During the first six years (July 1999-June 2005), we funded 22 projects. The beginning number for the 2005-06 funding cycle is #23.

Project #23

Institution:	The University of Michigan
Core Area:	Industrial Hygiene
Faculty Sponsor:	Edward T. Zellers, Ph.D.
Research Trainee:	Kathryn Sensenig Hunt, Ph.D. Student, Chemistry
Title:	A Microfabricated Diffusional Vapor Sampler with Integrated Thermal Desorption Heater
NORA Area(s):	Indoor Environments, Emerging Technologies, Exposure Assessment Methods
Direct Cost Budget:	$19,750
Funding Period:	July 2005-June 2006

Abstract:

The development of a passive microfabricated diffusional vapor sampler (μDVS) with integral
thermal desorption heater, occupying a volume of ~0.15 cm3, is proposed. Advantage will be taken of the micron-scale dimensions of the device components to achieve high (pumpless) effective sampling rates, high preconcentration factors, and power-efficient desorption of ambient volatile organic vapors (VOCs). Performance will be assessed in light of theoretical models of diffusional transport and adsorption capacity. The device will be interfaced with a conventional photo-ionization detector as well as a microsensor array and subjected to chamber tests to document the quantitative capture, release, and detection of common indoor and workplace contaminants at ambient concentrations ranging from low-ppb to low-ppm with a duty cycle of ~1-15 minutes. Through this work, the feasibility of performing direct measurement of vapor exposures in occupational environments with such a microsystem will be demonstrated. Different, partially selective adsorbent materials will be tested to explore the possibility of using an array of samplers within a single module for broad-based vapor monitoring. If these preliminary tests are successful, this diffusive sampler design could be adapted for incorporation into the next prototype micro-gas chromatograph (μGC) being developed in an on-going parallel effort funded through the Michigan Center for Wireless Integrated Microsystems (WIMS) in which the PI and co-PI are involved. This research will address needs identified as NIOSH NORA research priorities in the areas of indoor environments, emerging technologies, and exposure assessment methods.

Current Position of Research Trainee:

Ms. Hunt resigned from the PhD program and is employed by a local chemical company.

Papers and Presentations:

Patent Disclosure: "Integrated Microsampler-injector", submitted October 3rd, 2006.

Proposals Submitted/Funded:

Submitted:
Sponsor: Agilent Technologies
PI: E. T. Zellers
Title: MEMS Integrated Sampler-Injector
Project Period: 01/01/07 – 12/31/08
Funding: $ 60,000 (TC)

Project #24

Institution:	The University of Michigan
Core Area:	Ergonomics and Safety
Faculty Sponsor:	Thomas J. Armstrong, Ph.D.
Research Trainee:	Michael Lau, Ph.D. Student, Industrial and Operations Engineering
Title:	Investigating the effect of parallax on upper limb posture analysis
NORA Area(s):	Musculoskeletal disorders, Exposure assessment methods
Direct Cost Budget:	$19,250
Funding Period:	July 2005-June 2006

Abstract:

Observational methods are widely used to estimate work postures for application of job analysis tools used to evaluate stresses associated with hand and wrist musculoskeletal disorders. Often, observations for these methods, which include RULA, OWAS, VIDAR, Strain Index, ACGIH TLV for HAL, REBA, and GM-RFCII, are made retrospectively from video recordings. Available studies show that these estimates may be subject to significant error (Lowe, 2004). The aim of this study is to investigate factors that affect the accuracy and precision of wrist posture estimates based on observations from video recordings. Specific factors include parallax, image size and hand postures.

The effect of parallax on the angle between two intersecting lines can be easily computed and show that the perceived angle changes as a tangent function of the viewing angle. Unless the camera or observer is perfectly aligned with the axis of rotation, there will always be parallax. As a practical matter, it is almost impossible to not have some parallax error for wrist postures; an aspect seldom accounted for in existing literature.

The hand is a solid object, not simply two intersecting lines. The surfaces of the hand have shape, texture and color that provide visual queues that can help observers compensate for parallax. We believe that while these cues assist in posture estimation, they are insufficient to eliminate the effects of parallax.

This project has two aims. First, we will systematically investigate the effect of camera angle, image size and hand posture on observer estimates of static wrist postures. Second, we will determine the effect recording angle has on observer identification of peak and awkward postures in repetitive dynamic wrist motions. We will attempt to relate the findings to relevant risk assessment tools. This project will lay important foundations for research that examines the way ergonomic data are collected; the long term goal being to create a standardized approach to the recording and use of video data. Results can be used to develop preliminary correction factors to reduce observational error introduced by non-ideal video recording angles. Results may also prompt ergonomics researchers to begin reporting video capture methods so that results may be interpreted more carefully. By reducing exposure assessment error, the results will lead to improved exposure-response models and will help practitioners make fewer errors identifying workplace stresses and problematic jobs.

Project #24, continued

Institution:	The University of Michigan
Core Area:	Ergonomics and Safety
Faculty Sponsor:	Thomas J. Armstrong, Ph.D.
Research Trainee:	Michael Lau, Ph.D. Student, Industrial and Operations Engineering
Title:	Investigating the effect of parallax on upper limb posture analysis
NORA Area(s):	Musculoskeletal disorders, Exposure assessment methods
Direct Cost Budget:	$19,250
Funding Period:	July 2005-June 2006

Current Position of Research Trainee:

Mr. Lau remains a Ph.D. student in the Department of Industrial and Operations Engineering. He expects to complete his Ph.D. in the fall of 2007. This project will form the basis of a major portion of his dissertation.

Papers and Presentations:

Planned Presentations:

An abstract from the results of the first study examining the effect of camera angle upon wrist posture estimation from static images will be submitted in October, 2006 for presentation at the annual American Industrial Hygiene Conference and Exhibition. This abstract will focus on the differences observed between particular views for wrist flexion and extension.

An abstract from the results of the second study examining the ability of observers to estimate peak 95th percentile and average wrist posture from videos of simulated tasks will be submitted to Human Factors and Ergonomics Society (HFES) in Februrary 2007 for presentation at the 51st Annual Meeting.

Planned Papers:

A draft of a journal article describing the method and results of the effect of camera angle upon wrist posture estimation from static images will be completed for submission by December 2006. Journals currently being considered are Human Factors, Ergonomics, Applied Ergonomics, and the International Journal of Industrial Ergonomics.

Proposals Submitted/Funded:

None.

Project #25

Institution:	The University of Michigan
Core Area:	Ergonomics and Safety
Faculty Sponsor:	Thomas J. Armstrong, Ph.D.
Research Trainee:	Jaewon Choi, Ph.D. Student, Industrial and Operations Engineering
Title:	Development of a Biomechanical Hand Model for Study of Hand Posture, Strength, and Musculoskeletal Disorders
NORA Area(s):	Musculoskeletal Disorders, Exposure Assessment Methods
Direct Cost Budget:	$16,450
Funding Period:	July 2005-June 2006

Abstract:

The hand is essential for nearly all work activities. Numerous examples of hand-intensive work can be found in manufacturing, offices, health care, the performing arts, and service jobs. Musculoskeletal disorders of the hand and wrist are a leading cause of disability and workers' compensation in many hand intensive jobs. There is strong epidemiological and biomechanical evidence relating musculoskeletal disorders of upper extremities to repeated and sustained exertions, high forces and certain postures. There is a strong need for biomechanical models that can be used to investigate the mechanisms of work-related musculoskeletal disorders and for evaluation and design of jobs.

This study aimed to develop a biomechanical model that can be used for predicting hand posture, strength, and tendon excursion for a given task. Four objectives were proposed to achieve the stated aim. The first objective was to enhance an existing kinematic model to include predictions of tendon excursions. The second objective was to test the hypothesis that MCP (Metacarpophalangeal), PIP (Proximal Interphalangeal) and DIP (Distal Interphalangeal) joint angles change as handle size changes. The third objective was to the test the hypothesis that the tendon excursions and wrist movements are associated with increased risk of WMSDs. The fourth objective was to test the hypothesis that grip force for a cylindrical handle is related to handle size and orientation.

The first objective was achieved by adding C++ code to the existing model (Armstrong and Chaffin, 1979) that predicted tendon excursions. The second objective was achieved by conducting an experiment in which 4 female and 6 male subjects reached for and grasped fixed cylindrical handles 26.2 mm, 60.0 mm and 114.3 mm in diameter. Three replications were obtained for each trial in random order. Light emitting diodes were attached to the back of each joint so that their position could be tracked at 100Hz using an NDI OptoTrak system. MCP, PIP and DIP joint angles were calculated for each sample. Joint angles were found to decrease to a minimum as the subjects reached for the object and then increase to a final angle. Using one-way ANOVA, handle size was found to significantly ($p<0.05$) affect the minimum DIP and PIP joint angles; however, handle size did not significantly affect the minimum MCP joint angle. Final joint angles were found to be significantly affected by handle size for all joints.

The third objective was achieved via a re-analysis of jobs from a cross-sectional study of the relationship between repetitive work and the prevalence of upper limb

musculoskeletal disorders (Latko, et al., 1999). A time-based analysis was performed to determine wrist flexion/extension and radial/ulnar deviation angles from video recordings of 10 jobs ranging from low to high repetition (4 high risk jobs, 3 medium risk jobs and 3 low risk jobs) as described by Armstrong et al. (2003). Mean wrist velocity, mean wrist acceleration and mean tendon excursions of FDP and FDS tendons were found to be significant ($p<0.05$) factors that differentiate MSD risk levels using one-way ANOVA.

The fourth objective was achieved by an experiment that measured grip strength of 11 subjects (6 males, 5 females) using both JAMAR and cylindrical strain-gauge dynamometers. The cylindrical strain-gauge dynamometer was designed to measure a single axial force. By rotating the cylindrical dynamometer by specific angles such as 0º, 30º, 45º, 60º and 90º, the effect of handle orientation was observed. Two-way ANOVA revealed that both handle size and handle orientation with respect to the hand affected grip strength ($p<0.05$).

This work can be used for designing hand-intensive tasks and studying Work-related Musculoskeletal Disorders. Using time-based analysis and laboratory simulation, tendon excursions during specific job can be assessed. The results of the hand movement study can be applied to predict hand posture for different sized and shaped handles. The hand tool can be designed by considering strength capability for various sized and shaped handles with different orientations.

Current Position of Research Trainee:

Mr. Choi is continuing as a Ph.D. student in the Department of Mechanical Engineering. He expects to complete his Ph.D. in April, 2007.

Papers and Presentations:

J. Choi and T.J. Armstrong, J. Young, "Examination of Hand Movements during Certain Gripping Tasks of Small to Large Cylindrical Objects", Preparing for submission to Journal

J. Choi and T.J. Armstrong, J. Young, "3-Dimensional Analysis of Force Vectors during Maximum Gripping of Cylindrical Objects", Preparing for submission to Conference

J. Choi and T.J. Armstrong, "Evaluation of Risk Factors using Time-based Analysis of High/Medium/Low Risk Jobs", Preparing for submission to Conference

Proposals Submitted/Funded:

Two proposals are currently being developed on the following topics:

1. Laboratory studies to enhance the understanding of the biomechanics of hand movements
2. Additional studies of hand strength

Both studies will allow improvements and enhancements of biomechanical hand models.

Project #26

Institution:	The University of Michigan
Core Area:	Occupational Health Nursing
Faculty Sponsor:	Oisaeng Hong, Ph.D.
Research Trainee:	Ae Suk Jeong, Ph.D., Post-Doctoral Research Fellow, Community Health Nursing
Title:	Occupational Exposure, Knowledge and Protective Behaviors Among Korean Dry Cleaners
NORA Area(s):	Special Populations at risk, Mixed Exposures
Direct Cost Budget:	$16,050
Funding Period:	July 2005-June 2006

Abstract:

Introduction: Numerous health and safety risks to dry-cleaning workers have been reported in the literature. However no study has investigated health and safety problems among Korean-American drycleaners, who comprise largest ethnic minority in the dry-cleaning industry in the United States. The purpose of this study was to investigate common occupational injuries, knowledge and protective behaviors among Korean-American dry-cleaning workers.

Methods: A survey of Korean-American drycleaners in Michigan was conducted from December 2005 to February 2006. Question topics included injury experiences from four major hazards (accidental, physical, chemical, and biological) and symptoms related to chemical exposure experienced in the past 12 months, knowledge of chemical exposures and protective behaviors including PPE (Personal Protective Equipment) use and safe work practices. Data were collected through mail and visits to facilities and ethnic organizations.

Results: A total of 164 workers from 126 dry-cleaning facilities completed the occupational exposure and injury survey. Of all participants, 59.1% were male, and 55% had multiple duties with dry-cleaning machine operations. Mean age was 45 (range 22~70) and average working years in dry-cleaning was 11 (range 0.5~30). The most frequently reported problems were thermal burns (52.5%), fatigue and heat exhaustion (32.5%), irritation of eyes, nose, and throat (20%) and low back injury (19.4%). Several symptoms related to chemical exposure were also reported: headache (51.1%), loss of visual perception (38.6%), irritation of eyes, throat and nose (33-34%), dizziness (31.8%), skin irritation and redness (28.6%), loss of memory (20.7%), and nausea (16.5%). The participants demonstrated poor scores on their knowledge on the source of chemical exposures in the workplace, compared to their knowledge of health effects and safety work practice. The majority of respondents did not use PPE, and reported low intentions to use protective equipment in the future. Uncomfortable fitting of PPE was the primary reason cited by respondents for not using PPE.

Conclusion: The study revealed that Korean-American dry cleaning workers are exposed to
various and serious occupational hazards while having inadequate knowledge on chemical exposures and low intentions of using PPE. Development and implementation of training programs for this population is needed.

Current Position of Research Trainee:

Dr. Jeong remains in her position as a Post-Doctoral Research Fellow in the Department of Community Health Nursing at The University of Michigan.

Project #26, continued

Institution:	The University of Michigan
Core Area:	Occupational Health Nursing
Faculty Sponsor:	Oisaeng Hong, Ph.D.
Research Trainee:	Ae Suk Jeong, Ph.D., Post-Doctoral Research Fellow, Community Health Nursing
Title:	Occupational Exposure, Knowledge and Protective Behaviors Among Korean Dry Cleaners
NORA Area(s):	Special Populations at risk, Mixed Exposures
Direct Cost Budget:	$16,050
Funding Period:	July 2005-June 2006

Papers and Presentations:

Jeong A.S., Hong O.S. (2006). Health and Safety Issues among Korean-American Dry-cleaners. NORA (National Occupational Research Agenda) Symposium 2006, Washington DC (Oral & Poster).

Jeong, A.S., Hong, O.S. (2006). Common Occupational Problems among Korean-American Dry-cleaning Workers. The 134th Annual Meeting & Exposition of the American Public Health Association, Boston, MA (Oral Presentation).

Jeong A.S. (2006), Chemical Exposure, Knowledge, and Protective Behavior among Korean-American Dry-cleaning Workers in Michigan. MPH thesis, Karolinska Institutet, Sweden.

Planned Papers:

Health and Safety Issues among Korean Drycleaners: Findings of a Focus Group

Occupational Exposure and Protective Behavior among Korean-American Dry-cleaning Workers in Michigan.

Proposals Submitted/Funded:

An R03 study is planned with a bigger sample size of Korean American drycleaners in from multiple states.

Project #27

Institution:	Purdue University
Core Area:	Occupational Safety
Faculty Sponsor:	Shirley Rietdyk, Ph.D.
Research Trainee:	Christopher Rhea, Ph.D. Student, Health and Physiology
Title:	Gait Adaptations: Role of Visual Information and Repeated Exposures in Risk Assessment of Tripping for Construction Workers
NORA Area(s):	Traumatic Injuries, Risk Assessment Methods
Direct Cost Budget:	$13,385
Funding Period:	January 2006-December 2006 (completion date extended due to late start and equipment problems)

Abstract:

Slips, trips, and falls are a major contributor to injuries in the construction industry. While recent research has found that industry workers adequately perceive the risk of slipping on a surface, the risk of tripping over obstacles has not been investigated. Toe clearance, a quantity of the risk of tripping, increases from level walking to stepping over obstacles and further increases with visual interference. Construction workers navigate a cluttered environment where obstacles are frequently in their walking path. In addition, construction workers regularly carry objects that obstruct their view of the ground and a potential obstacle. This project will investigate if construction workers can accurately perceive various obstacle heights and will assess the risk of tripping based on perception-action theory. Also, this project will attempt to identify if construction workers have developed different obstacle crossing strategies compared to non-construction workers. This project addresses the National Occupational Research Agenda (NORA) Priority Research Areas: Traumatic Injuries and Risk Assessment Methods. Research outcomes will potentially identify strategies for avoiding tripping hazards thus reducing injuries and fatalities from such hazards in the construction industry. Results from this pilot research will enable future project proposals that will identify risk factors and prevention strategies for falling from tripping in cluttered construction environments.

Current Position of Research Trainee:

Mr. Rhea is continuing as a Ph.D. student in the Department of Health and Kinesiology. He expects to complete his Ph.D. in May 2008

Current Status:

During January and February 2006, data collection and analysis of five pilot subjects occurred. Following the investigation of the pilot data, it was determined that a better way to control vision was with a pair of
liquid crystal goggles, which we possess. However, a control box was needed to control the amount of time the goggles allowed vision. This control box was built by the engineering shop at Purdue and took two months to design, test, and debug. Data collection was ready to resume in June 2006, but the goggles malfunctioned during testing on subject one. It was discovered that the goggles needed to be sent back to the manufacturer. We received the goggles back in August 2006 and found that the problem had not been

fixed. After contacting the manufacturer again, they agreed to send us a "loan" pair of goggles for us to complete the project. We plan to resume data collection as soon as we receive the goggles, which should be the end of September 2006.

Project #27, continued

Institution:	Purdue University
Core Area:	Occupational Safety
Faculty Sponsor:	Shirley Rietdyk, Ph.D.
Research Trainee:	Christopher Rhea, Ph.D. Student, Health and Physiology
Title:	Gait Adaptations: Role of Visual Information and Repeated Exposures in Risk Assessment of Tripping for Construction Workers
NORA Area(s):	Traumatic Injuries, Risk Assessment Methods
Direct Cost Budget:	$13,385
Funding Period:	January 2006-December 2006 (completion date extended due to late start and equipment problems)

Papers and Presentations:

Rhea, C. & Rietdyk, S. Dynamic versus static vision prior to obstacle avoidance: Does optic flow affect foot placement and limb elevation? Canadian Society for Biomechanics, Waterloo, ON, August 2006. National
Conference, poster.

Proposals Submitted/Funded:

None to date.

UNFUNDED/DEFERRED PROJECTS (2005-06)

Unfunded Project 2005/06-1

Institution:	The University of Michigan
Core Area:	Occupational Ergonomics
Faculty Sponsor:	W. Monroe Keyserling, Ph.D.
Research Trainee:	Cassandra Morrison, Ph.D. Student, Industrial and Operations Engineering
Title:	Case-crossover analysis of risk factors for back injury during patient handling tasks – a pilot study
NORA Area(s):	Low Back Disorders, Special Populations at Risk, Exposure Assessment Methods

Abstract:

Patient handling has been identified as one of the most high-risk tasks associated with injury to nurses and other hospital workers, with overexertion injuries to the back being the most prevalent outcome. This phenomenon does not elude the University of Michigan Medical Center. During the time period of February 2003 – January 2004, 71 out of 146 lost-time injuries were back injuries resulting from patient handling tasks. Previous studies of back injuries in nursing personnel have relied on traditional epidemiological approaches such as cohort, case-control, cross-sectional, and/or quasi-experiment study designs. The drawback of these studies is that they tend to look only at the long-term or cumulative effects of exposure to a risk factor or injury reduction method. An alternative study design that allows for analysis of transient risk factors that are temporally-proximal to the injury event is the case-crossover method. We plan to use the case-crossover study design to evaluate the contribution of eight possible transient triggers for overexertion injuries to the back. We also plan to evaluate the effectiveness of two comparison period methods used in case-crossover studies: 1) usual frequency, and 2) matched pair techniques. Information on the eight temporally-proximal transient factors (rushing, patient weight, patient dependence level, availability of mechanical and non-mechanical patient
handling equipment, staff availability, distractions, location of task and awkward trunk postures) will be collected through a telephone interview. Participants will be recruited through Employee Health Services and will be interviewed as soon as possible after written consent is received, with a maximum delay of five days. The survey will collect information relating to the task in which the injury occurred, the previous patient handling task successfully completed without injury, the frequency of exposure to each of the eight injury triggers, demographic data, and work organization data. The outcomes of this study will help to understand the importance of transient exposures in overexertion injuries during patient handling, as well as to determine the
feasibility of using case-crossover methods for studying injuries related to patient handling tasks.

Status:

Ms. Morrison is on a leave of absence from her Ph.D. program for personal reasons. This project will be funded when she returns to the university.

Unfunded Project 2005/06-2

Institution:	The University of Michigan
Core Area:	Industrial Hygiene
Research Trainee:	Chuanwu Xi, Ph.D., Assistant Professor, Department of Environmental Health Sciences
Title:	Microbial Characterization of Metal Removal Fluids and Associated Biofilms Using Molecular Approaches
NORA Area(s):	Infectious Diseases, Indoor Environments, Exposure Assessment Methods, Asthma and Chronic Obstructive Pulmonary Disease,

Abstract:

Each year, billions of gallons of metal removal fluids (MRFs) are consumed in manufacturing for purposes such as metalworking (e.g., cooling and lubrication), surface preparation (e.g., cleaning and pickling), and finishing (e.g., coating and plating). A number of human health effects have been associated with exposure to MRFs, including various respiratory diseases, skin conditions, and cancers. It has become clear that the growth of microorganisms in MRFs may cause health hazards to workers. Several molecular techniques have been developed for the purpose of characterizing microorganisms in MRFs; however, no comprehensive study of microbial communities in MRFs has been reported yet. In this pilot project, we will develop and validate different molecular techniques for microbial characterization of MRFs samples. We will use the validated molecular methods to characterize microbial composition in detail in MRFs and to quantify the abundance of *Mycobacteria*, specifically *M. immunogenum* and Pseudomonades in MRFs environments including bulk fluids, biofilms and possibly bioaerosols to elucidate a possible critical role of biofilms in the microbial ecology in MRFs.

Status:

This project has been approved for funding during the July 2006-June 2007 funding year.

Appendix PPRT – 5
Updated Pilot Project Publications, Proposals, etc.
(since last progress report)

Note: Project numbers are based on the serial number of all funded pilot projects. This appendix reports all publications, proposals, and job changes of pilot project trainees that have occurred since the last progress report submitted with our competitive renewal application in July 2004.

Project #1

Institution:	The University of Michigan
Core Area:	Occupational Safety and Ergonomics
Faculty Sponsor:	Thomas J. Armstrong, Ph.D.
Research Student:	Matthew Marshall, Ph.D. student, Industrial and Operations Engineering
Title:	Quantifying Forceful Manual Exertions in Industry
NORA Area(s):	Musculoskeletal Disorders
Direct Cost Budget:	$12,225
Funding Period:	July 1999 – June 2000

Papers and Presentations:

Marshall, M.M., Armstrong, T.J., and Ebersole, M. "Verbal estimation of peak force," 45th Annual Meeting of the Human Factors and Ergonomics Society, 1026-1030, 2001. (not previously reported)

Marshall, M.M. and Armstrong, T.J. (2004). "Observational assessment of forceful exertion and the perceived force demands of daily activities," Journal of Occupational Rehabilitation, 14(4):281-294, 2004. (not previously reported)

Project #2

Institution:	The University of Michigan
Core Area:	Occupational Health Nursing
Faculty Sponsor:	Sally L. Lusk, Ph.D.
Research Student:	Oisaeng Hong, Post-Doctoral Fellow, Health Promotion & Risk Reduction
Title:	Noise Induced Hearing Loss and Hearing Protection in African-American Workers
NORA Area(s):	Hearing Loss and Special Populations at Risk
Direct Cost Budget:	$12,667
Funding Period:	July 1999 – June 2000

Current Position of Research Trainee:

Associate Professor, School of Nursing, The University of Michigan

Papers and Presentations:

Hong, O., Lusk, S.L., and Ronis, D.L. "Ethnicity differences in predictors for hearing protection behavior in Black and White workers," Research & Theory for Nursing Practice: An International Journal, 19(1), 63-76, 2005.

Proposals Submitted/Funded:

P30-Michigan Center for Health Intervention (MICHIN), NINR, " NIHL-Expert (NIHL-e) System Intervention: Developmental Stage I", Funded.

NIOSH & NIDCD, Competing Continuation "Effectiveness of computer-based training: NIHL-e", in preparation of resubmission, 2R01 OH004034-04A1

Pusan National University, Republic of Korea, "Web-based survey for hearing protection behavior among workers in six power plants in Korea", Funded.

Project #3

Institution:	The University of Wisconsin at Madison
Core Area:	Occupational Safety and Ergonomics
Faculty Sponsor:	Robert G. Radwin, Ph.D.
Research Student:	Jia-Hua Lin, Ph.D. student, Industrial Engineering
Title:	A Biomechanical Model of Ergonomic Design and Selection of Hand Tools
NORA Area(s):	Musculoskeletal Disorders
Direct Cost Budget:	$12, 944
Funding Period:	July 1999 – June 2000

New Publication:

Lin, J. H., Radwin, R. G., and Nembhard , D. A., Ergonomics applications of a mechanical model of the human operator in power hand tool operation, *Journal of Occupational and Environmental Health*, 2(2), 111-9, 2005.

Project #5

Institution:	The University of Michigan
Core Area:	Occupational Safety and Ergonomics
Faculty Sponsor:	Thomas J. Armstrong, Ph.D.
Research Student:	Christian Grieshaber, Ph.D. student, Industrial and Operations Engineering
Title:	A Biomechanical Model of the Hand and Wrist
NORA Area(s):	Musculoskeletal Disorders
Direct Cost Budget:	$14,595
Funding Period:	July 2000 – June 2001

Current Position of Research Trainee:

Mr. Grieshaber is an Assistant Professor of Safety in the Department of Health Sciences at Illinois State University. He expects to defend his dissertation in 2007.

New Publications:

Grieshaber, D.C. and T.J. Armstrong (2004). Characterization of hand postures employed by industrial workers during hose installation tasks. Proceedings of the Human Factors and Ergonomics Society 48th Annual Meeting (not previously reported).

Grieshaber, D.C., T.J. Armstrong and N.J. Seo (2005) How does method affect forearm muscle activity during flexible hose insertion tasks? Proceeding of the 29th Annual Meeting of the American Society of Biomechanics/XXth Congress of the International Society of Biomechanics

Grieshaber, D.C., T.J. Armstrong and N.J. Seo (2006). Changes in the grasp envelope during rubber hose insertion tasks. Proceedings of the XVIth Triennial Congress of the International Ergonomics Association, Maastricht, The Netherlands.

Grieshaber, D.C. and T.J. Armstrong (2006). Insertion Loads and Forearm Muscle Activity During Flexible Hose Insertion Tasks. *Human Factors*. In review.

Project 7

Institution:	The University of Wisconsin at Madison
Core Area:	Occupational Safety and Ergonomics
Faculty Sponsor:	Robert G. Radwin, Ph.D.
Research Student:	Mary Sesto, Ph.D. student, Industrial Engineering)
Title:	The Effects of Eccentric Contractions on Muscle Mechanical Properties
NORA Area(s):	Musculoskeletal Disorders
Direct Cost Budget:	$16,300
Funding Period:	July 2000-June 2001

Current Position of Research Trainee:

Dr. Sesto has been promoted to Associate Scientist, University of Wisconsin-Madison, Department of Biomedical Engineering and Trace Center.

New Publication:

Sesto, M. E., Radwin, R. G., and Richard, T. G., "Short-term changes in upper extremity dynamic mechanical response parameters following power hand tool use," *Ergonomics*, 10:48(7):807-20, 2005.

Sesto, M.E., Radwin, R.G., Block, W.F., and Best, T.M., "Upper limb dynamic responses to impulsive forces for selected assembly workers.," J Occup Environ Hyg. 3(2):72-9., 2006.

Radwin, R.G., Chourasia, A.O., Sesto, M.E., Upper limb mechanical changes following simulated repetitive power tool use. 16th World Congress of the International Ergonomics Association Meeting, Maastricht, The Netherlands, July, 2006

New Proposal Funded:

NIOSH, "Functional Limitations in Lateral Epicondylitis," Mary E. Sesto, PI, Funded, K01 OH008640-01

Project #8

Institution:	The University of Wisconsin at Madison
Faculty Sponsor:	Robert G. Radwin, Ph.D.
Research Student:	Curtis Irwin (Ph.D. student, Biomedical Engineering)
Title:	Investigation of Handle Surfaces and Grasping Tasks
NORA Area(s):	Musculoskeletal Disorders
Direct Cost Budget:	$18,835
Funding Period:	July 2001-June 2002

New Publication:

Irwin, C. B. and Radwin, R. G., “A new method for estimating hand internal loads from external force measurements,” Submitted.

Project #11

Institution:	Purdue University
Core Area:	Occupational Safety
Faculty Sponsor:	James McGlothin, Ph.D.
Research Scientist:	Shirley Rietdyk, Ph.D., Assistant Professor, Department of Health and Kinesiology
Title:	Can Visual References Enhance Balance Control in the Occupational Environment in Both Younger and Older Construction Workers?
NORA Area(s):	Special Populations at Risk, Traumatic Injuries (falls)
Direct Cost Budget:	$28,550
Funding Period:	July 2002-June 2003

New Publication:

Rietdyk S, Torgerud SR, McGlothlin JD, Knezovich MJ. Stationary visual cues reduced centre of pressure displacement in a dynamic environment for experienced roofers. XXth Congress of the International Society of Biomechanics, Cleveland, Ohio, August 2005.

Torgerud SR, Rietdyk S & McGlothlin JD. Sensory re-weighting in postural control as a function of work experience in visually challenging environments. S*ubmitted to Experimental Brain Research, July 2006.*

New funded proposal:

Title: Interdisciplinary Airline Job Hazard Assessment
Agency: Interdisciplinary Innovation Initiative, School of Technology, Purdue
Duration of Funding: 05/01/2004 – 04/30/2005
Role: Rietdyk, McClothlin, Co-PIs
Goals: To assess airline job risk as a function of falls and carrying loads.

Project #12

Institution:	The University of Michigan
Core Area:	Industrial Hygiene
Faculty Sponsor:	Stuart Batterman, Ph.D.
Research Trainee:	Christopher Godwin, DDS, MPH, Ph.D. Student, Environmental Health Science)
Title:	Indoor air quality in public schools: an assessment of exposures and symptoms of teachers
NORA Area(s):	Exposure Assessment Methods, Indoor Environment, Special Populations at Risk
Direct Cost Budget:	$33,000
Funding Period:	July 2002-June 2003

New Publications:

Jia, Chunrong, Stuart A Batterman, Chris Godwin, "Levels and Sources of VOC Exposures in Microenvironments: A Monte Carlo Analysis", Philadelphia, PA, International Society of Exposure Analysis Annual Meeting, October 17-21, 2004. (not previously reported)

Batterman, S, C Jia, C Godwin, G Hatzivasilis, "Distributions of Volatile Organic Compounds (VOCs) in Indoor and Outdoor Air among Industrial, Urban and Suburban Neighborhoods," presented at IAQ 05, Beijing, China, Sept. 4-9, 2005.

Proposals Submitted/Funded:

Dr. Batterman received support from the American Chemistry Council (6/1/03 – 5/30/06) for a project entitled "Understanding Exposure to Volatile Organic Air Toxics" in which Dr. Godwin plays a major role.

Dr. Batterman is currently preparing a proposal titled "Diesel Exhaust Exposure and Aggravation of Childhood Asthma"

Project #14

Institution:	The University of Michigan
Core Area:	Occupational Health Nursing
Research Trainee:	Janis M. Miller, Ph.D., R.N., Assistant Research Scientist, School of Nursing
Title:	The Differences in Female Levator Ani Muscle Function Between Occupational Lifters and Non-Lifters
NORA Area(s):	Special Populations at Risk, Musculoskeletal Disorders
Direct Cost Budget:	$15,870
Funding Period:	June 2003-July 2004

New position of trainee:

Dr. Miller is an Assistant Research Scientist in the School of Nursing and a Research Assistant Professor Investigator in the OB/GYN Department of the School of Medicine at The University of Michigan.

New funded proposals:

The methodology developed in the pilot study entitled "The Differences in Female Levator Ani Muscle Function Between Occupational Lifters and Non-Lifters" is now being used in two funded NIH projects. Specifically, the one-billed instrumented speculum tested for usability and repeatability in the pilot study, is now one of the main instruments in use in Phase II of the Incontinence Research Intervention Study (P50 HD44406) and throughout the Evaluating Maternal Recovery from Labor and Delivery study (R 21 01-HD049818). Both of these NIH-funded projects are detailed below, and are the only studies to date, aside from the pilot, with data from this newly developed instrumented speculum. Each of these two NIH funded studies is also collecting questionnaire data on women's habits of lifting on a daily basis. On completion of these studies we will, for the first time to my knowledge, have obtained data on approximately 120 women that documents both amount of lifting typically taking place in the woman's life and a quantified score of pelvic floor strength as measured by the one-billed speculum.

Funding Institution:	NIH, 1 P50 HD44406	
Grant Title:		"Selection Criteria for Pelvic Muscle Therapy in SUI", an R01 study within the "University of Michigan Specialized Center of Research on Sex and Gender Factors Affecting Women's Health (SCOR)".
Project Leader:		Janis Miller
Date:		Sept. 1, 2002 – Aug. 31, 2007

Funding Institution:	NIH, R 21 01-HD049818-0 1	
Grant Title:		"Maternal Birth-Related Neuromuscular Injury and Recovery"
Principal Investigator:		Janis Miller
Date:		May 1, 2005 – April 31, 2007

Project #15

Institution:	The University of Wisconsin
Core Area:	Occupational Safety and Ergonomics
Faculty Sponsor:	Robert G. Radwin, Ph.D.
Research Trainee:	Robert H. Meyer, Ph.D. Student, Dept. of Industrial Engineering
Title:	Comparison of back and neck fatigue in stoop versus prone postures while performing a simulated manual agricultural task
NORA Area(s):	Special Populations at Risk, Musculoskeletal Disorders
Direct Cost Budget:	$19,981
Funding Period:	June 2003-July 2004

New Publications:

Meyer, R.H., and Radwin R. G., "Comparison of stoop versus prone postures for a simulated agricultural harvesting task," Applied Ergonomics, In Press.

Meyer, R. H. and Radwin, R. G., Comparison of stoop versus prone postures for a simulated agricultural harvesting task, 16th World Congress of the International Ergonomics Association Meeting, Maastricht, The Netherlands, July, 2006.

Meyer, R. H. and Radwin, R. G., Strength limits and interventions for gas utility wrenching tasks, 16th World Congress of the International Ergonomics Association Meeting, Maastricht, The Netherlands, July, 2006

Project #16

Institution:	The University of Michigan
Core Area:	Industrial Hygiene
Research Trainee:	Peter Mancuso, Ph.D., Assistant Professor of Environmental Health Science
Title:	Alveolar macrophage responses to fine and ultrafine particles
NORA Area(s):	Asthma and Chronic Obstructive Pulmonary Disease, Exposure Assessment
Direct Cost Budget:	$20,000
Funding Period:	June 2003-July 2004

New Publication:

J. Phipps, J. Curtis, P. Christensen, D. Aranoff, and P. Mancuso. Regular and low-tar mainstream cigarette smoke exposure attenuates murine pulmonary host defense against *Streptococcus pneumoniae*. 2006. *Proc. Am. Thoracic Soc 3:*A:806.

New funded proposals:

University of Michigan Tobacco Research Network
Funding for a pre-doctoral fellow
Title: The effect of low tar cigarette exposure on pulmonary antibacterial host defense
Date: 9/1/04-8/30/05
Annual direct costs: $40,000

New unfunded proposals:

NIH NIEHS P42 Superfund Grant with University of Tennessee
Title: PAHs suppress pulmonary antibacterial host defense

Project #18

Institution:	The University of Michigan
Core Area:	Occupational Epidemiology
Faculty Sponsors:	Alfred Franzblau, M.D., W. Monroe Keyserling, Ph.D.
Research Trainee:	Jennifer Chang D'Sousa, Ph.D. Student, Occupational Epidemiology
Title:	Expert Ratings of NHANES Occupational Categories
NORA Area(s):	Musculoskeletal Disorders, Exposure Assessment
Direct Cost Budget:	$17,257
Funding Period:	June 2004-July 2005

Current Position of Research Trainee:

Ms. D'Souza has completed her Ph.D. in Occupational Epidemiology and is currently working at the Institute of Gerontology, at the University of Michigan.

New Publications:

Jennifer C. D'Souza; Alfred Franzblau; W.Monroe Keyserling; Brenda Gillespie; Robert A. Werner. Occupational factors and Knee Osteoarthritis (OA): An analysis of the Third National Health and Nutrition Examination Survey (NHANES III) using Expert Ratings, 28th International Congress on Occupational Health, Milan, Italy, June 2006.

Jennifer C. D'Souza; Alfred Franzblau; W. Monroe Keyserling; Brenda Gillespie; Robert A. Werner. Expert consensus ratings of occupational physical exposures, 28th International Congress on Occupational Health, Milan, Italy, June 2006.

Jennifer C. D'Souza, Robert A. Werner, W. Monroe Keyserling, Brenda Gillespie, Randall Rabourn, Sheryl Ulin, Alfred Franzblau. Analysis of the Third National Health and Nutrition Examination Survey (NHANES III) using Expert Ratings of Job Categories, working paper to be submitted to AJIM.

Jennifer C. D'Souza, W. Monroe Keyserling, Robert A. Werner, Brenda Gillespie, Alfred Franzblau. Expert Consensus Ratings of Job Categories from the Third National Health and Nutrition Examination Survey (NHANES III), working paper to be submitted to AJIM.

New proposals submitted/funded:

Proposal to National Center of Health Statistics/ Research Data Center to release data on NHANES Subjects' specific job codes using 3-digit 1980 Census job codes. Proposal to release data accepted with no additional funding.

Project #19

Institution:	The University of Wisconsin
Core Area:	Safety and Ergonomics
Faculty Sponsor:	Robert G. Radwin, Ph.D.
Research Trainee:	Amrish Chourasia, Ph.D. Student, Biomedical Engineering
Title:	Comparison of biomechanical effects of eccentric and concentric exertions
NORA Area(s):	Musculoskeletal Disorders
Direct Cost Budget:	$19,401
Funding Period:	June 2004-July 2005

New Publications:

Radwin, R.G., Chourasia, A.O., Sesto, M.E., Upper limb mechanical changes following simulated repetitive power tool use. 16th World Congress of the International Ergonomics Association Meeting, Maastricht, The Netherlands, July, 2006

Project #20

Institution:	The University of Michigan
Core Area:	Industrial Hygiene
Faculty Sponsor:	Edward T Zellers, Ph.D.
Research Trainee:	Chunguang Jin, Ph.D. Student, Environmental Health Sciences
Title:	Chemometric Methods for Assessing Exposures to Indoor Air Contaminants with a Microanalytical System
NORA Area(s):	Indoor environments, Emerging technologies, Exposure assessment
Direct Cost Budget:	$15,000
Funding Period:	June 2004-July 2005

New Publications:

Jin, C. and Zellers, E.T., "Pattern Recognition Techniques for VOC Detection by a Multi-sensor Array", Poster presentation, American Industrial Hygiene Conference & Exposure, Anaheim, May 2005. (not previously reported)

Jin, C. and Zellers, E.T., "Artificial Neural Networks for a Multi-Sensor Micro-GC Detector", Poster presentation, Engineering Research Center for Wireless Integrated MicroSystems on-site meeting, Ann Arbor, May 2005. (not previously reported)

Lu, C. J., Jin, C. and Zellers, E.T., "Chamber evaluation of a portable GC with tunable retention and microsensor-array detection for indoor air quality monitoring", *J. Environ. Monit.*, 2006, 8, 270-278

Jin, C, Kursawski, P, Hierlemann, A., Zellers, E. T., "Performance Analysis of a Multi-Transducer Vapor Sensor Array", manuscript in preparation

New Proposals Submitted/Funded:

Grant # 06-G-024
Transportation Security Administration-Dept. Of Homeland Security
E. Zellers, PI; C. Kurdak:, co-I
Au-Thiolate Nanoparticles as Interfacial Layers on Microsensor Arrays for Trace Explosive Vapor Detection
09/29/06 – 09/28/09
$ 1,303,877 (TC)

Project #21

Institution:	The University of Michigan
Core Area:	Occupational Health Nursing
Research Trainee:	Anne G. Thomas, Ph.D., Assistant Professor, Community Health Nursing
Title:	Worksite Intervention to Promote Physical Activity
NORA Area(s):	Special populations at risk, Intervention effectiveness research
Direct Cost Budget:	$8,300
Funding Period:	June 2004-July 2005

New publications:

Thomas, Anne G. "University Worksite Intervention to Increase Physical Activity, Proceedings: Midwest Nursing Research Society 30th Annual Research Conference, Milwaukee, WI, April 2006.

Thomas, Anne G. "Increasing Physical Activity in an Academic Work Environment: Focus Group Results," Proceedings: Midwest Nursing Research Society 30th Annual Research Conference, Milwaukee, WI, April 2006.

Thomas, Anne G. "Increasing Physical Activity in an Academic Setting: An Intervention for Faculty and Staff," International Congress for Occupational Health, Milan, Italy, June 2006 (abstract accepted, but not presented).

Project #22

Institution:	The University of Michigan
Core Area:	Ergonomics, Industrial Hygiene
Faculty Sponsor:	Thomas J. Armstrong, Ph.D.
Research Trainee:	Andrew Comai, Ph.D. Student, Environmental Health Sciences
Title:	Developing and testing guidelines for ergonomic assessment tools
NORA Area(s):	Musculoskeletal disorders, Exposure assessment methods
Direct Cost Budget:	$20,000
Funding Period:	June 2004-July 2005

Proposals Submitted/Funded:

A followup grant proposal to follow up on these findings was submitted to Michigan Interdisciplinary Center on Social Inequalities, Mind and Body (MICOSIMB), but was not funded. The proposed work included resampling job risk factors at plants involved in the initial study and expanding the study to several more locations.

Appendix PPRT – 6.
Summary of Funded and Unfunded Pilot Projects – Next Budget Year (2006-07)

FUNDED PROJECTS

Note: Project numbers are based on the serial number of all funded pilot projects. During the first six years (July 1999-June 2006), we funded 27 projects. The beginning number for the 2006-07 funding cycle is #28.

Project #28

Institution:	The University of Michigan
Core Area:	Industrial Hygiene
Research Trainee:	Chuanwu Xi, Ph.D., Assistant Professor, Department of Environmental Health Sciences
Title:	Microbial Characterization of Metal Removal Fluids and Associated Biofilms Using Molecular Approaches
NORA Area(s):	Infectious Diseases, Indoor Environments, Exposure Assessment Methods, Asthma and Chronic Obstructive Pulmonary Disease
Direct Cost Budget:	$15,400
Funding Period:	July 2006-June 2007

Abstract:

Each year, billions of gallons of metal removal fluids (MRFs) are consumed in manufacturing for purposes such as metalworking (e.g., cooling and lubrication), surface preparation (e.g., cleaning and pickling), and finishing (e.g., coating and plating). A number of human health effects have been associated with exposure to MRFs, including various respiratory diseases, skin conditions, and cancers. It has become clear that the growth of microorganisms in MRFs may cause health hazards to workers. Several molecular techniques have been developed for the purpose of characterizing microorganisms in MRFs; however, no comprehensive study of microbial communities in MRFs has been reported yet. In this pilot project, we will develop and validate different molecular techniques for microbial characterization of MRFs samples. We will use the validated molecular methods to characterize microbial composition in detail in MRFs and to quantify the abundance of *Mycobacteria*, specifically *M. immunogenum* and Pseudomonades in MRFs environments including bulk fluids, biofilms and possibly bioaerosols to elucidate a possible critical role of biofilms in the microbial ecology in MRFs.

Project #29

Institution:	The University of Michigan
Core Area:	Industrial Hygiene
Research Trainee:	Simone Charles, Ph.D., Post-doctoral Research Fellow, Department of Environmental Health Sciences
Faculty Sponsor:	Stuart Batterman, Ph.D., Professor, Department of Environmental Health Sciences
Title:	Post-doctoral Training in Exposure Assessment of Emerging Contaminants in the Indoor Environment
NORA Area(s):	Indoor Environments, Exposure Assessment Methods
Direct Cost Budget:	$20,000
Funding Period:	July 2006-June 2007

Abstract:

Brominated flame retardants (BFRs) such as polybrominated diphenyl ethers (PBDEs) and biphenyl are widely used in plastics, textiles, foams and electronic equipment. These contaminants are of great concern as body burdens are increasing at an exponential rate in both occupationally-exposed workers and in the general public. The emission sources and transport pathways that cause these exposures are poorly understood, particularly in the workplace. The available but limited measurements show that indoor concentrations of BFRs are high and greatly exceed outdoor levels. Because indoor and workplace environments are known to contain these materials, and since indoor levels appear to accumulate due to the presence of these sources and the slow rate of degradation, industrial and commercial buildings may represent an important exposure source. To date, however, the literature contains few occupational exposure studies that have characterized BFRs, and all of the identified studies have been conducted in Europe, though much higher exposures have been reported in North America. The proposed research aims to better understand occupational exposures of BFRs by characterizing their distribution and emissions in both commercial and industrial buildings. Emissions from indoor materials will be quantified by measuring vapor and particulate phase BFR-related compounds at 12 industrial and 12 commercial sites. At each site, we will measure incoming (outdoor) and exiting (indoor) BFR concentrations; determine air exchange rates using tracer gas techniques; assess building volume and other building parameters; and conduct a building walkthrough audit. Emission rates will be derived from the collected data by mass balance. Complementary but separate work will characterize these compounds in residential environments for comparison.

Project #30

Institution:	The University of Michigan
Core Area:	Occupational Safety and Ergonomics
Research Trainee:	NaJin Seo
Faculty Sponsor:	Thomas J. Armstrong, Ph.D., Professor, Department of Industrial and Operations Engineering
Title:	Development of a Biomechanical Model for Torque and Thrust Strength on Cylindrical Handles
NORA Area(s):	Musculoskeletal Disorders of the Upper Extremity, Traumatic Injuries
Direct Cost Budget:	$19,360
Funding Period:	July 2006-June 2007

Abstract:

The aim of this work is to develop models for predicting the capacity of the hand to apply torque and thrust force about and along the long axis of cylindrical handles. More specifically, this work will develop a biomechanical model of isometric or "quasi isometric" torque and thrust force that can be exerted on cylindrical handles of a given diameter and surface friction when gripped at a given angle.

Our proposed biomechanical model and preliminary research show that torque strength about the long axis of a cylindrical handle is greater when torque is applied in the direction of the fingers than in the direction of the thumb.

The proposed study will 1) validate the biomechanical model for various handle materials. It will also examine 2) the effect of torque on pushing and pulling along the long axis of the handle and 3) the effect of grip force on wrist flexion and extension strength. In addition, the coefficient of friction will be measured for different parts of the hand with different normal force levels and handle materials.

The models developed in this study can be used to establish force design limits for work tasks that will accommodate desired percentiles of the male and female population. They also can be used to design equipment that minimizes force requirements, localized fatigue and the risk of work-related musculoskeletal disorders.

Project #31

Institution:	The University of Michigan
Core Area:	Occupational Safety and Ergonomics
Research Trainee:	Sarah Womack
Faculty Sponsor:	Jeffrey K. Liker, Ph.D., Professor, Department of Industrial and Operations Engineering
Title:	Modeling the Relationship between Work-related Musculoskeletal Disorder Risk Exposure and Lean Manufacturing
NORA Area(s):	Musculoskeletal Disorders of the Upper Extremity, Organization of Work
Direct Cost Budget:	$14,300
Funding Period:	July 2006-June 2007

Abstract:

This project examines the effects of lean manufacturing practices on work-related musculoskeletal disorder (WMSD) risk exposure. Japanese Management Systems have come under scrutiny because some believe that lean production methods increase the prevalence of WMSC injuries compared to traditional management systems.

Two studies will be conducted to:

1. Determine if there is a difference in the organization of work between exemplar lean and quasi-lean work sites.
2. Determine if there is a direct and measurable relationship between lean manufacturing practices and WMSD risk exposure
3. Gain insight into how the exemplar lean organizations manage and integrate productivity, ergonomics, and safety

To investigate the degree of leanness, the lean factors that will be examined at the plant level for both studies include quality, inventory, workforce flexibility and involvement in problem solving. Lean factors at the job level include wasteful motions in the job cycle such as walking, waiting, and unnecessary handling of parts and tools. The WMSD factors that will be evaluated include forceful exertions, repetition, and awkward postures of the wrist, shoulder and trunk.

UNFUNDED/DEFERRED PROJECTS (2005-06)

Unfunded Project 2006/07-1

Institution:	The University of Michigan at Flint
Core Area:	Occupational Health Nursing
Principal Investigator:	Janice Brady, Ph.D., Assistant Professor, Department of Nursing, The University of Michigan at Flint
Title:	Occupational Noise Exposure and Hearing Loss in Emergency Medical Services (EMS) Workers
NORA Area(s):	Hearing Loss, Special Populations at Risk, Exposure Assessment Methods

Abstract:

Emergency medical service (EMS) workers face multiple occupational threats to their health and well-being. Among these threats is the potential for noise-induced hearing loss (NIHL) as a result of exposures to sirens and high-noise hazards at emergency/disaster sites. A few studies have reported about occupational hazards experienced by firefighters; however, the literature reveals limited current research that specifically focuses on occupational hazards encountered by EMS workers, particularly work-related hazards associated with NIHL. Information about training programs related to preventing NIHL in EMS workers is also lacking.

The purpose of this pilot research project is to conduct focus groups with EMS workers to obtain data related to their awareness about NIHL and to obtain information about typical EMS activities and tasks that may contribute to NIHL. Relying upon data obtained from the focus group sessions, noise measurements (noise survey) will subsequently be conducted. Sound pressure level data will be collected for the job-related activities and tasks identified by the EMS workers during the focus groups. If feasible, the use of Task-Based Exposure Assessment Model (T-BEAM) will be employed to model a representative EMS worker's typical noise exposure day.

Once NIHL occurs, no treatment or assistive technology can restore the damaged auditory function. Unfortunately, hearing loss that results from exposure to high-noise levels in work settings is a prevalent occupational health problem; however, NIHL can be prevented (NIOSH, 1996). Protecting individuals against exposure to hazardous noise levels in their work environments can be an effective method to reduce the incidence of occupational NIHL. Therefore, providing training to EMS workers about the potential hazards associated with high-noise job activities and the importance of protecting their hearing is essential. In order to develop effective training programs, it is necessary to investigate how EMS work environments and job activities may contribute to NIHL.

Status:

Dr. Brady has been invited to resubmit this proposal.