

The logo is a white rectangular box with a thin black border, containing the text "Northwest Center for Occupational Health & Safety" in a serif font. It is positioned in the top left corner of a dark green banner with a swirling pattern.

Northwest Center for
Occupational
Health & Safety

Northwest Center for Occupational Health and Safety

FINAL PROGRESS REPORT

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Submitted by:

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HIGHLIGHTS/SIGNIFICANT RESULTS

The central mission of the Northwest Center for Occupational Health and Safety (NWCOSHS or the Center) is to conduct high level educational programs for professions serving the occupational health needs of the region, and nation. Our academic programs, supported by accomplished leaders in the various OH&S disciplines, train students with a combination of didactic class-room instruction, practical experience and interactions with workers and businesses in the field, and the conduct of scientific research. The record of the programs in training professionals over the past five years (2005-2010) is summarized in Table A.

Table A. Summary of Trainees, 2005-2010

	IH		OHN		OMR	HSAT	OHSRT	TOTAL
	MS	PhD	MN (MS)	PhD	MPH	MS	PhD	
# Students Enrolled	57	16	18	11	33	34	15	184
# Trainees Supported	36	5	18	8	10	11	7	95
# of Graduates	38	7	15	3	22	22	5	112

While these numbers indicate a sustained contribution to the preparation of the OH&S professional workforce, some notable accomplishments of our alumni should be acknowledged.

- A significant number of graduates during the current training period have already successfully been appointed in faculty positions: two in IH, four from OMR, and three in OHN.
- Since July 2005, Program faculty and students have produced 488 articles published in scientific, peer-reviewed journals. Program trainees were first author or co-author for 103 of these papers.

Our Continuing Education program has been highly successful by combining standard courses offered at the University of Washington, with a mix of contract courses, distance learning classes, and other types of worker and professional education including the OSHA Education Center courses, NIEHS classes for Native Americans and others handling hazardous substances, and specific courses developed in the context of pilot or research projects, such as the aging workforce curriculum development.

The Center has also conducted a set of additional projects that help support our programs and the cohesiveness of the Center as a whole.

On a quarterly basis, the Center hosts an Interdisciplinary Research Seminar designed to stimulate interdisciplinary discussion of research methods, important and emerging topics in occupational health, and research or training themes of importance to the Center. Typically, these seminars will have a series of talks by researchers from different disciplines – leading with a faculty presentation of current research, followed by two or three student research presentations. This is one of the few forums in which research approaches are shared across

the disciplines, and provides an important opportunity for students to learn about occupational health research from the different perspectives.

As part of our effort to improve needs assessments, we adopted the Council of State and Territorial Epidemiologists (CSTE) methodology for surveillance of Occupational Health Indicators. This is an innovative compilation of surveillance indicators for the region, and the final report can be found at (<http://depts.washington.edu/nwcohs/pdf/ohindicatorsregion10.pdf>). As a result of this activity, the Center presented our surveillance activity at a first Annual Meeting of Western States OH Surveillance (OH in the West), hosted by NIOSH in September, 2008.

In 2008-2009, we conducted a comprehensive Alumni Survey to assess the adequacy of our training programs and assess needs going forward in time. The program evaluation component of this survey is presented below.

In January, 2006 the Northwest Center, in collaboration with the Pacific Northwest Agriculture Safety and Health Center, assisted NIOSH in organizing the National Occupational Health Research Agenda Symposium, with a NORA sector focus on Agriculture, Fishing and Forestry. The symposium attracted many representatives from the Pacific Northwest, and provided NIOSH with valuable testimony concerning the construction of NORA 2.

Beginning in 2005, the Center has solicited and funded pilot or small research projects. The program was initially funded through the NORA funds provided to the Center, and subsequently, we competed successfully for a Pilot/Small Projects Research Training Program (PSPRTP). The projects supported through these programs included several at institutions other than the UW, and always included support for graduate student training in research methods. This program was discontinued in 2005.

Alumni Survey

We have recently completed a survey of alumni of our programs addressing evaluation of our current (and past programs) and directions and needs for the future. The program evaluation components of the survey are discussed here. The full report may be found online at: <http://depts.washington.edu/envhlth/pdf/reportdeohs.pdf>.

The survey included all ERC programs, as well as undergraduate, toxicology and MPH programs associated with DEOHS, though highlights presented here refer only to the graduate programs associated with the Center. The survey was answered either on the web (n=145) or by telephone interview (n=271) for an overall response rate of 38.3%. Respondents included 43 graduates of the OHN program, 92 graduates of the IH program, and 15 graduates of the OMR program. Ninety-four percent of graduates of graduate-level programs had worked in the field of occupational or environmental health, with 57% of them working for more than 10 years, and 55% reported earning more than \$75,000 per year. Among graduate program graduates, 39%, 37% and 26% described their work as 'practitioner,' 'manager/executive,' or 'academic/research,' respectively, demonstrating a significant engagement in the field, and a high level of achievement. Sixty-three percent of graduates of Center programs stated that they had received professional certifications after leaving the program. About 40% work in a public agency or private industry, each. Overall, about 18% described their work as primarily consulting.

Overall, graduates rated our program very highly: 44% rated the training excellent, with another 41% giving it a very good. On eleven specific program elements, more than 50% of graduates

rated each element as excellent or very good (e.g., research mentorship: 62%; access to faculty: 74%; classroom instruction: 69%). Ratings of non-technical items were also very positive with 51%, 53% and 44% of grads rating teamwork skills and experience, social/professional networking, and communications skills training, respectively, as excellent or very good.

Sixty-two percent of alumni of graduate programs reported taking continuing education classes, and 85% of those that had taken CE courses at UW reported their experience as excellent or very good.

The results of this alumni survey provided overall, a very positive reflection on the quality of our programs and the success of our graduates. In addition, suggestions for future improvements were obtained, and are discussed in the Center-Wide Activities section.

Summary of Center Accomplishments

The Northwest Center has been highly active and effective over the past four years. In addition to funding the academic training of professionals for the occupational health and safety workforce, and providing for continuing education of a large number of regional OH professionals, the Center has effectively coordinated interdisciplinary interactions among the multiple programs, helped support outreach and R2P related research and activities throughout the region, and conducted comprehensive needs assessments and a program evaluation. The Center must continue to support effective research and training in prevention of work-related injury and illness, while continuing to evolve to address new hazards, new organizational structures in the workplace and economy, and new roles for professionals.

TECHNICAL REPORT

Center-Wide Administration (CWA)

Director: Noah Seixas, PhD, CIH

Introduction

The Northwest Center for Occupational Health and Safety (NWCOHS or Center) is a multi-component training program, dedicated to prevention of work-related injury and illness in the four federal Region X states of Alaska, Idaho, Oregon and Washington. The central mission of the Center is to conduct high level educational programs for professions serving the occupational health needs of the region, and nation. Our academic programs, supported by accomplished leaders in the various OH&S disciplines, train students with a combination of didactic class-room instruction, practical experience and interactions with workers and businesses in the field, and the conduct of scientific research. The Center has been funded since 1977 as a NIOSH Education and Research Center. The Center is housed within the University of Washington's Schools of Public Health, Nursing and Medicine. Location of the Center at the University of Washington and in Seattle provides a vast array of opportunities for training and research activities. The UW is among the top public universities in the country, with over \$1 billion in extramural research each year, and top rated programs in medicine, health sciences, law, international studies and environmental policy. In addition, Seattle is home to a number of significant preventive health-oriented institutions with close ties to the UW, including the William Gates Foundation, and the Fred Hutchinson Cancer Research Center.

The primary focus of the Center is graduate student training with a strong emphasis in research-based education. In addition, the Center serves as a regional resource for continuing education and other forms of outreach to occupational safety and health practitioners in the region. The Center has been in continual existence since it was first funded by the National Institute for Occupational Safety and Health (NIOSH) in 1977. Region X, which includes Washington (WA), Oregon (OR), Idaho (ID) and Alaska (AK), has a non-farm labor force of over five million workers, and given the nature of the region, is characterized by natural resource-based industries including agriculture, fishing, forestry, mining and other extraction industries; shipbuilding and aerospace; transportation (including trade to the Pacific Rim); as well as construction. In recent years, a large high technology sector including computer and software development, silicon chip manufacture and biotechnology-based industries have rapidly expanded. The region is also characterized by a concentration of population and industries in the Willamette valley of Oregon and Puget Sound area of Washington, and by very large distances between these centers and other areas of population and industrial activity. As a result, there are significant challenges to delivery of effective occupational health and safety training and services over this large and diffuse region.

The programs of the NW Center train Masters and Doctoral level researchers and practitioners in several occupational health and safety disciplines, and provide continuing education programs to the Region's practitioners. The Center also collaborates with several other institutions in the Region to enhance the prevention activities of the Center, and of the collaborating partners.

The Northwest Center is made up of an administrative core (now included in Center-Wide Activities), three core academic programs (Industrial Hygiene (IH), Occupational Health Nursing (OHN) and Occupational Medicine Residency (OMR)), and two allied academic programs (Occupational Health Services Research Training (OHSRT), Hazardous Substances Academic Training (HSAT)). In

addition, the Center includes Continuing Education (CE) and Hazardous Substance Training (HST) programs.

The Center's administrative core, made up of the Director (Noah Seixas, PhD, CIH), Deputy Director (Steven Hecker, MS), Executive Committee (made up of the program directors) and support staff, coordinates the activities of the Center, distribute training funds and insure effective use of the Center's resources. The Center is also guided by an External Advisory Board, which includes seven professionals (4 of whom are alumni of Center programs) representing a broad distribution of professional and geographic constituencies. The Center Administration for the NW Center has included a NORA Research Training Program, and a Pilot/Small Projects Research Training Program over the past several years.

The three core academic programs of IH, OHN and OMR train graduate students in the traditional disciplines associated with occupational health prevention services. In response to recognized changes in the practice of Industrial Hygiene, the IH program is now housed within the "Exposure Sciences" academic program, and includes emphasis tracks in traditional occupational hygiene, ergonomics and human factors, health and safety management, and exposure biomarkers – all of which include substantial content in industrial hygiene topics. The OHN program provides advanced practice training in occupational health, with emphasis areas in management of occupational health programs in industry, psychosocial aspects of work and health, including occupational stress, and populations at high risk. The OMR program trains physicians in clinical and academic Occupational and Environmental Medicine with a combined MPH and an extended residency leading to board certification in Occupational Medicine. The OMR program additionally offers training to Occupational Medicine and Preventive Medicine residents from a local military base, by providing the MPH portion of the program.

The allied academic programs provide special training in specific aspects of occupational health. Our Occupational Health Services Research Training provides a unique opportunity for students to explore efficient delivery of health services in the occupational context, especially in relation to workers' compensation. As a result of our close association with the WA State Department of Labor and Industries, Occupational Health Services students can address a multitude of prevention, treatment and economic issues based on the State-run comprehensive workers' compensation management system. Our Hazardous Substances Academic Training program supports students studying occupational hygiene aspects of contaminants in the general environment, especially issues associated with hazardous waste clean-up activities.

In addition, the Northwest Center includes a large and active continuing education and outreach program, including a Hazardous Substances Training program specifically addressing the needs of local governmental and emergency response personnel. The CE program provides up-to-date training for practicing occupational health and safety professionals, and is part of a larger CE program which includes the region's only OSHA Education Center providing OSHA-approved courses for workers and managers in a variety of industries, and an NIEHS-supported training program reaching special populations including emergency response personnel, port personnel, immigrants and other special risk populations, and Native American tribal organizations. The combination of these CE activities provides the opportunity for synergism between and among each of the training programs.

To summarize, the Northwest Center for Occupational Health and Safety provides a focal point for attention to work-related health and safety problems within the dynamic environment of the University of Washington and the Region X states. In addition to providing research-based training in the traditional core disciplines involved in the prevention of occupational disease and injury, the center

strives to collaborate with institutions across the region to provide innovative and cutting edge solutions to the problems associated with work in the twenty-first century.

Center Structure

The Northwest Center for Occupational Health and Safety includes a Center Administrative Core, three core academic programs, a Continuing Education and Outreach program (CE), which includes a Hazardous Substance Training program (HST), and two additional academic components: Occupational Health Services Research Training (OHSRT) and Hazardous Substances Academic Training (HSAT).

The Northwest Center is a cross-disciplinary program housed within the UW School of Public Health (SPH) within the Departments of Occupational and Environmental Health Sciences (DEOHS) and Health Services, the School of Nursing (SON) Department of Psychosocial and Community Health, and the School of Medicine (SOM) Department of Medicine.

The Center Administration for the Northwest Center for Occupational Safety and Health consists of the Center Director, Dr. Noah Seixas, Deputy Director, Steven Hecker, the directors of each of the ERC programs, and the external advisory board, made up of eight professionals practicing in Region X states. The Center Administration is supported by Center Manager Sean Schmidt, with additional part time assistance from Administrative Assistant Alicia Pearce, data manager, Dr. Bert Stover, and Assistant CE Director, Annie Bruck. The role of the Center Administration, in addition to fiscal and grant management, is to coordinate the programs and activities of the component academic and service programs to ensure effective use of Center resources, stimulate interdisciplinary interaction, serve as a public focus for the Center's activities, and to assess regional needs and program effectiveness to assist in planning activities.

Center Leadership

The Center Director and Deputy Director draw heavily on the Program Directors to help guide the programs of the ERC. The Program Directors form an Executive Committee and meet at least quarterly to review budget, program and trainee progress, and coordinate interdisciplinary activities of the Center. The leadership of the Northwest Center includes accomplished academic researchers and leaders in each area covered by the included disciplinary programs.

External Advisory Board

An external advisory board (EAB) includes seven practicing professionals in occupational health and safety and is designed to be representative of the Region X states, and the disciplines and constituencies served by the Center. A Charter for the Committee was created since the last renewal, instituting a three-year term for members. The current membership of the EAB is given in Table B.

The advisory board meets annually and also provides feedback and guidance between annual meetings to the Center Director and Program Directors. The EAB importantly provides liaison with professional societies and labor and industry outside the Puget Sound region. Currently, the Chair of the EAB is Dr. Mary Salazar, who is retired from the UW after a long academic career and involvement with the Center as Director of the Occupational Health Nursing (OHN) program. Robin Baker from University of California joined the Board to provide an external perspective and expertise in outreach and education. Four of the six other members are graduates of our ERC programs and are practicing professionals in the field. Jerry Dzugan, from the Alaska Marine Safety Education Association is a NIOSH TPG recipient, and works closely with NIOSH in Alaska.

Table B. 2010 Center External Advisory Board membership

NAME	STATE	DISCIPLINE	ORGANIZATION
Mary Salazar, CHAIR	WA	Occupational Health Nursing	UW (retired)
Robin Baker	CA	Public Health Education	UC, Berkeley
Dede Montgomery, MS, CIH	OR	IH, Outreach and Education	CROET, Oregon Health & Science University
Guy Silvey	OR	IH&S, Construction Industry	Turner Construction
Jerry Dzugan	AK	Marine Safety	Alaska Marine Safety Education Association
Sharon Ness	WA	Labor and Health Care	UFCW
John Holland	WA	Occupational Medicine	Holland Associates, Inc.
Kai Elgethun	ID	Exposure and Risk Scientist	Idaho Division of Health

Student Recruitment and Alumni Tracking

The Center primarily relies on individual departments and programs for recruiting graduate students, however the Center participates in recruitment by staffing booths annually at the American Industrial Hygiene Conference and Exposition and American Public Health Association Conferences. The Center also supports and attends regional research and educational conferences, as described in the Outreach section, below. The primary recruitment mechanism is the website (<http://depts.washington.edu/nwcohs/>) which has information about our programs and each program's admissions procedures, and is linked to the NIOSH ERC website.

DEOHS also recruits largely through its presence on the internet, which describes funding opportunities including Center support. DEOHS has made a significant effort in recruiting underrepresented groups, as described in the section entitled Diversity Recruitment Plan, below. The department also makes an effort to recruit students from UW undergraduate (UG) programs, including the department's own UG major in Environmental Health. This UG program is a large source of our graduate students, especially in the Industrial Hygiene program. The department has a publications staff that produces award-winning biannual reports, an annual calendar and several brochures, including one aimed at introducing students unfamiliar with career opportunities in environmental health broadly. Each of these publications is circulated to assist in attracting top students to our programs.

DEOHS conducts a comprehensive and aggressive tracking of our graduates and maintains a database of current employment and contact information. The department's graduate programs office periodically mines the UW Alumni database to identify changes in current addresses. In addition, the office regularly queries students' faculty supervisors for updated professional information. The comprehensive Alumni Survey conducted this past year was able to reach a large fraction of our alumni by a combination of mail, email and phone contacts, producing a response rate of thirty-eight percent. The department takes advantage of events like Career Day and Student Research Day to invite alumni back to interact with current students and keep abreast of the programs. In addition, the department biennial report always profiles a small group of alumni to reflect the breadth of professional involvement by our graduates.

Location and Facilities

The Northwest Center for Occupational Health and Safety, is located at the UW, however, because its programs span several schools, departments and clinical and research facilities, we occupy multiple locations.

The UW Health Science Building (HSB) is the primary location for the UW Schools of Public Health, Medicine and Nursing. Within the HSB, are teaching facilities including classrooms, conference rooms and lecture halls. Central teaching facilities including the Health Sciences Library, graphical design and printing services, classroom services are also located in HSB.

The primary space for DEOHS is in the HSB, including administrative offices, the graduate program office and a small library, as well as offices for about half the DEOHS faculty. The department's Environmental Health Laboratory (EHL) is a full range analytical chemistry laboratory accredited by the American Industrial Hygiene Association, is also here. EHL facilities consist of 2,300 square feet of laboratory space for wet chemistry and instrumental analysis. Faculty research laboratories are at this location, including offices of the Pacific Northwest Agriculture Safety and Health Center. OHN program offices and teaching facilities are also in HSB.

The DEOHS has established a satellite facility at 4225 Roosevelt Way, about a 10 minute walk from HSB. The Center administrative offices are located at this facility, along with research laboratories for faculty members Seixas, Hecker, Johnson, Gleason and Camp. In addition, at this location are the CE and HST program staff, the field laboratory for the Field Research and Consultation Group, and the extensive laboratories of the Toxicology program. Also located at the Roosevelt building are the offices and laboratories associated with the HSAT program faculty.

The Occupational Medicine Residency (OMR) program has faculty offices in HSB and Roosevelt buildings; the Occupational Medicine (OM) clinic and staff associated with OMR are located in suite next to the Harborview Medical Center near downtown Seattle. Finally, the DEOHS has a research facility shared by Drs. Yost and Kaufman equidistant from the Roosevelt and HSB locations containing a human exposure chamber with a diesel exhaust generation system and advanced exposure monitoring systems.

Outreach

The Northwest Center for Occupational Health and Safety serves as a regional resource for business, labor, government, and especially for practicing occupational health and safety professionals throughout the four-state Region X. Our outreach activities to these groups include cooperation with institutions in the region, support of students in various training programs, professional training—especially the various modalities of continuing professional education—and an extensive array of consulting and practice-oriented research activities.

Regional Institutions

Although the UW is the only institution in Region X providing a comprehensive program of graduate level training and research in occupational health and safety there are several notable institutions in the region with whom we collaborate.

The Occupational Health Psychology program located at Portland State University (PSU-OHP) provides graduate training in that specialty area—an area that is not covered by UW. Thus, there is significant potential for collaboration to enhance programs at both institutions. The PSU program is supported by NIOSH as a Training Project Grant (TPG) and trains graduates for MS and PhD degrees. We have had two notable collaborations with the PSU-OHP. First, Dr. Ryan Olson, a junior faculty member from the program applied and was awarded NORA research project pilot funds. The project helped develop and pilot test a motivational curriculum to address health and safety factors for long-haul truck drivers. Sara Schmidt, a doctoral student in OH Psychology worked on the project for her dissertation. At this writing, Dr. Olson's group has another pilot project approved for funding.

Second, the Center and PSU-OHP also collaborated on a needs assessment survey related to occupational health continuing education needs in Oregon and Washington, particularly looking at the balance between degree and noncredit offerings to our constituents in the two states. In 2007-2008 these two organizations, joined by Center for Research on Environmental Toxicology at Oregon Health and Science University, jointly developed and administered a survey at a series of statewide and regional safety conferences, and UW analyzed the findings. Findings from the first survey indicated that credit was less important than skills improvement, personal interest, and job requirements in decisions about training, even though almost 75% of the respondents had some college experience.

The Center for Research on Occupational and Environmental Toxicology (CROET) located at Oregon Health and Science University in Portland, conducts research and provides outreach and training on occupational health problems. Dede Montgomery, MS, CIH, a graduate of our Industrial Hygiene program runs their outreach and CE activities and has developed an excellent web-based information resource (CROETWeb, at <http://www.croetweb.com/>). Ms. Montgomery serves on our EAB and provides an important link between the Center and the professional communities in Oregon. In addition, we have developed several collaborative research projects between UW and CROET investigators. In particular, Dr. Kent Anger of CROET has collaborated with Professors Harvey Checkoway and Matt Keifer on long-term studies of neurologic outcomes associated with pesticide exposures. Dr. Anger has participated as an instructor in Center continuing education courses on effective safety training (Safety and Health Training: What's New, What Works, What's Needed, Tacoma, Sept. 2007) and toxicology (Small Dose of Toxicology, Portland, December 2006) where he was joined also by CROET's Dr. William Lambert. The UW Center jointly sponsored and contributed presenters and workshop facilitators to CROET's June 2007 symposium on Safety at Work in Informal and Non-Traditional Settings: Protecting Vulnerable Workers. Finally, the Center collaborated with CROET and PSU in the training needs assessment survey described above.

The Alaska Marine Safety Education Association (AMSEA) provides training to commercial fishing personnel and other non-commercial boaters in Alaska. AMSEA Director, Jerry Dzugan serves on the Center's EAB providing important linkages to Alaska occupational safety community. In 2006-2007, CE Director Steve Hecker consulted with Mr. Dzugan on the design of an evaluation of retention of fishing emergency safety training information.

Northwest Center faculty and students have extensive involvements with the Safety and Health Assessment and Research for Prevention (SHARP) Program at the Washington State Department of Labor and Industries. Dr. Barbara Silverstein, the director of SHARP, and Drs. David Bonauto, Steven Whitaker and Stephen Bao from SHARP each have affiliate faculty appointments in DEOHS. Numerous trainees have had placements with SHARP for practica, internships, or for collaborative research projects. The Center CE program has collaborated extensively with SHARP researchers in facilitating implementation of Washington's Safe Patient Handling legislation in Washington hospitals. Furthermore, the unique employment and worker's compensation data resources from the Department of Labor and Industries provide a basis for many projects in the OHSRT program and others, with the assistance of Dr. Gary Franklin, medical director of WA Department of Labor and Industries and proposed co-director of the OHSRT program.

Regional OH&S Professionals

A major component of our on-going outreach to the region involves multiple modes of delivery of continuing education, as described more fully in our CE program section narrative. In addition to a full program of in-person short courses designed for practicing professionals, the CE program conducts on-line training, a full complement of OSHA certification courses (through our Pacific Northwest OSHA Education Center), worker training in hazardous materials management (through our NIEHS worker

training grant as part of the Western Region University Consortium), and tailored courses for specific groups. Details of our CE offerings are provided in the CE program section.

Conferences / Collaborations with Professional Societies

The Center supports regional research and training through participation in several regional conferences. The annual Northwest Occupational Health Conference (NOHC) is a collaboration between the Center, the Pacific Northwest Section of the American Industrial Hygiene Association (PNS-AIHA), the WA State Association of Occupational Health Nurses and the Northwest Association of Occupational and Environmental Medicine. The NOHC is among the largest and longest-running regional occupational health and safety conferences in the country, attracting 200-250 participants each year. The Northwest Center assists by facilitating a short course as the first day of the conference, providing speakers for several sessions, and supporting students in attending the conference. The venue serves both as a regional coordination activity, and as an interdisciplinary research activity, while also supporting training. The program for last year's conference can be viewed at <http://www.pnsaiha.org/Documents/NOHC%20Program.htm>.

Since 2009, the Center has supported student involvement in the conference by sponsoring a student research award. Student papers (work conducted while in training) will be solicited from all the regional institutions with training programs, and scholarships awarded to students in each of the OH disciplines of Industrial Hygiene, Occupational Safety, Occupational Health Nursing, Occupational Medicine and allied disciplines (epidemiology, psychology, business, etc).

The Center also actively participates in each of the region's Governor's H&S Conferences, which are held annually in WA, OR, AK, ID, by offering continuing education courses and conference session presentations by our own faculty or other experts in particular fields. In 2009, the Center co-sponsored the National Health Care Ergonomics Conference held in conjunction with the Oregon Governor's Occupational Safety and Health Conference in Portland and supported the attendance and participation of several members of the Washington Safe Patient Handling Steering Committee who presented in workshops and short courses. We worked closely with the Oregon Nurses Association and the Oregon Coalition for Health Care Ergonomics in this project, and in Washington we similarly plan programs with several nursing unions. Our faculty and staff are regular participants in the Puget Sound Ergonomics Roundtable.

In addition, the Center helps to support a research conference held annually between the University of Washington and the University of British Columbia, and more recently, the Simon Fraser School of Public Health at Semiahmoo, a hotel near the Washington-Canada border. This conference presents research activities at the participating schools and provides a forum for stimulating methods innovation and cross-border collaborations in research. Students from each of the institutions are encouraged to attend and present their research, and the Center provides support for UW students attending. In addition, the Center supports the awarding of a David Bates Lectureship at the conference, bringing a special presenter into the conference to provide a focal point for the discussions.

Other Training

Developing effective distance learning opportunities is very important, especially in a geographically large region such as ours, and very challenging because of the limitations associated with distance learning technologies. We piloted a course during the 2009-2010 year using a combination of in-class and distance learning targeted to practicing nurses throughout the region. The course was delivered at UW, with a target enrollment of ten local attendees, ten out-of-area participants who travel to participate (with support from the Northwest Center), and ten out-of-area participants who participated

synchronously through web-based technologies. Evaluation of the course will be a comparison of the in-class and online modes of training delivery. Taking lessons from this pilot delivery of this course, we plan to continue it annually in the future and will also explore use of similar concepts for regional delivery to students in other allied disciplines such as safety, construction management, engineering and others. One possible direction is to offer a course on clinical assessment for Nurse Practitioners (NPs). Washington State has just passed legislation allowing NPs to conduct assessments of occupational disability for worker's compensation insurance. Basic training in the diagnosis of occupational injury and illness will thus be an important area for post certification training for NPs in the state. Our advisory board member from Alaska has expressed particularly strong interest in such courses for practitioners in his state.

Research and Services

Consultation, applied research, research to practice (R2P) projects, and intervention research are among our primary tools for outreach to the region, as well as graduate level training to our students. Several service units run by DEOHS provide direct services and consultation to regional individuals, business or labor groups.

- The Field Research and Consultation Group (FRCG) provides on-site industrial hygiene, safety and ergonomics consultation for Washington State businesses or labor groups. Staffed by four industrial hygienists and one technician, the FRCG performs approximately fifty consultations per year. The FRCG also collaborates with DEOHS faculty in the development of field-based research to practice, or intervention research projects, and helps train graduate students in field-based research and consultation techniques.
- The Harborview Occupational Medicine Clinic and Center for Chemically-Related Illness provides a secondary referral clinic for occupational disease and injury. Located at the Harborview Medical Center in downtown Seattle, the clinic is led by Dr. Jordan Firestone, and is staffed by core occupational medicine faculty and the current occupational medicine fellows.
- The Environmental Health Laboratory (EHL) provides environmental analytical services to employers and labor through support to industrial hygiene and occupational medicine professionals in Washington State and has been AIHA accredited since 1977. In addition to providing consultative and analytic services, the laboratory conducts research on analytic techniques for workplace chemical hazards and provides training to graduate students in analytic methodologies.

Through extramural funding, and in some cases Center pilot funding, faculty have developed a wide array of R2P-style research activities involving Region X workers and businesses. A few notable examples of these research activities are provided here.

Addressing the Aging Workforce: A workshop was designed, entitled "Designing the Age-Friendly Workplace," to help employers and unions develop action plans based on relevant research in order to prepare for the aging workforce. The workshop distills and communicates research on the demographics of the aging workforce, physical and cognitive effects of aging, age-related health and safety issues, universal design and cost-effective health promotion strategies. Workshops have been completed with a manufacturing company, a large state agency, and a public employee union. Additional workshops are planned in the future and NIOSH has agreed to partially fund a conference to roll out this curriculum to other ERCs around the country.

CPC Permeation of isocyanate paints in autobody shops: Diana Ceballos, a trainee in the PhD program in Industrial Hygiene has conducted an extensive evaluation of dermal exposure and the

effectiveness of chemical protective glove materials to isocyanate paints in the autobody industry. The project involved a survey of current autobody shop protection practices, an isocyanate surface contamination assessment in autobody shops, development of monitoring techniques for surface contamination, an inter-method comparison of isocyanate analytical chemistry current methods, and an assessment of protection afforded by the gloves used in the industry. Based on the results, painters are recommended to use medium to thick nitrile gloves and these recommendations will be implemented in a follow-up dissemination study.

Increasing hearing protection device use among construction workers: Dr. Seixas, with several trainees over the past four years, has conducted an intervention study among construction workers to test the effectiveness of training and use of a noise indicator device in increasing the use of hearing protection devices (HPDs) among construction workers. Prior to intervention, about forty percent of workers used HPDs when in high noise prior to training. Preliminary results indicate little substantial change in use with training alone, but that use of the noise indicator significantly increase usage in a sustainable way. These results will be reported to participating sites, as well as disseminated to the construction industry.

Improving worker's compensation utilization: The Centers of Occupational Health and Education (COHE) in Washington State aim to prevent disability among injured workers by promoting occupational health best practices such as timely and efficient coordination of health care services. Harborview Medical Center's COHE project, directed by Dr. Jordan Firestone and with active participation of all OM trainees, is one of four OM clinics in Washington State serving as a model COHE program. Over the last several years, COHE providers in Washington State have reduced worker time away from work due to disability by an average of nine days compared to non-COHE providers, which equates to nearly half a million dollars per 1000 workers in claims reductions. With COHE, Harborview is at the forefront of efforts to improve quality in occupational healthcare by reducing disability.

Assessing whole body vibration among metropolitan bus drivers: Dr. Peter Johnson and ERC trainee Ryan Blood have assessed whole body vibration (WBV) on Seattle city buses, comparing high and low entry buses. The project has demonstrated that low floor buses do not attenuate impulsive WBV exposures well. As a result, we recommended that the type of bus should match the type of route (do not use low floor busses on routes with speed humps or routes with many impulsive exposure, e.g. rough city streets). In a second study, two types of seats were compared for differences in WBV attenuation. Only a few small performance differences between seats were identified, but seat pressure settings were found to significantly affect vibration exposures. The results indicate that the current air ride seats standard on buses may not be universally beneficial, due to seats always oscillating up and down during driving, and these recommendations have been reported to the transport agency, and in the literature.

The Center includes myriad outreach activities, which are integral to our training, research and service activities. These include collaboration with regional educational and research institutions, placement of student trainees in regional organizations for practica and internships, participation in regional professional and research-oriented conferences, provision of consultation and continuing education to practicing professionals, and developing research activities with an explicit R2P focus on occupational health issues of importance in the Region X states. In these ways, the Center serves as a regional resource, as well as a professional training institution.

Diversity

Over the past several years, the DEOHS has made concerted efforts to recruit and retain qualified applicants from underrepresented groups to our graduate programs. We intend to continue these efforts. The recruitment activities include:

- Target mailings to a national register of underrepresented students interested in pursuing graduate education (Western and National Name Exchanges) provided by sixty colleges and universities
- Attend and display a booth at the annual meetings of the Society for Advancement of Native Americans and Chicanos in Science and American Public Health Association
- Create a special departmental web page dedicated to environmental justice issues which highlights how environmental and occupational health can benefit communities of color (viewable at <<http://depts.washington.edu/envhlth/ej/index.php>>).
- Maintain a close collaboration with ongoing recruitment efforts made by the UW DO-IT (Disabilities, Opportunities, Internetworking, and Technology) program's STEM (Science, Technology, Engineering and Mathematics) recruiter who has established relationships nationally with colleges that primarily serve underrepresented students
- Maintain a close collaboration with the UW GO-MAP office (Graduate Opportunities and Minority Achievement Program)
- Offer special funding packages to well-qualified under-represented students.

In addition, in 2007, Dr. David Kalman, Chair of DEOHS, was awarded a five year training grant from the National Institute of Environmental Health Sciences (NIEHS) titled "Undergraduate Summer Research Experience in Environmental Health Science." Its twin goals are to provide high quality environmental research activities to students of outstanding potential and to actively recruit highly qualified students from disadvantaged or under-represented groups. In the summer of 2008, six students participated in a variety of research programs. Four of those students were from underrepresented groups. During 2009, Dr. Kalman was awarded supplemental funds for this internship project to support an additional three students, and to support a 'visiting science educator.' This visiting scholar will come from an institution serving minority undergraduates, such as Heritage University in the Yakima Valley, and will use the summer experience to build capacity at his/her home institution for undergraduate research in occupational and environmental health sciences.

These activities have proven effective, in that our percentage of under-represented groups among our entering graduate classes have steadily increased as shown in Table C.

Table C. DEOHS under-represented (UR) groups graduate student enrollment (2005-2010)

Year	Students Enrolled	Number from UR Groups	% from UR Groups
2009	76	6	8
2008	72	7	10
2007	68	6	9
2006	72	5	7
2005	86	6	7

Recruitment of students from under-represented groups is also emphasized in the School of Nursing and the Departments of Health Services and Global Health. The SON conducts recruitment efforts in a centralized fashion, and the OHN program recruits students expressing some interest in occupational

or environmental nursing issues from within the entering class. In support of recruitment of a diverse student body, the SON has taken several significant steps recently: developing a multicultural student website, creating self-generated career planning interfaces, increasing involvement of faculty, students and staff in national and local minority-based organizations, funding and maintaining a community network in support of minority students, applicants, and alumni, and cultivating as many scholarship and student funding opportunities as possible for minority and disadvantaged applicants and students. Despite mounting recruitment challenges, enrollment of minority students in the SON's graduate programs increased from 14.6% in 2003 to 19% in 2007.

The expansion of Center continuing education efforts with under-represented groups is providing an additional avenue in reaching these populations. Our CE program has developed several bilingual Spanish instructors who now instruct in our courses. Through our CE courses in tribal communities we raise awareness of occupational and environmental health as potential careers for native students, though no Native Americans have yet been recruited to our programs.

Interdisciplinary Coordination

Interdisciplinary interaction is a hallmark of the UW training programs related to occupational safety and health and is fostered by the ERC in a number of important ways.

Coursework

Several core courses offered or required within our programs offer substantial opportunity for interdisciplinary training and interactions. These include:

Toxic Chemicals and Human Health (ENVH 405): An introductory course in toxicology, taken by students in the IH, OHN and HSAT programs

Environmental Health Readings I" (ENVH 581): An introduction to the breadth of environmental health sciences and critical reading of the scientific literature, taken by all first year students in the MS programs of the DEOHS

Environmental Health Readings III (ENVH 583): An introduction to research methods and the development of a research proposal taken by all first year MS students in DEOHS

Recognition of Health and Safety Problems in Industry (ENVH 564): Introduces the range of issues in occupational health and safety practice, through recognition of hazards and control strategies, taken by IH, OEM and OHN students (and some in OHSRT and HSAT)

Current Issues in Occupational Medicine (ENVH 596 / Nursing 580): A multidisciplinary seminar-style course covering a range of topics in the practice of occupational health. During most quarters roughly equal numbers of OM and OHN students participate, and are required to work together (groups are always "mixed" disciplines) on projects in the class, with excellent results.

Applied Industrial Hygiene, Safety and Ergonomics (ENVH 559): A practical field-based course, taken by IH, OHN and students from the Industrial Engineering program. Students work in multidisciplinary teams to comprehensively evaluate the occupational safety and health needs of a local business and recommend control strategies.

Occupational Health Policy and Politics (ENVH 584): Addresses the historical, regulatory, legal, and policy aspects of occupational safety and health, taken by students from IH, OHN and OEM programs

Research

Students in all Center programs produce a thesis or scholarly project in the course of their studies, and these products are supervised by a faculty committee. In many cases, these committees include

faculty from multiple disciplines, allowing for significant inter-disciplinary input into the research experience.

The Department of Environmental and Occupational Health Sciences holds a weekly research seminar (ENVH 580) with invited speakers addressing a wide range of pertinent topics. All DEOHS students are required to attend this seminar for at least three quarters.

The Center sponsors a quarterly “Interdisciplinary Research Seminar” oriented to interdisciplinary interaction between trainees in all our ERC programs. The seminar usually takes the form of a faculty presentation, followed by three student presentations from different disciplines. Approximately thirty students and faculty meet for three hours of research presentations and discussions.

Each spring, the DEOHS holds Student Research Day, in which all MS and PhD students nearing completion of their research present their research to the Department. Students representing each of the Department’s programs (including IH, EH and OEM) present their research findings in plenary session, and all other students display their work in a poster-session for students, staff and faculty to view. Students receiving Pilot Projects NORA research funding have also presented the results of their projects in this forum.

Regional conferences, especially the Northwest Occupational Health Conference (NOHC) and the Semiahmoo Conference present faculty and student research from several OH&S disciplines. Students in the IH, OEM, OHN and OHSRT programs regularly attend.

The Northwest Center is one of nine centers and institutes associated with the DEOHS, each of which stimulates interdisciplinary interactions within and beyond the disciplines directly involved in occupational safety and health. A full listing of these Centers can be found at <http://depts.washington.edu/envhlth/centers/centers.html>. Of particular relevance to the faculty and students of the NWOHC are the Pacific Northwest Agricultural Safety and Health Center (PNASH), the Fogarty International Scholars in Occupational and Environmental Health, the Center for Ecogenetics and Environmental Health (CEEH) and the Institute for Risk Analysis and Risk Communication (IRARC). Each of these Centers provides opportunities for interdisciplinary work related to occupational safety and health for faculty associated with the centers and students interacting with center staff and faculty or participating in their varied scientific and educational activities.

Research Ethics Training Requirements

An additional aspect of interdisciplinary training is addressing research ethics. All master’s students in their first year in DEOHS are required to take ENVH 583, which provides an introduction to research ethics and human subjects’ protection. All students involved in research involving human subjects are required to take the human subjects training offered by the UW human subjects division, prior to collecting or using any information obtained from individuals.

The UW School of Medicine annually provides Biomedical Research Integrity (BRI) training (see <http://depts.washington.edu/uwbri/>). This training is available to all UW students and staff and covers five of the seven NIH-required topics: conflict of interest, data acquisition and ownership, peer review, responsible authorship and research misconduct. The two other areas, researcher / trainee responsibilities and collaborative science, are also included in each lecture. For those unable to attend, the lectures can be viewed online. A series of workshops are also held following each lecture to enhance learning and delve deeper into the topics covered in each lecture. Northwest Center trainees are required to attend these lectures, and a policy specifying trainee responsibilities is distributed to all

trainees during orientation and at the beginning of the BRI training cycle (http://depts.washington.edu/nwcohs/pdf/bri_policy.pdf).

New Management Course Development

In response to the large number of alumni reporting the need for additional training in management aspects of occupational safety and health, we developed a new interdisciplinary course covering a range of topics in program management. The target audience for this course includes all students in the Center core and allied discipline programs, and is listed as an elective for each of those curricula. The course addresses management topics including leadership and personnel management skills, budgeting and budget projection, workforce training techniques, effective communication skills, regulatory compliance and organizational policy implementation, and economic aspects of safety and health management. The course is taught by a combination of academic and practitioner experts in each of these areas, and coordinated by a Center core faculty member.

Needs Assessments & Alumni Survey

The Northwest Center has conducted a broad-based needs assessment for occupational health and safety in Region X, a needs assessment as a component of our comprehensive alumni survey (described in Past Performance), and multiple smaller needs assessment projects in several venues. Each of these assessments is described briefly here and the full report of our Region X needs assessment (Occupational Health Indicators for Region X is available online (<http://depts.washington.edu/nwcohs/hsindicators.html>), as well as our alumni survey (<http://depts.washington.edu/envhlth/pdf/reportdeohs.pdf>).

Occupational Health and Safety Indicators for Region X, 2000-2005

The Council of State and Territorial Epidemiologists (CSTE) has developed a set of nineteen surveillance based indicators of occupational health and safety. We applied these indicators to the four states in Region X, gathering data over the period 2000-2005—the most recent data available at the time the project was conducted. Many of these data had previously been assembled for WA and OR, which have state-based surveillance activities, but not ID or AK. Some of the indicators were unavailable from these latter states; for instance, ID does not participate in the employer-based Bureau of Labor Statistics(BLS) Survey of Occupational Injury and Illness (SOII). Furthermore, caution is required in comparing indicators across states because of the many differences in the states' rules regarding workers compensation and other data sources. Nevertheless, the report is able to provide a broad look at workforce, occupational injury and illness and prevention activities in the region, and trends over the six years included.

A summary of key employment statistics and the overall occupational injury and illness and fatality experience in Region X is provided in Table D. It is notable that according to these data, employment in several high risk industries is higher than the national average, and the injury and illness rate is higher than the national average in all three states for which data are available.

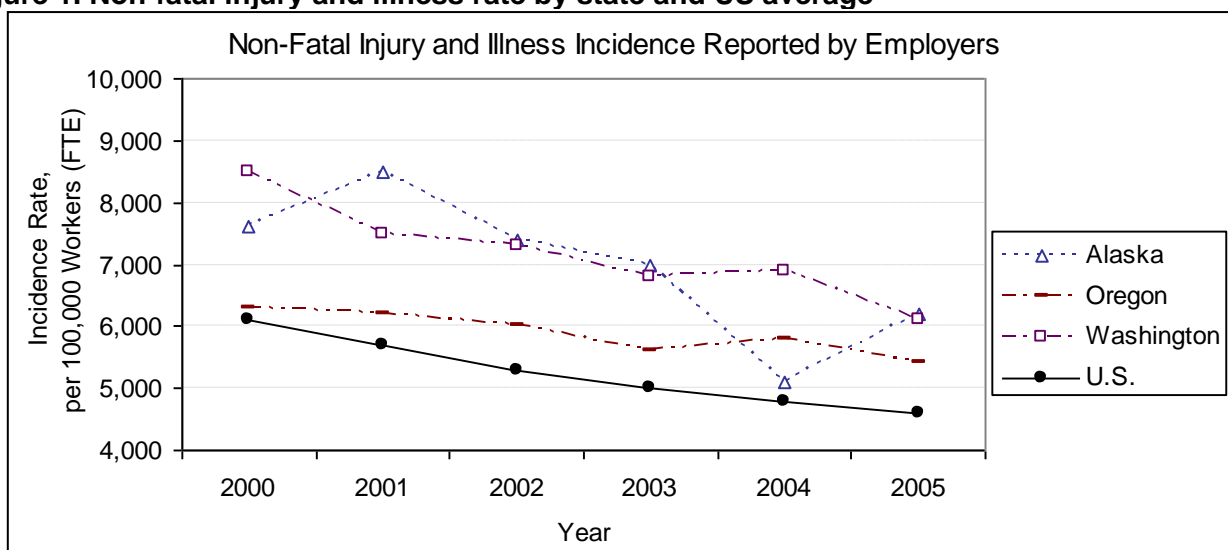
Table D. Key indicators by Region X states, 2005

	ALASKA	IDAHO	OREGON	WASHINGTON	REGION	NATIONAL
Employment civilians over 15 years	320,000	713,000	1,732,000	3,111,000	5,876,000	141,730,000
% Ag	2.2	5.7	3.1	2.1	2.8	1.6
% in Construction	9.1	9.0	7.7	7.0	7.6	7.6
% in Mining	2.2	0.3	NA	0	NA	0.4
% in Transportation	8.5	4.9	4.1	6.1	5.5	4.9
% in High Risk Industries*	18.7	19.7	15.5	13.6	15.2	14.2
Injury and Illness Count	12,000	40,371	59,200	109,900	221,471	4,214,200
Injury and Illness Rate / 100,000 FTE	6,200	6,569	5,400	6,100	NA	4,600
Fatalities Count	29	35	65	85	214	5,702
Fatalities Rate /100,000 FTE	9.1	4.9	3.7	2.7	3.6	4.0

*High risk defined as those with fatality rate >10/100,000

Non-fatal injury rates for the three states participating in the BLS SOII and the national average are shown in Figure 1. Although a downward trend is apparent in all states, the injury rates in all three Region X states are higher than the national average. The degree to which this represents the proportion of high hazard industries in these states, or a more active and complete reporting system is uncertain. Similar and more detailed data can be found in the full report.

Figure 1. Non-fatal injury and illness rate by state and US average



Despite a relatively active professional community in the region, the need for occupational health and safety professionals remains high. Estimates based on board certified professional occupational medicine physicians, occupational health nurses and industrial hygienists are provided in Table E. Overall, there are almost 50,000 workers per Board Certified occupational physician, about 33,000 per occupational health nurse and almost 15,000 workers per certified industrial hygienist in the region. Larger numbers of uncovered employees occur in Alaska and Idaho in comparison with Oregon and Washington. While these numbers are lower than the national average, the demand for trained professionals appears to remain strong, as a large fraction of our graduates remain within Region X and play leadership roles in many regional companies and professional societies.

Table E. Labor force and the supply of occupational health professionals in Region X

	ALASKA	IDAHO	OREGON	WASHINGTON	REGION	NATIONAL
Civilian Labor Force over 15 years of age ¹	343,000	743,000	1,843,000	3,295,000	6,224,000	149,320,000
# Board Certified Professionals:						
Occupational physicians	8	10	32	80	130	2579
Occupational health nurses	10	18	64	96	188	6351
Industrial hygienists	21	57	81	264	423	6942
# workers per professional:						
Occupational physicians	42,875	74,300	57,594	41,188	47,877	57,898
Occupational health nurses	34,300	41,278	28,797	34,323	33,106	23,511
Industrial hygienists	16,333	13,035	22,753	12,481	14,714	21,510

¹ Current Population Survey, Preliminary 2006 Data on Employment Status by State and Demographic Group.
<http://www.bls.gov/lau/ptable14full2006.pdf> (accessed 4-22-2009)

Alumni Survey

We have recently completed a survey of alumni of our programs addressing evaluation of our programs and directions and needs for the future. The program evaluation components of the survey were discussed in the Past Performance section of this proposal, while the needs and future directions aspects of the survey are discussed here. The full alumni survey report may be found online at: (<http://depts.washington.edu/envhlth/pdf/reportdeohs.pdf>).

Eighty-three percent of graduate program respondents said they expected to maintain or increase their EOH staff over the next five years, suggesting a continued strong expectation for employment. 40% of graduates said they were very or somewhat likely to take additional CE courses in the next five years. Graduates were asked questions concerning current and future directions in their field – including the degree of importance of global issues in their current practice, and the degree to which training should address environmental, in addition to occupational health issues. 32% of respondents said they were involved with global issues in EOHS – and higher percentages were found among those with longer experience, work in the private sector and with higher incomes. Forty-six percent of graduates suggested that we offer more classes and training on global issues in occupational health. Asked if occupational and environmental health issues should be combined (rather than addressed separately), 39% of grads gave a rating of four or five (five being ‘totally combined’), and among those in the Industrial Hygiene program, 44% gave a response of four or five.

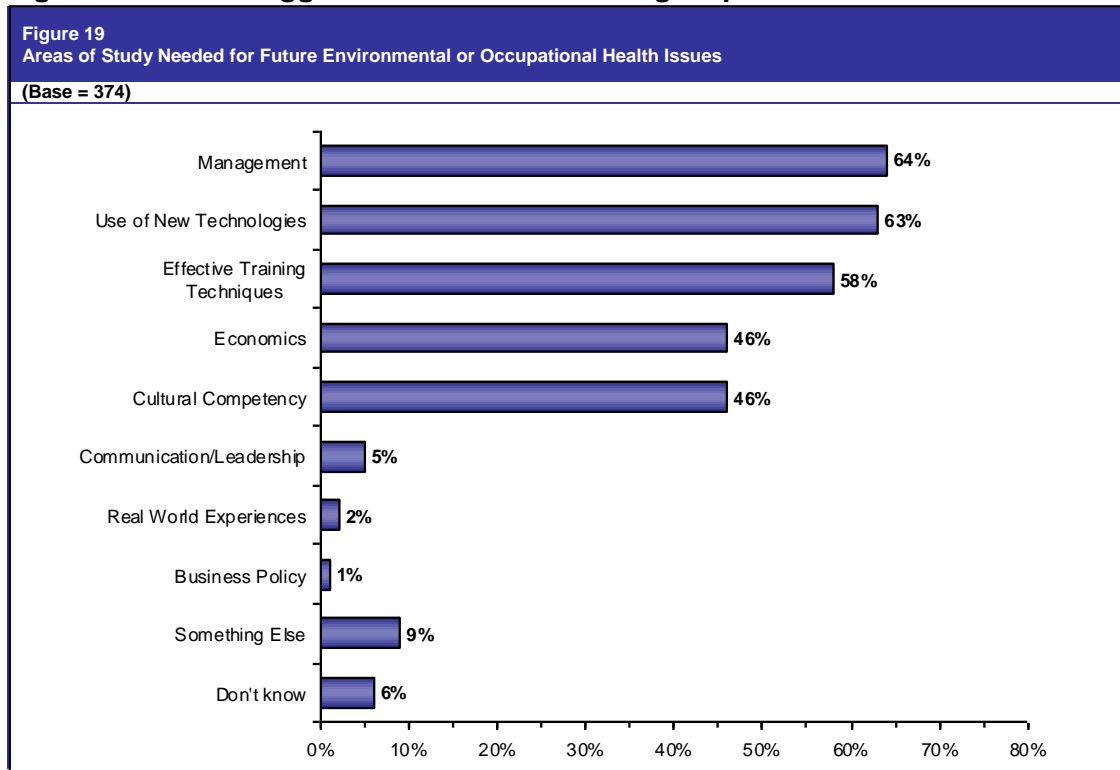
When asked about needed developments in OHS training curricula, there was strong support for training in management (64%), new technologies (63%), effective training techniques (58%), economics (46%), and cultural competency (46%). See Figure 2. These comments suggest that our graduates feel that some additional training in occupational health program management, including budgeting, human resources, and training would be helpful. A new course has been designed for pilot delivery in 2009-2010 in response to this suggestion.

Other Needs Assessments

The Northwest Center exhibits and presents at a series of safety and health conferences around the region each year. These include Governor’s safety conferences in Oregon, Washington, and Alaska, regional safety conferences in Oregon, and the Northwest Occupational Health Conference (NOHC), an annual professional conference co-sponsored by the regional industrial hygiene, occupational medicine, and occupational health nursing professional organizations. During 2007 – 2008 the Center collaborated with Oregon Health and Science University and Portland State University to conduct needs assessment surveys of attendees at these events. In all, over 300 attendees completed surveys. One purpose was to assess the interest among non-credentialed practicing safety professionals or

collateral safety practitioners in academic training in safety and health, particularly for those outside of the Puget Sound area. The safety conference respondents indicated that degree programs were not a high priority, with just under twenty percent saying they were very interested in them. More common reasons for seeking CE in safety and health were personal interest, job requirements, and enhancement of skills and qualifications. Academic credit was much less important than reputation, schedule, and cost in making determinations about which training to attend. About thirty percent were very interested in online courses, a number that we believe would be considerably higher today due to the economic climate. Finally, the topics of most interest to this group are OSHA standards and regulations and safety and health management and policy.

Figure 2. Alumni suggestions for future training emphases



In sum, broad scale needs assessment activities indicate a continuing demand for well-trained occupational health professionals, and continuing education programs for current practitioners. In addition, our alumni present very positive ratings of our graduate programs, while identifying some specific areas for enhancement.

Seattle and the University of Washington have become centers for the rapidly expanding fields of global health, with the location of the Gates Foundation, Puget Sound Partners for Global Health, the Institute for Health Metrics and Evaluation (IHME), PATH (Program in Appropriate Technology in Health), Microsoft, Boeing and other multinational corporations, and an active center for transportation throughout the Pacific Rim countries. Faculty and students at the Northwest Center for Occupational Health and Safety are increasingly challenged to address workplace hazards in a global context, which includes serving the needs of multinational corporations (and corporations contracting for manufacturing abroad), addressing the occupational health needs in developing economies, especially in Asia, and incorporating immigrants who have come to the Pacific Northwest for work in our local economies.

There continues to be a significant demand for well-trained occupational health professionals and researchers and significant room for improvement in the infrastructure and services provided to workplaces in the four Region X states. The Northwest Center at the University of Washington is uniquely situated to provide the training and workforce development needed to reduce work-related injury and illness in the region. Through cooperation with other regional institutions and support of the practicing professional communities, the Center's faculty, staff and students address myriad issues in workplace health and safety. The interdisciplinary graduate training programs in combination with the research activities of the UW faculty make the Northwest Center a vital regional resource for occupational health prevention.

Industrial Hygiene (IH)

Program Director: Michael Yost, PhD

The program faculty has maintained a strong national presence: Senior faculty include Dr. Michael Morgan, Dr. Richard Fenske, Dr. Noah Seixas, and Dr. Michael Yost, at the rank of Professor in the Department of Environmental and Occupational Health Sciences (DEOHS). Dr. Peter Johnson and Dr. Christopher Simpson both have achieved the rank of Associate Professor in the project period. The faculty have taken on a major role in both the teaching and research activities in Industrial Hygiene. Some program highlights are shown below:

- Rick Neitzel PhD received the 2009 Gilbert S. Omenn Award for Academic Excellence for a doctoral student from the UW School of Public Health. Mr. Neitzel, one of our ERC students, also is a full-time research scientist in the department. He has distinguished himself in the field of noise exposure since he began his master's degree in 1997. Among his accomplishments, Neitzel has published numerous articles in peer-reviewed journals and served as a leader in national organizations as well as a teacher in the department. This fall, Neitzel will receive his PhD in Environmental and Occupational Hygiene and is now on the faculty at the University of Michigan.
- Professor Michael Morgan was the recipient of the 2008 Meritorious Achievement Award from the American Conference of Governmental Industrial Hygienists (ACGIH). The award recognizes Dr. Morgan's outstanding long-term contributions to the field of occupational health and industrial hygiene. He joined our faculty in 1974. His research topics focus on human responses to the inhalation of air contaminants, including combustion products (sulfur dioxide and sulfate particles), ozone, and volatile solvents. His research program in pharmacokinetics and biological monitoring of organic solvents is funded by the National Institute of Environmental Health Sciences. He also is editor in chief of the Journal of Occupational and Environmental Hygiene and author of more than 65 peer-reviewed publications.
- Dr. Chris Simpson was successfully promoted to the rank of Associate Professor in July of 2009, after joining the program core faculty in March 2003 as a new Assistant Professor. Dr. Simpson has been developing novel source tracers and exposure biomarkers for combustion products and organic solvents.
- Dr. Peter Johnson was also promoted to the rank of Associate Professor in 2008, and also holds an Adjunct Associate Professor appointment in the department of Industrial Engineering at UW.
- The research training portion of the program was enhanced by the awarding of more than fifty major research grants totaling more than \$15M from extramural sources to members of the program faculty.
- Dr. Richard Fenske was named Associate Chair of our department in 2006, and his outstanding research contributions in pesticide exposure assessment using fluorescent tracers earned him two national and international awards: in 2006, the NIOSH Director's Award for Scientific Achievement in Occupational Safety and Health, and in 2007, the International Society of Exposure Analysis Jerome Wesolowski Award for "sustained and outstanding contributions to the knowledge and practice of human exposure assessment."
- Steve Hecker joined the IH program faculty as Senior Lecturer, replacing Sharon Morris who retired in 2005. Mr. Hecker is now directing our Educational Outreach and Continuing Education programs.
- We received renewal funding in 2007 for the Pacific Northwest Agricultural Safety and Health (PNASH) Center through 2011. Continued efforts by this center will focus on prevention of and intervention in agricultural injuries and illnesses throughout our Northwest region.

- Loren Kaehn, a MS student in the Exposure Sciences program, received a Veterans of Safety scholarship in December and became a Certified Safety Professional in February. In June, he became the department's first MS student to complete a portfolio instead of a thesis under the new curriculum.
- EOH doctoral student Clarita Lefthand (also included in HSAT program section) was awarded the prestigious Bullitt Environmental Prize for 2008. The Prize is given annually to an outstanding graduate student at a university in the Pacific Northwest and carries a cash award of \$100,000. Ms. Lefthand, a member of the Navajo Nation, also was awarded a three-year Science to Achieve Results (STAR) fellowship from the Environmental Protection Agency, which supports some of the nation's most promising masters and doctoral candidates.

Program faculty and students have presented research papers at the annual American Industrial Hygiene Conference and Exposition meeting and other scientific conferences. Thirty-four trainees graduated from the program in the reporting period, and seven of the thirty-four earned PhD's in Environmental and Occupational Hygiene. Several students in the program were honored by scholarship awards: Anna Schmidt, IH, MS, Gilbert S. Omenn Award for Academic Excellence in 2010; Oleg Antonchuk, IH, MS, 3M Occupational Health & Environmental Safety, Industrial Hygiene Scholarship, May 2007; Stephanie Griffin, IH, MS; Student travel award from the National Hearing Conservation Association February 2007; Diana Ceballos, EOH PhD, Scholarship from the Pacific Northwest Section - American Industrial Hygiene Association in 2006; Loren Kaehn, MS, American Industrial Hygiene Foundation Scholarship 2007-08 and Pacific Northwest Section of the American Industrial Hygiene Association Scholarship fall 2006.

Faculty Participation

No major changes to the core faculty have been made during the reporting period. The IH training program at UW has continued to maintain and develop a national presence. The Industrial Hygiene ERC training program has maintained a stable faculty and succeeded in promoting two core faculty from assistant professor to associate professor. The program carries on a strong research and research training program to complement its commitment to the education of industrial hygienists with career ambitions in industry and government. IH program faculty authored over 115 peer-reviewed publications during the project period.

Curriculum

The Industrial Hygiene program curriculum has undergone significant reorganization to respond to a variety of needs affecting our field, and to enhance recruitment of qualified young scientists. The program website can be found at: <http://depts.washington.edu/envhlth/acad_programs/es>. The program has been renamed to more accurately reflect the breadth and nature of our work in the field, and is now referred to as Occupational and Environmental Exposure Sciences, or Exposure Sciences for short.

The revised curriculum defines a set of core materials that we believe all students should be familiar with, and placed this within three core classes required for all students in our program. These include Principles of Human Exposure Science, Exposure Monitoring Methods, and Exposure Controls. We also recognize that the scope of practice in our field is very broad, and we provide the opportunity for students to emphasize particular areas of exposure science for their career paths. Graduates of the IH program over the project period, along with their dissertation or thesis titles are shown in Table F below.

Table F. July 2005 - June 2010 IH program graduates

Graduate	Preceptor	Thesis/Dissertation Title
Doug Johns	Morgan	The Effect of Ethanol Consumption on the Biotransformation of 1,1,1-Trichloroethane in Human Volunteers
Parveen Bhatti	Yost	DNA Double Strand Break Repair Polymorphisms, Ionizing Radiation Exposure and Breast Cancer Risk
Wayne Turnberg	Daniell	Respiratory Infection Control Practices among Healthcare Workers in Primary Care and Emergency Department Settings
Ming Yi Tsai	Yost	The Washington Orchard Spray Drift Study: Understanding the Broader Mechanisms of Pesticide Spray Drift
Robert Crampton	Yost	Transmission Quantification for Open Path Fourier Transform Spectroscopy with Temperature Compensation
Stephanie Carter	Seixas	Characterization of Peak Exposures in Aluminum Smelter Potrooms
Diana Ceballos	Yost	Evaluation Of Protective Gloves Used In The Collision Repair Industry
Amber Govert	Simpson	Development of an Analytical Method for the Determination of 3-Nitrotyrosine in Human Samples by HPLC-MS/MS
Janet Blackstone	Johnson	Physical Exposure Differences Between Children & Adults on Different-Sized Computer Input Devices
Yi-Nien Lin	Johnson	The Effects of High Frequency Stimulation on Fatigue and Twitch Potentiation
Amy Sly	Meschke	Optimization of polyurethane foam (PUF) as a pre-filter for an aerodynamic lens aerosol concentrator (ALAC) in the collection of bioaerosols
Cheng Han	Johnson	The development of testing software to measure and characterize differences in computer mouse use proficiency: comparison of children and adults.
Chris Ballew	Fenske	An Intervention Aiding in the Reduction of Organophosphate Pesticides From Take-Home Pathways
Elizabeth Gray	Morgan	Exposure Assessment and Exhaled Breath Analysis of Solvent Exposed Workers
Jason Woodruff	Seixas	Validation of Task-Based Noise Exposure Predictions in teh Construction Trades
Maggie Trabeau	Seixas	An Evaluation of "Train-The-Trainer" vs. Expert Training Modalities for Hearing Protection Use in Construction
Peter Lang	Morgan	Steady-state permeation rates for two polymeric glove materials and two common solvents
Christopher Jacomme	Morgan	Evaluation of a Two-zone Model Used to Predict Workplace Air Contaminant Concentrations
Christopher Miele	Yost	Applying Optical Remote Sensing Techniques to Monitor Community Air Particulate Pollution
Stephanie Griffin	Seixas	Indicators of Hearing Protection Use: Self-Report and Researcher Observation
Benjamin Wischmeier	Yost	Evaluation of the Efficacy of the BioSampler Aerosol Collection Device for Collection and Retention of Various Particle Sizes
Jannette Kibogy	Fenske	Assessment of Chlorpyrifos Exposure in Agricultural Workers During Airblast Applications
Loren Kaehn	Morgan	An Occupational Exposure Assessment at a Petroleum Refinery

Oleg Antonchuk	Seixas	Evaluation of Local Exhaust Ventiation for Welding
Ryan Blood	Johnson	Whole Body Vibration Exposure Among Transit Workers in King County, Washington
Seong Hyun Hwang	Johnson	Race, Gender and Finger Anthropometry: Implications for Computer Input Device Design
Danielle Parette	Morgan	Particle Size Distribution and Bioavailability of Haxavalent Chromium Exposure in Various Industries
Eric Coker	Yost	Measurement of Gasses by UV-DOAS for a Reference Spectral Library
Jackelin Tran	Morgan	Effects of Glove Material and Thickness on Permeation by Solvents Commonly Used in the Auto Painting Industry
Jacob Braden	Yost	Modeling the Fate of Diesel Particulate Matter Emissions from Selected Marine Vessels Using CALPUFF View
Lauren Dunbar	Meschke	Endotoxin Collection and Electrochemical Detection Method for Use in Bioaerosol Personal Sampling Device
Timothy Carter	Morgan	Particle Size Distribution and Bioavailability of Chromium VI Compounds in Electroplating and Spray-Painting
Travis Cook	Simpson	Evaluation of Chlorpyrifos Protein Adducts in Rat Blood Plasma by Mass Spectrometry-based Proteomics
Ryan Bible	Meschke	Efficiency Assessment of an Omni-Directional, Wind & Water Tolerant, High-Volume Bioaerosol Inlet
Margaret Hughes	Johnson	Effects of Keyboard Travel Distance & Switch Mechanism on Typing Forces, Muscle Activity and Wrist Posture
Christine Kim	Yost	Nasal Inhalation Exposure Method of Quantum Dots to Mice using a Nebulizer
Yuh-Chi Niou	Yost	Investigation of Children's Respiratory Symptoms due to Poor Indoor Air Quality in Sichuan, China
Miyoko Sasakura	Simpson	Iodinated Tribalomethane Exposure Potential from Point-of-Use Water Treatment
Julie Wagner	Morgan	Evaluation of Quantitative Respirator Fit Testing of Workers Exposed to Cr VI Aerosols from Various industrial Work Processes
Jill Walters	Morgan	Evaluation of Quantitative Respirator Fit Testing of Workers Exposed to Cr VI Aerosols from Various Industrial Work Processes
Stephanie Wong	Kaufman	A Spatial Model to Assess the Impact of Major Roadways on a Low Income Seattle Neighborhood using an Intensive NOx Sampling Campaign
Ling Cui	Johnson	Physical Exposure Difference Between Children & Adults When using Different Computer Input Devices
Richard Neitzel	Seixas	Improving Estimates of Occupational Noise Exposure
Phayong Thepaksom	Fenske	Measurements of Ambient NO using an Ultraviolet Differential Optical Absorption Spectroscopy (UV-DOAS)
Diana Ceballos	Yost	Evaluation of Protective Gloves used in Collision Repair Industry
Lynn Wilder	Fenske	Variation in Urinary Creatinine & Dissolved Solids from Childhood to Adulthood: Impact on the Interpretation of Urinary Biomarkers of Chemical Exposure

Student research highlights

Several activities of note described below address our interdisciplinary research training. We have continued our quarterly interdisciplinary research seminar in which advanced graduate students and

faculty present research methods and findings for an audience that includes trainees from all disciplines and the major faculty from each program.

Ryan Blood (MS 2008) worked on a project to evaluate whole body vibration exposures in King County Bus Drivers. The results showed that low floor buses may be prone to more vibration and thus bus drivers of such vehicles will need well-performing seats to attenuate the vibration to acceptable levels. Mr. Blood is now in the PhD program and will continue this; his preceptor, Professor Johnson, has just received a new RO1 award from NIOSH to continue these studies in a larger bus driver population.

Ben Wischmeier (MS 2008) investigated exposures to bioaerosols in agricultural animal care workers working in confined animal feeding operations. Mr. Wischmeier worked jointly under the supervision of Professor Scott Meschke, a microbiologist in the Environmental Health faculty in DEOHS, and Professor Yost in the Industrial Hygiene program. His work involved both laboratory and field sampling for bioaerosols, with biological culturing performed in Professor Meschke's lab.

Ms. Jannette Kibogy (MS 2008) evaluated bio-monitoring data collected from workers using various intervention measures to reduce exposures among pesticide applicators. Ms. Kibogy is a native of Kenya, and did her research in cooperation with Professor Fenske's Ag-Center project to reduce worker exposures to pesticides.

Ms. Kibogy and Mr. Wischmeier have both been hired as industrial hygienists by Chevron. The nature of these topics demonstrates the breadth of subject matter encompassed by our Center.

Occupational Health Nursing (OHN)

Director: Butch de Castro, PhD, MSN/MPH, RN

Highlights

- Patricia Butterfield, PhD, RN, FAAN, Associate Professor, served as the occupational health nursing (OHN) Program Director until September 2006. In 2006, following a competitive search, Butch de Castro, PhD, MSN/MPH, RN was hired as an Assistant Professor and appointed as the new Occupational Health Nursing (OHN) Program Director. Additional program changes include the appointments of Ms. Annie Bruck as Assistant Program Director (2006), Dr. Randal Beaton as the current Acting Assistant Program Director, and Dr. Jenny Hsin-Chun Tsai as core program faculty. Dr. Mary Salazar (previous OHN Program Director), Dr. Marcia Killien, and Ms. Phyllis Zimmer continued serving as active core faculty and advisors/mentors to trainees.
- Collectively, the OHN program faculty's research areas employ mixed methods approaches and emphasize occupational health disparities, work stress and health, and work organization. Program faculty have been successful in obtaining both intramural and extramural research funding, including two research career development (K) awards from the National Institutes of Health (NIH) and the National Institute of Occupational Safety and Health (NIOSH), respectively.
- OHN program faculty maintain a high presence and visibility in regional, national, and international arenas. For example, Dr. de Castro maintains research collaborations with the Occupational Health Nurses Association of the Philippines, and serves on the Washington State Nurses Association (WSNA) state-wide Occupational and Environmental Health and Safety Committee and the Editorial Board for the AAOHN Journal. Dr. Beaton collaborates and consults with the Centers for Disease Control (CDC), State Departments of Health in Washington and Oregon, Washington State Department of Labor and Industries, and Washington State Council of Firefighters. He is also on the editorial board of the International Journal of Stress Management and is an Associate Editor for the Journal of Traumatology. Ms. Phyllis Zimmer provides national leadership in nurse practitioner education and primary care, having served as past President of the National Organization of Nurse Practitioner Faculties and the American College of Nurse Practitioners and current President of the Nurse Practitioner Healthcare Foundation.
- Core faculty, students, and graduates received numerous awards in recognition for their work and contributions to worker health and safety. For example, Dr. de Castro received NIOSH National Occupational Research Agenda Partnering Awards for 2007 and 2008 and the WSNA 2009 Researcher Award. Dr. Beaton received the International Association of Fire Fighters Commendation Award. Dr. Tsai was awarded the American Public Health Association 2005 Public Health Education Health Promotion Materials Contest. Dr. Salazar received the 2006 March of Dimes Research Award and the 2007 University of Washington (UW) School of Nursing (SON) Distinguished Alumni Award. Students and graduates received the UW School of Nursing MN Outstanding Student Award, UW Citizen of the World Scholarships, the AAOHN Journal Golden Pen Award, and the WSNA Public Health Nurse Award. In addition, several have been named as Nurse Luminaries by Health Care without Harm. Others participated in summer internships with the Occupational Health Internship Program, OSHA Nurse Intern Program, and WHO Occupational Health Program.
- Both faculty and students have authored/co-authored fifty-two publications in peer-reviewed, scientific journals and given ninety presentations at regional, national, and international conferences.

The OHN program has undergone significant changes over the past four years, as detailed above. During this period, there has been overlap in leadership providing for a smooth transition without disruption in overall program management and administration. When Dr. de Castro assumed the OHN Program Director position during his first year (2006-2007), Dr. Butterfield maintained a strong presence in program activities while serving as Chair of the Department of Psychosocial and Community Health. Dr. Salazar also continued to be very active in program activities assisting with teaching and advising and mentoring students. Both Drs. Butterfield and Salazar worked closely with Dr. de Castro as he transitioned into the leadership and management roles for the program, assuring overall continuity and consistency. Moreover, both within the Department of Psychosocial and Community Health and the UW SON, the OHN program is viewed as a key and valued program to which faculty, department chairs, and the Dean’s office are strongly committed. Consequently, the OHN program has sustained high visibility and respect in the UW SON.

The OHN program has maintained a rigorous training experience while incorporating enhancements that build on the long track record and history of accomplishments. With changes to core faculty, curriculum and degree options, as well as evolution in orientation, the OHN program is positioned to meet current and emerging occupational health and safety issues, and, to prepare students for scholarly, leadership, and advanced practice roles. Moreover, the overall nature of the program, influenced by core faculty perspectives, seeks to expand trainees’ conceptualizations of occupational health and their understanding of how factors both within and beyond the workplace impact the health and well-being of worker populations.

On-going improvement of the OHN program occurs by using NIOSH ERC funds to support student tuition and stipends, salary for core faculty and personnel, student and faculty travel for professional development, books for students, and other program expenses. OHN faculty and personnel work to assure fiscal and ethically-responsible stewardship of NIOSH funds by prioritizing student expenses and moving students with alternative funding sources off of ERC funding lines and using departmental funds for all departmental activities. This ensures that ERC funds are used strategically to support evolving program and student needs.

Trainees

Table G lists each trainee supported from July 2005 to August 2010 along with period of support, faculty mentors, research / scholarly project conducted, and resultant thesis or publication titles. Trainee publications, along with those of the core faculty are also listed in Appendix A, Section II.

Table G: Trainee research and publications (July 2005 – June 2010)

PHD TRAINEES			
NAME	FACULTY MENTOR(S)	RESEARCH CONDUCTED	RESULTANT THESIS / PUBLICATIONS
G. McKenzie (2002-2006)	M. Salazar	Organizational stressors and injury and psychosocial health among unlicensed direct care workers.	Organization of work in assisted living: Implications for the occupational health and safety of unlicensed direct care workers. <i>AAOHN J</i> , 53(9), 381-384.
J. Postma (2003-2007)	M. Salazar	Occupational and environmental justice among migrant farm workers.	Environmental justice: Implications for occupational health nurses. <i>AAOHN J</i> , 54(11), 489-496. Balancing power among academic and community partners: The case of El Proyecto Bienestar. <i>J Adv Nurs</i> , 62(4), 441-450.

S. Matt (2004-2008)	P. Butterfield	Workplace climate issues among nurses with disabilities.	Changing the disability climate: promoting tolerance in the workplace. <i>AAOHN J</i> , 54(3), 129-133. Nurses with disabilities: self-reported experiences as hospital employees. <i>Qual Health Res</i> , 18(11), 1524-1535.
M-A. Sanon (2009-2010)	D. Boutain	Hypertension management among Haitian immigrant hotel housekeepers.	(Just completed 3 rd year)
J. Green (2007-2011)	R. Beaton & B. de Castro	Ergonomic issues.	(Just completed 2 nd year)
S. Johnson (2008-2012)	B. de Castro	Workplace bullying among nurses.	(Just completed 1 st year)
MN TRAINEES (Nurse Administrator Option)			
NAME	FACULTY MENTOR(S)	RESEARCH CONDUCTED	RESULTANT THESIS / PUBLICATIONS
L. Filipo (2004-2006)	P. Butterfield	Parental perceptions of environmental health risks for low-income rural children.	Parental perceptions of risk in low income rural populations: A secondary analysis from the ERRNIE Project.
L. Marinescu (2004-2006)	M. Salazar	Role of OHNs in designing/implementing programs to manage health risks in the workplace	Integrated approach for managing health risks at work--the role of occupational health nurses. <i>AAOHN J</i> , 55(2), 75-87.
S. Bramwell (2005-2007)	B. de Castro	Developing web-based archive for environmental health nursing publications.	Pub Hub: Environmental health nursing archive.
B. Tinker (2005-2007)	P. Butterfield	Perceived barriers and facilitators to deliver environmental health risk reduction messages	What factors contribute and detract from public health nurses delivering environmental risk reduction in the home setting?
L. Wheadon (2005-2007)	M. Salazar	Nurses' use of safe patient handling equipment.	Barriers and facilitators of the use of safe lift equipment: A nursing perspective.
S. Cabrera (2006-2008)	B. de Castro	Occupational health and safety among Philippine nurses; Emergency preparedness for OHNs	Occupational health and safety issues among nurses in the Philippines. <i>AAOHN J</i> , 57(4), 149-157. The role of occupational health nurses in terrorist attacks employing radiological dispersal devices. <i>AAOHN J</i> , 57(3), 112-119.
K. Ivcek (2007-2009)	M. Salazar	Use of problem-based learning to deliver pesticide training to OHNs	In development.
A. Ruppin (2007-2009)	B. de Castro	Biomarkers for allostatic load among Latino day laborers	In development.
M. Tinkham (2007-2009)	B. de Castro	Hospital housekeepers' exposure to cleaning chemicals	Hospital housekeepers' exposure to cleaning chemicals (submitted to <i>AAOHN J</i>).
J. Ward (2007-2009)	B. de Castro & J. Tsai	Health and safety training to prevent injuries among teen restaurant workers.	Preventing Injuries among Teen Restaurant Workers: Washington State's ProSafety Project (submitted to <i>AAOHN J</i>).
K. Barber (2008-2010)	R. Beaton	(Just completed 1 st year)	(not applicable)
A. Crollard (2008-2010)	B. de Castro	(Just completed 1 st year)	(not applicable)

MN TRAINEES (Nurse Practitioner Option)			
NAME	FACULTY MENTOR(S)	RESEARCH CONDUCTED	RESULTANT THESIS / PUBLICATIONS
A. Ochsner (2006-2007)	M. Salazar	Integration of pesticide exposure content into nurse practitioner training.	Health care provider curriculum development addressing pesticides and environmental health.
T. Sarich (2006-2007)	M. Salazar	Integration of pesticide exposure content into nurse practitioner training.	Pesticide-related environmental health content: Integration into graduate advanced practice nursing curricula.
J. Beitz (2008-2009)	B. de Castro	Integration of pesticide exposure content into nurse practitioner training.	Childhood pesticide exposure risk assessment, reduction, and screening: Integrating occupational and environmental health information into advanced practice nursing curriculum (submitted to <i>AAOHN J</i>).
A. Binder	B. de Castro	Emotional distress in healthcare workers	Development of a screening tool to assess healthcare professionals emotional distress after error

Trainee Accomplishments

All three PhD trainees, Drs. Glenise McKenzie, Julie Postma, and Susan Matt, that graduated within the reporting period were hired into nursing faculty positions. Dr. Glenise McKenzie is currently faculty in the Oregon Health and Science University School of Nursing (Ashland) and is a member of its Hartford Center of Geriatric Nursing Excellence. Dr. Julie Postma was hired as a Research Associate in 2008 at the Washington State University College of Nursing, where she is collaborating with former OHN Program Director Dr. Butterfield on an NIH-funded children's environmental health study. While a doctoral student, she received the Citizen of the World Scholarship from the UW Dean's Club members and Hegyvary Citizens of the World donors in August 2006 to support a two-week service learning experience in Guatemala. Dr. Susan Matt was hired in 2008 as Assistant Professor at Seattle University College of Nursing and recently received a summer fellowship award to continue her PhD dissertation research to establish initial psychometrics for a survey instrument that she developed as part of her dissertation research (Attitudes toward Nurses with Disabilities in the Hospital Workplace). There, she joins Dr. Betsy Gilbert, also a former OHN program PhD graduate in 2005.

Two MN administrator graduates, Ms. Luiza Marinescu and Ms. Elizabeth Tinker, currently have positions in the Seattle King County Public Health Department. Three additional MN administrator graduates, Ms. Linda Wheadon, Ms. Suzette Bramwell, and Ms. Suzanne L. Cabrera, are working in employee health clinics in health care organizations in Seattle, Utah, and Connecticut, respectively. Also, Ms. Allison Ochsner, graduate of the MN nurse practitioner option, is working for SeaMar Clinic in Marysville, WA, which is a community-based clinic that primarily serves the Latino community. These graduates join an extensive group of OHN program alumni who continue to have strong ties to the UW SON and serve as clinical faculty and practicum preceptors for students.

Also worth noting are internship pursuits among more recent trainees. Ms. Kristy Llvicsek (MN administrator) was selected for the competitive OSHA Nurse Intern Program, spending four weeks during the summer of 2008 on a project to evaluate the US Department of Labor's young worker health and safety media campaign. She also spent the remainder of that summer interning at the World Health Organization Occupational Health Program in Geneva, assisting with developing materials to build occupational and environmental health knowledge and capacity among nurses and other health care workers globally. There, she was joined by Mr. Jerry Green (PhD trainee) who assisted with conducting literature and policy reviews about avian influenza and its impact on workplaces in a

multinational context. Also, in summer 2008, Ms. Ayelet Ruppin (MN administrator) was selected for the competitive Occupational Health Internship Program (OHIP), directed by the ERC at University of California, Berkeley. She worked with a hotel housekeepers union in San Diego, CA to conduct a workplace hazard evaluation with Latina women. Ms. Julie Ward (MN administrator) student was selected for a two-week opportunity in South Africa during the winter of 2008, that focused on cultural and technical aspects of conducting business, and preparing business cases, for a variety of local and multinational companies. She also received the 2009 MN Outstanding Student Award, selected from among all graduating MN students for the entire UW SON.

OHN program alumni have also been recognized for their continued and significant contributions to the profession. Ms. Karen Bowman (MN administrator graduate) is currently the President of the WSAOHN and was awarded the WSNA Marguerite Cobb Public Health / Community Health Nurse Award in 2009. Ms. Luiza Marinescu (MN administrator graduate) received the prestigious AAOHN Journal Golden Pen Award for 2007-2008 for her journal article entitled, "Integrated Approach for Managing Health Risks at Work: The role of the occupational health nurse." In 2007, Dr. Mary Salazar, Ms. Annie Bruck, Dr. Julie Postma, and Ms. Elizabeth Tinker were each named as a Nurse Luminary for their work and advocacy in occupational and environmental health nursing by Health Care Without Harm.

Occupational Medicine Residency Program (OMR)

Director: Joel Kaufman, MD, MPH

Highlights

- The residency program continues uninterrupted accreditation from the Accreditation Council for Graduate Medical Education. Our latest accreditation provides full accreditation through 2010. The OMR program support provided through the ERC continues to support primarily traditional two-year integrated academic and practicum phase training for residents who will practice Occupational Medicine (OM). We will have a total of three full-time residents this (2009-2010) year, with two continuing practicum year residents and one resident transferring from Johns Hopkins University for her practicum year.
- Over this period, nine OMR ERC trainees have graduated from the program and begun careers as Occupational and Environmental Medicine (OEM) physicians. Two of our trainees were recipients of the prestigious Occupational Physicians Scholarship Fund, which recognizes the most qualified physicians in the US. One of our trainees received the Gilbert S. Omenn Award for Academic Excellence, which recognizes the most outstanding master's level student from the UW School of Public Health annually for academic excellence and commitment to public health.
- Over the reporting period, our ERC-supported graduates have had impressive levels of academic productivity. Recent graduates since July 2005 have published nine articles in peer-reviewed journals, including articles in the preeminent clinical journals in respiratory disease (*AJRCCM* and *Chest*), spinal disorders (*Spine*), and environmental health (*EHP*). Several trainees have presented at national and international conferences, including the American Thoracic Society and the International Society for Environmental Epidemiology annual conferences.
- The ERC support provided to the OMR program continues to reach far beyond the residents graduating from the residency. It serves as foundational funding for the OMR program which provides academic phase occupational and environmental medicine training opportunities to several other groups of trainees who enhance the nation's (and world's) OEM workforce. These include: general physician enrollees from the community who expand their knowledge of OEM through the MPH program, NIH/Fogarty-funded International Scholars in Occupational and Environmental Health (ISOEH), and Madigan Army Hospital Preventive Medicine Program (MPMP) trainees. Selected candidates from Madigan complete their preventive medicine at Madigan but receive their OEM MPH, and thus the academic portion of board eligibility through the OMR program academic training.
- During the reporting period, eleven additional trainees in the above non-resident pathway categories have obtained OEM MPH degrees, three graduated in 2009, and three are currently enrolled in the academic phase of the program. All who have graduated have entered into careers in Occupational and Environmental Medicine.
- In response to comments from prior review, the specific learning objectives for each practicum experience now include a formal assessment of interdisciplinary interaction with industrial hygiene, social work, nursing, case managers, and other ancillary staff. In addition, newly-implemented 360 degree evaluations now include assessments from the multidisciplinary staff, focusing on communication and collaboration with other disciplines throughout both academic and practicum years.
- Several important changes have strengthened the OMR program over this cycle: Our clinic industrial hygienist now works directly with residents in clinic; three new clinic opportunities have

been added (Occupational Dermatology, Puget Sound Sports and Spine, and Harborview Otorhinolaryngology); the biweekly seminar / case conference series now meets weekly as the ENVH 590B required course offering; course objectives have been redesigned to encourage interdisciplinary collaboration and attainment of core physician competencies; the OMR program now receives periodic feedback from the experienced UW School of Medicine Graduate Medical Education Committee, which conducts formal Internal Reviews at midpoint between ACGME review cycles; and formal Annual Program Evaluations began this year, including all OEM faculty and current residents.

- Several changes have occurred within the OEM faculty. Jordan Firestone MD, PhD, MPH, was appointed as Assistant Professor and recruited to the position of Occupational Medicine Clinic Director. Dennis Shusterman, MD, MPH, became Residency Program Director, also assuming the position as Director of the OMR Component of this Center. After three years of leadership in the program, Dr. Shusterman left Washington to take a position with the California Department of Public Health. In Dr. Shusterman's absence, Dr. Joel Kaufman assumed the position of Director of the OMR Component of this Center, and Dr. Matthew Keifer resumed his role as Residency Program Director. As this reporting period comes to a close, former UW OMR trainee Dr. Victor Van Hee has recently been recruited (July 09) to an assistant professor position and has assumed responsibility as Residency Program Director. Dr. Matthew Keifer has returned to his prior role as Associate Residency Program Director. Drs. Kaufman, Keifer, and Sheppard were each promoted to Professor.

The current project period covers the academic years July 1, 2005 to June 30, 2010. The following highlights graduates who received at least partial support from the ERC.

2006 graduates:

- Chris Carlsten, MD (ERC). Thesis topic: Cytokines and Cell Markers in Cement Mason Apprentices.
- Gabrielle Morris, MD (ERC). Thesis topic: Decompression Illness -- a case series.
- Spencer Olsen, MD (ERC). Thesis topic: Fine Particulate Air Pollution and All-Cause Mortality in a Sample of Older US Veterans.
- Satish Subramaniam, MD (ERC). Thesis topic: Baseline Characteristics and Predictors of Mesothelioma in the CARET Asbestos Cohort.

2007 graduates:

- Victor Van Hee, MD (ERC Partial). Thesis topic: Air Pollution Exposure and Left Ventricular Mass and Function: The Multi-Ethnic Study of Atherosclerosis.

2008 graduates:

- Enass A/Rahman, MD (ERC). Thesis topic: The Natural History of Opiate Use among Workers with Low Back Injuries in the Washington State Workers' Compensation System.
- Rachel Roisman, MD (ERC). Thesis topic: Pulpmill-related Particulate Matter Exposure and Respiratory Disease in Children.

2009 Graduates:

- Ingeborg Cox, MD (ERC). Thesis topic: Testing Validity of Audio Computer Assisted Self Interview (ACASI) Among Low Literate Pesticide Handlers.

2010 Graduates

- Rachel Fischer, MD – 2nd year (ERC)

- Sukriti Singhal, MD (ERC). Thesis topic: Effect of Air Pollution on Exercise-Induced Bronchospasm in Children.
- June Spector, MD. Dr. Spector did not receive ERC support, she had already completed her MPH by the time she joined our program. Dr. Spector did not complete a thesis.

As described above, our recent graduates over the reporting period have already begun to fill important leadership roles in academics, government, and clinical practice. Dr Stephen Hunt (2005) is Medical Director of the Deployment Health Clinic at the VA Puget Sound Health Care System and UW Clinical Assistant Professor of Medicine. Dr. Sham Juratli (2005) is Assistant Professor of Family Medicine at Wayne State. Dr. Chris Carlsten (2006) is Chair of Occupational and Environmental Lung Disease at the University of British Columbia. Dr. Spencer Olsen (2006) is Medical Director at US Healthworks, San Diego. Dr. Victor Van Hee (2007) is Residency Program Director at our institution. Dr. Rachel Roisman (2008) is a Public Health Medical Officer with the California EPA Office of Environmental Health Hazard Assessment. Dr. Enass A/Rahman (2008) is an Occupational Medicine Physician at Kaiser Permanente.

The OMR program has launched a highly successful, multidisciplinary OEM Grand Rounds series which meets five times during the academic year. This series attracts Occupational Medicine physicians, nurses, exposure scientists, and policymakers from around the region. Recently, in addition to recording the sessions for free web access, we have expanded OEM Grand Rounds to include national and even international participants interactively through live webinar. Grand Rounds features nationally and internationally recognized experts in the field (more information can be found in the CE Program Narrative). Occupational Medicine residents regularly attend these sessions, which provide them an excellent opportunity for networking and interdisciplinary interaction with others in the field. The OMR program continues to provide CME to the community in its regular full day CME seminars, of which the recent Occupational Allergy session was a part.

Occupational Health Services Research Training (OHSRT)

Director: Diane Martin, PhD

Highlights

- The Occupational Health Services Research Training (OHSRT) program at the University of Washington (UW) supported six doctoral students from July 2005 to the present. Three have graduated with an average time to graduation of 3.7 years and three continue as students conducting dissertation research in the area of occupational health and safety.
- Tom Wickizer, PhD, Professor of health services, served as the OHSRT program director from 2000-2009. Diane Martin, PhD, epidemiologist and Professor of health services, and Gary Franklin, MD, Medical Director of Labor and Industries (the department responsible for the workers' compensation program for Washington State) and UW Research Professor, took over leadership of the program beginning September 2009.
- The OHSRT program faculty are national leaders in teaching and research using both quantitative and qualitative methods in two broad topic areas: (1) the evaluation of workers' compensation programs and policies; and (2) improving worker health to increase safety and productivity.
- During the past five years, core faculty have published ninety-one peer reviewed articles and given fifty-seven presentations at regional or national conferences.
- Drs. Wickizer and Kopjar received the Eisenberg award for best article in *Health Services Research* in 2005.
- Drs. Turner, Wickizer and Franklin received the ISSLS Prize for Lumbar Spine Research for their article in *Spine* 2008.
- Dr. Franklin, noticing a spike in deaths among injured workers on opiates, initiated web-based guidelines for opiate prescriptions for all Washington State insurance programs in collaboration with WA clinical experts on pain.
- OHSRT alumni have provided leadership and made substantial contributions to occupational health services in Region X and nationally: Bert Stover produced the first comprehensive report of safety and injuries for Region X; Jeanne Sears evaluated an innovative program allowing nurse practitioners to serve as independent attending providers for workers' compensation claimants, and her research results were used to change policy in Washington State; Colleen Daly works at Microsoft on employee diversity and occupational health disparities; and Larkin Strong is employed at MD Anderson Cancer Research Center in Houston examining community-based cancer control programs.
- OHSRT alumni and students have obtained six grants, published nineteen articles and given twenty-two posters or presentations at conferences. Dr. Wickizer coordinated a special health services research oral presentation session for OHSRT doctoral students for the Occupational Health and Safety section of the annual American Public Health Association conference in Washington, DC in 2005.
- One of the OHSRT students, Jeanne Sears, won the most prestigious School of Public Health research award, the Gilbert S. Omenn Award for Academic Excellence, in 2007, for her scholarly contribution examining quality and outcomes of workers' compensation-related care provided by nurse practitioners in Washington State.

The OHSRT program has admitted ten PhD students since it was established in July 2000. Of these students, three came with strong professional backgrounds in occupational health and safety, and others had some prior background and/or interest in occupational and environmental health. All of the trainees, with one exception, entered the program with a prior master's degree in public health, nursing, or public administration. Early in the program, 2001 and 2002, two trainees were supported for less than a year, one pre-doctoral student withdrew for family reasons to return to the east coast and a physician post-doctoral withdrew to pursue the Occupational and Environmental Medicine program.

Of the eight trainees supported by the OHSRT ERC program, four have graduated, three during the current funding cycle 2005-2010. The graduates completed the program in an average time of 3.7 years. One went on to a postdoc program at the University of Michigan and all are now working in occupational health-related jobs. Four trainees remain in the OHSRT doctoral program. Three continue to be supported by the ERC training grant and one sought other support to conduct her occupational health dissertation research with Public Health – Seattle King County.

A complete list of student publications is provided in Appendix A, IV. As shown, all of the alumni and three of the four current OHSRT students have prepared journal articles and/or given formal presentations at national meetings reporting findings of research, not including dissertation research. Students have submitted their work to the following journals among others: *Journal of Occupational and Environmental Medicine*, *American Journal of Industrial Medicine*, *American Journal of Public Health*, *Medical Care*, and *Journal of Rural Health*.

OHSRT alumni gave fourteen presentations and completed ten publications while in the program. They have won numerous awards. Jeanne Sears received the prestigious Gilbert S. Omenn Graduate Student Award for Academic Excellence from the School of Public Health at the UW in 2007, and received the Canadian Institutes of Health Research (CIHR) Scholarship from 2006-2008. Larkin Strong was an Environmental Health Promotion Student Fellow at the Society for Public Health Education/Agency for Toxic Substances and Disease Registry in 2006. She also received the Fahs-Beck Doctoral Dissertation Grant (\$3,000) from the Fahs-Beck Fund for Research and Experimentation in 2005. OHSRT alumni have taken positions as: Research Scientists in the Department of Psychiatry in Behavioral Sciences and in the Department of Occupational and Environmental Health Sciences at the UW, an Instructor in the Department of Epidemiology at the University of Texas M.D. Anderson Cancer Center, and a Researcher in Human Resources at Microsoft examining diversity and flexible working schedules on health and safety. After graduation, alumni have given fourteen presentations, published eighteen articles in peer reviewed journals and have received six grants.

Current OHSRT students have given eight presentations and have one publication in press, two submitted, and eleven in progress. They also have received several honors. For instance, Janessa Graves received the James P. Keogh Memorial Scholarship from the American Public Health Association Occupational Health and Safety in 2008, as well as the Gilbert S. Omen Award for Academic Excellence, School of Public Health and Community Medicine, University of Washington, in 2008. In addition, Sarah Veele-Brice was an American Public Health Association Public Health Nursing Section-Junior Investigator Award Nominee (May 14, 2009), and a Harry Bridges Center for Labor Studies Grant Recipient (July 2008 – July 2009). She is also a peer reviewer for the American Journal of Public Health (2007 – present).

Changes in OHSRT Faculty and Curriculum

Update – Over the reporting period there has been little change in the OHSRT program faculty or curriculum. Dr. Frederick Zimmerman left the UW to take a position at UCLA, but all other program faculty maintained their program affiliation throughout the reporting period. Drs. Diane Martin, PhD, and

Gary Franklin, MD, will direct the OHSRT program during the next grant cycle (NIOSH approval of this change in personnel will be requested in August, 2009). Drs. Martin and Franklin will bring outstanding leadership capabilities and research experience to the OHSRT program. Dr. Wickizer will remain as a supporting faculty member in the program and continue to participate actively in collaborative research with Dr. Franklin. Ohio, like Washington, administers its workers' compensation program as a state fund organization. Drs. Franklin and Wickizer have already discussed the possibility of pooling data from both states to conduct research studies which would create additional research opportunities for OHSRT trainees.

There have been no significant changes to the program's curriculum. OHSRT trainees follow the same curriculum as other Health Services (HS) doctoral students, but focus on occupational health and safety as their content area and dissertation research area.

Effect of OHSRT Training Program on Curriculum and Research Direction

The OHSRT training program has had a positive effect on the overall HS doctoral program. Four of the OHSRT students have given multiple lectures on occupational health in HS courses taken by MHA and MPH students. OHSRT trainees' research has created an awareness of and interest in occupational health and safety issues among the larger group of HS doctoral students. This interest has been demonstrated in the selection and orientation of dissertation topics by HS doctoral students not directly involved in the OHSRT training program. For example, one HS doctoral student, Ms. Courtney Hughes, conducted her dissertation research on employees' views of health promotion in the workplace. A current HS doctoral student, Ms. Dolly John, is conducting her dissertation on the topic of workplace stress on Asian Americans' mental health and safety. Ms. John will be supported by NORA funding next year. These examples demonstrate the expanding interest in occupational health services research engendered by the OHSRT program.

Summary of Trainees Supported by OHSRT Program and Research Activities

During the past reporting period (2005 to 2009), the OHSRT program supported six doctoral students (three students admitted during the initial funding cycle and three admitted since July 2005). (Two others were supported during the initial 2000 to 2005 funding cycle). Alumni and students supported under the OHSRT grant and their research accomplishments are summarized below:

Program Graduates:

1. **Larkin Strong (Beti Thompson, mentor):** Strong started the HS doctoral program in September 2002, completed her dissertation in August 2006, and received OHSRT funding from September 2002 through July 2005. Strong's dissertation research focused on assessing the effects of a community-based prevention program to limit pesticide exposure among Hispanic farm workers in the Yakima Valley. This research resulted in the publication of four papers in leading journals, including the *American Journal of Industrial Medicine* and the *Journal of Occupational and Environmental Medicine*. Region X has a significant agricultural sector that requires the wide application of pesticides by farm workers. Direct exposure to pesticides by farm workers, and indirect exposure of their families, is a significant public health concern. Strong's research helped expand the knowledge base of potential approaches to address this public health problem and improve the health of Hispanic farm workers. In addition to this research, Strong published two other papers in leading journals, the *American Journal of Public Health* and *Spine*. One paper analyzed lost work time among African American workers, Hispanic workers, and White workers, based upon data from a national longitudinal survey. The other paper examined interventions to reduce disability associated with back pain, one of the most disabling conditions affecting workers. In addition, Strong gave two oral presentations and presented a poster at the annual American

Public Health Association meetings during her HSRT traineeship. After completing her doctoral degree, Strong spent two years (2006 to 2008) as a Postdoctoral Research Fellow in the Kellogg Health Scholars Program, Community Track, at the University of Michigan School of Public Health. She currently works as an instructor in the Department of Epidemiology at the University of Texas M.D. Anderson Cancer Center in Houston, Texas, where she conducts research on cancer prevention.

2. **Colleen Daly (Tom Wickizer and Diane Martin, mentors):** Daly started the HS doctoral program in September 2003, completed her dissertation in June 2007, and received OHSRT funding for three years starting in September 2003. Prior to entering the HS doctoral program, Daly received training in health education and health promotion through the MPH program at the University of North Carolina. She applied this training in her dissertation research, which focused on the effect of work organization, flexible work schedules and telecommuting on worker health. She conducted her research in collaboration with the Boeing Company. Her research on an important area pertaining to occupational health should gain attention as more firms adopt telecommuting programs in response to changing economic, business and environmental conditions. This research should have an impact on companies and public organization operating within Region X, as well as elsewhere. Daly hopes to publish one to two papers from her dissertation research. She currently works as a Specialist in Human Resources at the Microsoft Corporation. She is conducting research on the effects of diversity and flexible work schedules on workers' health and retention.
3. **Jeanne Sears (Tom Wickizer, mentor):** Sears entered the HS doctoral program in September 2004 and completed the program in June 2007. She combined previous training in nursing, research experience in occupational health and safety, and an interest in policy, to formulate an important and highly successful dissertation. The objective of her dissertation was to assess the impact of a state law that allowed expanded use of advanced registered nurse practitioners (ARNPs) on a pilot basis to provide healthcare to injured workers as independent attending providers. Using data provided by Department of Labor and Industries, Sears conducted a detailed evaluation study examining the impact of the program on access to care, costs and outcomes. This research showed the program had positive effects on access with no meaningful adverse impact on costs or quality, and led to subsequent legislation making the policy change permanent. Jeanne's work had a significant impact on the delivery of workers' compensation health care, especially in rural areas within Region X. She has had numerous inquiries from workers' compensation programs around the country regarding her research findings. It is hard to imagine dissertation research having a more significant, direct and immediate impact on policy. Sears published three papers from her dissertation work in leading journals, including *Medical Care*, *Journal of Rural Health*, and *Journal of Occupational and Environmental Medicine*, and gave several presentations on her research at major conferences, including annual meetings of the American Public Health Association. In addition, Sears authored or co-authored three additional papers that represented work undertaken while she was an OHSRT trainee. As a result of her dissertation research, Sears was awarded the prestigious Gilbert S. Omenn award for academic excellence from the School of Public Health. Sears is currently a Research Scientist in the Department of Health Services at the University of Washington. She is working on a two-year study of access to quality health care with Tom Wickizer of injured workers and providers in California, funded under contract with the California Division of Workers' Compensation. In addition, Sears is the PI on a five-year study to evaluate the effects of reforms initiated to improve the performance of L&I's vocational rehabilitation program.
4. **Martha Perla (Allen Cheadle, mentor):** Perla began the OHSRT program in September 2003 and she is expected to graduated in 2010. She was an ERC trainee during the first cycle, and is now supported by other funding. Martha's dissertation work focuses on the environmental

exposure risks faced by Hispanic (Mexican American and other Latino) children in the United States. Specifically, her research will: develop a profile of environmental toxins in Hispanic children using NHANES biomarker data from 1999-2006 (project 1); evaluate relationships among environmental exposures, health outcomes (e.g. asthma), and demographic characteristics using NHANES data from 1999-2006 (project 2); and explore using focus groups the knowledge, perceptions, concerns, and behaviors of Hispanic families regarding environmental and occupational exposures and associated health outcomes of their children (project 3). These will be a significant contribution to the limited research that currently exists in this area.

5. **Sarah Veele-Brice (Tom Wickizer and Diane Martin, mentors):** Veele-Brice started the doctoral program in September 2005 and is expected to completed her dissertation work in December 2009. Her research focuses on an important area that has received limited attention over the years—workplace violence. She is combining secondary analysis of a national data set on injuries resulting from violence with primary data collection involving nursing staff working in Washington State and Florida prisons. Her work should add to the limited body of knowledge regarding the factors associated with workplace violence in the general labor force, and among nursing staff working in the high risk environment of prisons. This work should help inform policy and program development to advance injury prevention efforts within the state correctional system and elsewhere. Findings regarding workplace violence from her analysis of national data should add to the broader knowledge base regarding this under-studied public health problem.
6. **Ben Keeney (Gary Franklin & Tom Wickizer, mentors):** Keeney started the program September 2007, and successfully completed his HS doctoral preliminary exam in June 2008. Keeney is currently working on developing his dissertation proposal, which focuses on predictors of re-injury among workers with back sprain, the effects of extended disability on worker obesity, and predictors of back surgery among workers with back sprain. He will combine administrative data from L&I with data collected through a recently completed NIOSH prospective study of predictors of long-term disability (Turner et al. 2008).
7. **Janessa Graves (Gary Franklin and Tom Wickizer, mentors):** Graves is the most recent student admitted to the HS doctoral program (September 2008). She received a MPH degree from the UW DEOHS in June 2008. As an MPH student, she received the school's prestigious Omenn Award in June 2008 for her research and academic performance during her MPH program. Graves recently passed the preliminary PhD exam (June 2009). She is currently considering different options for dissertation research. One possibility would be to conduct a study of recently enacted state legislation designed to improve the efficiency and effectiveness of costly MRI imaging used by injured workers and other persons insured through state public insurance programs.

Hazardous Substances Academic Training (HSAT)

Director: John Kissel, PhD, MS

Highlights

- Twelve recipients of Hazardous Substances Academic Training (HSAT) support received the Master of Science (MS) degree in the reporting period.
- Ten journal articles and one book chapter with trainees as authors or co-authors were published in the reporting period. Two additional journal articles are currently under review.
- Twenty-five conference presentations with trainee authors or co-authors were delivered in the reporting period.
- The Alumni Survey, conducted in 2008 and published in 2009 revealed that 96.6% rated their professional preparation “excellent” (62.1%) or “very good” (34.5%) in comparison to their employee peers.
- Update - ten of twelve trainee graduates and two of two trainees expected to graduate in in this period completed all requirements for the 40-hour HAZWOPER certification. Fifteen additional certifications or re-certifications were issued to non-trainees under HSAT auspices.
- Graduation rates have been steady since the last five-year renewal. Trainee publication and conference presentation totals represent significant increases over the last cycle. HAZWOPER certification accounting is a new feature and will provide a benchmark going forward. A survey of DEOHS alumni produced very positive results.

Faculty Participation

Core faculty, including Richard Fenske, David Kalman, John Kissel, Scott Meschke, Michael Morgan, Gwy-Am Shin, and Michael Yost, instructed in required courses in HSAT-eligible MS curricula. Drs. Faustman, Fenske, Kissel, Meschke, and Shin directly supervised HSAT MS candidates in the conduct of their master’s thesis research project during the reporting period. Dr. Marilyn Roberts joined the DEOHS and EH program faculties in 2006, at the rank of Professor.

Trainees

EH MS graduates and current students supported as HSAT trainees listed in Table H. Publications produced by trainees and core faculty during the current funding period are listed in Appendix A, Section V.

TABLE H: HSAT supported trainees (July 2005 – June 2010)

MS TRAINEE GRADUATES			
NAME	FACULTY MENTOR(S)	PERIOD OF SUPPORT	THESIS
K Takatani	Meschke	Sep 2003- Jun 2004	Persistence of E.coli O157:H7, S. typhimurium, and Coliphage MS2 in a Model Home Water System after Ultraviolet (UV) Disinfection Treatment, August 2005
EW Spalt	Kissel	Sep 2004- Jun 2005	Dermal Absorption of Contaminants from Soil: A Review of Current Literature and Investigations with DEET, August 2005

J Shultz	Meschke	Sep 2005- Jun 2006	Pathogen Prevalence and Antibiotic Resistance in Ready-to-Eat Food Products, June 2006
JA Smith III	Kissel	Sep 2004- Jun 2005	Reconciliation of Aggregate Probabilistic Exposure Model Predictions with Observed Biomarkers: A Case Study Using Data from the CTEPP Child Cohorts, August 2006
AC Scherer	Faustman	Sep 2005- June 2006	Fish Consumption Risk Communication: A Comparative Analysis of Fish Consumption Advisories to Pregnant Women and Women of Childbearing Age, August 2007
LA Leggett	Shin	Sep 2006- Jun 2007	Inactivation of Human Adenovirus Type 2 by Sequential Disinfection with UV Irradiation and Free Chlorine, June 2008
MR Winters	Fenske	Sep 2006- Jun 2007	The Washington Aerial Spray Drift Study: A Comparison of Children's Inhalation Exposures to Methamidophos Estimated Using Diary and Personalized Global Positioning System Data, June 2008
KL Stumbaugh	Kissel	Jun 2007- Jun 2008	Estimation of Skin Permeability of Aqueous Chloroform from Human In Vivo Trials and Relative Contribution of Dermal Absorption to Multi-route Exposure to Chloroform in Drinking Water, August 2008
HB Bennett	Shin	Sep 2007- Jun 2008	A Novel Electropositive Filter for the Concentration of Viruses from Deionized and Simulated Marine Water (expected 2009 graduation)
CM Rohlik	Meschke	Sep 2007- Jun 2008	Characterization of Bioaerosol and Surface Microorganism Exposures in Dairy Operations (tentative, expected 2009 graduation)
CM Bergstrom	Kissel	Sep 2008- Sep 2009	Metal concentrations in selected geologic media size fractions, adherence to skin, and implications for human exposure (tentative, expected 2010 graduation)
EA Wong	Shin	Sep 2008- Jun 2009	Removal of <i>Mycobacterium avium</i> complex from drinking water by coagulation, flocculation, and sedimentation (tentative, expected 2010 graduation)
AR Domesle	Kissel	Sep 2009- Jun 2010	The Implications of Elevated Dermal Absorption Efficiencies at Low Loads for Indoor Exposures (tentative, expected 2010 graduation)
A Cousins	Kissel	Sep 2009- Jun 2010	Assessment of Children's Aggregate Indoor Exposure to a Phthalate Found in Floor Tile

Continuing Education (CE)

Director: Steven Hecker, MSPH

Highlights

- Steven Hecker assumed full-time duties as Continuing Education and Outreach Director in September of 2006, replacing Scott MacKay, and also assumed the position of Deputy Director of the ERC. Mr. Hecker has a 30-year career in occupational health and safety training and research at the University of Oregon. He is very familiar with Center from his service as a previous advisory board member and chair, instructor in Continuing Education (CE) programs, and as a graduate and current faculty member of the Industrial Hygiene (IH) program.
- Update - Over the recent project period (2005 – 2010), 243 different courses were delivered, serving 15,800 trainees. Approximately sixty-five percent of the total trainees have taken these courses online.
- New courses added over this current project period include information in the following topic areas: the aging workforce, laboratory safety, safe patient handling and ergonomics, flu pandemic and infectious disease in the workplace, agricultural safety and health, and nanotechnology health and safety.
- The annual five-session series of Occupational Medicine Grand Rounds continue to be highly successful, recruiting nationally recognized speakers. In 2007, digital recordings of the presentations were made available on the Internet for Continuing Medical Education (CME) credit. In 2009, Grand Rounds went global in real time via trial implementation of the Webinar program. Joining these real-time distance Grand Rounds sessions, were webinar physician participants from Peru, Vietnam, and Portland.
- The CE program made a concerted effort to increase continuity and collaboration through ongoing work with organizations representative of specific Occupational Health and Safety (OHS) missions and regional needs. Examples include CE courses, conferences, and educational materials offered related to: safe patient handling, designing an age-friendly workplace curriculum and train-the-trainer, hazards to healthcare workers, and protecting vulnerable workers. Examples of 2009 conferences include the Health Care Ergonomics Conference and the Nanotechnology Health and Safety Forum.
- Delivery of research to practice (R2P) in terms of assessing evolving needs and promoting knowledge translation and adoption is effectively witnessed in follow-up and outreach conducted by CE instructor Rick Gleason for the online training classes, and through ongoing efforts with safe patient handling and the age friendly workforce.

The CE Program has changed significantly over this past project period. Leadership passed to Mr. Steven Hecker in 2006, who has emphasized strategic planning, thematic programming, and expansion of collaborative work with regional organizations with interest in OHS education. Hecker's experience as an OHS educator in another state in the region and as a member of the Center external Advisory Board has given him particular sensitivity to serving the entire region. Ms. Maribeth Moore has worked closely with Mr. Hecker to guarantee that the CE programs are well planned, logistically efficient, and of high quality and responsive to consumer needs. Joining the CE team in 2009, Ms. Annie Bruck, brings a new perspective culled from years as an OHN in practice as well as that of School of Nursing faculty. Her professional networks

within the OHN Nursing Program, the School of Nursing, and several professional nursing associations are anticipated to open the doors to new CE opportunities and partnerships for program development and delivery.

The Northwest Center CE program has continued to involve leading researchers and practitioners from the UW, the Pacific Northwest and the larger occupational health and safety world as program instructors over the past project period. Visiting faculty represent diverse areas of occupational health and safety, as well as geographical locations and institutions. This diversity in faculty enables us to provide content expertise to meet the broad scope of educational needs across the region. A sampling of faculty from courses over the current project period include: John Howard, MD, JD, PhD, Director of NIOSH; Audrey Nelson RN PhD, Director of Patient Safety Center, VA Hospital, Tampa, FL; Lee Newman, MD, MPH, University of Colorado at Denver, David Prezant, MD, MPH, Albert Einstein College of Medicine; Jane Lipscomb RN, PhD, University of Maryland-Baltimore, Roel Vermeulen, PhD, Utrecht University, Netherlands; Paul Apostolidis, PhD, Whitman College, Robert Harrison, MD, MPH, UCSF, and Gregory Belenky MD, Washington State University.

The CE program has continued to respond to regional needs by delivering essential and innovative training programs. Partnerships are diverse and include labor unions, governmental agencies, professional associations, regional business, and non-governmental organizations. Particularly noteworthy partners include the Washington State Safe Patient Handling Steering Committee, Puget Sound Ergonomics Roundtable, Washington Department of Labor and Industries, the Oregon Coalition on Health Care Ergonomics, and the Tribal Solid Waste Advisory Network. Partnerships with PSU and CROET-OHSU have supported a needs assessment and co-sponsorship of courses. Collaborations with all of these institutions have extended the center's circle of influence and partners, and in the process yielded relevant program requests. As the CE program meets the regional challenges in the coming project period, and seeks to address current and emerging issues in occupational health and safety, these partnerships will continue to be vital to program success.

Program evaluations conducted as a part of each course delivered (classroom and online), along with more broad-based survey and data collection efforts, have provided an ongoing flow of valuable data from which to incorporate program changes. In response to the previous site visit critique several improvements were implemented including ongoing evaluation of online courses, increasing our program coordination with academic institutions in the region that have occupational safety and health programs, and emphasizing participatory pedagogical methods in course development. The program also engages in much more intensive formative and impact evaluations for select programs that are of a multi-phase design, as discussed earlier with regard to the safe patient handling program.

Each critique-driven modification of the program has produced growth in benefits to the consumer, programmatic outcomes, and organizational lessons learned. As an example, the webinar Grand Rounds programs have provided the opportunity for global participation wherever the Internet is available. This involved a relatively simple off-the-shelf technology, but lessons learned in implementing this change have provoked thinking about more ambitious plans for distance learning. The occupational health nursing institute scheduled for next summer will provide a focus for further development of distance technology and the opportunity for detailed evaluation of its effectiveness. It is anticipated and hoped that lessons from this experience can and will be applied to other topics and constituencies. From the position that in R2P there is the opportunity for a mutually beneficial relationship between research and practice, the diverse regional CE partnerships, and activities conducted, pose opportunities for

research to inform practice, and open the door for practice to also inform research.

Continued implementation and improvement of the Northwest Center CE program occurs by the support of NIOSH ERC funds to provide honoraria and travel expenses for guest faculty; marketing materials and advertising for courses and conferences; faculty and staff travel for professional development, presentations and networking; and other program expenses. CE personnel work to assure responsible stewardship of NIOSH funds by prioritizing program needs and expenses. This ensures the program is efficient while meeting the educational interests and needs of Region X constituents. Furthermore, the past four years has shown excellent results in terms of leveraging NIOSH-provided funds to obtain additional external funding, for example obtaining a Washington State Safety and Health Investment Project (SHIP) grant to extend and expand efforts in safe patient handling.

Hazardous Substance Training (HST)

Director: Steven Hecker, MSPH

Highlights

- In September 2006, Steven Hecker replaced Scott MacKay as Director of the Continuing Education (CE) and Hazardous Substance Training (HST) program, and also assumed the Deputy Director position of the ERC. Mr. Hecker has a long career in occupational health and safety training and research at the University of Oregon. His familiarity with the Center program stems from his service as a previous advisory board member, as an instructor in CE programs, and as a graduate of, and current faculty member in, the Industrial Hygiene (IH) program.
- New courses developed or introduced include: the New Generation Responder Series; Composite Hazards: Potential Health Hazards of Carbon Fiber Reinforced Materials; Chemical Reactivity Hazards – Laboratory Scale Recognition and Control; and the Nanotechnology Health and Safety Forum
- The Center's participation in the National Institute of Environmental Health Science (NIEHS)-funded Western Regional University Consortium has provided excellent synergy with the HST program in terms of additional training experience with diverse audiences and important interaction with regional and national hazardous materials instructors.
- Over the recent project period (2005 – 2010), fifty-six different courses were delivered, serving 1256 trainees. Approximately 1893 additional trainees have taken HST-related courses online. 347 of those were reported as HST in the funding year 2005 – 2006.
- As of the funding year 2006 – 2007, online courses are reported in the CE report but no longer as HST courses.
- Course locations have included Seattle, Olympia, and Richland (Washington), Portland (Oregon) and Anchorage (Alaska).

The HST program has evolved significantly over this past project period. The leadership passed to Mr. Steven Hecker in 2006. He has focused the program on improved pedagogy and identification of cutting edge issues while maintaining the long-term vision, and strong, effective aspects of the program. Ms. Maribeth Moore has worked closely with Mr. Hecker to guarantee that the HST programs are of the highest quality and responsive to consumer needs. Her ongoing contact with public agency attendees and our longtime contract instructors maintains program continuity and institutional memory. The CE program has maintained a high profile in Region X. Joining the CE team in 2009, Ms. Annie Bruck, brings a new perspective culled from years as an OHN in practice as well as that of School of Nursing faculty.

HST programs were conducted in Washington, Oregon, and Alaska and were successful in reaching our target audience of state and local government employees with hazardous materials responsibilities. New courses were offered and include: the Certified Hazardous Materials Management National Overview Course, which was held in collaboration with the Pacific Northwest chapter of the Academy of Certified Hazardous Materials Managers; the Composite Materials Hazards course, covering the health hazards of carbon fiber reinforced materials and taught for the Boeing Company; a webinar nanotechnology course, offered in collaboration with the local AIHA section; and the Chemical Reactivity Hazards course, designed for laboratory personnel.

The Northwest Center's hazardous waste refresher courses continue to be extremely successful and well-attended. Numerous participants come to our course, reporting that, in the past and at other venues, they have frequently found eight-hour training dull and lacking in new, practical information. In contrast, we have received feedback that our courses serve their purpose of refreshing knowledge, while giving participants new perspectives and useable material for dealing with hazardous waste issues. The HST program has added courses to appeal to a wider range of public sector employees with hazardous materials responsibilities, in particular front-line agency personnel not traditionally considered emergency responders. The initial offerings of the "new generation" courses were successful, but we have also learned of the need to differentiate courses. This differentiation will serve to target the varying experience levels of our diverse audiences, and provide training more applicable to the context of their practice. Future offerings will take this into account. The Northwest Center's participation in the NIEHS-funded Western Regional University Consortium has provided excellent synergy with the HST program in terms of additional training experience with diverse audiences and important interaction with hazardous materials instructors both throughout the region and nationally.

The major changes in the hazardous materials and emergency response landscape following 9/11 and the establishment of the Department of Homeland Security pose the most significant challenges to the HST program in terms of adjusting our focus and maintaining our profile. The surge of funding to public agencies for training in these areas provides new competition for some of the programs that UW has successfully offered for years. Given our established experience and expertise in such trainings, the HST advisory committee firmly believes that there remains a strong need for the type of hazardous materials incident response courses that we have historically offered. The HST program is using previously established connections and others around the region to develop a re-oriented simulation course that could potentially be targeted to those in rural areas. This would provide the kind of hands-on training that is rarely available in these parts of our region.

The program offers online courses but during the coming year and the next project period a priority is to optimize their quality and improve interactivity. The development cost of truly immersive computer-based instruction limits the availability of truly interactive programs, but external funding opportunities are being sought to increase our capacity in this area.

APPENDIX A: PUBLICATIONS

I. IH Publications

*Note: Core faculty denoted by bold and trainees denoted by underline

- Adams JC, Dills RL, **Morgan MS**, Kalman DA, Pierce CH: [2005] A Physiologically-Based Toxicokinetic Model of Inhalation Exposure to Xylenes in Caucasian Men. *Regulatory Toxicology & Pharmacology* 43:203-14. [PMID: 16169135].
- Allen RW, Mar T, Koenig J, Liu LJS, Gould T, **Simpson CD**, Larson T: [2008] Changes in Lung Function and Airway Inflammation among Asthmatic Children Residing in a Woodsmoke-Impacted Urban Area. *Inhalation Toxicology* 20:423-433. [PMID: 18302050].
- Armstrong J, **Fenske R**: [2010] Analysis for organophosphorus pesticides and oxygen analogs during agricultural spraying and implications regarding proper exposure assessment of migrant worker communities in Yakima Valley, WA. 19th Annual Western Migrant Stream Forum. *Nuestra Comunidad – Nuestro Futuro Overcoming Barriers, Working for Change*, February 11 – 14.
- Astrakianakis G, **Seixas NS**, **Camp JE**, Christiani DC, Feng ZD, Thomas DB, Checkoway H: [2006] Modeling, Estimation and Validation of Cotton Dust and Endotoxin Exposures in Chinese Textile Operations. *Annals of Occupational Hygiene* 50:573-582. [PMID: 16632488].
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- Astrakianakis G, **Seixas NS**, Ray R, **Camp JE**, Gao DL, Feng ZD, Li WJ, Wernli KJ, Fitzgibbons ED, Thomas DB, Checkoway H: [2007] Lung Cancer Risk among Female Textile Workers Exposed to Endotoxin. *Journal of the National Cancer Institute* 99:357-364. [PMID: 17341727].
- Blackstone JM, Karr C, **Camp JE**, **Johnson PW**: [2008] Physical Exposure Differences between Children and Adults When Using Standard and Small Computer Input Devices. *Ergonomics* 51:872-889. [PMID: 18484401].
- Blood RP, Ploger JD, and **Johnson PW**: [2010] Whole body vibration exposures in forklift drivers: a comparison of a mechanical and air-ride seat. *Ergonomics*, 53 (11): 1385 - 1394. [PMID: 20967660].
- Blood RP, Ploger JD, **Yost MG**, Ching RP, **Johnson PW**: [2010] Whole body vibration exposures in metropolitan bus drivers: A comparison of three seats. *J Sound and Vibration* 329(1): 109-120.
- Bowman JD, Touchstone JA, **Yost MG**: [2007] A Population-Based Job Exposure Matrix for Power-Frequency Magnetic Fields. *Journal of Occupational & Environmental Hygiene* 4:715-728. [PMID: 17654227].
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- Burch JB, Reif JS, **Yost MG**: [2008] Geomagnetic Activity & Human Melatonin Metabolite Excretion. *Neuroscience Letters* 438:76-79. [PMID: 18472329].

- Burch JB, **Yost MG**, **Johnson PW**, Allen E: [2005] Melatonin, Sleep, and Shift Work Adaptation. *Journal of Occupational & Environmental Medicine* 47:893-901. [PMID: 16155474].
- Carden A, **Yost MG**, **Fenske RA**: [2005] Noninvasive Method for the Assessment of Dermal Uptake of Pesticides Using Attenuated Total Reflectance Infrared Spectroscopy. *Applied Spectroscopy* 59:293-299. [PMID: 15901309].
- Carter S, **Seixas NS**: [2005] Fluorine and Related Compounds. In: *Textbook of Clinical Occupational & Environmental Medicine* (eds. L Rosenstock, M Cullen, C Redlich, C Brodtkin), Elsevier Saunders 2nd ed, pp. 964-966.
- Ceballos DM, **Yost MG**, Whittaker SG, **Camp J**, Dills R: [2009] Objective Color Scale for the SWYPE Surface Sampling Technique Using Computerized Image Analysis Tools. *J Occ. and Env. Hygiene* 6(10): 604-611.
- Chang CH, Amick BC, Menendez CC, Katz JN, **Johnson PW**, Robertson M, Dennerlein JT: [2007] Daily Computer Usage Correlated with Undergraduate Students' Musculoskeletal Symptoms. *American Journal of Industrial Medicine* 50:481-488. [PMID: 17450542].
- Chang CK, Astrakianakis G, Thomas DB, **Seixas NS**, **Camp JE**, Ray RM, Gao DL, Wernli KJ, Li WJ, Fitzgibbons ED, Vaughan TL, Checkoway H: [2006] Risks of Biliary Tract Cancer and Occupational Exposures among Shanghai Women Textile Workers: A Case-Cohort Study. *American Journal of Industrial Medicine* 49:690-698. [PMID: 16830349].
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- Clark ML, Burch JB, **Yost MG**, Zhai Y, Bachand AM, Fitzpatrick CTE, Ramaprasad J, Cragin LA, Reif JS: [2007] Biomonitoring of Estrogen and Melatonin Metabolites among Women Residing near Radio and Television Broadcasting Transmitters. *Journal of Occupational & Environmental Medicine* 49:1149-1156. [PMID: 18000420].
- Clark M, Paulsen M, Smith KR, Canuz E, **Simpson CD**: [2007] Urinary Methoxyphenol Biomarkers and Woodsmoke Exposure: Comparisons in Rural Guatemala with Personal Co and Kitchen Co, Levoglucosan, and Pm2.5. *Environmental Science & Technology* 41:3481-3487. [PMID: 17547167].
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- Dennerlein JT, **Johnson PW**: [2006] Changes in Upper Extremity Biomechanics across Different Mouse Positions in a Computer Workstation. *Ergonomics* 49:1456-1469.

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II. OHN Publications

*Note: Core faculty denoted by bold and trainees denoted by underline

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III. OMR Publications

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IV. OHSRT Publications

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V. HSAT Publications

*Note: Core faculty denoted by bold and trainees denoted by underline

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