

**JOHNS HOPKINS EDUCATION and
RESEARCH CENTER for
OCCUPATIONAL SAFETY and
HEALTH**

FINAL PROGRESS REPORT

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Submitted by:

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LIST OF TERMS AND ABBREVIATIONS

AAOHN	American Association of Occupational Health Nurses
ABET	Accreditation Board for Engineering and Technology
ABIH	American Board of Industrial Hygiene
ABOHN	American Board for Occupational Health Nurses
ACGIH	American Conference of Governmental Industrial Hygienists
ACGME	Accreditation Council for Graduate Medical Education
ACHMM	Academy of Certified Hazardous Materials Managers
ACOEM	American College of Occupational and Environmental Medicine
AHRQ	Agency for Healthcare Research and Quality
AIHA	American Industrial Hygiene Association
AIHce	American Industrial Hygiene Conference and Expo
ANA	American Nurses Association
ASAC	Applied Science Accreditation Commission
ASSE	American Society of Safety Engineers
ATSDR	Agency for Toxic Substances and Disease Registry
BOES	Biomarkers of Occupational Exposure and Susceptibility
CAFO	Concentrated Animal Feeding Operation
CBRNE	Chemical, Biological, Nuclear, and Explosives
CDC	Centers for Disease Control and Prevention
CE	Continuing Education
CEPH	Council on Education for Public Health
CHMM	Certified Hazardous Materials Manager
CIRP	Johns Hopkins Center for Injury Research and Policy

CME	Continuing Medical Education
DISCOVER	Disease Investigation through Specialized Clinically-Oriented Ventures in Environmental Research
DOE	Department of Energy
DOT	U.S. Department of Transportation
DrPH	Doctor of Public Health
EPA	U.S. Environmental Protection Agency
ERC	Education and Research Center for Occupational Safety and Health
GPMR	General Preventive Medicine Residency
HAZWOPER	Hazardous waste operations and emergency response
HBCUs	Historically Black Colleges and Universities
HST	Hazardous Substance Training
HUD	U.S. Department of Housing and Urban Development
IJHN	Institute for Johns Hopkins Nursing
IPM	Integrated Pest Management
JHBSPH	Johns Hopkins Bloomberg School of Public Health
JHCIRP	Johns Hopkins Center for Injury Research and Policy
JHH	Johns Hopkins Hospital
JHU	Johns Hopkins University
MAAOHN	Maryland Area Association of Occupational Health Nurses
MARCOM	Mid-Atlantic Regional Conference on Occupational Medicine
MCOEM	Maryland College of Occupational and Environmental Medicine
MDE	Maryland Department of the Environment
MHS	Master of Health Science
MNA	Maryland Nurses Association
MSN/MPH	Master of Science in Nursing and Master of Public Health

MWAOHN	Metropolitan Washington Association of Occupational Health Nurses
NCC-AHMP	National Capital Chapter of the Alliance of Hazardous Materials Professionals
NCHS	National Center for Health Statistics
NEHA	National Environmental Health Association
NIEHS	National Institute of Environmental Health Sciences
NIH	National Institutes of Health
NIOSH	National Institute for Occupational Safety and Health
NORA	National Occupational Research Agenda
NRSA	National Research Service Award
OEH	Occupational and Environmental Hygiene
OEHN	Occupational and Environmental Health Nursing
OEMR	Occupational and Environmental Medicine Residency
OIEP	Occupational Injury Epidemiology and Prevention
OSHA	U.S. Occupational Safety and Health Administration
OSH	Occupational Safety and Health
OPSF	Occupational Physicians Scholarship Fund
OSHA	Occupational Safety and Health Administration
PDC	Professional Development Conference
PESA	Public Employees Safety Association
PhD	Doctor of Philosophy
PI	Principal Investigator
PPE	Personal Protective Equipment
PPRT	Pilot Project Research Training
PSA	Petroleum Safety Authority (of Norway)
PTIB	Part-time/Internet-based

Principal Investigator/Program Director (Last, First, Middle): Agnew, Jacqueline

R2P	Research to Practice
ROHC	Regional Occupational Health Conference
ScD	Doctor of Science
SEIU	Service Employees International Union
SVAOHN	Seneca Valley Association of Occupational Health Nurses
TPG	Training Project Grant/Grantee
UAW	United Auto Workers
UM	University of Maryland
USAF	United States Air Force
USUHS	Uniformed Services University of the Health Sciences

ABSTRACT

The Johns Hopkins Education and Research Center (ERC) was established in 1977 in response to the need for interdisciplinary training programs that would help meet the need for a professional workforce dedicated to worker safety and health. Since that time, the center has prepared leaders in occupational safety and health research and practice in the following disciplines. Master's and doctoral training is provided in Occupational and Environmental Hygiene (MSPH, PhD, DrPH, ScD), Occupational and Environmental Health Nursing (MPH, MSN/MPH, PhD, DrPH), Biomarkers of Occupational Exposure and Susceptibility research training (PhD, DrPH), Occupational Injury Prevention (PhD) and residency training in Occupational and Environmental Medicine. Continuing Education and Outreach components bring the strengths of the core programs to practicing occupational safety and health professionals in Region III and beyond.

Annual trainees per program have averaged 8 in Occupational and Environmental Health Nursing, six to eight in Occupational and Environmental Medicine, 20 in Occupational and Environmental Hygiene, eight to 10 in Biomarkers research, and five to six in Occupational Injury Prevention. The Continuing Education program reaches working occupational safety and health professionals, totaling 5,557 in a total of 207 courses over this six-year period.

This ERC has also had a significant impact on the training capacity of other institutions and thereby has enhanced the overall preparation of the occupational safety and health workforce throughout the nation and internationally. The Pilot Project Research Training Program has, since 2006, funded 22 projects, 10 of which were to students and junior faculty at six universities outside of Johns Hopkins. Additionally, several program graduates now serve in university faculty positions. Others hold significant leadership positions at the national level.

The school and ERC programs maintain accreditation by all respective organizations. The Occupational and Environmental Medicine program successfully completed the ACGME accreditation review and has been reaccredited for the maximum of five years. Likewise, the Occupational and Environmental Hygiene program was reaccredited through ASAC-ABET.

Faculty members have extensive interdisciplinary research support and productive publication records that frequently include students as co-authors. Over the recent grant period, faculty and students produced more than 300 publications on work that was related to their role in the ERC. Additionally, ERC faculty hold leadership positions in professional societies and serve on major advisory and policy making committees. Their proficiency and recognition as national and international experts comprise a major strength of the center.

There are approximately 120 million workers in the United States whose work-related health, quality of life and productivity are affected directly or indirectly by the expertise of safety and health professionals. The health needs of workers are best met by integrated teams of professionals, trained to work in an interactive setting, to provide care, set policy, design and manage safety and health programs, and conduct research that discovers new knowledge to advance the body of knowledge in this field. The Johns Hopkins Education and Research Center trains occupational hygienists, nurses, physicians, injury epidemiologists and specialized researchers to achieve this goal and also provides educational and outreach opportunities to practicing community partners. Thus, this ERC, through its interdisciplinary training mission, builds the national capacity to evaluate risks, detect and assess vulnerable populations, and deliver cost-effective and state-of-the-art care to prevent and mitigate health threats in the workplace.

SECTION 1

Highlights/Significant Results

Over this project period, the Johns Hopkins Education and Research Center (ERC) continued to make major contributions to the field of occupational health and safety. Consistent with the program objectives, we have prepared outstanding occupational professionals in the disciplines of occupational and environmental medicine, occupational and environmental health nursing, and occupational and environmental hygiene, as well as researchers in the field of occupational injury prevention and in the application of biomarkers in the practice of occupational health. In all, 24 students have graduated from our doctoral programs and 35 have received MSPH (previously known as MHS), MPH, or MSN/MPH degrees. Another 12 students have completed the Occupational and Environmental Medicine Residency. In addition, we have reached an extraordinarily large proportion of practicing professionals: 5,557 from Region III and across the nation. As described below, we feel the faculty, graduates, and ERC as a whole have positively impacted the health and safety of workers.

A significant change that occurred during this period was the creation of a part-time/internet-based (PTIB) master's delivery option for the OEH MSPH program. Prior to initiating the PTIB program, students wishing to complete a part-time program were required to take time off from work in order to take classes during the day. The PTIB delivery option was reviewed as a part of the recent ABET site visit. Full-time and PTIB delivery options were both approved for accreditation.

The Occupational and Environmental Medicine also received full accreditation by ACGME, attesting to its quality.

The availability and accessibility of the school's highly sophisticated Distance Education Division has enabled us to develop Internet versions of academic and continuing education course offerings. During this period, the physical facility that houses the studios and other support for providing distance courses was completely renovated to state-of-the-art conditions. The division is very responsive to requests for assistance in translating face-to-face courses to Internet format; thus, we have greatly increased enrollment in courses such as *Fundamentals of Occupational Health, Noise and Other Physical Agents in the Environment*, and *Principles of Occupational and Environmental Hygiene*. The availability of on-line versions of many of the basic public health courses and departmental core courses has made it possible for more part-time students to take part in our programs. Thus, this option is enormously beneficial to our new part-time OEH MSPH degree program. We have also expanded our use of distance technologies in continuing education. Seminars and conferences can now be converted into more enduring forms by recording them for Web-based presentation or CD versions, for which we offer continuing education credits. Finally, the school offers an option to present academic courses, generally without audio, as free access materials open for use by all, including individuals who are not enrolled in Johns Hopkins courses. This format is called Open Courseware. A select number of occupational health courses are offered by the school for no cost. This can be a means for prospective students to evaluate our academic programs.

We also have had an impact on the research training capacity of other institutions. The Pilot Project Research Training program has provided one means of supporting junior faculty, as well as doctoral students at other universities. We have also provided assistance to a number of academic institutions who sought help in developing programs and courses and in strengthening existing occupational health programs. Our contacts in this regard included Purdue University and several international schools and universities. Examples are: University de Los Andes in Bogota; Mongolia Health Sciences University School of Public Health; and the School of Environmental Health in Liberia.

Another means by which we have developed research training capacity in the field of occupational safety and health has been our high rate of doctoral student graduation, thereby producing future faculty in the field. Graduates of each program have gone on to teaching careers, nationally and internationally. As examples, graduates now hold faculty positions at Johns Hopkins University, Yale University, Mongolia Health Sciences University School of Public Health; the University of Maryland, Case Western Reserve University, Drexel University, Vanderbilt University, and the College of Nanoscale Science and Engineering at the University of Albany. Also of note is the significant number of graduates who have entered or returned to the military or government agencies, including NIOSH and OSHA.

As suggested above, we have a growing international presence. To this end, we have: trained laboratory scientists from tobacco control laboratories in China, Mexico, India, and Argentina; collaborated on a Fogarty training grant for environmental and occupational health in Mongolia; and taught courses on ventilation for the Regional Laboratories of Occupational Health Safety Centre in Turkey. As an additional facet of our ongoing relationship with the Mongolia Health Sciences University School of Public Health, we taught a week-long course on occupational and environmental air sampling and have trained four Mongolian students in our MSPH degree program. More than 100 Mongolian professionals have attended short courses over the last two years. Additionally, Dr. Weaver directed a course on clinical occupational toxicology for occupational medicine physicians employed by the India government, and an offering in the U.S. is being considered.

We have maintained and strengthened our relationships with several collaborators, such as the military services, the University of Delaware, Morgan State University, Columbia University, Boston University, Eastern Kentucky State University, the Uniformed Services University of the Health Sciences (USUHS), the International Association of Fire Fighters (IAFF), the Association of Occupational and Environmental Clinics (AOEC), CASA de Maryland, and the National Transportation Safety Board.

We have also remained a prominent partner of internal centers and institutes within Johns Hopkins. Examples include the MidAtlantic Public Health Training Center, the Center for Public Health Preparedness, the Center for a Livable Future, the Center for Urban Environmental Health, and the Global Tobacco Institute. We interact with these centers on a regular basis and leverage resources to present training, fund students and faculty, and collaborate on research. Our relationships with these partners provide students and faculty access to additional facilities, laboratories, and other resources, and are a means by which we leverage the ERC support.

From 2006 to 2012, we were fortunate to be able to train professionals who deal with hazardous materials. This separately supported program, Hazardous Substances Training, allowed us to expand our network with government agencies, professional associations, business, labor, and internal programs. We offered critical trainings that included the well-known requirement for many professions, *Hazardous Waste Operations and Emergency Response (HAZWOPER)*. Despite the unfortunate termination of this program, we are committed to sustain as many of these activities as possible.

During this funding period, our continuing education activities have reached 5,557 professionals in 207 courses. Many of these, which are also a form of outreach, have addressed contemporary issues such as: distracted driving; the links between employee and patient safety in health care; healthy housing, including control of risks to workers and community health workers; aging health care workers; sustainable environmental assessment; and vulnerable worker populations.

In only the past few years, we have assisted, through many forms of outreach, more than 2,400 organizations, including small and large businesses, labor organizations, all levels of government, professional organizations, the military, and others.

With regard to minority recruitment, we have also enjoyed increasing success. For example, the proportion of minorities entering our Occupational and Environmental Medicine program exceeds 50%. We have also been more active in professional interactions with regional universities that are considered Historically Black Colleges and Universities (HBCUs). Our faculty are involved in school wide efforts to support minority recruitment and retention; this has inherent benefits to ERC recruiting.

Finally, it is important to note that the funds we receive from NIOSH are used by us to leverage additional resources in support of our trainees. The school and department supplement tuition and scholarship funding directly, and several of our students are awarded specific scholarships that are based on merit, thus releasing ERC funds to support additional trainees. Similarly, external sources of scholarships have been available. One of these was the Occupational Physician Scholarship Fund (OPSF), which was granted to several of our occupational medicine residents based on merit, but was unfortunately discontinued by its sponsor, ACOEM. The ERC has some success in attracting named gifts. Employers, too, provide full or partial support for trainees who take advantage of our offerings. The strength of the ERC makes it possible to acquire funding for large projects that then become venues for student training and research. The best example of this is our longstanding project that provides medical surveillance to a cohort of former employees of the Department of Energy.

Outcomes/Relevance/Impact

There are approximately 120 million workers in the United States whose work-related health, quality of life, and productivity are affected directly or indirectly by the expertise of occupational safety and health professionals. The annual direct and indirect costs associated with occupational injury and illness in the U.S. is estimated to be \$250 billion. The *National Assessment of the Occupational Safety and Health Workforce* report has predicted that the need for OSH service in the future will exceed that which can be provided by the supply of appropriately trained practitioners. The health needs of workers are best met by integrated teams of professionals, trained to work in an interactive setting to provide care, set policy, design and manage safety and health programs, and conduct research that advances the body of knowledge in this field.

The Johns Hopkins ERC helps fill this need with our strong record of preparing graduates in the core and allied areas of OSH—occupational and environmental hygiene, occupational and environmental health nursing, occupational and environmental medicine, biomarkers of occupational exposure and susceptibility, and occupational injury epidemiology and prevention—and also provides educational and outreach opportunities to practicing community partners. The significant proportion of our graduates who become certified in their fields meet an expressed expectation of potential employers. Graduates are employed in professional positions in institutions including: businesses, industries, government agencies, labor organizations, health agencies, and health care facilities. Additionally, many of our doctoral graduates have assumed positions in academic institutions where they, in turn, prepare a new generation of providers.

Employers surveyed in the workforce assessment have indicated that they would prefer that providers be trained in OSH areas that are beyond their primary discipline. This concept is embodied in the mission of this ERC—i.e., our model is one of interdisciplinary training. The Johns Hopkins ERC remains exceptional in this regard; through our interdisciplinary training mission, this ERC builds the national capacity to evaluate risks, detect and assess vulnerable populations, and deliver cost-effective and state-of-the-art care to prevent and mitigate health threats in the workplace. We play a significant role regionally and nationally in moving newly

documented best practices to the workplace to reduce or eliminate workplace injuries, illnesses, and deaths, and we serve as a regional and national resource on occupational safety and health issues for business, labor, government, and the public.

The Johns Hopkins ERC also has a vigorous continuing education program for occupational safety and health professionals and others with worker health and safety responsibilities. This program, combined with the success of our outreach activities, has reached almost 2,500 organizations, including small and large businesses, labor organizations, the military, and all levels of government.

The recent workforce assessment survey identified sets, by discipline, of specific skills and knowledge areas that employers felt would be useful. We address many of these areas in academic curricula, continuing education, and professional outreach, and will use these results in further planning.

SECTION 2

Scientific Report

Background for the Project

Established in 1977 in response to the need for interdisciplinary training programs that would prepare occupational health and safety professionals who would meet the need for a professional workforce dedicated to worker safety and health, the Johns Hopkins Education and Research Center for Occupational Safety and Health (ERC) has evolved over time in response to the changing demands of the field.

Dr. Jackie Agnew directs the ERC, which includes five academic programs: Occupational and Environmental Medicine (directed by Dr. Virginia Weaver), Occupational and Environmental Health Nursing (directed by Dr. Sheila Fitzgerald), Occupational and Environmental Hygiene (directed by Dr. Patrick Breyse), Biomarkers of Occupational Exposure and Susceptibility (directed by Dr. Paul Strickland), and Occupational Injury Prevention (directed by Dr. Keshia Pollack). The first three programs have existed since the inception of the ERC and have grown since that time. Occupational Injury Epidemiology and Prevention was added in 1990 and was expanded in 2001 through the award of a NIOSH supplemental initiative that focused on research training. The Biomarkers of Occupational Exposure and Susceptibility program was added in 2002. Additional components of the ERC are: the Continuing Education and Outreach programs (directed by Ms. Mary Doyle), which bring the strengths and resources of the core program faculty to serve the educational needs of practicing professionals in Region III; and the Pilot Project Research Training program (directed by Dr. Peter Lees, who is also the center deputy director), which supports regional students and junior faculty who are in the initial stages of developing their research projects and programs. Our former Hazardous Substance Training program, which rested within the overall Continuing Education program, was in place from July 2006 until funding for the program was discontinued in June 2012. While we do not offer a specific core program in occupational safety, training in the principles of safety, safety management and ergonomics are incorporated into the curriculum of ERC students.

The Occupational and Environmental Hygiene program offers a professional MSPH degree, as well as doctoral degrees (PhD, DrPH, ScD). The Occupational and Environmental Health Nursing program offers masters degree programs that lead to the MPH or MSN/MPH degrees, and also PhD, DrPH, and ScD doctoral programs. The Occupational and Environmental Medicine program offers occupational medicine residency training—a two-year program consisting of an MPH along with a wide range of required and elective practicum rotations. During this time period, training in the Biomarkers of Occupational Exposure and Susceptibility and the Occupational Injury Epidemiology and Prevention programs has been directed exclusively to doctoral degrees (PhD, DrPH, ScD). All ERC programs, including CE, take advantage of the distance education facilities and support within the school to enhance their educational offerings. ERC faculty have contributed by adding online courses to the school's offerings, and the OEH program now has a part-time program that largely relies on distance education.

The ERC is located in the Johns Hopkins Bloomberg School of Public Health, the most highly ranked school of public health in the world. We are located on the East Baltimore campus of Johns Hopkins University, where the Johns Hopkins Hospital, School of Medicine, and School of Nursing also reside. All ERC components, with the exception of the Occupational Injury Epidemiology and Prevention program, sit in the Department of Environmental Health Sciences in the Division of Occupational and Environmental Health and the Division of Environmental Health Engineering. The Occupational Injury Epidemiology and Prevention program is located nearby in the Department of Health, Policy and Management. The geographic proximity of these programs has fostered interdisciplinary collaboration and

communication among students and faculty. Interaction with the Schools of Nursing and Medicine are similarly facilitated by their nearby locations. The Johns Hopkins University is fully accredited by the Middle States Commission on Higher Education, and the Bloomberg School of Public Health is accredited by the Council on Education for Public Health. Our Occupational and Environmental Medicine Residency and Occupational and Environmental Hygiene programs have been recognized for their excellence by full-term accreditation by their respective credentialing bodies.

A strong interdisciplinary emphasis underlies all ERC training activities, and the importance of such interaction and collaboration is communicated to students in courses, seminars, and informal discussions, and is reinforced through research and professional practice in each program. Each academic program upholds the strong research tradition of the school, and we strive to address the priority areas of occupational safety and health set by NIOSH. Research activities in each academic program address topics relevant to the core and allied OSH areas, and our Pilot Project Research Training program also enables faculty and students to advance that agenda.

Specific Aims

The mission of the ERC is to provide an integrated, interdisciplinary approach to training researchers and practitioners in the field of occupational health. The ultimate objective of this project is to protect the health and safety of all working individuals. Additionally, as the only ERC in DHHS Region III, the center is dedicated to meeting regional and national needs through occupational safety and health practitioner and researcher training.

In support of these overall objectives, the specific goal of the ERC is to maintain programs of excellence in: occupational and environmental hygiene, occupational and environmental medicine, occupational and environmental health nursing, occupational injury prevention, biomarkers of occupational exposure and susceptibility, pilot project research training, NORA-related training, continuing education and outreach. The success of the center in meeting these objectives is presented, by program, in the Results section.

Results and Discussion: Occupational and Environmental Hygiene (OEH)
Director: Patrick Breysse, PhD, MHS

Background and Program Objectives

The Occupational and Environmental Hygiene program at the Johns Hopkins Bloomberg School of Public Health traces its roots to Dr. Anna Baetjer, who joined the faculty in 1924. The modern-day OEH program began in 1977 with the award of the NIOSH ERC training grant, which has provided support to this program since that time.

During much of the last cycle, the core faculty included Dr. Breysse, Dr. Peter Lees, Dr. Allison Geyh, and Dr. Ana Rule. In February 2011, Dr. Geyh passed away after a prolonged illness. We recruited Dr. D'Ann Williams to join the faculty in 2011. Drs. Breysse and Lees, with a combined 53 years of faculty service, have provided continuity of leadership and direction to the program since the mid-1980s. Numerous other faculty within and outside the department provide support to the program. The program has been ABET-accredited since 1990.

During the previous (2006) grant review, we noted that changes within the profession resulted in important adjustments to the OEH program objectives and outcomes, and the program name now includes both occupational and environmental hygiene. This change was endorsed by the External Advisory Board and graduates' feedback. The Occupational and Environmental Hygiene training program includes master's (MSPH) and doctoral (PhD, ScD, and DrPH) training programs. A significant change that occurred during the last review cycle was the creation of a part-time/internet-based (PTIB) master's delivery option for the OEH MSPH program. Prior to initiating the PTIB program, students wishing to complete a part-time program were required to take time off from work in order to take classes during the day. The PTIB delivery option was reviewed as a part of the recent ABET site visit. Full-time and PTIB delivery options were both approved for accreditation. Another change during the last review cycle was the change in degree name. We previously offered a Master of Health Sciences (MHS) degree. The Bloomberg School of Public Health recently standardized the naming of all non-MPH professional master's degrees as Master of Science in Public Health (MSPH).

The National Assessment of the Occupational Safety and Health Workforce. Prepared for: National Institute for Occupational Safety and Health. 200-2000-08017, Task Order 18.) on the education and training needs for occupational safety and health personnel concluded that the estimated number of OSH professionals employers expect to hire over the next five years is "substantially higher" than the number estimated to be produced from OSH training programs. These reports clearly document the ongoing need to provide trained safety and health professionals, including occupational and environmental hygienists. The OEH program at Johns Hopkins helps fill this important need.

The Johns Hopkins OEH program has four broad educational objectives:

1. To provide courses in occupational and environmental hygiene and related fields that are critical to the training of other ERC core students and students in other disciplines;
2. To provide high quality interdisciplinary master's-level professional education with a research-/problem-solving perspective, including the five core areas of public health as specified by the Council on Education for Public Health (CEPH);
3. To prepare doctoral students for careers as independent investigators with OEH research skills and the ability to translate research findings to best practices in worker safety; and
4. To be an occupational and environmental health resource regionally, nationally, and internationally, and to support occupational health practitioners and organizations with resources for professional development and assistance in solving health and safety concerns and ensuring healthy workplaces.

Accomplishments over the Project Period

During the period July 1, 2007 through June 30, 2013, the OEH program has continued to provide high-quality master's and doctoral training and to grow in enrollment. During the previous funding cycle, the OEH program graduated 13 doctoral students and 23 master's students. A principal new program accomplishment includes re-accreditation by ABET and creation of a Part-Time Internet-Based (PTIB) delivery option for the MSPH program. The PTIB option is now up and running and we currently have 16 students in the program (fall of 2013). Three have graduated. Significant accomplishments also include maintaining a high level of research funding (approximately \$2 million per year), which is summarized in Table OEH-1 in Appendix B to this report.

Our graduate students go on to become national and international leaders in the field of occupational and environmental hygiene. Of our most recent doctoral graduates has taken a post-doctoral associate position at Yale School of Forestry and Environmental Studies, and, of the seven master's students who graduated within the past academic year, we are happy to report that all have found placement in the field of occupational safety and health: one has taken a position as a safety engineer at the College of Nanoscale Science and Engineering at the University of Albany, New York; two are working as industrial hygienists (one for the U.S. Army and one for Booze Allen Hamilton); one is currently a CDC fellow at NIOSH in Washington, D.C.; one has been hired as a research assistant here at the Johns Hopkins Bloomberg School of Public Health; one is enrolled as a PhD student in an occupational safety and health program at Duke University in Durham, N.C.; and another is now a faculty member at the Health Sciences University of Mongolia, Department of Environmental Health Sciences.

During the grant period, the NIEHS/EPA-funded Center for Childhood Asthma in the Urban Environment was successfully renewed. Other funding includes a update of large study of Health Effects of Low-Level Radiation in Shipyard Workers funded by the US Navy. The major goal of this project is to evaluate radiation and chemical exposures and resulting health outcomes for a cohort of approximately 600,000 individuals involved in repair and overhaul of nuclear-powered Naval vessels during the period 1955 to 2010.

Throughout the last five year grant period, the faculty and students have maintained a strong publication record, with 87 faculty and student publications and more than 40 publications with students. See Appendix A for a complete list of publications by faculty and OEH students during the last grant cycle.

OEH program faculty are actively involved in continuing education and outreach. Examples include co-sponsoring the local AIHA Section Professional Development Conference; conducting laboratory training scientists from for tobacco control laboratories in China, Mexico, India, and Argentina; and collaborating on a Fogarty training grant for environmental and occupational health in Mongolia; and teaching ventilation for Regional Laboratories of Occupational Health Safety Centre in Turkey. We have six-to-seven students currently pursuing on on-line certificate with the goal of possibly applying to an OEH academic degree program.

Our faculty remain leaders in practice and research education and outreach, and their activities extend locally, nationally, and internationally. Extensive outreach activities of OEH faculty include:

- Speaking and presenting at national and international meetings (OEH faculty have made more than 50 presentations at scientific meetings during the last six years);
- Peer-reviewing journal articles;
- Collaborating with institutions in our region (University of Delaware, Morgan State University) and outside our region (Columbia, Boston University, Eastern Kentucky State University);
- Serving as grant reviewers for NIH, CDC, and NIOSH;

- Serving on National Academy of Sciences, National Toxicology Program, Department of Agriculture and EPA expert panels;
- Interacting with numerous press contacts;
- Serve on planning committees for national and international meetings;
- Offer on-line course content free through OpenCourseWare (<http://ocw.jhsph.edu/>).
- Provide course syllabi to Purdue University and University de Los Andes in Bogota.
- Drs. Ana Rule and D'Ann Williams have been working with community groups in a neighborhood in Baltimore (Turner Station) that is impacted by chromium pollution from legacy industrial activity.
- Dr. Pat Breyse, Dr. Williams, and Dr. Rule conducted a week-long training on occupational and environmental air sampling at the Mongolia Health Sciences University School of Public Health, and we have trained four Mongolian students in our MSPH degree program and more than 100 Mongolian professionals in short courses over the last two years.
- Dr. Breyse served on a PhD examining committee for a student at the University of Los Andes in Bogota Columbia, for a student conducting occupational asbestos exposure and health research.

- Drs. Rule and Williams organized and led a symposium session on Agricultural Exposures and Rural Health at the recent Joint International Society for Environmental Epidemiology and International Society for Exposure Science meeting in Basel, Switzerland.
- OEH faculty participate in frequent interdisciplinary coordination with faculty and students from other ERC programs.
- As noted above, OEH faculty and students have maintained a strong publication record, with 87 faculty and student publications and more than 40 publications with students. See Appendix A for a complete list of publications by faculty and OEH students during the last grant cycle.

Results and Discussion: Occupational and Environmental Health Nursing (OEHN)
Director: Sheila Fitzgerald MSN, RN-C, PhD

Background and Program Objectives

Initiated in 1977, the Occupational and Environmental Health Nursing program has existed since the establishment of the Johns Hopkins ERC. Currently directed by Dr. Sheila Fitzgerald, the OEHN program is located in the Division of Occupational and Environmental Health within the Department of Environmental Health Sciences. The OEHN program's location—administratively and physically—facilitates interaction with faculty and students of the Occupational and Environmental Medicine program, the Biomarkers of Occupational Exposure and Susceptibility program, and the Occupational and Environmental Hygiene program. The ERC also provides a strong link with members of the Occupational Injury Epidemiology and Prevention program, which resides one block away in the Department of Health Policy and Management.

The primary goal of the Johns Hopkins OEHN program is to prepare nurses to function as consultants, researchers, managers and educators in industry, academia, and a variety of new occupational health service models, such as membership in OSH advocacy organizations. This is accomplished by offering an academic program of excellence that leads to the graduate degrees of MPH, MSN/MPH, MPH/MBA, PhD, or DrPH. An additional goal of the OEHN program is to serve as a resource to Region III nurses, educational institutions, and organizations, such as, labor, government, private sector organizations and occupational health services. This is accomplished through the interdisciplinary preparation of nurses, many of whom remain in the region in positions that draw on the skills unique to the OEHN program. The program also makes contributions—regionally, nationally and internationally—in its outreach and continuing education efforts.

Accomplishments over the Project Period

During the funding period July 1, 2007 through June 30, 2013, the Occupational and Environmental Health Nursing program continued to graduate top-quality occupational health nurses, and the program has prospered and grown despite the economic challenges of the present fiscal climate.

Dr. Maureen Cadorette, our newest member of the OEHN program, has expanded and strengthened opportunities for students and has furthered our program objectives. Currently, Dr. Cadorette, course director of *Principles of Occupational Health*, teaches the course every year as an online distance education offering and in-class in alternate years. Enrollment in these courses has grown and she has been formally recognized for “excellence in teaching” for this course. She has increased her ERC core teaching responsibilities in the OEHN program by presenting seminars and assisting Dr. Fitzgerald with student recruitment. Dr. Cadorette now has a joint appointment in the School of Nursing. With our School of Nursing's decision to offer only graduate level degree programs, there will be an opportunity to again offer an elective in occupational and environmental health nursing to students in 2014. Drs. Fitzgerald and Cadorette will develop and conduct this course.

Dr. Sheila Fitzgerald has increased OEHN program efforts to recruit new students, in coordination with our school's development team, and the program graduated four doctoral students and twelve master's students during this funding cycle. Our current students have earned several honors and accolades. MSN/MPH student Matt Lindsley was chosen to represent Johns Hopkins University on a multidisciplinary team of graduate and undergraduate students that competed in the Emory University Global Health Case Competition, which addresses public health issues of underserved and vulnerable populations. The Hopkins team won the first-place prize among multiple university teams from across the United States. MBA/MPH student Nicole Roskowski completed an eight-week summer internship at Johnson &

Johnson in Princeton, NJ, where one focus of her experience was on the economics of employee health, and MSN/MPH student Alexandra Maher has been invited to participate in the American Public Health Association's online program "Not everyone is safe at home: Youth perspectives on violence around the world" (APHA, Boston; 2013).

The success of our graduates is having a direct impact on the field of occupational and environmental health nursing nationally and internationally. One recent doctoral graduate holds a position in the Department of Community Health in the Johns Hopkins School of Nursing, two doctoral graduates hold full-time faculty positions in community health nursing at the University of Maryland, a fourth is seeking a post-doctoral fellowship in occupational and environmental health, and a fifth is at the Ministry of Health in Thailand, working in the division that addresses occupational health. One of our graduates at the University of Maryland School of Nursing has designed and will direct the Certificate Program in Environmental Health. These educators are now preparing the next generation of occupational practitioners, researchers, and educators who will follow in the steps of the current occupational health nursing cohort.

The MSN/MPH has been in existence since 1993, is thriving, and has led to closer working relationships with the School of Nursing. Since that time, more than 30 students have been supported with funding from the NIOSH ERC, and these highly talented and experienced nurses have successfully completed the OEHN program; most are employed in occupational and environmental nursing positions.

During this funding period, we identified more opportunities for preceptorships and practicum experiences for OEHN students in occupational and environmental health settings. Many have promoted the translation of didactic coursework to real-world applications (e.g., protection of immigrant construction workers from injury, development of an educational program for brownfields workers, development of a health promotion survey of workers in a large retirement facility, and development of a breastfeeding program in the workplace). We have identified a cadre of former graduates of the OEHN program in the Baltimore-Washington metropolitan area who have been instrumental as role models and mentors to our students. Additionally, they provide opportunities for the students to work with interdisciplinary teams in their setting; for example, the Maryland Department of Health and Mental Hygiene, the Agency for Toxic Substances and Disease Registry (ATSDR) and the Erickson Living Retirement Communities located across the US. The latter provides employee health and wellness programs at on-site clinics and immediately hired one of our graduates on completion of her program.

The MPH has remained the appropriate degree for some—especially if the student has extensive work experience and does not plan a career that requires an MSN. An advantage to the MPH degree, taken alone, is the flexibility it allows with regard to elective courses. OEHN students in the MPH program have been able to take additional OSH courses or add an area of focus that complements their occupational safety and health competencies (such as management, policy and finance courses). As mentioned above, one student is pursuing the dual MPH/MBA degree.

We have taken an active role in the transition of the doctoral program to two distinct degrees, the PhD and DrPH. We have ensured balance in requirements across both programs, and we have been successful in melding the programs so that the OEHN component is the same for all. Doctoral students in the OEHN program remain a single cohesive cohort. Students appreciate the choice in programs and we have found it relatively easy to help students identify the best program for them.

The program faculty have made significant contributions to professional societies in the region, another means of reaching and developing the occupational and environmental health workforce. Dr. Fitzgerald is the educational director for the local MAAOHN Chapter and Ms. Doyle serves on the Board of Directors for the MWAOHN and is on the regional conference committee for the annual conference of three AAOHN chapters in Region III. As new centers

and institutes related to the practice of public health have emerged in this school and university, OEHN program members (including students) have played a significant role by representing occupational health and nursing. We are in the process of seeking a joint appointment in the Department of Environmental Health Sciences for a recent program graduate who is a faculty member in the Johns Hopkins School of Nursing, which will strengthen the presence of occupational health in the School of Nursing curricula.

Results and Discussion: Occupational and Environmental Medicine Residency (OEMR)
Director: Virginia Weaver, MD, MPH

Background and Program Objectives

The Occupational and Environmental Medicine Residency program of the Johns Hopkins University Bloomberg School of Public Health was created in 1978 to address a need for physicians with the skills to protect the health of working populations. This need still exists, as evidenced by the recent *National Assessment of the Occupational Safety and Health Workforce* report which, based on employer and training program provider surveys, revealed that the estimated number of OSH professionals employers expect to hire over the next five years will be “substantially higher” than the number estimated to be produced from OSH training programs.

The OEMR is a two-year program which includes coursework culminating in the MPH degree and eligibility for board certification in occupational medicine. Practicum rotations are located at key training sites in the mid-Atlantic region. An optional third year for research is also offered.

The objective of the OEMR is to train physicians who will be leaders in occupational and environmental medicine. Our graduates are able to manage and improve the health of populations through: 1) the development and implementation of programs to reduce or mitigate occupational or environmental exposure; 2) the direction of clinical care and health management of individuals exposed to potentially harmful chemical, physical and biological agents in a variety of occupational and non-occupational settings; 3) application of new technologies, new research findings and new management techniques to improve the health of working populations; and 4) application of population health skills to improve population health status and minimize disability. Since its inception, more than 145 physicians have completed our residency program. Alumni have taken positions in a wide range of settings, including academia, government, corporate, military, and clinical organizations. They have made significant contributions to occupational and environmental medicine and have assumed positions of leadership around the country in every sector of the field.

Accomplishments over the Project Period

This has been a very productive and influential period for the JHU OEMR. First and most importantly, the ACGME proposed removing the MPH requirement from preventive medicine training programs during this period. This would have had a very detrimental impact on these training programs, resulting in graduates with much narrower skill sets and further reducing an already shrinking applicant pipeline since the MPH degree is a major recruiting tool for OEMR programs. Dr. Weaver chaired the national OEM residency directors group in the year that this was formally proposed by ACGME. She organized a letter writing campaign to provide the ACGME with a rationale for the need to retain an MPH or equivalent degree in OEM training. Many stakeholders responded, including NIOSH, and the ACGME noted that the magnitude of the response was unique in their experience. These efforts were successful and the final requirements, effective in July 2011, while instituting many sweeping changes, retained public health training.

JHU OEM residents and Dr. Weaver also participated in national efforts to increase recruitment to OEM programs. In response to declining numbers of applicants sitting for the American Board of Preventive Medicine exam and membership in ACOEM, the organization established a Task Force on OEM Education. Dr. Weaver was a member of the Task Force and co-chair of the ACOEM Outreach Workgroup within it. Subsequently, Dr. Weaver was a member of the ACOEM Task Force on Expanding Awareness of OEM as a Medical Specialty. Further, she worked with two OEM residents, Drs. Grussendorf and Duffy, on an outreach research to practice project. Two surveys were used. A survey of current outreach activities by OEM

programs was sent to OEMR directors; the other survey went to the student and resident membership of ACOEM regarding outreach activities they experienced that attracted them to OEM residencies. A poster of the results was presented at AOHC in 2010 and is now posted on the ACOEM Web site, along with a recap of the highlights from this conference.

The JHU OEMR professional outreach program, over the past six years, has accomplished the following awareness and recruitment activities:

- In the last two years, we provided lectures on occupational and environmental health that included information on the OEMR in an introductory environmental health course required for all JHU MPH students.
- We revised our residency Web site to provide detailed information on the strengths of the program and to increase visibility on the School's website and with search engines. Recently we added a one-page flyer we developed that provides an overview of OEM and our program. We use this flyer as a handout during our grand rounds and other outreach activities.
- We sent emails about the program, including links to the Web site, to all regional internal medicine (IM), family practice (FP) and emergency medicine (EM) residencies. In these emails, we offered to present preventive medicine conferences to the residents in those programs and noted the ACGME requirements for preventive medicine content that could be addressed by such a lecture.
- Faculty have presented grand rounds on OEM topics to six regional IM programs
- Johns Hopkins and Uniformed Services University of the Health Sciences (USUHS) OEM residents and Dr. Weaver did a booth presentation for ACOEM at a 2011 American Medical Student Association conference in Baltimore
- The American Medical Association has a website where residency and fellowship openings can be posted (<http://www.ama-assn.org/ama/pub/about-ama/our-people/member-groups-sections/resident-fellow-section/rfs-resources/residency-vacancies-work-environment/find-residency-fellowship.page>). We successfully recruited one of our current residents by our posting at this site and we have made other OEM residencies aware of this option.
- Our residents have also presented information on our program in presentations to the General Preventive Medicine Residency program at Stony Brook, New York; the Internal Medicine program in Greenwich, CT and at a career day for the Johns Hopkins medical students.
- Drs. McDiarmid and Hines continue outreach activities in the internal medicine residency program at the University of Maryland and regularly have residents rotate with them.
- As part of a joint U.S. Department of Labor and Indian government project, Dr. Weaver directed a course on clinical occupational toxicology for occupational medicine physicians employed by the India government, and an offering in the U.S. is being considered.

The International Association of Fire Fighters (IAFF) has been a core rotation for our residents for the past three decades and is also a key source of funding for the residency program. Dr. Weaver, who directs the OEMR, is the medical preceptor for residents during their IAFF rotation.

The Johns Hopkins Center for Occupational and Environmental Health Clinic continued in our status as a long-standing member of the Association of Occupational and Environmental Clinics (AOEC).

In 2006, just prior to this grant period, we increased resident stipend support by 33% and successfully requested that the JHU SPH fund our program with two tuition scholarships per

year in order to retain ERC funds to cover those stipend increases. We also partnered with our colleagues in the military to identify and respond to their training needs of OEM physicians so that we could expand our program with their trainees.

We also made strides in occupational health practice. Dr. Reddy, chief resident and graduate in June 2011, was involved in a CASA de Maryland /Bienestar Occupational Health for Latinos in Baltimore project which is a multi-stakeholder program effort that involves the CASA de Maryland Baltimore Workers' Center, Bienestar Hopkins Tri-School Student Volunteer Group and Hopkins Bloomberg School of Public Health Division of Occupational and Environmental Health. The overall goal is to create a more aware, self-efficacious, healthier and safer Latino workforce at CASA de Maryland Baltimore. She worked with Dr. Agnew and a post-doctoral fellow on this project and presented the work at an APHA annual conference round table in November 2011.

During the previous funding cycle, we had 12 graduates from the program (an average of two per year). Graduates of the OEMR continue to be heavily recruited, and all twelve of our graduates from the last funding cycle (as well as one resident who transferred to another residency and one who left early) have been successfully placed in a number of important OEM positions in a variety of settings (see Table OEMR-1, "Placement of OEMR Program trainees (with state location and/or sector of job position), 2007-2012," in Appendix B to this report). One of these recent graduates is working as a staff physician at Temple University's occupational medicine clinic, and another is chief of preventive and occupational medicine for the Office of the National Guard Chief Surgeon at the Pentagon. While in her second year of the residency, summer 2013 program graduate Dr. Claudine Holt was awarded one of only three highly competitive fellowships at Johns Hopkins Bloomberg School of Public Health for the Council of Women World Leaders at the Woodrow Wilson Center in Washington, D.C. Dr. Holt spent her two-month fellowship at the International Labor Organization in Geneva, Switzerland, where she was tasked with developing implementation guidelines for the ILO-WHO Joint Global Framework for National Occupational Health Programmes for Health Workers. The framework is designed to raise awareness and improve the health of health care workers globally. Another recent (2012) graduate, Dr. Nimisha Kalia-Satwah, co-presented "Monitoring Worksite Clinic Performance Using a Cost-Effectiveness Tool" at the November 2012 American Medical Association conference in Honolulu.

Our alumni continue in influential positions in the federal government, corporations and academia. Dr. Reddy was recently elected president of ACOEM's Resident and Recent Graduate Section (2012-2013) and holds two positions in our regional ACOEM chapter (House of Delegates Delegate and Member of the Board of Directors for 2012-2013).

The program received a full five-year accreditation approval at the last ACGME site visit in November 2012. We continue to attract the most qualified applicants in the country, as evidenced by the fact that 10 of the 18 residents in our program during this time had either OPSF or military scholarships.

Results and Discussion: Biomarkers of Occupational Exposure and Susceptibility (BOES)

Director: Paul Strickland, PhD

Background and Program Objectives

The BOES research training program was founded in 2000 with NIOSH support commencing in 2002. The rationale for the BOES program is to expand the opportunities for students to utilize state-of-the-art molecular and biochemical methods to measure biomarkers of importance in occupational health research. Application of these biomarkers spans the entire range of the exposure-disease continuum described below and leads to interdisciplinary research with other components of the ERC, as well as school-wide collaborations. The large size of the school and the strong emphasis on research makes this setting a unique environment for research and doctoral studies. The importance of collaboration and interdisciplinary research is well accepted in the department and the school. As a result, the school's faculty members are readily willing to assist students by serving as informal advisors, committee members, and by providing laboratory resources.

Development of this field has led to the concept of the "exposome," a measure of all exposures to an individual over their lifetime. NIOSH has recently identified three priority research areas for the "occupational exposome" (<http://www.cdc.gov/niosh/topics/exposome/>):

- Investment in and exploration of new technologies and tools to measure internal and external exposures
- Molecular epidemiology studies are needed to determine associations between exposures and disease
- Development and validation of biomonitoring techniques for both legacy and response monitoring

Our training program produces doctoral level professionals capable of contributing to these research areas. The purpose of this program is to provide interdisciplinary research training for PhD or DrPH degree candidates in the development and application of biological markers in human populations exposed to occupational and environmental hazards. Thus, the expertise and knowledge gained by program graduates is applicable in risk assessment, biomonitoring and surveillance, disease etiology, and the diagnosis and prevention of human diseases of occupational origin.

Graduates from the program are prepared to enter research, teaching, or regulatory careers in several venues including academic universities, research institutes, governmental health agencies, and international health organizations. BOES faculty have advised an average of six doctoral students per year over the past ten years in this program area, whereas these faculty advised an average of only three-to-four doctoral students prior to the beginning of NIOSH funding in 2002. More importantly, the BOES program has provided a more defined curriculum for these students and interaction with students and faculty with related interests through affiliation with an ERC.

Accomplishments over the Project Period

Our Biomarkers of Occupational Exposure and Susceptibility program had five graduates during the period July 1, 2007 and June 30, 2013, and we currently have five doctoral trainees in various stages of their degree programs. One of our current doctoral students is working with OEH and School of Medicine faculty to study environmental triggers of asthma, and another doctoral student is using biomarkers to study the relationship between heavy metals and albuminuria.

Over the course of the last grant cycle, we have made additions to the Biomarkers program curriculum to improve student training in genomics, proteomics and bioinformatics. All

students are now required to take *Environmental Health: The Molecular Basis* (187.632) which contains extensive coverage of recent technological advances in the molecular and genetic tools available to study toxicological problems including bioinformatics, proteomics, genomics, epigenomics, gene arrays, and transgenic animal models. For students undertaking research projects requiring extensive use of bioinformatics, proteomics, or genomics, two further courses are available: *Genomics* (260.605) and *Protein Bioinformatics and Structure* (260.655). More advanced courses are also available for those students wishing further training in bioinformatics: *PERL for Bioinformatics* (140.636), *Analysis of Biological Sequences* (140.638), and *Statistics for Genomics* (140.688).

The expansion and formal recognition of the BOES training program has contributed, in part, to the school's development of a joint interdepartmental MSc/PhD program in Molecular Epidemiology. Dr. Strickland played an instrumental role in the initiation of this program by serving on both the school-wide committee charged with founding the program and on several earlier committees that explored the potential and feasibility of such a program. Students in the Departments of Epidemiology, Environmental Health Sciences, Biochemistry & Molecular Biology, and Microbiology & Molecular Immunology, are eligible for the program—obtaining a PhD from one department and an MSc degree from one of the other departments listed.

Overall, we have continued to improve our course offerings and training, particularly in the areas of molecular and population genetics, and the newer “omic” technologies. This complements expanded research opportunities in the area of genetic susceptibility to diseases of occupational or environmental origin.

The accomplishments of this program are illustrated by the success of our students: one 2007 graduate studied “the relationship between bone mineral density, blood lead levels, bone lead levels, and the apolipoprotein E and vitamin D receptor genotypes. She has published two manuscripts on her doctoral research and was appointed as a safety specialist in the Occupational Safety and Health Bureau of the Department of Labour Protection in her native Thailand. She was subsequently promoted to the position of Labour Officer in the department and serves as one of three national representatives from Thailand to the Occupational and Safety Health Network of the ASEAN (Associations of Southeast Asian Nations); <http://www.aseanoshnet.org/index2.php?menu=page&id=6>.

Another student conducted an analysis of human and bacterial proteomes in which he examined effects of maternal smoking on the human proteome, and has published several manuscripts on this research. He was a postdoctoral fellow in the Department of Biological Chemistry of the JHSOM prior to becoming in the Bloomberg School of Public Health. As a senior staff scientist in the Department of Molecular Microbiology and Immunology, he continues to work on characterizing the human serum proteome and examining perturbations in the proteome due to exogenous exposures and infections. This work has future implications for using the serum proteome as an indicator of early effects of exogenous occupational or environmental insults and characterizing the occupational exposome.

Another graduate evaluated methods to assess dietary exposure to polycyclic aromatic hydrocarbons and heterocyclic amines. This work is important to occupational studies because it is necessary to account for dietary contribution to PAH exposure in order to adjust/control for this alternative exposure pathway. After working as a research coordinator for the National Children's Environmental Health Study for two years, she received the prestigious Sallie Rosen Kaplan Fellowship for Women Scientists in Cancer Research to work in the Occupational and Environmental Epidemiology Branch of the NCI. She has recently been appointed as an assistant professor in the Yale University School of Public Health, Environmental Health Sciences Department.

Another BOES student received an EPA STAR fellowship to support her research on the health effects of heavy metal exposures during pregnancy on maternal and infant health. This work is particularly relevant to potential workplace exposures during pregnancy, and she has

published several manuscripts on her research. Following her graduation from our program, she took a position as a postdoctoral scholar in the Department of Environmental Health Sciences at Case Western Reserve University with a joint appointment as coordinator of the Center for Environmental Health and Human Ecology at the Cleveland Museum of Natural History. Most recently, she was appointed as an assistant professor of occupational health sciences at Purdue University School of Health Sciences.

Another graduate studied abandoned coal mines and severity of diabetes in Pennsylvania. In this work, she used biomarkers of effect to characterize type 2 diabetes severity and progression. She is currently preparing several manuscripts on this work and is a postdoctoral fellow in the Department of Epidemiology of the Bloomberg School of Public Health, where she is studying the environmental and epigenetic causes of obesity.

The following are research topics of current students: the role of combustion products (PAHs) in the exacerbation of asthma; the risk of methicillin-resistant *Staphylococcus aureus* in relation to animal feeding operations in Pennsylvania (this student was selected to become a Hopkins Sommer Scholar this year, joining other doctoral students in the school in this prestigious leadership-oriented program and serving as an example of the opportunity to leverage NIOSH funding for student support); and urinary biomarkers of arsenic exposure to assess the association of arsenic exposure and chronic kidney disease in Native Americans.

A list of BOES faculty and student publications is presented in Appendix B. We believe this list—in which publications of past and current program graduates are listed separately from faculty-only publications—demonstrates sound productivity by our graduates. BOES faculty and students had a total of 75 publications during this funding period.

Results and Discussion: Occupational Injury Epidemiology and Prevention (OIEP)
Director: Keshia Pollack, MPH, PhD

Background and Program Objectives

In 1990, the ERC expanded to include the newly developed Occupational Injury Epidemiology and Prevention program. Professor Susan Baker directed the program until the beginning of this grant period, when Dr. Keshia Pollack became co-director. Dr. Pollack then became the director in July 2009, and she was also promoted to the rank of associate professor during this grant period. The primary focus of the OIEP program has always been to train occupational injury prevention researchers and educators using the public health model. Thus, OIEP training is offered only at the doctoral level (PhD, ScD, DrPH). In 2001, we applied for and received supplemental funding through 2007 under the new NIOSH training initiative that recognized the need for researchers in this field. With increased funding, we built a program of recognized stature and productivity. We were able to attract outstanding leadership and trainees. Unfortunately, the cessation of supplemental funding and our return to the status of an allied program in 2007 reduced the resources to support trainees. Despite this change in funding six years ago, we have continued to attract excellent trainees and to graduate trainees who become leaders in the field.

Accomplishments over the Project Period

OIEP faculty and students have achieved some noteworthy accomplishments, including:

- Professor Baker continues to conduct critical research in the area of transportation safety, specifically that related to aviation.
- Dr. Pollack's research contributions have included the areas of: motor vehicle crashes in the U.S. Army; risk assessment and injury prevention among career firefighters; health, wellness, and safety among volunteer firefighters; and injuries to athletes. She is also developing expertise in transportation research and policy, and she has new research in preventing pedestrian- and bicycle-related injuries.
- Renan Castillo does research related to return to work after back injury and measurement of post-surgical pain in trauma patients.
- Professor Baker received the Champion award from the Society for Advancement of Violence and Injury Research (SAVIR). Additionally, she received the Calderon Award, which is one of the greatest honors in the field of public health. She was the first award recipient to have a focus in injury prevention.
- OIEP director Dr. Keshia Pollack was awarded the APHA Injury Control & Emergency Health Services Mid-Career Outstanding Service Award and was named co-chair of the 2013 National Injury & Violence Prevention Conference.
- For her expertise in occupational safety and health impact assessments, Dr. Pollack was appointed to the IOM committee on "A Framework for Assessing the Health, Environmental, and Social Effects of the Food System."

Program members have fostered relationships with several organizations that provide opportunities for research venues and collaboration. These include: the Applied Physics Laboratory of Johns Hopkins University; the U.S. Army Center for Health Promotion; Liberty Mutual Research Institute for Safety; the Office of the Chief Examiner of Maryland; the Maryland Institute for Emergency Medical Services and Systems; the Veterans Administration; the National Transportation Safety Board; the Daimler Chrysler-UAW Health and Safety Committee; and the Maryland Injured Workers Insurance Fund (IWIF).

Our most recent graduate is beginning a post-doctoral fellowship in occupational injury and disability research with Liberty Mutual and the Harvard School of Public Health. He has presented his paper on work-related distracted driving at the October Advances in Automotive Medicine meeting, and it was published in the Annals of that organization.

Several other graduates have secured faculty positions in universities, including Johns Hopkins University, Vanderbilt University, and Drexel University.

Results and Discussion: Continuing Education (CE) & Outreach

Director: Mary Doyle, MPH, RN, COHN-S/CM

Background and Program Objectives

The Continuing Education training program is an interdisciplinary effort coordinated across multiple departments at the Johns Hopkins Bloomberg School of Public Health and is a key component of the Johns Hopkins Education and Research Center for Occupational Safety and Health. The ERC's Continuing Education training program, directed by Ms. Mary Doyle, addresses these objectives by offering short courses and seminars to practicing professionals such as physicians, nurses, industrial hygienists, safety engineers, hazardous materials managers, and sanitarians. In addition, the CE program serves as a resource to private, state, local, and federal government personnel working in Region III and nationally to ensure occupational and environmental safety and health.

Accomplishments over the Project Period

In the past training grant period, the Johns Hopkins ERC Continuing Education training program trained 5,557 occupational health and safety professionals in a total of 207 courses. Under the leadership of Ms. Doyle, the CE program has provided excellent high quality continuing education programs through courses, seminars, and workshops that cover a multitude of broad and innovative topics. Ms. Doyle has developed new internal and external partnerships, and has increased the visibility of the program during the past grant period.

External Partnerships

Ms. Doyle has greatly strengthened the Continuing Education program by developing and expanding numerous external partnerships within Region III occupational safety and health professional organizations and federal, state, and local agencies and organizations, unions, and non-profit corporations. Examples of professional organizations can be seen below, with their respective events. Partnerships with these various organizations have enhanced the CE training program by providing speakers, trainers, members of the advisory board, course participants, and assessment of needs for course topics. Based on needs assessments within these professional organizations, Ms. Doyle has been able to collaborate with these groups to develop new training courses to meet their specific continuing education needs. She also served on several planning committees for local and regional meetings and conferences involving occupational health and safety professionals, and was invited to join the board of the Public Employees Safety Association (better known as PESA) in 2011. Our CE program collaborations with external organizations included:

- Co-sponsorship of bimonthly Abbott Global Occupational Health Services continuing education conference calls on a variety of OSH topics, since 2004
- *5th Annual Mid-Atlantic Regional Conference on Occupational Medicine (MARCUM V)*, October 13, 2007
- Maryland College of Occupational and Environmental Medicine (MCOEM) biannual conferences, since 2008
- *Regional Occupational Health Conference (ROHC)* in 2008, 2010, 2012, co-sponsored with four regional occupational health nursing chapters of AAOHN; in addition to traditional evaluations of this conference, we surveyed participants and non-participants to determine barriers to attendance, and results will inform future planning
- Co-sponsor Maryland Area Association of Occupational Health Nurses dinner meetings.
- Annual joint professional development conference with Chesapeake Sections of AIHA/ASSE, since 2008

- Fourteen-day *Principles of Environmental Health/ Registered Sanitarian Review Course* developed with the Maryland Department of the Environment (MDE) and the Maryland Board of Environmental Sanitarians, May 2008
- Annual Professional Development Conference (PDC) co-sponsored with National Capital Chapter of the Alliance of Hazardous Materials Professionals (NCC-AHMP), since 2009
- Co-sponsor, Metropolitan Area Construction Safety Association (WMACSA), May 12, 2011
- Co-sponsor, biannual PESA conferences for public OSH employees; the Johns Hopkins ERC CE Program was responsible for marketing, registration, course logistics, and course accounting
- The Johns Hopkins ERC had a contract with Delaware Division of Public Health to develop the "Delaware Healthy Homes Summit," which brought together academic researchers, federal agencies (HUD, EPA), non-profits, and healthcare practitioners to discuss the impact of the indoor environment on inhabitants' health (June 5, 2012)
- Delivered numerous National Center for Healthy Housing courses as a university Network Partner since 2005, such as: *Essentials for Healthy Homes Practitioners Course; IPM in Multi-Family Housing; Healthy Homes for Community Health Workers; and Code Inspection for Healthier Homes and Health Opportunities in Energy Audits*
- Assisted Healthy Housing Solutions, Inc., in obtaining OSH continuing education credits for the biannual *CDC National Healthy Homes and Lead Poisoning Prevention Training Center course* (2006 to 2010)
- The ERC CE program has co-sponsored the biannual *Mercer ORC Corporate Health Directors Network Conference* since 2010; this network of fortune 200 companies—primarily in the manufacturing, telecom, transportation, and energy sectors—discusses current and emerging corporate occupational health problems, practices, and solutions in a variety of formats; the ERC CE program is instrumental in identifying subject matter experts and obtaining CME credits for the conference
- Symposium on "*Occupationally-Related Distracted Driving*" co-sponsored by NIOSH in partnership with DOT, OSHA, and the Johns Hopkins CIRP; speakers included federal officials, private employers, technology firms, labor union representatives, and academia; this conference included live Web streaming, DVD recording, and a white paper was generated from the proceedings (April 18, 2011)
- "Quality Work, Quality Care: A State of the Art, National Conference for Home Care Stakeholders" (April 2, 2012) with FHI 360 (a Washington, D.C.-based non-profit), NIOSH, Pennsylvania Direct Care Workers Association, SEIU 1199, and a variety of academic institutions described below
- More recently, we developed an asthma education program for primary care practitioners in Delaware

Our partnerships with other academic institutions, particularly other Education and Research Centers and Training Project Grants (TPGs)—including: Virginia Tech; the University of Maryland School of Nursing; Georgetown University School of Nursing; the University of Illinois, Chicago; the Mountains and Plains ERC; the University of Washington ERC; the Northeast IPM Center at Cornell University; and Harvard University—have increased the visibility of the CE program and have enabled us to offer conferences and seminars that have attracted a broader group of occupational and environmental health professionals. Collaborations with these organizations were as follows:

- The ERC CE program invited Dr. Jeffrey Hickman from Virginia Tech Transportation Institute at Virginia Polytechnic Institute to present his research at the symposium on “Occupationally-Related Distracted Driving” (April 18, 2011)
- “Quality Work, Quality Care: A State of the Art, National Conference for Home Care Stakeholders” (April 2, 2012); the Johns Hopkins ERC CE Program collaborated with the following academic institutions on this conference: Georgetown University School of Nursing and Health Studies; the University of California, Berkeley School of Public Health; the University of Illinois at Chicago ERC; the University of Massachusetts, Lowell; the University of California, San Francisco; and the University of Maryland School of Nursing
- The Johns Hopkins ERC CE program invited noted researchers Gary Adamkiewicz from Harvard University and Allison Taisey from the Cornell University Northeast IPM Center to speak at the “Delaware Healthy Homes Summit” (June 5, 2012)
- The ERC CE program co-sponsored *Orientation to Sustainable Environmental Assessment* (July 30 through August 3, 2012), which was taught by adjunct faculty from the University of Illinois, Chicago ERC, federal officials (HUD, EPA), MDE, the Maryland Historical Trust, and others; we are currently developing an online offering of this course
- The ERC collaborated with the University of Maryland School of Nursing, the University of Washington, the Mountain and Plains ERC, NIOSH, and the U.S. Department of Veterans Affairs to develop the workshop “Designing the Age Friendly Healthcare Workplace” (September 7, 2012)
- For “Frontline Workers and the Worker Safety/Patient Safety Relationship” (October 25, 2012), the ERC collaborated with Georgetown University School of Nursing and Health Studies, SEIU 1199, the U.S. Department of Veterans Affairs, NIOSH, OSHA, the Agency for Healthcare Research and Quality (AHRQ), The Joint Commission, and the University of Illinois, Chicago ERC
- Ms. Doyle represented OEH nursing in the interdisciplinary Occupational Health and Safety Consortium
- To follow up our highly successful conference, “Frontline Hospital Workers and the Worker Safety/Patient Safety Relationship,” we will continue to work with our co-sponsor, Dr. Rosemary Sokas of Georgetown University, to develop safety climate strategies to improve worker health and patient health
- Through our CE collaboration with the Delaware Division of Public Health, we arranged for MPH student Loretta Khangura (ERC Occupational and Environmental Health Nursing program) to survey immigrant workers in the agriculture and poultry industries in Delaware as her Capstone project
- We have been working with Dr. Leslie Nickels at the NIOSH Office of the Director and with the World Health Organization on an initiative promoting occupational health in primary care and community health settings
- OEH faculty met with officials of the University of Public Health in Yangon, Myanmar, to discuss assistance to their occupational hygiene program. We are planning a course for faculty and government scientists there.
- Our *Fundamentals of Occupational Health* course has recently been adopted for an ongoing project to develop faculty capacity in the School of Environmental Health in Liberia

Internal Partnerships

Within the Johns Hopkins Bloomberg School of Public Health, Ms. Doyle has established links between the ERC and several other important centers relevant to professional continuing education training. These centers include the Institute for Johns Hopkins Nursing, the MidAtlantic Public Health Training Center, the Center for Public Health Preparedness, the Center for Injury Research and Policy, and the Center for Public Health and Human Rights. Examples of continuing education offerings that have resulted from these partnerships are:

- Multiple nursing continuing education offerings co-sponsored with the Institute for Johns Hopkins Nursing from 2007 to 2008, until application costs became prohibitive (nursing CE credits are obtained from AAOHN, valid for two years)
- Courses co-sponsored with the Mid-Atlantic Public Health Training Center and offered on multiple occasions include: *Investigating Environmental Public Health Complaints*; *Empowering Individuals Healthcare Management*, and *Advanced Advocacy*
- Collaboration with the Center for Public Health Preparedness on 33 online modules and conference proceedings that offer CE credits for industrial hygienists and hazardous materials managers (attendees included occupational health nurses, safety specialists, and government personnel); presentations included: *Pandemic Flu*; *Crisis Risk Communication*; *Occupational Health Preparation for CBRNE*; *Emergency Risk Communication*; and *Incident Command Systems: Overview of Public Health Emergencies*
- Collaboration since 2009 with the Johns Hopkins CIRP to hold the *Institute for Injury Research and Policy Summer Institute*, taken for continuing education or academic credit (ERC OIEP Director Dr. Keshia Pollack serves as faculty on this)
- 2009 NORA symposium: "Making Their Voices Heard: Vulnerable Worker Populations," co-sponsored with the Center for Public Health and Human Rights, featuring: the film "Sugar Babies" about sugar cane workers and their families; discussion with the film's producer; a keynote speech on vulnerable workers by Dr. Rosie Sokas; presentations by PPRT recipients; and an exhibit by photojournalist Dr. David Parker

Response to Requests for Training and Consultation

Ms. Doyle and faculty in the CE training program also sought out training opportunities with local public health agencies and organizations, private companies, and international organizations to provide specialized training for specific occupational and environmental health professionals. Examples of these are listed below:

- Responding to a request from the Maryland Board of Environmental Sanitarians, we developed and directed a 14-day course, *Principles of Environmental Health/Registered Sanitarian Review*, for sanitarians-in-training. The course focused on competencies required for practice and to pass the state examination. We plan to develop a three-day review course to prepare students for the NEHA Environmental Sanitarian exam.
- Ms. Doyle participated in the Westat focus group on occupational health continuing education to contribute to the *National Assessment of the Occupational Safety and Health Workforce* (Westat, 2011).
- We regularly respond to requests for expert advice on occupational health issues by identifying resources within our OSH network. For example, when a neurosurgeon from Brazil posed a question about exposure to anesthetic gases, we referred the inquiry to the associate director of health, safety and environment at Johns Hopkins Hospital and assistant professor in the School of Medicine, who provided relevant protocols and other types of guidance.

- The ERC CE program has provided training and consultation to the Delaware Department of Public Health for three years, providing 20 healthy homes training courses and one major conference. This CE program is approved to grant nursing credits for Delaware courses.

New Course Development

Needs assessments from various occupational safety and health professional organizations have been instrumental in identifying course topics for the CE program. All proposed topics are discussed with the internal and external advisors of the program to develop the ERC CE training plan.

During this grant period, we utilized several new course methods (and plan to expand these efforts), especially in the area of distance education. Creating CDs or Web streaming videotaped conferences and seminars have significantly increased the numbers of occupational health and safety professionals who are able to access our trainings.

Although the foundation of our Continuing Education program is built on the various courses that will prepare occupational and environmental health practitioners for professional certification in their specialty areas, we are continually assessing which new and innovative courses are needed to keep practitioners current in the knowledge and trends key to their field. During the grant period, we developed several exciting new courses and seminars. Each has the appropriate continuing education credits for their specialty. The courses are outlined below under each academic program area.

Program Area: Occupational and Environmental Hygiene—

Co-sponsorship of the Chesapeake section AIHA annual professional development conference has greatly increased the ERC CE program's integration with the industrial hygiene community. Ms. Doyle coordinates the poster sessions during the conference, in which master's and doctoral students in the Environmental Health Engineering program have an opportunity to present their research. Lecture opportunities are available for students and junior faculty and are welcomed by the conference planning committee.

Although the funding for the Johns Hopkins Hazardous Substance Training CE program is no longer available from NIEHS, Ms. Doyle remains committed to the hazardous materials management professionals in the OSH community. The JHU CE program co-sponsored with the Potomac section of AIHA and the NCC-AHMP to hold their annual conference. Ms. Doyle continues to participate on the planning committee for the annual Hazardous Materials Management professional development conference held in February every year, and we will continue to co-sponsor the four-day *Essentials of Hazardous Materials Management* course as well.

The *Principles of Environmental Health/Registered Sanitarian Review* course was developed in response to requests from numerous sanitarians-in-training who were experiencing difficulty passing the State of Maryland Registered Sanitarian examination. In our 2008 course, students who took the review course had a 78.5% pass rate, while students who did not had a 38.5% pass rate on the state board examination. We are in discussions with the Maryland Environmental Health Directors regarding a new three-day *Registered Sanitarian Review Course*.

During this grant period, the JHU CE program held 28 National Center for Healthy Housing training classes for the Delaware Division of Public Health and the Delaware Healthy Homes Summit. Trainings will continue in the new grant year, as the JHU CE program signed a new contract in 2012 to provide education to primary care physicians in Delaware regarding asthma triggers in the home and additional healthy homes training classes.

After many successful years, the *Comprehensive Industrial Hygiene Review Course* was not offered during this grant cycle. The ERC course was offered for two years, but canceled due

to low enrollment. The Potomac Chapter has decided to offer the course biennially, so the ERC CE program will coordinate with the Potomac Chapter to offer the course in the years that they do not.

Program Area: Occupational and Environmental Health Nursing—

In addition to the course *Overview of Occupational Health Nursing*, which assists the occupational health nurse to prepare for the American Board for Occupational Health Nurses (ABOHN) Board certification exam, two other courses are considered core continuing education offerings for nurses: *Occupational Spirometry* and *Occupational Hearing Conservation*. While the courses are open to all, registered nurses and nurse practitioners are the predominant registrants in these courses. We will continue to offer them twice a year.

Since 2004, the JHU CE program, the Institute for Johns Hopkins Nursing, and—later—AAOHN and Abbott have co-sponsored a Web-based bi-monthly continuing education program open to Abbott Laboratories nurses as well as ERC students. Each session is one hour in length, and is recorded and available for 30 days after the session. Post-session evaluations are coordinated by the ERC CE program and completed via the Internet using SurveyMonkey.com.

Program Area: Occupational and Environmental Medicine—

During the beginning of the last grant period, the highly successful 5th Annual Mid-Atlantic Regional Conference on Occupational Medicine was held. Based on feedback that more frequent continuing medical education was desired, a new format was developed in 2008 by Ms. Doyle and ERC faculty in collaboration with the Maryland College of Occupational and Environmental Medicine (MCOEM), the local chapter of the American College of Occupational and Environmental Medicine. *Occupational and Environmental Medicine Update* is a half-day course that was offered twice a year, on Saturday, at the Bloomberg School of Public Health. Speakers were from a variety of settings, including private practice, government agencies, and academia. Continuing medical education (CME) credits were obtained from the School of Medicine, ACOEM, or the American Academy of Family Physicians (while ACOEM's provider privileges were suspended.) Each session addressed an average of three "hot topics" in the area of occupational medicine research or practice as identified by a needs assessment survey of MCOEM members.

The ERC co-sponsors the "*Mercer Corporate Health Directors Network Meeting*." As mentioned above, this network of Fortune 200 companies—primarily in the manufacturing, telecom, transportation, and energy sectors—discusses current and emerging corporate occupational health problems, practices, and solutions in a variety of formats. The biannual meetings are member-driven and discuss hot topics, best practices, research, and presentations by content experts. The ERC CE program identifies subject matter experts and obtains CME credits for the conference. ERC faculty often attend these meetings in order to network with the corporate occupational health community to assess their needs. Mercer also keeps us apprised of trends in the occupational and environmental health arena in the areas of legislation, regulation, policy, human resources issues, etc.

Program Area: Occupational Injury Prevention—

The Johns Hopkins Education and Research Center served as a network training partner with the National Healthy Homes Training Center to offer a multidisciplinary two-day *Essentials of Healthy Homes Practitioners Course*. This course brought together a wide variety of people who shared perspectives and experiences in a series of exercises that kept the training lively and engaging. The training complements hazard-specific training in lead-based paint, radon, mold, pests, and asbestos by identifying root causes of health problems in a home and linking them to housing problems related to ventilation, moisture, contaminants, and structural design. Ms.

Doyle participated in regular meetings and conferences with the National Center for Healthy Housing to develop and evaluate curricula for this course and plans for the center.

Annual conferences were co-sponsored with the Chesapeake and Potomac Sections of ASSE, which provides a rich opportunity to interact with the safety community. Ms. Doyle is also on the planning committee for the Annual Chesapeake Region Safety Council's Conference and Expo and provides guidance on topics, speaker selection, and continuing education credits. She was also invited to join the board of the Public Employees Safety Association (PESA) in 2011, and the CE program co-sponsors their biannual safety conferences.

The Johns Hopkins ERC and NIOSH partnered with OSHA, DOT, and the Johns Hopkins Center for Injury Research and Policy (CIRP) to convene a highly successful symposium "Occupationally-Related Distracted Driving," which was Web-streamed live and produced a white paper and DVD. ERC CE and Occupational Injury Epidemiology and Prevention program faculty were on the planning committee and helped identify key stakeholders in this important issue.

A one week intensive summer course, *Principles and Practice of Injury Prevention*, was (and continues to be) sponsored by the Department of Health Policy and Management through the Center for Injury Research and Policy in the Summer Institute. Faculty from the ERC have appointments in the Center for Injury Research and Policy and teach in this course.

Organized and innovative financial management was practiced over the duration of the last grant cycle in order to most efficiently utilize both ERC and other funding sources. Doing this has allowed the CE program to provide the most training courses to the widest audience of participants. Ms. Doyle instituted an array of measures and techniques to greatly improve overall course efficiency and to allow the greatest return for ERC and other funding support. During the last ERC grant period, Ms. Doyle's improvements included:

- Using her knowledge of the Johns Hopkins Bloomberg School of Public Health financial management systems to carefully track the flow of all funds to ensure that only properly incurred charges were paid and that all charges were correctly allocated, particularly if not the direct responsibility of the ERC CE training program;
- Finding the most effective means for obtaining the necessary supplies and materials required for all CE program training courses, including the practice of purchasing bulk food and beverages where appropriate, rather than incurring expensive catering services;
- Assessing the costs and benefits of each CE course, including carefully assessing the proper class size for profitability;
- Ensuring that all payments owed are collected, with the additional use of late fees to compensate for the extra costs of registering students late in the course planning cycle;
- Streamlining the registration process and utilizing free on-line registration through Google Docs to make course registration as easy as possible;
- Introducing the acceptance of credit cards to allow for flexibility in course payment, thus increasing the convenience and potential base of trainees thought to be the audiences for the ERC CE training program; and
- Obtaining salary support from an array of internal and external sources using the conference management capabilities that Ms. Doyle has developed within the CE training program.

All of these measures have resulted in the increased scope and size of the program and have made the CE training program more efficient and a better value for the funds expended.

Results and Discussion: Hazardous Substance Training (HST)

Director: Mary Doyle, MPH, RN, COHN-S/CM

Background and Program Objectives

The Continuing Education program in Hazardous Substance Training received initial approval and funding in July 2006 and was discontinued in 2012, when the NIH's National Institute of Environmental Health Sciences halted funding for this area. The HST program was an interdisciplinary effort within the Johns Hopkins Education and Research Center for Occupational Safety and Health and built on the strengths of the Continuing Education and Outreach programs. Faculty who played key roles in the HST program were sourced from the ERC core programs of Occupational and Environmental Hygiene, Occupational and Environmental Health Nursing, Occupational and Environmental Medicine, Biomarkers of Occupational Exposure and Susceptibility, and Occupational Injury Epidemiology and Prevention, as well as from other specialty areas such as Environmental Health Engineering.

All occupational health and environmental personnel must be adequately prepared to evaluate, manage, and or/or handle hazardous substances and natural disasters based on their level of training. The HST program provided public health professionals from a variety of sectors with the skills needed to develop strategies to protect persons, property, and the environment. The terrorist attacks of September 11, 2001 and natural disasters such as Hurricane Katrina demonstrate the relevance of hazardous substance training to public health. In response to such events, we developed a plan for continuing education training that addressed variable needs across sectors. This HST program built on that plan, as well as the past training experience of this ERC.

The HST program had the following long-term objectives:

- Develop and implement a program of instruction to take place during the grant period;
- Coordinate training activities with agencies responsible for cleanup, enforcement and training of personnel who deal with hazardous substances;
- Implement Web-based modules, short courses and continuing education programs for private, state and local health and environmental professionals involved in evaluating, managing and handling hazardous substances; and
- Conduct evaluations to demonstrate that the regional needs for training professionals are met.

Accomplishments over the Project Period

Accomplishments of the HST program are listed below:

- The HST program partnered with local sections of the Academy of Certified Hazardous Materials Managers (ACHMM) to develop professional continuing education programs. Additionally, HST program faculty attended the Academy of Certified Hazardous Materials Managers chapter meetings to do a needs assessment of local chapter members in Washington, D.C. and Baltimore. Additionally, we assisted in the development of a new Baltimore chapter of ACHMM.
- During the initial year of the previous grant cycle, we developed several close working relationships and partnerships that enhanced our opportunities to present training. For example, we worked closely with Debora Jones, a regional expert in the area of health and safety who has served on the board of directors of the Chesapeake Region Safety Council. We also developed a partnership with the Cecil County Health Department of

Maryland to develop a successful personal protective equipment course to its employees.

- Development of courses specifically geared toward regional public employees, such as *Hazard Communication Awareness* and *Workplace Violence Awareness*.
- Development of a one-day *Confined Space Awareness Course* and a two-day *Permit Required Confined Space Training* course. HST scholarship funds allowed us to offer these trainings to state, local and municipal occupational and environmental health professionals at a substantial discount.
- Annually, Ms. Doyle collaborated with the Washington, D.C. and Maryland chapters of the Alliance for Hazardous Materials Professionals and with the D.C. chapter of ASSE on two significant continuing education events. First, the ERC co-sponsored a one-day professional development conference, "What's New in Waste Management," providing program planning, speakers, logistic support, and scholarships to state, local, and municipal professionals who attended this PDC. Secondly, this collaboration also resulted in the co-sponsorship of the three-day *Essentials of Hazardous Materials Management* course for occupational safety and health professionals who wished to prepare for the Certified Hazardous Materials Manager exam credential offered by the Institute of Hazardous Materials Management.
- In 2009, Ms. Doyle successfully obtained Certificate Maintenance Points from the Institute for Hazardous Materials Management and Clock Hours from the Maryland Board of Sanitarians for 37 on-line continuing education modules and conferences developed by ERC faculty. Most modules ranged from one to four hours, thus providing short, no-cost opportunities to obtain continuing education credits necessary to maintain professional certifications.
- Our HST course, *Investigating Environmental Public Health Complaints*, co-sponsored with the MidAtlantic Public Health Training Center, was so well-received its first year, 2009, that we could not accommodate all interested students. We repeated this course on January 28, 2010 in Annapolis, Maryland, to make it more accessible to those working on the Eastern Shore of Maryland.
- We developed close working relationships and partnerships, both internal and external, which enhance our opportunities to present training. For example, we worked closely with the Johns Hopkins Public Health Preparedness Programs to offer continuing education training on all hazard preparedness, and with the Mid-Atlantic Public Health Training Center to develop continuing education for public health professionals such as registered sanitarians, nurses, and environmental health practitioners.
- The HST program partnered with state agencies such as the Maryland Department of the Environment, Maryland Occupational Safety and Health (MOSH), the Maryland Environmental Health Directors and Health Officers, local health departments in Region III, and with local professional organizations such as AHMP, AIHA, AAOHN, and ASSE to identify needs and provide training. HST scholarship funds allowed us to offer these training to state, local and municipal occupational and environmental health professionals at a substantial discount.
- Ms. Doyle partnered with the American Training Center and associates to provide HAZWOPER (hazardous waste operations and emergency response) training to local, state, and municipal professionals at no cost. As training funds for public employees have been especially tight in the current economic climate, this course was marketed to the local Environmental Health Directors, the Maryland Department of the Environment, and MOSH.
- During this funding period, the Johns Hopkins ERC's HST program trained a total of 1, 011 trainees from diverse backgrounds in the nursing, hygiene, and safety professions.

All in all, the Johns Hopkins ERC's HST program developed a total of 31 courses and trainings. Although the ERC's HST program has been officially discontinued, our CE program does continue to offer some HST courses, and the Johns Hopkins Center for Public Health Preparedness still hosts some of the online modules that we cosponsored (<http://www.jhsph.edu/research/centers-and-institutes/johns-hopkins-center-for-public-health-preparedness/training/online/>). A complete list of our HST courses is included in Table HST-1 in Appendix B of this report.

Results and Discussion: Pilot Project Research Training Program (PPRT)
Director: Peter S.J. Lees, PhD, CIH

Background and Program Objectives

Our highly successful Pilot Projects Research Training program, directed by Dr. Peter Lees, has been in place since FY 1999 and has supported a grand total of 82 pilot projects since its inception. The goal of the PPRT program is to enhance the research training capacity of the Johns Hopkins Education and Research Center and other institutions with occupational health and safety training programs in Region III through direct support of pilot project research activities. The PPRT training program is intended to support small research projects being conducted by pre-doctoral students, post-doctoral fellows, or junior faculty as part of the ERC research training program or as part of other research training programs in occupational safety and health in Region III. Funds are used to support short-term research projects to explore the feasibility of new or improved areas of study, as well as to enable new investigators to obtain data to successfully compete for support through conventional research funding sources. Specific allocation of funds depends on the merits of the proposed projects and needs that are not covered through other means. The mechanism for evaluation of merit and need was modeled after the National Institutes of Health process. The program fosters interdisciplinary interaction and promotes collaboration with Training Program Grantees (TPGs) and other institutions with occupational health and safety research training programs in Region III.

The following are examples of research activities that are appropriate for Pilot Projects Research Training program funding:

- Collection of preliminary data in support of a subsequent extramural grant application
- Feasibility studies to test and develop new methods, approaches, and applications
- Travel costs to field sites for data collection
- Data entry or computer costs for data analysis
- Costs for printing and reproduction of data collection instruments

Accomplishments over the Project Period

During this grant cycle, we have continued our efforts to disseminate information regarding the program and the process for participation to a wider audience, and awareness of our PPRT program grew considerably both within the Johns Hopkins ERC and within other institutions. We now regularly receive inquiries—both from the existing cadre of awardee institutions and, increasingly, from additional institutions such as Morgan State University—and we are experiencing increased participation within the region. Thus, the process for proposal review and funding has become more competitive.

During the period July 1, 2007 through June 30, 2012, 64 pilot project applications were received and 22 projects were funded.

Researchers from seven different institutions have received awards during the project period: West Virginia College of Engineering, Towson University, the University of Maryland Schools of Medicine and Nursing, Virginia Polytechnic Institute and State University, the University of Delaware, the University of Pennsylvania Schools of Medicine and Nursing, and the Johns Hopkins Bloomberg School of Public Health. These institutions represent three of the four regional TPGs with graduate OSH programs and all of the states within Region III, except the District of Columbia. Thus, we feel that the program has enhanced the training capacity of other institutions. The distribution of awards by institution and recipient category is presented as

Table PPRT-1 in Appendix B. Interest in the program continues to be strong among eligible investigators and institutions.

During this project period, the program has supported research conducted by student and faculty investigators from occupational and environmental medicine (three), occupational and environmental hygiene (eight), occupational and environmental health nursing (five), occupational injury prevention and ergonomics (four), and others (two), and the topics have represented at least nine of the ten NIOSH sector priorities (see Table PPRT-2 in Appendix B). A complete list of the 22 pilot projects funded during the project period is presented as Table PPRT-3 in Appendix D.

In summary, the PPRT program has, during this project period, demonstrated success in achieving all objectives. It has reached and supported investigators from all core OSH disciplines, both within and external to Johns Hopkins, and the number of junior faculty awards suggests that research training capacity is being enhanced in Region III. Support for pre-doctoral students has helped expedite their progress and decrease their time to completion (and consequent expenses related to time and funding).

Conclusions

The Johns Hopkins ERC continues to carry out its mission to provide an integrated, interdisciplinary approach to training researchers and practitioners in the field of occupational safety and health in order to protect the health and safety of all working individuals. As the only ERC in Region III, this center fulfills regional and national needs through occupational safety and health practitioner and researcher training.

Non-Applicable Report Sections

The following report sections are not applicable to the Johns Hopkins Education and Research Center for Occupational Safety and Health:

- Inclusion of Gender and Minority Subjects
- Inclusion of Children
- Materials Available for Other Investigators

APPENDIX A: PUBLICATIONS

Occupational and Environmental Hygiene Faculty and Student Publications

[**Bold** = current or former OEH faculty; Underlined =OEH master's or doctoral students; double underline = OEH program PDFs]

1. Rivera-Mariani FE, Matsui EC, **Breyse PN**. Performance of the Halogen Immunoassay to Assess Airborne Mouse Allergen-Containing Particles in a Laboratory Animal Facility. *J Expo Sci Environ Epidemiol*. doi: 10.1038/jes.2012.76 (2012).
2. Berman JD, Fann N, Hollingsworth JW, Pinkerton KE, Rom WN, Szema AM, **Breyse PN**, White RH, Curriero FC. Health Benefits from Large-Scale Ozone Reduction in the United States. *Environ Health Perspect*. <http://dx.doi.org/10.1289/ehp.1104851> (2012).
3. Chau E, Galloway JF, Nelson A, **Breyse PN**, Wirtz D, Searson PC, Sidhaye VK. Effect of Modifying Quantum Dot Surface Charge on Airway Epithelial Cell Uptake In Vitro. *Nanotoxicology* doi:10.3109/17435390.2012.711862 (2012).
4. Clark KA, C O'Driscoll, CA Cooke, BA Smith, K Wepasnick, DH Fairbrother, **PSJ Lees**, and JP Bressler: Evaluation of the Interactions Between Multiwalled Carbon Nanotubes and Caco-2 Cells, *J Tox Environ Health, Part A*: 75(1): 25-35 (2012).
5. **Breyse PN**, Delfino RJ, Dominici F, Elder ACP, Frampton MW, Froines JR, **Geyh AS**, Godleski JJ, Gold DR, Hopke PK, Koutrakis P, Li N, Oberdörster G, Pinkerton KE, Samet JM, Utell MJ, Wexler AS. U.S. EPA Particulate Matter Research Centers: Summary of Research Results for 2005–2011. *Air Quality, Atmosphere and Health*. Accepted (2012).
6. Davis MF, Baron P, Price LB, **Williams D**, Jeyaseelan, Hambleton I, Diette GB, **Breyse PN**, McCormack MC. Dry Collection and Culture Methods for Recovery of Methicillin-susceptible and Methicillin-resistant Staphylococcus Aureus from Indoor Home Environments. *Appl Environ Microb*. Accepted (2012).
7. Wang T, Wang L, Moreno-Vinasco L, Usatyuk PV, Natarajan V, **Breyse PN**, **Geyh AS**, Samet JM, Garcia JG. Particulate Matter Air Pollution Disrupts Endothelial Cell Barrier via Calpain-mediated Tight Junction Protein Degradation. *Am J Respir Cell Mol Biol*. Accepted (2012).
8. Datta S, **Rule AM**, Mihalic JN, Chillrud SN, Bostick BC, Ramos-Bonilla JP, Han I, Polyak LM, **Geyh AS**, **Breyse PN**. Use of X-ray Absorption Spectroscopy To Speciate Manganese in Airborne Particulate Matter from Five Counties Across the United States. *Environ Sci Technol*. 46 (6):3101–3109 (2012).
9. Miranda J, Wipfli H, Shahida S, Avila-Tang E, Samet J, **Breyse PN**, Navas-Acien A. Secondhand Tobacco Smoke: An Occupational Hazard for Smoking and Non-Smoking Bar and Nightclub Employees. *Tobacco Control*. Accepted (2011).
10. Lee, NL, JM Samet, G Yang, M Zhou, J Yang, A Correa and **PSJ Lees**: Prenatal Secondhand Smoke Exposure and Infant Birth Weight in China. *Int. J. Environ. Res. Public Health*. 2012 Sep 26;9(10):3398-420.
11. Wang T, Lang GD, Moreno-Vinasco L, Huang Y, Goonewardena SN, Peng YJ, Svensson EC, Natarajan V, Lang RM, Linares JD, **Breyse PN**, **Geyh AS**, Samet JM, Lussier YA, Dudley S, Prabhakar NR, Garcia JG. Particulate Matter Induces Cardiac Arrhythmias via Dysregulation of Carotid Body Sensitivity and Cardiac Sodium Channels. *Am J Respir Cell Mol Biol*. doi:10.1165/rcmb.2011-0213OC (2011).

12. Apelberg BJ, Hepp LM, Avila-Tang E, Kim SR, Madsen C, Ma J, Samet JM, **Breyse PN**. Racial Differences in Hair Nicotine Concentrations among Smokers Nicotine and Tobacco Research. DOI10.1093/ntr/NTR311 (2011).
13. Williams DL, **Breyse PN**, McCormack MC, Diette GB, McKenzie S, **Geyh AS**. Airborne Cow Allergen, Ammonia and Particulate Matter at Homes Vary with Distance to Industrial Scale Dairy Operations: An Exposure Assessment. *Environ Health*. 10(1):72- (2011).
14. Tremblay NJ, Byung JJ, **Breyse P**, Katz HE. Digital Inverter Amine Sensing via Synergistic Responses by n and p Organic Semiconductors. *Advanced Functional Materials*. 21(22):4314-4319 (2011).
15. Robinson CL, Baumann LM, Romero K, Combe JM, Gomez A, Gilman RH, Cabrera L, Gonzalez G, Hansel NN, Wise RA, Barnes KC, **Breyse PN**, Checkley W. Effect of Urbanisation on Asthma, Allergy and Airways Inflammation in a Developing Country Setting. *Thorax*. 66(12):1051-1057 (2011).
16. Hansel NN, Matsui EC, Rusher R, McCormack MC, Curtin-Brosnan J, Peng RG, Mazique D, **Breyse PN**, Diette GB. Predicting Future Asthma Morbidity in Preschool Inner City Children. *J of Asthma*. 48(8):797-803 (2011).
17. Jachak A, Lai SK, Hida K, Suk JS, Markovic AN, Biswal S, **Breyse PN**, Hanes J. Transport of Metal Oxide Nanoparticles and Single-walled Carbon Nanotubes in Human Mucus. *Nanotoxicology*. DOI: 10.3109/17435390.2011.598244 (2011).
18. Mazique D, Diette GB, **Breyse PN**, Matsui EC, McCormack MC, Curtin-Brosnan J, Williams D, Peng RD, Hansel NN. Predictors of Airborne Endotoxin Concentrations in Inner City Homes. *Environmental Research*. 111(4):614-7 (2011).
19. Noel S, Saams J, Ong MJ, **Breyse P**, Diette G, Biswal S, Matsui EC. Opposing Effects of Nasal Epithelial NQO1 and HO-1 Expression on Upper and Lower Airway Symptoms in Adolescents with Asthma. *JACI*. 128(2):422-424 (2011).
20. Butz AM, Matsui EC, **Breyse P**, Curtin-Brosnan J, Eggleston P, Diette, G, Williams, D, Yuan, J, Bernert JT, Rand C. A Randomized Trial of Air Cleaners and a Health Coach to Improve Indoor Air Quality for Inner-city Children with Asthma and Secondhand Smoke Exposure. *Arch Pediatr Adolesc Med*.165(8):741-8 (2011).
21. Butz AM, **Breyse P**, Rand C, Curtin-Brosnan J, Eggleston P, Diette GB, Williams D, Bernert JT, Matsui EC. Household Smoking Behavior: Effects on Indoor Air Quality and Health of Urban Children with Asthma. *Matern Child Health J*. 15(4):460-8 (2011).
22. McCormack MC, **Breyse PN**, Matsui EC, Hansel NN, Peng RD, Curtin-Brosnan J, Williams DL, Wills-Karp M, Diette GB. Indoor Particulate Matter Increases Asthma Morbidity in Children with Non-atopic and Atopic Asthma. *Ann Allergy Asthma Immunol*. 106(4):308-15 (2011).
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Occupational and Environmental Health Nursing Faculty and Student Publications

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Occupational and Environmental Medicine Residency Faculty and Student Publications

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Occupational Injury Epidemiology and Prevention Faculty and Student Publications

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Principal Investigator/Program Director (Last, First, Middle): Agnew, Jacqueline

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APPENDIX B: TABLES/ILLUSTRATIONS/ETC.

Table OEH-1. Research funding for OEH faculty (active and completed), 2007-2012	
Agency	Title
NIEHS/EPA	Center for Childhood Asthma in the Urban Environment – Active (Breysse Co-PI)
NIEHS	Genetic Susceptibility to Asthma and Indoor Air Pollution in Peru – Active (Breysse and Williams Co-investigators)
HUD	Intervention Trial to Reduce Nitrogen Dioxide and Carbon Monoxide Concentrations in Baltimore City Homes – Active (Breysse Co-investigator)
NIOSH	Development of New Generation Gas and Vapor Sensors Using Organic Electronics – Active (Breysse PI, Rule and Williams Co-investigators)
NIOSH	Why Hospital Workers Catch the Flu? – Active (Rule Co-investigator)
JH-IGTC	Secondhand Exposure to Workers in Hookah Bars – Active (Breysse Co-PI)
US Navy	Update of Health Effects of Low-Level Radiation in Shipyard Workers – Active (Lees PI)
NIEHS	Center for Urban Environmental Health (Breysse and Rule co-investigators)
NIEHS	Validating Particulate Matter Monitors for Multiple Parameters - Active (Breysse and Williams Co-investigators)
NIEHS	Validation of Genomic Biomarker of Response to Environmental Tobacco Smoke - Active (Breysse and Williams Co-investigators)
NIEHS	Cookstove Replacement for Prevention of ARI and Low Birth Weight in Nepal - Active (Breysse Co-investigator)
EPA	Baltimore Chromium Study Update – Completed (Lees PI)
NSF/NIOSH/DOE	Physicochemical Characterization, Transport, Biological Response, and Occupational Exposure of Engineered Nanometal Oxides – Completed (Breysse Co-investigator)
CDC	Baltimore Healthy Homes Initiative – Completed (Breysse Co-investigator)
NIEHS	Domestic Endotoxin Exposure and Chronic Obstructive Pulmonary Disease (Breysse and Williams Co-investigators)
EPA	Particulate Matter Research Center – Completed (Breysse PI)

Table OEMR-1. Placement of OEMR Program trainees (with state location and/or sector of job position), 2007-2012

Academic OEM	Y Globina (NY); J Spector (WA; transferred)
Clinical OEM practice	O. Malomo (DC); S Sood (MD; internal and occupational medicine); J Tinch (TN); G Reddy (MD)
U. S. Armed Services	A Patterson (USN); C Grussendorf (USAF); S Madhavan (civilian employee at Naval clinic); E Duffy (USN); C Hardy (USN)
Government	J Eaton (DC; left program early due to her recruitment)
Corporate	M Ardaiz (DC; corporate position of federal agency)
Other	N Kalia completing MBA (did combined MPH/MBA and OEMR) but working part-time in OEM

Table HST-1. HST Courses

Certified Hazardous Materials Manager (CHMM) Exam
CHMM Review Course
CHMM Exam
Personal Protective Equipment (PPE) for All Staff
PPE for Rad Team
Workplace Violence & Hazardous Communication
Pesticides & Chesapeake Bay Watershed
Principles of Env Hlth
Confined Space Course
Professional Development Conf, "What's New in Waste Mgt"
Essentials of Hazardous Materials Manager (EHMM) Review Course
Investigating Env Pub Hlth Complaints
The New Certification Process for the Next CHMM Cycle
Ensuring Safe and Efficient Transport of Hazardous Materials Around the Globe
EHMM Prof Dev Conf
EHMM Review Course
Investigating Env Pub Health Complaints
NCC-AHMP Association: NCRP's New Estimates Ionizing Radiation
Occ Hlth Prep for CBRNE
Emergency Risk Communications for OHNs
Planning for Effective Crisis Risk Communication
Emergency Risk Communications for OHNs
EHMM HST PDC
Investigating Environmental Complaints
Crisis Risk Communications
Incident Command System

Table PPRT-1: PPRT awards by institution and recipient category, 2007-2012

Recipient Institution	Junior Faculty	Pre-doctoral Student	Post-Doctoral Fellow / Occ Med Resident	TOTAL
Johns Hopkins University	2	9	1	12
Other Universities	6	3	1	10
TOTAL	8	12	2	22

Table PPRT-2: PPRT awards by NORA sector group, 2007-2012

NORA Sector Group	No. of Pilot Projects
Agriculture, Forestry & Fishing	2
Construction	4
Healthcare & Social Assistance	5
Manufacturing	8
Mining (except Oil & Gas Extraction)	1
Oil & Gas Extraction	0
Public Safety	1
Services (except Public Safety)	3
Transportation, Warehousing & Utilities	1
Wholesale & Retail Trade	1

Table PPRT-3: PPRT Awardees, 2007-2012

Awarded 2006-2007

Name: Rebecca Clouse, RN, MS
Status: PhD Candidate, Department of Environmental Health Sciences, Johns Hopkins Bloomberg School of Public Health
Mentor: Jacqueline Agnew, PhD / Virginia Weaver, MD, MPH
Project title: *Measurement of NHANES Urinary Metals Panel in Korean Lead Workers*

Name: Christopher Coleman, PhD, MPH
Status: Assistant Professor, University of Pennsylvania School of Nursing
Mentor: N/A
Project title: *The Impact of HAART on the Functional Health Status of Employed Individuals with AIDS*

Name: Carrie D. Dorsey, MD, MPH
Status: Assistant Professor, University of Maryland School of Medicine
Mentor: N/A
Project title: *Human Breast Milk Biomonitoring: Detection of Hazardous Drugs in the Breast Milk of Oncology Nurses*

Name: Harry Hochheiser, PhD
Status: Assistant Professor, Towson University
Mentor: N/A
Project title: *Evaluating Menu Selection Task Performance of Blind Users of Screen Readers*

Name: Keshia M. Pollack, PhD, MPH
Status: Assistant Professor, Department of Health Policy and Management, Johns Hopkins University, Bloomberg School of Public Health
Mentor: N/A
Project title: *Ergonomic Hazards: An Exploratory Study of Personal Protective Equipment and Obesity*

Name: Julie Richman, MHS
Status: PhD Candidate, Department of Environmental Health Sciences, Johns Hopkins University, Bloomberg School of Public Health
Mentor: Alison Geyh, PhD
Project title: *Determining the Kinetics of Blood Mn after Exposure to Welding Fume*

Name: Deborah E. Young, MS
Status: PhD Candidate, Grado Dept. of Industrial and Systems Engineering, Virginia Polytechnic & State University
Mentor: Maury A. Nussbaum, PhD
Project title: *Evaluation of Engineering Control Technology for Drywall Sanding Operations*

Awarded 2007-2008

Name: Katherine Clark, MHS
Status: DrPH Candidate, Department of Environmental Health Sciences, Johns Hopkins Bloomberg School of Public Health
Mentor: Peter SJ Lees, PhD, CIH
Project title: *An in vitro Model of Human Intestinal Transport of Nanoparticles*

Name: Julie Richman, MHS
Status: PhD Candidate, Department of Environmental Health Sciences, Johns Hopkins University, Bloomberg School of Public Health
Mentor: Alison Geyh, PhD
Project title: *Determining the kinetics of blood Mn after exposure to welding fume*

Name: Amir Sapkota, PhD
Status: Assistant Professor, University of Maryland School of Public Health
Mentor: N/A
Project title: *Occupational Exposure of Bus Drivers to Volatile Organic Compounds (VOCs) and Particulate Matter (PM_{2.5})*

Name: Maria Tellez-Plaza, MD, MPH
Status: PhD Candidate, Department of Epidemiology, Johns Hopkins University, Bloomberg School of Public Health
Mentor: Ana Navas-Acien, MD, PhD
Project title: *Cadmium Exposure, Metallothionein Levels, and Kidney Disease in a General Motors Company Assembly Plant*

Awarded 2008-2009

Name: Whitney Austin, BA
Status: PhD candidate, Department of Health Policy and Management, Johns Hopkins Bloomberg School of Public Health
Mentor: Shannon Frattaroli, PhD, MPH
Project title: *The Impact of LEED Certified Green Building Design on Occupational Safety and Health*

Name: Jan Jaeger, RN, PhD
Status: Assistant Professor, University of Pennsylvania, School of Nursing
Mentor: N/A
Project title: *A Feasibility Study of Occupational Health and Safety and Emerging Nanotechnologies*

Name: Leora Vegosen, MHS
Status: PhD candidate, Department of Environmental Health Sciences, Johns Hopkins University, Bloomberg School of Public Health
Mentor: Patrick N. Breyse, PhD
Project title: *Occupational Exposures to Campylobacter jejuni and Autoimmune Peripheral Neuropathy in Cow Farmers*

Awarded 2009-2010

Name: Ronda Brewer, MD, MPH
Status: Occupational Medicine Resident, University of Pennsylvania, School of Medicine
Mentor: Judith Green-McKenzie, MD, MPH
Project title: *Characterization of Occupational Blood Born Pathogen Exposures in Health Care Workers at a University Hospital: A Three Year Retrospective Study*

Name: Victoria M. Pak, BSN
Status: PhD candidate, University of Pennsylvania, School of Nursing
Mentor: Jennifer A. Pinto-Martin, PhD, MPH
Project title: *Assessing Workplace Phthalate Exposures among Massage Therapy Students*

Name: Brandon Takacs, MS
Status: Assistant Professor, West Virginia University College of Engineering and Mineral Resources
Mentor: N/A
Project title: *Field Evaluation of a Newly Designed Miners' Helmet Equipped with Cap Mount Muffs*

Awarded 2010-2011

Name: David Swedler, MPH
Status: PhD candidate, Johns Hopkins Bloomberg School of Public Health
Mentor: Keshia Pollack, PhD, MPH
Project title: *Analysis of Felonious Homicide of Law Enforcement Officers*

Name: Dionne Williams, MPH
Status: DrPH candidate, Johns Hopkins Bloomberg School of Public Health
Mentor: Jacqueline Agnew, PhD, MPH
Project title: *Perceptions of Occupational Safety in Operating Rooms and Surgeons' Compliance with Sharps Safety Behaviors*

Awarded 2011-2012

Name: Shannon Carter, BS
Status: PhD candidate, University of Delaware, Department of Plant and Soil Sciences
Mentor: Donald Sparks, PhD
Project title: *Distribution and Speciation of Metals and Metalloids in Particulate Matter Emitted from Delmarva Poultry Operations*

Name: Airín D. Martinez, PhD
Status: Post-doctoral Fellow, Johns Hopkins Bloomberg School of Public Health
Mentor: Jacqueline Agnew, PhD, MPH
Project title: *Needs Assessment for the Development of an Occupational Health Education Program for Latinos in Baltimore*

Name: Ana Rule, PhD
Status: Research Associate, Johns Hopkins Bloomberg School of Public Health
Mentor: N/A
Project title: *Validation of a Sampling Method for the Preservation of Chromium (+6) in Airborne Samples*



Education and Research Center for Occupational Health and Safety
Jacqueline Agnew, PhD, Director

September 27, 2013

Mary Pat Shanahan
Grants Management Specialist
Centers for Disease Control and Prevention
Procurement and Grants Office
OD, Environmental, Occupational Health and
Injury Prevention Services Branch/Team1
626 Cochran Mill Rd
Pittsburgh, PA 15236-0070

Reference: T42 OH0008428 (Johns Hopkins University ERC)

Dear Ms. Shanahan:

Enclosed please find an original and two copies of the final progress report for the project period July 1, 2007 through June 30, 2013 of the above grant. Additionally, I am sending electronic versions by email to you and a copy to Mr. Robison. Please contact me with any questions.

Thank you for your support and attention.

Sincerely,

A handwritten signature in black ink, appearing to read "Jacqueline Agnew".

Jacqueline Agnew, PhD
Professor
Director, Johns Hopkins ERC