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9th Annual

PILOT RESEARCH PROJECT (PRP) SYMPOSIUM

October 2-3, 2008

University of Cincinnati College of Medicine

Kresge Auditorium

Thursday, October 2nd 1 pm—5:30 pm ◊ Friday, October 3rd 8 am—12:30 pm

PRP Keynote Speakers

"Environmental Risks of Respiratory Disease In Lower Income Countries"

William J. Martin, II, M.D.
Director, Office of Translational Research
National Institute for Environmental Health Sciences (NIEHS)
Thursday, October 2nd @ 1 pm

"Emerging Issues in Occupational Health"

Paul A. Schulte, PhD
Director, Education and Information Division
National Institute for Occupational Safety and Health (NIOSH)
Friday, October 3rd @ 8 am

Welcoming Remarks By
Noble Maseru, PhD, MPH, Cincinnati Health Commissioner
Camille Jones, MD, MPH, Assistant Cincinnati Health Commissioner

Podium and Poster Presentations by PRP Awardees

Pilot Research Training Program & Symposium

October 2-3, 2008 marks the University of Cincinnati Education and Research Center's (ERC) **9th Annual Pilot Research Project (PRP) Symposium** here at the University of Cincinnati Kresge Auditorium (located in the Medical Sciences Building). The purpose of the PRP is to increase the research capacity of research trainees and young investigators in occupational health and safety and to encourage those in related disciplines to pursue occupational health and safety research.

Under the administrative direction of Dr. Amit Bhattacharya, research proposals are solicited and peer-reviewed annually from qualifying faculty and graduate students from the **University of Cincinnati and the following PRP partnering institutions – Air Force Institute of Technology, Bowling Green State University, University of Toledo – Medical Science Campus, Central State University, Purdue University, University of Kentucky, Western Kentucky University, Eastern Kentucky University, Murray State University, Ohio University and Kentucky State University.**

At this symposium, the 2007-08 awardees will be presenting results of their research and the 2008-09 awardees will make poster presentations of their proposed work. This year's keynote speakers will be **Dr. William J. Martin, Director, Office of Translational Biomedicine, National Institute of Environmental Health Sciences (NIEHS)** who will deliver his keynote address on, ***"Environmental Risks of Respiratory Disease in Lower Income Countries"*** on **Thursday, October 2, 2008 at 1 pm. Dr. Paul A. Schulte, Director, Education and Information Division for the National Institute for Occupational Safety and Health (NIOSH),** will deliver his keynote address on ***"Emerging Issues In Occupational Safety and Health"*****,** on **Friday, October 3, 2008 at 8 am.** Both presentations will be given in the Kresge Auditorium, College of Medicine campus of University of Cincinnati. There will also be opportunities to speak with all of the presenters individually.

The University of Cincinnati's Education and Research Center is one of 17 such centers funded by the National Institute of Occupational Safety and Health (NIOSH) nationally. Dr. C. Scott Clark served as the director of the ERC until July 2008 when the reigns were passed on to Dr. Carol Rice. The University of Cincinnati ERC is based in the Department of Environmental Health within the College of Medicine. The purpose of ERC is to train professionals in the didactic and research skills necessary to lead the occupational safety and health disciplines. Results of research are translated into action through an outreach program and shared with professionals and practitioners in the region via continuing education.

Since 1999, the PRP program has allocated over $700 thousand dollars to support pilot research projects. These projects have served as a catalyst in bringing over $7.3 million in additional research support to the region from sources independent of the PRP program, such as, the National Institute of Occupational Safety and Health (NIOSH), United States Department of Agriculture (USDA), National Science Foundation and the Centers for Disease Control and Prevention (CDC). Additionally, the PRP also brought 19 new investigators from other fields of expertise to the area of occupational safety and health research.

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Symposium attendees are eligible for:

◊1 ABIH (IH) CM Point Approval #08-2385

◊ Meets BCSP criteria for continuation of certification credit

◊ 8.7 Continuing Education Contact hours for nurses are approved by the Ohio Board of Nursing through the OBN Approver Unit at the University of Cincinnati College of Nursing, Continuing Education Program (OBN-011-93). Contact hours are valid in most states.

The 9th Annual PRP Symposium is free and open to the public.
For more information about the PRP program, please contact
Dr. Amit Bhattacharya, PRP Program Director, at (513) 558-0503 or
Amit.Bhattacharya@uc.edu

KEYNOTE SPEAKER, THURSDAY, OCTOBER 2, 2008

William J. Martin, MD
Director
Office of Translational Biomedicine
National Institute of Environmental Health Sciences (NIEHS)

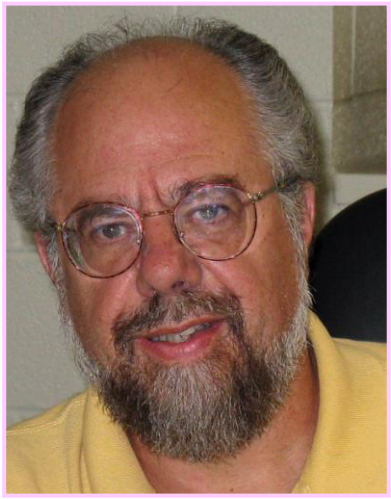
William J. Martin II, M.D. joined the National Institute of Environmental Health Sciences as Associate Director, NIEHS and Director, Office of Translational Research, in March 2006. In this capacity, Dr. Martin is facilitating the application of NIEHS supported research to improve human health. He also chairs the NIH Translational Research committee for the new Clinical Translational Science Awards (CTSA). In 2007, he received the NIH Director's award for these efforts.

Dr. Martin received his M.D. from the University of Minnesota in 1974, and completed his pulmonary and critical care training at Mayo Clinic in 1979. Following completion of his research training in the Pulmonary Branch at the National Heart, Lung and Blood Institute, he joined the staff of Mayo Clinic as a clinician-investigator in 1981. While on faculty at Indiana University, Dr. Martin recently served as a Health Policy Fellow, United States Senate, Labor and Human Resources Committee in 1995.

He also served as the Director of Pulmonary and Critical Care at Indiana University for twelve years before becoming the Executive Associate Dean for Clinical Affairs at the University's School of Medicine. Dr. Martin recently served as the Dean of the University of Cincinnati College Of Medicine and is a past president of the American Thoracic Society.

He has authored more than 130 research and clinical papers, and has been an NIH-funded scientist for the past 24 years. Dr. Martin has been an invited speaker for nearly 200 events, including testifying before the World Health Organization and U.S. Congress. Dr. Martin has received numerous awards including the Sagamore of the Wabash, the highest award presented to a citizen of Indiana by the Governor of In*diana.*

KEYNOTE SPEAKER, THURSDAY, OCTOBER 3, 2008



Paul A. Schulte, PhD

Director
Education and Information Division
National Institute for Occupational Safety and Health (NIOSH)

Paul A. Schulte, Ph.D., is the Director of the Education and Information Division (EID), and Manager of the Nanotechnology Research Center for the National Institute for Occupational Safety and Health (NIOSH). EID is responsible for developing the technical basis of many of NIOSH policy documents, managing the website, conducting quantitative risk assessments, and conducting research on the effectiveness of training.

Dr. Schulte earned a B.A. from the University of Toronto, and a M.S., and Ph.D. from the University of Cincinnati. Dr. Schulte started his career as an epidemiologist with NIOSH and later became Chief of the Screening and Notification Section, Industry Wide Studies Branch in the Division of Surveillance, Hazard Evaluations, and Field Studies (DSHEFS). He has over 35 years experience in particle and fiber research and control. Dr. Schulte has conducted extensive research on occupational cancer and various other occupational diseases.

He is the co-editor of the textbook entitled, "Molecular Epidemiology: Principles and Practices." He has served as guest editor of the Journal of Occupational Medicine and the American Journal of Industrial Medicine, the Journal of Rural Health, and was on the initial editorial board of Cancer Epidemiology, Biomarkers and Prevention. He has served as a consultant to the World Health Organization, the International Agency for Research on Cancer, and various state and federal agencies. Dr. Schulte has authored and co-authored over 200 publications, presentations, abstracts, chapters, and editorials.

PODIUM PRESENTATION SCHEDULE

	Title	Speaker	Affiliation
	Thursday, October 2, 2008		
	Moderator: Henry Spitz, PhD		***University of Cincinnati***
1—1:30 pm	Welcome and Opening Remarks	Carol Rice, PhD, CIH ERC Director Shuk-Mei Ho, PhD Department Chair Dr. Noble Maseru, Health Commissioner Dr. Camille Jones Assistant Health Commissioner Amit Bhattacharya, PhD, CPE, PRP Program Director	Environmental Health University of Cincinnati Environmental Health University of Cincinnati Department of Health City of Cincinnati Department of Health City of Cincinnati Environmental Health University of Cincinnati
1:30-1:35 pm	Introduction of Keynote Lecturer: William J. Martin, MD, Director, Office of Translational Biomedicine, NIEHS	Amit Bhattacharya, PhD, CPE PRP Program Director	Environmental Health University of Cincinnati
1:35—2:20 pm	Keynote Address: " Environmental Risks of Respiratory Disease in Lower Income Countries"	William J. Martin, M.D., Director, Office of Translational Biomedicine	National Institute for Environmental Health Sciences
2:20-2:30 pm	Keynote Q & A		
2:30-2:50 pm	Chemical Analysis of Firefighter's Garment Fabric	Vesselin Shanov, PhD	College of Engineering University of Cincinnati
2:50– 3:10 pm	Urinary 1-Hydroxypurene In Tank Workers Exposed to Crude Oil During Tank Cleaning	Nancy Hopf, MS	Environmental Health University of Cincinnati
3:10—3:30 pm	Partial Enclosures for Noise and Dust Control in Underground Longwall Coal Mining	Major Jeremy Slagley, PhD	Air Force Institute of Technology Wright-Patterson Air Force Base
3:30-3:50 pm	The Impact of Coping and Gender Role Identification on the Work-Family Interface	Erin Smith	Psychology Department Bowling Green State University
3:50—4:15 pm	Poster Session I and Break		
4:15-4:35 pm	Checklist Model to Reduce Dust Exposure in Small-scale demolition	Custodio Muianga, MPH	Environmental Health University of Cincinnati
4:35-4:55 pm	Evaluation of Adults' Perception of Slipperiness After Training Intervention	Thomas Herrmann, Ed D	Allied Health Sciences University of Cincinnati
4:55—5:15 pm	A Biomechanics Sensor for Measuring Friction Properties in Walking	Mark Schulz, PhD	College of Engineering University of Cincinnati
5:15-5:35 pm	The Impact of Injury Status of Pain Response During Physical and Mental Stress	Susan Kotowski	Environmental Health University of Cincinnati
5:35—7:15 pm	PRP Networking Picnic Sponsored by the Academy of Kettering Fellows		CARE/CRAWLEY Building & Patio

	Friday, October 3, 2008		
	Moderator: Steve Jex, PhD		***Bowling Green State University***
8:00-8:10 am	**Opening Remarks**	**Amit Bhattacharya, PhD, CPE PRP Program Director**	**Environmental Health University of Cincinnati**
8:10—8:15	**Introduction of Keynote Lecturer: Dr. Paul A. Schulte, Director,**	**Amit Bhattacharya, PhD, CPE PRP Program Director**	**Environmental Health University of Cincinnati**
8:15– 9:00 am	**Keynote Address: "*Emerging Issues In Occupational Safety and Health*"**	**Paul A. Schulte, PhD, Director, Education and Information Division**	**National Institute for Occupational Safety and Health**
9:00—9:10 am	**Keynote Q & A**		
9:10-9:30 am	**The Role of Human Factors and Ergonomics in Retirement Decision-Making Behavior**	**Diana Schwerha, PhD**	**Industrial Systems Engineering Ohio University**
9:30—9:50 am	**Examining the Effect that Tailored Messages Have on Intentional Physical Activity**	**Tracey Yap, PhD**	**College of Nursing University of Cincinnati**
9:50—10:10 am	**Understanding the Relations Between Intrusion and Health**	**Jason Kain**	**Psychology Department Bowling Green State University**
10:10-10:30 am	**Development of a Receptance Based Modeling Technique for Hand-Arm Vibration**	**Jay Kim, PhD**	**College of Engineering University of Cincinnati**
10:30—11:00 am	**Poster Session II and Break**		
11:00- 11:20 am	**New Lab-On-A-Chip Sensor for Worksite Assessment of Individual Manganese Exposure**	**Jin-Hwan Lee**	**College of Engineering University of Cincinnati**
11:20—11:50 am	**Genetic Differences in Response to Mn**	**Eric Kendig**	**Environmental Health University of Cincinnati**
11:50 am–12:10 pm	**Occupational Noise Exposure Assessment of South-Central Kentucky Farms**	**Emmanuel Iyiegbuniwe, PhD**	**Public Health Western Kentucky University**
12:10-12:30 pm	**Numerical Modeling of Pollutant Dispersal from Exhaust Systems**	**Urmila Ghia, PhD**	**College of Engineering University of Cincinnati**
12:30–12:40 pm	**Closing Remarks and Program Evaluation**		

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◊This course meets BCSP criteria for continuation certification credit

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POSTER PRESENTATION SCHEDULE

No.	Title	Author	University
1	Efficacy Study of a Nicotine Barrier Cream	Youcheng Liu, MD	Preventive Medicine and Public Health University of Kentucky
2	Immunoregulatory Responses in Trimellitic Anhydride Occupational Sensitization	Debajyoti Ghosh, PhD	Internal Medicine University of Cincinnati
3	Is Manganese Exposure A Risk Factor for Hearing Loss?	Tony Almazan, MD	Environmental Health University of Cincinnati
4	Transport of Pollutants Through Liquid-Gas Interfaces- A Numerical Approach	Urmila Ghia, PhD	College of Engineering University of Cincinnati
5	Identifying Environmental Influences on Obesity Risk Factors of Commercial Truckers	Lisa M. Turner, RN	College of Nursing University of Kentucky
6	Lab-On-A-Chip Sensor for On-Site Detection and Sizing of Nanoparticles	Ali Asgar Bhagat	College of Engineering University of Cincinnati
7	Work Survey Instrument Revision for Case Management Work	Jane Christianson, RN	College of Nursing University of Cincinnati
8	Tracking Toxic Gases Penetration Through Firefighter's Garment	Vesselin Shanov, PhD	College of Engineering University of Cincinnati
9	Applied Cognitive Task Analysis of the Bedside Nurse in the Critical Care Setting	Mary Catherine Lee, RN	College of Nursing University of Cincinnati
10	Evaluation and Development of a Silica Scavenging System for Cut-Off Saws	Bryan Hubbard, PhD, PE	Building and Construction Management Purdue University
11	Effects of Breathing Rate and Activity Level on Efficiency of Respirators	Kyungmin J. Cho, PhD	Environmental Health University of Cincinnati

Poster Sessions are held in the Medical Sciences Building (MSB)
(outside of Kresge Auditorium, E Level)

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◊This course meets BCSP criteria for continuation certification credit
◊ 8.7 Continuing Education Contact hours for nurses are approved by the Ohio Board of Nursing through the OBN Approver Unit at the University of Cincinnati College of Nursing, Continuing Education Program (OBN-011-93). Contact hours are valid in most states.

PODIUM PRESENTERS

Chemical Analysis of Firefighter's Garment Fabric

Shanov, V., Lee, L Schulz, M., Yun, Y.
Chemical & Materials Engineering, College of Engineering
University of Cincinnati

The quality of the garment is a crucial component that protects the firefighters on the field. Frequent exposure of the garment to the fire environment causes deterioration of the fabric due to chemical and thermal destruction. In this project, representative samples were analyzed by chemical analytical method to determine the absorbed in the fabric chemicals. EDS, IGA and XRF data revealed that the concentrations of sulfur, nitrogen, chlorine elements, which represent possible toxic containments, are much high in used garment fabric compared to new one. Other inorganic elements such as K, Ca, Ti were also found. TGA analysis detected about 5.8% residual substances at 900 ^{o}C which confirmed the presence of foreign elements in the fabric. The morphology and mechanical properties of the fabric had also been studied and the generated data provided valuable information about the deterioration mechanism caused by the absorbed chemicals in the exposed to fire garment. The new garment was stronger and more flexible than the used one. The fibers of the exposed fabric were studied by SEM and revealed peel-off, hairy and worn-out structure. Further studies are in progress which includes increased number of samples exposed to fire events for different periods of time.

Urinary1-Hydroxypurene In Tank Workers Exposed to Crude Oil During Tank Cleaning

Hopf, N.[1], Talaska, G.[1], Kirkeleit, J.[2], Moen, B.[2]
Department of Environmental Health, College of Medicine
University of Cincinnati[1], University of Bergen, Norway[2]

Background Off-shore production are performed on permanent oil platforms and production vessels. These vessels can move from a depleted oil well to a new location, and can store the crude oil in cargo tanks before it is offloaded and transported onshore. Crude oil contains polycyclic aromatic hydrocarbons (PAHs), a human carcinogen. Workers cleaning and maintaining the cargo tanks have PAH exposures from PAH accumulating in the sludge coating vessel walls and bottoms. Workers can be exposed to PAHs through ingestion, inhalation, and though skin. It is advantageous to use biological monitoring of PAH exposure over environmental monitoring since it estimates the internal dose from all routes of exposure. We measured the internal dose as urinary 1-hydroxy pyrene (1OHP), a metabolite of pyrene, a compound always present in the PAH mixture. Objectives (1) compare differences in mean (point estimate) post-shift and pre-shift urinary 1OHP levels between exposed and non-exposed workers, after including covariates such as smoking, job, and age. (2) among the exposed workers, model the relationship between post-shift urinary 1OHP levels and level of PPE use, after controlling for pre-shift 1OHP levels, smoking, job, and age and other variables. Methods Participants (n=42) provided urine samples pre-, post-, and pre-next day shift. Urine samples were analyzed using high performance liquid chromatography (HPLC) with fluorescence detection. Statistical analysis performed were ANCOVA and included in the model was pre-shift and covariates. Conclusion (1) Significant covariates in the model for post shift urinary 1OHP were exposure group (control, tank worker, process operator), 1OHP preshift levels, and age*exposure group interaction term. Mean post-shift 1OHP levels were significantly higher in the exposed workers compared to the controls, after controlling for age and pre-shift 1OHP levels. (2) Including respiratory protection in the model with only exposed workers gave a final model consisting of

exposure group, age, and pre-shift 1OHP level. Tank workers and process operators did not show significantly different post-shift 1OHP levels, after controlling for age and pre-shift 1OHP levels.

Partial Enclosures for Noise and Dust Control in Underground Longwall Coal Mining

Jeremy Slagley, J., Sweeney, D.
Department of Systems and Engineering Management, Air Force Institute of Technology
Wright Patterson Air Force Base, Ohio

Exposure to hazardous noise and dust levels above regulatory limits is common to many industrial processes performed by United States Air Force (USAF) personnel. Likewise, the US mining industry struggles with controlling hazardous noise and dust exposures in underground mining. Specifically, studies have shown that coal mine longwall shearer operators are routinely exposed to noise levels at 151 percent of the allowable dose and approximately 20 percent of the shearer operators exceed regulatory dust levels. To address these overexposures, this study investigates the use of a simple engineering control to reduce noise and dust exposure in longwall mining. An initial field test at an underground coal mine longwall shearer operation demonstrated a 178x86x0.635 cm rubber sheet held between the shearer operator and the cutting drum reflected the direct noise path, creating an average noise reduction of 3.8 ± 0.8 dB(A) at the operator's position. Because the field test showed positive results, an above ground full scale model of the underground shearer operation was developed to test the feasibility of mounting a permanent partial barrier on the longwall shearer. A partial and full barrier were then constructed and tested at the National Institute for Occupational Safety and Health Pittsburgh Research Laboratory longwall gallery test facility. The barrier achieved a 7.3 dB(A) maximum reduction in noise levels and a 96 percent reduction of respirable dust at a relatively low ventilation rate. Thus, not only may this control be effective at reducing noise and dust exposure, it may also reduce operating cost by enabling lower ventilation rates within longwall mining. By developing effective engineering controls in the harsh environment found in underground mining operations, this study may lead to investigation of more effective engineering controls in USAF processes involving high noise and dust levels.

The Impact of Coping and Gender Role Identification on the Work-Family Interface

Smith, E., Fritz, C., Adelman, M., Kain, J., McInroe, J.
Psychology Department, College of Arts & Sciences
Bowling Green State University

The aim of this project is to study the relationships between individual differences (gender role identity, coping style) and work and family life for single and cohabitating parents. Research indicates that single parents are a population at risk for experiencing negative effects of work on their family life (Allen, Herst, Bruck, & Sutton, 2000). Participants with incongruent gender role identities are predicted to show increased levels of strain when faced with maintaining both a career and a family. Characteristics of a person's job (e.g., social support, role stressors) were measured as predictors of a person's family life (e.g., life satisfaction, family satisfaction) and general well-being (e.g., physical health symptoms, burnout). Surveys were administered online to a nationwide single parents' network and via mail through daycares in Northwest Ohio. In the current sample of N=38 women, 58.0% of women were single or separated. The mean age is 39.7 (*SD* = 6.7), and on average, participants work 39.7 hours per week (*SD* = 9.5). The most common reports of childrearing responsibilities were 2 children (43.6%) living with the mother seven days per week (69.2%).

Preliminary correlations between role stressors (job role ambiguity, overload, and conflict) and family variables were statistically significant and negative for role overload and role conflict ($p < .05$), suggesting that conflicting and overburdening work assignments lead to lower reported satisfaction with one's life and family. Also, women who identified a strong commitment to their parent role reported increased psychological exhaustion and disengagement from work, and decreased life and family satisfaction. While social support from friends was associated with lower levels of exhaustion and disengagement, social support from coworkers and supervisors at work were related to lower levels of exhaustion and disengagement and higher levels of life and family satisfaction. Implications for future research are discussed.

Checklist Model to Reduce Dust Exposure in Small-Scale Demolition

Muianga, C., Davis, K.
Department of Environmental Health, College of Medicine
University of Cincinnati

Work practices can influence exposure, especially in small-scale operations conducted by mobile work crews. This study evaluated the use of good work practice control guidance sheets adapted from UK Silica Essentials guidance sheets by workers and supervisors in small-scale concrete and masonry demolition operations. A one-page employee silica task-based control guidance sheet for each of four demolition tasks and multiple-page silica control guidance for supervisors were developed. Interactive, hands-on worker training on these task-based good work practice controls and guidance sheets was developed. Feedback on the training and task-based good work practice control guidance sheets was elicited. Observations of work practices were made before and after training. Training was presented to 26 participants from two demolition crews. Participants showed gains in knowledge and checklists were used to document skill attainment. The quality of the training and usefulness of the material/skills was rated highly by trainees. Increased use of water to suppress dust and wet cleaning methods were documented following the training. Additional follow-up after training is required to determine long-term impact of the training on sustained changes in work practices, and to identify the need for refresher training. Respirable crystalline silica quantitative exposure assessment results are being analyzed and will be reported later.

Evaluation of Adults' Perception of Slipperiness After Training Intervention

Herrmann, T., Talbott, N., Murphy, J.
Department of Rehabilitation Services, College of Allied Health Sciences
University of Cincinnati

Background and Purpose: Falling, the perceived risk of falling, and alterations in gait and balance based on surface slipperiness have been the topics of numerous investigations. Little research has been done to examine the contribution of internal musculoskeletal control mechanisms that may contribute to preventing falls on slippery surfaces. The purpose of this pilot study was to determine if a program of lower extremity neuro-muscular training on slippery surfaces altered a person's ability to quickly and accurately perceive the slipperiness of an unknown surface.

Subjects and Methods: 12 volunteer adult subjects (9 female, 3 male) between 19 and 32 years of age were enrolled in the study. The subjects were divided into 3 groups, control, non-weight bearing training and weight bearing training. All subjects underwent an initial training session on surfaces of 5 different friction coefficients identified to them as surface 1 (least slippery) to surface 5 (most slippery). This was followed by a pre-test in which the subjects were presented with 3 of the surfaces and asked to identify

the surfaces by number after very brief contact. Z-force data via a force plate and surface EMG data from the hip girdle muscles were collected during the testing. The two training groups returned for 8 training sessions over a maximum of 4 weeks where they experienced movements across all 5 surfaces. All subjects returned for a post-test identical to the pre-test.

Results: There were no significant differences among the groups on the ability to recognize the slipperiness of surfaces during the pre-test or during the post-test. Within group analysis revealed no significant changes in the ability of the subjects to recognize surface slipperiness from pre-test to post-test. EMG data revealed that the most active hip girdle muscles during testing were the hip abductors of the stable limb and the hip adductors of the moving limb. Z-force data illustrated an unloading pattern of the moving limb that distributed body weight approximately 75% to the stable limb and 25% to the moving limb.

Discussion and Conclusion: A treatment of 8 training cycles, either in weight bearing or non-weight bearing, had no significant effect on the subjects' ability to recognize the slipperiness of contaminated surfaces when compared to control subjects. Among the subjects who were individually more successful at recognizing the surface slipperiness there was a pattern of proportionally higher EMG activity in the hip abductors of the stable limb and the hip adductors of the moving limb and proportionally less body weight on the moving limb. These parameters did not significantly change from pre-test to post-test, however, and likely represent an intrinsic movement and control pattern that made the individual innately better at sensing movement through neuro-muscular mechanisms.

A Biomechanics Sensor for Measuring Friction Properties in Walking

Schulz, M., Yun, Y. Shanov, V. Mullapudi, S.
Mechanical Engineering Department, College of Engineering
University of Cincinnati

The aim of this project was to develop a prototype wearable sensor to measure the forces generated while walking. Measuring the forces generated at the foot-ground interface would give us the necessary data to diagnose and predict several gait and safety problems. It was envisioned that the sensor could be built into shoes and the minimum coefficient of friction computed based on the measured forces.

A literature survey was performed but a suitable sensor could not be found to measure shear forces. It was decided to design our own sensor. Different smart materials were considered as sensor elements. Our first approach was to load carbon nanotubes into an elastomer to form a piezoresistive elastomer that changed electrical resistance with strain. A second sensor type was to spin carbon nanotubes into a thread which changed electrical resistance with strain. These sensors can be conveniently embedded within elastomer materials such as the soles of shoes to provide strain sensing in the material. Initial testing of the sensor materials alone was performed but these two materials needed significantly more development before they could be integrated into shoes. A third sensor material was evaluated – polyvinylidene fluoride (PVDF) which is a piezoelectric material that produces an electrical charge in proportional to the strain rate of the material. This sensor material does not have a static output, i.e. cannot measure static forces. This commercial sensor material in the form of a plastic film with wire leads was used for our initial testing. A similar piezoresistive film sensor can be used in place of the piezoelectric sensor if necessary to measure static forces.

A sensor design was still needed that could measure shear forces in walking. Thus the forces in walking were analyzed using the principles of engineering mechanics. This analysis led to the design of a normal/shear sensor that independently could measure normal and shear forces in walking. A configuration of three PVDF sensor films was developed to obtain the two measurements. The normal/shear sensor design was tested in the lab and initial data from the sensor will be presented in the talk. Future work is to use this sensor to develop a smart shoe that can measure friction and eventually control friction on demand. This smart shoe could reduce injuries for workers and military/first responders involved in walking or climbing on changing surfaces, e.g. dry or wet, loose or hard, and smooth or rough surfaces. The sensor might also be used to improve the performance and life of friction drive systems.

The Impact of Injury Status of Pain Response During Physical and Mental Stress

Kotowski, S.[1], Davis, K.[1], Dunning, K.[2]
Department of Environmental Health[1], Department of Rehabilitation Sciences[2]
University of Cincinnati

An estimated 80% of the working population will experience a low back injury and pain at some point during their lifetime, with 20% experiencing a secondary episode. In addition to the high prevalence, low back pain has a great impact financially, with direct and indirect costs reaching upwards of $95 billion each year. Previous research on low back injury risk factors has mainly focused on physical task parameters such as load magnitude, lift frequency, and moment, with a much smaller amount of research focusing on psychosocial factors such as job demands, task pacing, concentration, and stress. Most of this research has focused on how a healthy population responds to these factors, little is known about how responses change once an individual has been injured. Therefore, the purpose of this study was to determine how injury status impacts biomechanical (spinal loading), biological (hormone levels), and perceived pain responses to different types of stressors (physical and mental). Individuals with and without low back pain were recruited and completed two different lifting tasks. In the first task (physical) individuals alternated lifting a 15lb box to a conveyor located 90° to the left or right of the individual. In the second task (mental and physical) an eight digit code was placed on the top of the box. The individual added the 3rd and 5th digit to determine which destination to place the box – if the sum was odd the box was placed on the left conveyor, even was placed on the right conveyor. Subjective pain ratings, a task risk rating, heart rate and blood pressure were assessed pre- and post-test. Trunk kinematics were collected using a Lumbar Motion Monitor and muscle activity was collected on ten muscle pairs using EMG. Along with data from a force plate, moment arm monitor, and pelvic angle monitor, the LMM and EMG data was put into a biomechanical model to predict spinal loads at L5/S1. The results show that healthy individuals had significantly higher spinal loads when performing the mental and physical task (~20-45%) as compared to just the physical task. Interestingly, compression and lateral shear were lower (~20%) for individuals with LBP when they performed the mental and physical task as compared to just the physical task. Healthy individuals increased sagittal trunk motion (~15%) during the mental and physical task compared to just the lifting task, while slightly decreasing off-plane motion. Individuals with LBP significantly decreased off-plane trunk motions, while increasing sagittal motion during the mental and physical task. Individuals with LBP shifted muscle activity to upper back muscles (RLAT and LLAT) and away from the lower back muscles (RES, LES, RIO, LIO) when performing the mental and physical task as compared to just the physical task. Healthy individuals showed slightly overall greater co-activation during the mental and physical task. Individuals with LBP reported slightly greater pain during the lifting with mental task condition. Both healthy and LBP groups reported higher RPE and TRR ratings during the physical with mental task condition than the physical task alone, with the LBP group

having higher overall ratings. Counter intuitive to the hypothesis, the more complex condition was not more detrimental to the individuals with LBP. The differences in responses between the LBP and healthy groups may be due to the fact that individuals with LBP may be guarding.

The Role of Human Factors and Ergonomics in Retirement Decision-Making Behavior

Schwerha, D.
Industrial Systems Engineering, College of Engineering
Ohio University

The purpose of this study was to perform a pilot study in two types of industry to determine perceptions about work context and its role in retirement decision-making behavior. We developed a survey regarding retirement and retention decision-making behavior that is unlike other surveys about older workers and retirement because: 1) it examines the differences in perceptions about retirement and retention issues between managers and non-managers, and 2) it includes questions about work context and human factors as well as traditional industrial/organizational determinants of retirement decision-making behavior. Two industries were canvassed, a healthcare facility and a distribution center. Results of the study indicate that work context can be an important factor in a person's decision to remain with an organization.

Examining the Effect That Tailored Messages Have on Intentional Physical Activity

Yap, T., Davis, L.
Occupational Health Nursing, College of Nursing
University of Cincinnati

Although the benefits of physical activity are well known, most adults in the U.S.A. are relatively sedentary, with about 60% of adults not regularly physically active and 25% of those are not active at all. This level of inactivity places the population at risk, medically and financially, for many chronic diseases (CDC, 1999).

The purpose of this study was to test the effectiveness of tailored e-mail communications designed to increase intentional physical activity in a group of employees. The specific aims were: 1) to examine the messages' effect on stage movement progression for participants in either Contemplation or Preparation stage-of-change; and 2) to examine the messages' effect on increasing the workers' physical activity levels.

A synthesized theoretical model based on TTM and Maslow's Hierarchy of Needs (Yap & Davis, 2007) guided message development and provided a framework for understanding the process of increasing intentional physical activity. A quasi-experimental design (two groups, repeated measures) was used. Two manufacturing plants from a multinational company, served as study sites (n = 36 from intervention plant; n = 37 from control plant). The intervention group received tailored messages weekly for six weeks, and the control group recieved sham health messages. The dependent variables were: 1) movement to a higher level of the stages-of-change, measured by a staging questionnaire and 2) an increase intentional physical activity in the intervention group, measured by an accelerometer. Ordinal regression revealed a small effect size for participants in the combined Contemplation and Preparation stages, but a medium effect size for the Contemplation participants. A two-way repeated ANOVA for

steps by groups showed a steps main effect $\Lambda = .89$, $F(3, 63) = 2.37$, $p = .039$, and groups by steps interaction, $\Lambda = .87$, $F(3, 63) = 2.95$, $p = .019$.

The positive direction of the process of behavioral change, combined with the increase in overall physical movement shows promise for future workplace interventions. Theory will now be directed toward strengthening the needs level concept and refining the messages. Research will be directed toward increasing power and the length of the intervention.

Understanding the Relations Between Intrusion and Health

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Research on interruptions at work indicates that when people's primary work tasks are interrupted by other tasks, they report increased levels of anxiety and annoyance (Bailey & Konstan, 2006). Recently, Jet and George (2003) have proposed that a type of interruption known as intrusions, or interactions with other people that interrupt the continued progress of work, will have the same types of detrimental effects. The current study is testing this proposition by examining whether higher frequency, expectedness, and duration of intrusions predicts reduced health (physical symptoms, burnout, fatigue, and anxiety). Age is hypothesized to strengthen this relationship because older people take longer to recall what they were doing after interruptions (Edwards & Gronlund, 1998). Time pressure (insufficient time to complete a job-related task) is also hypothesized to strengthen the relationship because they already have insufficient time to complete a task.

The first step in conducting the current study was to develop a questionnaire on intrusions. Based on Jet and George's (2003) definition, the researchers wrote 29 items, gave the items to 16 people to solicit feedback, and modified the questions based on their feedback. 283 students who worked at least 20 hours a week filled in the questionnaire. The researchers conducted a confirmatory factor analysis to examine if the three subscales of the questionnaire (frequency, duration, and expectedness) could be differentiated empirically. Results indicate a sufficient fit for the three-factor model (Chi-Square = 1214.07 df= 374, RMSEA =.0892, NNFI = .902, CFI=.910). So far, we have collected data from 22 employees. Correlations were run because the sample is not high enough to analyze the hypotheses. Results indicate that the duration of intrusions is significantly related to the disengagement dimension of burnout ($r=.53$, $p<.05$), depression ($r=.78$,$p<.05$), anxiety ($r=.43$,$p<.05$), fatigue ($r=.57$,$p<.01$), physical symptoms ($r=.43$, $p<.05$), and negative affect ($r=.62$,$p<.01$). The expectedness and frequency sub-scales were not associated with any of the outcomes we measured. Data is continuing to be collected to test the hypotheses.

Development of a Receptance Based Modeling Technique for Hand-Arm Vibration

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Exposure to excessive vibration causes the work-related MSD. Hand-arm vibration syndrome (HAVS) is a major MSD that occurs to construction workers and miners. Current HAVS guidelines are developed based on population tests and other crude methods, a better and advanced procedure and related techniques for computational analysis of hand and arm vibration responses is needed. The aim of this

research was to develop a Finite Element Method (FEM) based numerical analysis model of the hand-arm system. And also to develop a recepatance based technique to assemble the individual submodels.

The modeling and analysis was conducted using non-linear finite element analysis software Abaqus 6.7. The fingertip was modeled using dimensions of a typical human index finger with basic anatomical substructures like bone, subcutaneous tissue, skin, finger nail and tendon, where tissue and skin are viscoelastic hyperelastic material. The simulation goes through a series of steps, starting with a static pre-compression followed by extraction of natural modes and frequencies and ending with steady-state dynamic analysis. The finger was subjected to normal and shear vibrations, as experienced from most hand-tools.

The result shows a significant damping variation dependent on frequency of vibrations, with lower frequencies getting easily transmitted through bones to rest of the structures whereas higher frequencies tends to localize and create high strain at the tip of the finger due to the nonlinear behavior inherent in the viscoelastic & hyperelastic properties of the tissue. This significantly affects the blood flow at the tip of the finger and is predicted to cause vibration white fingers with prolonged exposure.

This research provides a better understanding of HAVS and hand-arm model, to assess the risk of HAVS by numerical analysis. This work will enable developing a more accurate frequency weighting and better safety guidelines in future. This work resulted in a presentation at the 2nd American Human Vibration Conference held in Chicago, IL in June 4-6,2008.

New Lab-On-A-Chip Sensor for Worksite Assessment of Individual Manganese Exposure

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Manganese (Mn) is an essential element, yet it is neurotoxic in excess. The neurological consequences of Mn exposure have a dose-related continuum. Working environments in which Mn exposure can occur are many, including welding, agricultural workers, steel production, Mn mining, Mn alloy production, and refinery. At lower levels of exposure, epidemiological studies of Mn-exposed industrial workers reveal subclinical neurological signs consistent with early manganism. At high levels of exposure, Mn can produce a neuro-logic psychiatric disorder, manganism, which resembles Parkinsonian syndrome. These extrapyramidal and neuropsychiatric symptoms progress even after cessation of exposure. Thus, it is imperative to efficiently monitor Mn in an occupational setting. Currently, whole blood is the most reliable parameter for biomonitoring Mn exposure. Air Mn concentrations have correlated well with blood Mn levels. However, costs and time delays associated with blood collection and Mn analysis are substantial.

In this work, we developed a proof-of-concept lab-on-a-chip for rapid point-of-care/on-site electrochemical sensing Mn for assessment of biological exposure. The sensor was fabricated using bismuth as working electrode and Ag/AgCl as integrated reference. Electrochemical performance of the sensor was characterized by measuring oxidation reduction potential (ORP) of reference solutions and square wave stripping voltammetry (SWSV) of Mn standard solutions. The integration of microfluidics with this type of environmental sensor will permit rapid monitoring and in the future could be extended to

simultaneous monitoring various heavy metals. In our future work, blood analysis of workers exposed to manganese will be performed.

Genetic Differences in Response to Mn

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Exposure to divalent cations, such as Mn^{2+} and Cd^{2+}, has been suggested as an environmental factor in the etiology of neurodegenerative disorders such as Parkinsonism. Recent evidence suggests that olfactory transport from inhaled particulate and fumes plays an important role in the translocation of these metals into the brain. Previous studies have shown that Mn is transported into the brain via the divalent metal transporter, DMT1, encoded by *Slc11a1*, and that ablation of the transporter's activity reduces uptake of ^{54}Mn into the brain (Thompson et al., 2007). The genes, *Slc39a8* and *Slc39a14*, encoding the proteins ZIP8 and ZIP14, respectively, have been characterized as divalent cation transporters with the potential to transport metals known to be transported into the brain after intranasal exposure. Here we examine the expression, immunolocalization, and ^{54}Mn transport characteristics of ZIP8 and ZIP14 in the olfactory and respiratory epithelia of the mouse nasopharynx using genetically divergent mouse strains shown to differentially express ZIP8 in tissues sensitive to heavy metal toxicity in B6 mice. We found that, while mRNA levels are the same across strains, protein levels are dramatically reduced in C3H mice compared with B6 and BT3 mice. Our findings suggest a difference in translational or post translational regulation of the ZIPs, resulting in reduced protein levels in the C3H mice. Transport of ^{54}Mn to the olfactory bulb or whole brain did not differ; however, transport to the blood was elevated in the B6, and even more so in the BT3 mice. These results, combined with previous studies, suggest that ZIP8 and ZIP14 are responsible for Mn transport to the blood but not to the brain, and that DMT1 is the likely transporter for olfactory uptake of Mn to the brain.

Occupational Noise Exposure Assessment of South-Central Kentucky Farms

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A study of 21 randomly selected cattle, dairy, hog, and poultry farms was conducted among a sample of South-central Kentucky farmers during normal activities. The purpose of the study was to assess noise exposures and develop an intervention program for capacity building with a view to reducing and controlling noise-induced hearing loss. It is well documented that in agriculture, physical hazards such as occupational noise exposure result from the operation of farm machinery and equipment. Although hearing loss due to hazardous noise is preventable through the implementation of hearing conservation programs, many small farmers lack adequate protection. Reducing noise exposures among farmers in rural communities represents an important opportunity to demonstrate the benefits of preventing and controlling the health impact of noise-induced hearing loss. The project involved the use of hearing survey questionnaires and occupational exposure assessment. Personal and area noise measurements were made across a range of activities and producer groups. The exposure assessment was conducted using calibrated noise dosimeters and sound level meters in accordance with the requirements stipulated in the Occupational Safety and Health Administration (OSHA) Noise Standard (29CFR1910.95). Descriptive statistics from questionnaires and noise exposures were analyzed to evaluate relationships between noise, work history and farming activities. The results of this survey describe farmers actual and time weighted average (TWA) noise exposures. The poultry operation recorded the lowest noise levels (<85 dBA) while

the cattle, dairy and hog operations had the highest noise levels. The results of high TWA noise exposure levels (>85 dBA) ranged from 85.9 dBA (Dose = 56.5%) for a farmer that moved spreader truck and backhoe to 105.5 dBA (Dose = 861%) for a farmer that worked in packaging area. Of the 21 farmers included in this study, 8 (38%) exceeded the OSHA Action Level (AL) of 85 dBA for 8 hours, without regards for the use of hearing protection. Four (50%) of these 8 farmers also exceeded the OSHA Permissible Exposure Limit (PEL) of 90 dBA for 8 hours. The pilot data from self-reported questionnaires indicated that the rural farmers included in this study seldom or never use any form of hearing protection or noise controls and that an intervention program would be effective in increasing their awareness of agricultural noise and noise-induced hearing loss. The project identified key stakeholders and various intervention options including engineering controls, substitution and the use of personal protective equipment for use by small farmers. A successful hearing conservation program for small farmers would require federal and state government support, policy enforcement, education, motivation, and an effective use of hearing protection to prevent hearing loss in this high-risk population.

Numerical Modeling of Pollutant Dispersal From Exhaust Systems

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The goal of this research is to analyze Carbon Monoxide (CO) dispersal from watercraft exhaust systems. These systems issue gaseous products of combustion from under the hull of the watercraft into the water. Carbon Monoxide is a toxic component of this exhaust. The aim of the present study is to simulate CO dispersal in the water, using Computational Fluid Dynamics (CFD).

The research is pursued in three phases. In the first phase, the methodology employed in this research is validated/verified by application to the canonical problem of a single Jet In Cross Flow (JICF), with air as the single-component fluid. The JICF is selected for this purpose because of the similarity in its physical configuration to that of the watercraft exhaust system. The results obtained are shown to compare well with published data, and our model accurately captures all the flow features reported in the literature. This serves to establish the adequacy of our methodology which can then be used with confidence to guide the simulation of the present problem.

Watercraft exhaust systems include dual exhaust ports, and hence, the methodology used to simulate the single jet is next applied to a system of dual air jets. Results show a flow field with pronounced jet interaction – a phenomenon important in the design and control of systems employing multiple jets to optimize mixing. The results also demonstrate that, in the dual-jet configuration, the jets do not penetrate as deep into the cross flow as the single jet. This has important implications for the exhaust dispersal problem.

Finally, the watercraft exhaust system problem is simulated, and includes the effects of gravity and multiple phases - water and CO, in a dual-jet system. The simulation results show that the boundary layer formed beneath the watercraft hull traps the buoyant CO in its slow-moving fluid, thereby causing an accumulation of CO below the stern of the watercraft. The results obtained are useful in guiding modifications of the exhaust system configuration to achieve CO dispersal mitigation. One such modification, namely, increasing the jet to cross flow velocity ratio, R, was evaluated, and the results show a decrease in the CO accumulation beneath the stern of the watercraft as R is increased from 3.5 to

6.5. The numerical approach employed in this research is general and, hence, can be applied to other similar problems involving hazardous situations caused by toxic gases.

Poster Presentations

Efficacy Study of a Nicotine Barrier Cream

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Tobacco farming is an important industry in Kentucky, the southeastern region of the US and in many countries around world. Tobacco harvesting workers, particularly seasonal and migrant workers, are exposed through the skin to high level of nicotine during the handling of green tobacco products which cause them the green tobacco sickness or GTS. Estimated incidence can be from 1 to 9% and prevalence as high as 47%. GTS causes severe symptoms, significant discomfort and lost productivity in tobacco farming workers. Measures and strategies to control exposures and GTS involving avoiding the direct contact with wet green tobacco leaves, the use of chemical protective clothing and gloves and hand wash with soap and water may not be so feasible and practical due to the hot work environment. and busy work schedules. More research in finding feasible and effective exposure control measures is needed. This study proposes to develop and test the efficacy in the laboratory setting of a barrier cream that may significantly reduce the skin exposure to nicotine. The aims of this study are to: 1) determine the background level of the nicotine and its metabolite, cotinine, in the urine in healthy non-smoking college students; 2) evaluate the efficacy of a barrier cream in reducing skin exposure to nicotine by measuring the levels of urinary nicotine and cotinine in healthy non-smoking college students after the use of a barrier cream. A total of 30 healthy and non-smoking college students will be recruited for this study. All students will be tested for their urinary background levels of nicotine and cotinine. The students then will be randomly classified into two groups, alternatively receiving nicotine exposure through a NicoDerm patch as well as applying a barrier cream on skin underneath the patch. Urine samples will be collected after nicotine is released into the blood from the NicoDerm for 24 hours in both the barrier cream and non-barrier cream use groups. The samples will be analyzed for urinary nicotine and cotinine levels using gas chromatography. The effectiveness of the barrier cream in reducing nicotine exposure will be evaluated. The project is innovative in developing and evaluating a simple barrier cream as a new GTS prevention strategy, which if effecitive, will be further evaluated for its efficacy in reducing nicotine exposure and GTS in tobacco harvesting workers. The purposes of this study conform to NORA sector goals for agriculture; the results may be of significant impact on the improvement of current GTS preventive measures for the tobacco farming industry and provide a more feasible and effective method for reducing tobacco harvesters' exposure to nicotine and its health consequences.

Immunoregulatory Responses in Trimellitic Anhydride Occupational Sensitization

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Trimellitic Anhydrides (TMA) are widely used in the plastic and paint industries. Occupational exposure to air-borne TMA is known to be very sensitizing and can cause a number of respiratory health problems including asthma. Numerous industries currently utilize TMA for product production where worker safety is a concern. The immunological basis of TMA-mediated sensitization is not well understood.

Allergen sensitization and subsequent disease development are often explained as a hampered Th1/TH2 balance and a deficiency in Treg activation. Th2 cells which produce 'pro-allergic' or type-2 cytokines like IL4, IL5 and IL13, involved in IgE production, eosinophil differentiation and migration that are involved in allergen sensitization. More recently, Th17 cells, producing IL17 (a pro-inflammatory cytokine) have been found to also play a key role in allergic sensitization and disease pathogenesis.

To date, there is no report investigating Th1/Th2 balance and/or Treg activation in TMA-workers. We hypothesize that an altered TH1/TH2 balance and deficient Treg activation will predict whether TMA exposed workers become sensitized or tolerant to TMA in the workplace. Presently, TMA workers are monitored as part of an immunosurveillance program, which depends on measurement of serologic TMA-specific IgG, IgG4 and IgE, atopic status, smoking history and other demographic characteristics. However, this type of program is hampered by demographic diversity, level of TMA exposure, atopic status and the lack of immune markers that could identify workers early on at risk for developing sensitization and subsequent occupational disease. The present study will involve a cohort of workers including TMA exposed/non-sensitized, TMA exposed/IgG sensitized, TMA exposed/IgG and IgE sensitized and TMA non-exposed/non-sensitized groups. Th1 and Th2 cytokine levels will be assessed in blood cell culture supernatant by ELISA and within cells by flow cytometry. Regulatory T-cells will be identified as CD4+CD25+Foxp3hi using flow cytometry. We anticipate that there will be a gradient of Treg cell activation across the spectrum of TMA non-sensitized (maximal Treg cell populations) to TMA sensitized symptomatic workers (minimal Treg cell populations).

Is Manganese Exposure A Risk Factor for Hearing Loss?

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Manganese (Mn) is an essential metal that is neurotoxic with excess exposure. Hearing loss has been associated with Mn exposure but the relationship is uncertain. Recent studies have shown that Mn accumulates in mouse ear after systemic exposure, suggesting that Mn may be ototoxic. This proposed pilot study is a cross sectional analysis of the effect of environmental Mn exposure on auditory function in children. Mn exposure will be assessed for participants residing in high and low Mn exposed communities. Audiometry performance of the two groups will be compared. Identifying early hearing loss as a sensitive measure of Mn exposure creates an opportunity to prevent progressive auditory deficits and associated problems. This will warrant further occupational studies of Mn exposure and hearing loss.

Transport of Pollutants Through Liquid-Gas Interfaces – A Numerical Approach

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We propose to conduct a numerical investigation of the transport process involved when pollutants move across a liquid-gas interface as encountered in watercraft exhaust systems. Previous investigation into tracking pollutant dispersal from a watercraft exhaust system indicates the need for accurate modeling of the interface between the surgace of the water-body and the air above this surface. Exhaust gases like Carbon Monoxide (CO) diffuse into the air and get entrained into the watercraft due to the aerodynamics of the craft (station wagon effect), thereby posing an occupational threat to employees in the marine industry. In this study, we propose to use advanced CFD techniques to predict the transport of pollutants by convection and diffusion across a liquid-gas interface, and apply this prediction methodology to the problem of mitigating CO entrainment into a watercraft cabin.

Identifying Environmental Influences on Obesity Risk Factors of Commercial Truckers

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According to recent statistics, over half of adults in the United States are either overweight or obese. Previous studies involving commercial truck drivers have noted high prevalence rates of obesity in this population. The National Occupational Research Agenda (NORA), a research framework for the National Institute of Occupational Safety and Health (NIOSH), has identified trucker health as a priority area of research. Being overweight or obese potentially influences a trucker's ability to safely perform their job, which in turn could influence the safety of all those who share the road. The proposed study will provide baseline data for obesity risk factors in commercial truckers and for developing appropriate nursing interventions to reduce commercial truckers' risk for obesity. The purpose of this study is to examine the exercise and dietary habits in a sample of commercial truck drivers and to examine various components of the work environment of commercial truck drivers in relation to their risk for obesity. The specific aims of this study are (1) to identify the key obesity risk factors for a convenience sample of commercial truck drivers, (2) to describe the feasibility of regular exercise and healthy eating based on the opinions and experiences of a convenience sample of commercial truck drivers, and (3) to compare the availability of exercise rooms at truck stops by geographic regions of the country. This study will involve surveying a convenience sample (n=370) of commercial truckers about their obesity risks while traveling for their job. The variables that will be measured are the obesity risk factor questionnaire, body mass index, body fat percentage, and waist circumference. This study will add to the limited knowledge regarding the obesity risks of commercial truckers.

Lab-On-A-Chip Sensor for On-Site Detection and Sizing of Nanoparticles

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Nanoparticles are playing an increasingly important role in nanomanufacturing. New manufacturing methods are being developed, with focus on high yields and low costs. As the use of nanoparticles in manufacturing increases, a growing need is anticipated to detect and measure particles of nanometer scale dimensions in fluids. This is needed to control emissions of possible toxic nanoparticles and protect the workers and the industrial workplace during the production/manufacturing of nanoparticles or nanoparticle-enhanced materials. Recent studies have indicated that nanoparticles can enter the human metabolic system though inhaling, drinking, and digesting nanoparticle-containing air, water, and foods. Concerns have been raised that nanoparticles are able to exert adverse impact on human health and environmental systems due to their unique properties such as particle size which is an important parameter in nanoparticle toxicity. As the prevalence of nanoparticles in manufacturing increases, new approaches need to be developed to evaluating worksite safety and occupational exposure. To protect human health from nanoparticle pollution, separation and removal of manufactured nanoparticles after their application appear to be critical. Unfortunately, the traditional size-based separation approaches, such as centrifugation, electrophoresis, fractional crystallization, chromatography, and stirred-cell ultrafiltration, are complicated and expensive. Therefore, developing efficient and cost-effective separation methods that can offer a greater control of nanoparticle size distribution and be easily applied at larger scale is becoming increasingly important.

The *objective of this seed grant application* is to develop passive spiral microfluidic devices to size and separate particles of nanometer scale dimensions in fluids. We propose a new spirally-shaped microfluidic device (lab-on-a-chip) that separates mixtures of nanoparticles by exploiting the hydrodynamic and inertial differences between particles of different sizes flowing through the microchannel. We seek to understand both the fundamental and technical issues involved in the sensor design and operation in order to develop a portable device with arrays of spiral microchannels capable of separating nanoparticle mixtures over a wide dynamic range.

O Our interdisciplinary research team is the collaboration across two departments, namely Electrical Engineering and Environmental Engineering. Because of the complementary expertise, the research environment is especially conducive to successful completion of the proposed work.

Work Survey Instrument Revision for Case Management Work

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"Chronic diseases are the #1 cause of death and disability in the U.S. and patients with chronic diseases account for 75% of the nation's health care spending" (Thorpe, 2008). Case management for individuals with chronic illness has the potential to decrease these cost significantly. Case management roles and functions have changed dramatically in the last five years. The study of case management work is essential to identify models of case management that will direct organizational case management work in a way that effectively uses the skills, knowledge, competencies of case managers. This study is preliminary essential for studying case management work. The goal of this study is the revision and pilot testing of a work analysis instrument that will be used to study case management roles and functions. Data on work tasks, skills, knowledge, and competencies will be obtained through a series of focus groups of nurses and social workers performing case management functions in a medical center which has both inpatient and outpatient settings. Data will be qualitatively analyzed for the tasks, skills, and knowledge and these will then be compared to national norms reported by the Case Managers Society of America to identify any missing domains of work. Case management tasks will be identified for the Work Survey Instrument (WSI). Reliability and validity of the revised instrument will be assessed using a group of case managers. Future studies will include a work analysis of nurses and social workers providing case management services for individuals with chronic illnesses.

Tracking Toxic Gases Penetration Through Firefighter's Garment

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Firefighters are exposed to an extremely hazardous environment when going on a mission. A large number of organic and inorganic chemicals and toxic gases are frequently generated during the fire from burning furniture and construction materials. The quality of the garment is a crucial component that protects the firefighters in the field. Frequent exposure of the garment to the fire environment causes deterioration of the fabric due to chemical and thermal destruction. The specific aim of this project is to study representative samples from different layers of firefighter's garment after fire events and to analyze the absorbed chemicals. The generated data are expected to reveal the concentrations of toxic gases remained on each garment layers showing how they penetrate through the garment. In addition, the deterioration mechanism caused by the absorbed chemicals in a high temperature environment will be

studied. This research will provide critical information for the industrial garments manufacturer Lion Apparel Inc. in order to improve the overall protectively and wearability of the garments. The research will be conducted with the help and contribution of the Sycamore Township Fire Department in Cincinnati.

Applied Cognitive Task Analysis of the Bedside Nurse in the Critical Care Setting

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Five years after the Institute of Medicine annual report To Err is Human (2000), health care systems have failed to measurably reduce medical errors (Scalise, 2004). The Institute of Medicine continues to identify patient safety as a national problem in health care. An analysis of sentinel events in hospitals across the nation has identified delay in treatment as one of the top five reasons for health care's failure to impact patient safety. Delay in treatment has two components: institutional gridlock; and failure to recognize critical physiologic and psychosocial cues and patterns indicating a change in patient status that require timely intervention (Parks, 2007). This study of nurses in a naturalistic setting is essential to identify the factors, which influence nursing care decisions made at the bedside. This study is essential for studying nurse clinical decision-making. The goal of this study is to develop a list of the cues and patterns of patient response that experienced nurses attend to and identify the cognitive strategies used by experienced nurses when providing bedside care. Data on work tasks, skills, and knowledge will be obtained through a series of observations and semi-structured interviews of nurses performing bedside care. Data will be qualitatively analyzed for tasks, skills, knowledge and the cognitive processes utilized. Future studies will include a validation of the identified patient cues and development of targeted educational materials for nurses new to the care setting.

Evaluation and Development of a Silica Scavenging System For Cut-off Saws

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The overall aim of the study is to develop and evaluate a new application of existing ventilation technology to decrease exposure to respirable crystalline silica for cut-offing sawing and conforming to specific construction needs. The proposed control technology would provide local exhaust ventilation protection for workers sawing or working in close proximity to this operation. The evaluation of this new control approach will focus on collection efficiency, applicability for highway construction, and cost efficiency.

The first objective is to compare the effectiveness of the respirable silica dust control using the new technology to traditional dry and wet methods. The second objective is to identify the applicability of the proposed technology, as demonstrated during actual construction activities. Using actual field data will allow rigorous assessment of the proposed design in practice. The third objective is to compare managerial information such as relative implementation cost, maintenance cost, supplementary equipment cost, and labor costs. The purpose for comparing managerial data is to determine if the new technology would be comparable or more cost effective than wet methods.

Effects of Breathing Rate and Activity Level of Efficiency of Respirators

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A parametric evaluation of the effects of breathing rate and work activity level on workplace protection factors (WPFs) provided by two common types of respirators (an elastomeric respirator and an N95 filtering facepiece respirator) will be conducted through laboratory and field experiments. First specific aim is to evaluate the effects of breathing rate and work activity level on WPFs of respirators in actual work places. Eight human subjects will be selected for the field sampling among the subjects that have been recruited for an ongoing NIOSH-funded study. Since heart rate is known to be correlated with activity level and age, heart rate will be used as the primary surrogate for work activity level. Work activity level also affects breathing rate, which may also affect the WPF. While heart and breathing rate correlate with level of physical activity, it may not be possible to differentiate the relative contribution of each. In the field sampling, WPF will be determined for 15 min at three different activity levels such as walking, feeding animals, and shoveling/spreading, with simultaneous measurement of heart rate and breathing rate using a LifeShirt system (RAE Systems Inc., USA). LifeShirt is a lightweight chest strap embedded with sensors which can measure several life sign parameters: breathing rate, heart activity, position, activity, skin temperature and movements of the person. While the first two parameters are the primary targets in this study, we will also explore the usefulness of the other parameters during this pilot study. Second specific aim is to evaluate the effect of breathing rate alone on the particle penetration in manikin-based laboratory experiments. Breathing rate of each human subjects tested in the field will be replicated in the laboratory. Particle penetration through the respirator filter will be determined when the respirator is fully sealed on a manikin face, and penetration through the faceseal leaks will be tested using artificial leaks. Comparison of field and laboratory data will give insights of the effects of breathing rate vs. human activity level on the WPF. Furthermore, faceseal leakage will be estimated by deducting filter penetration, which will be obtained from the laboratory experiment, from total penetration, which will be attained from the field experiment.

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Environmental and Occupational Hygiene Student PRP Committee

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Caterers

PRP Reception & Board Meeting:
Girlfriends Catering
Robyn Crowley, Owner
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PRP Networking Picnic:
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