

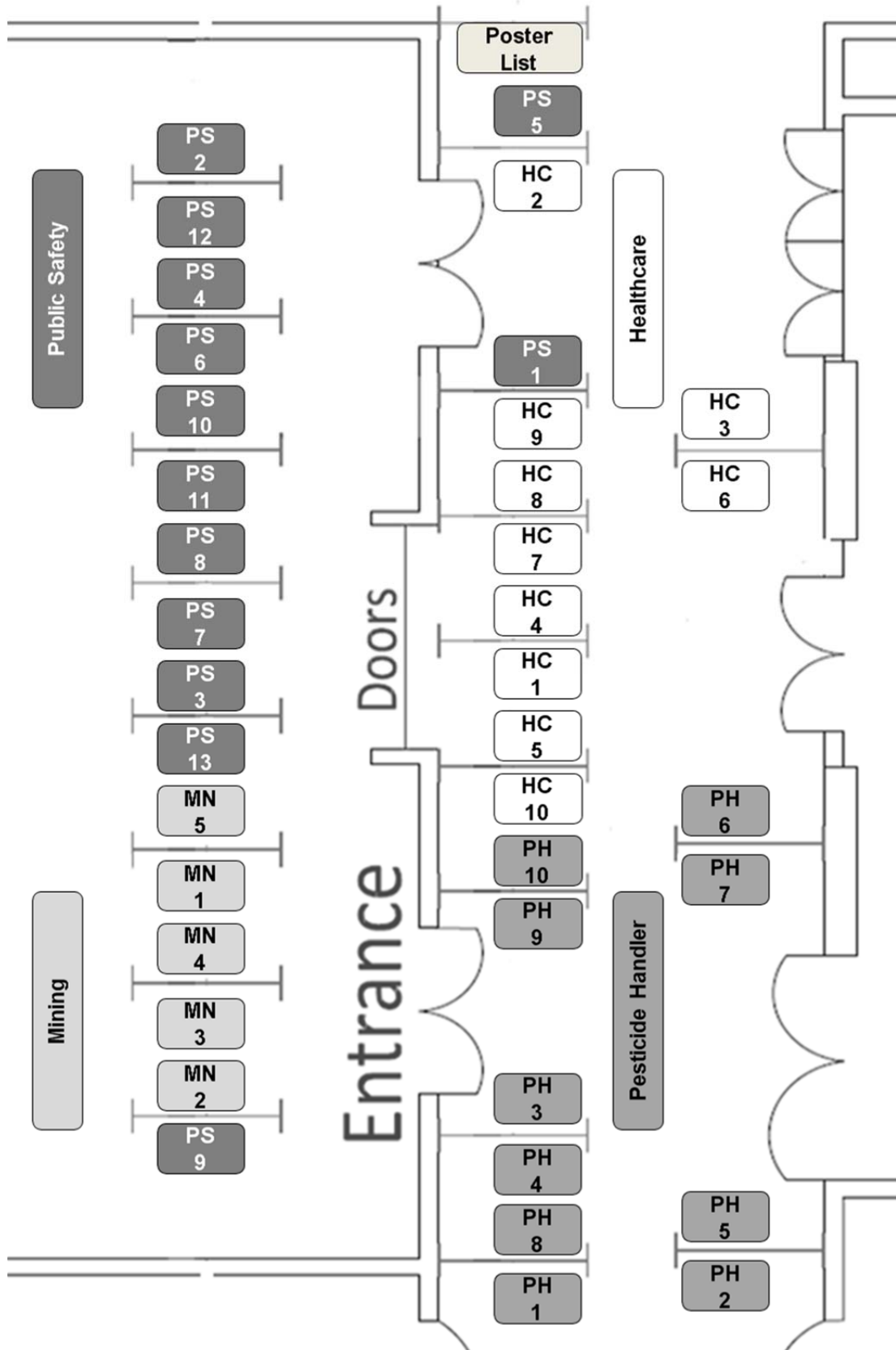
## PPT Stakeholders Meeting Mar 20, 2012 (Poster List)

Sector	#	Name	Poster Topic
HC	1	Cline, Kari / Univ of Minnesota	Relationship between safety climate, demographics and respiratory protection policies and practices in acute care hospitals
HC	2	Coyne, Judi / NIOSH NPPTL	Know It's NIOSH Approved
HC	3	D'Alessandro, Maryann / NIOSH NPPTL	Developing the Nonrespiratory Personal Protective Equipment Conformity Assessment Framework for the Nation
HC	4	Lindsley, Bill / NIOSH Held	Respiratory Protection and Influenza-laden Cough Aerosols in a Simulated Medical Examination Room
HC	5	Sietsema, Margaret / Univ of Illinois at Chicago	Scoring hospitals using written respiratory protection programs and survey responses based on the OSHA respiratory protection standard
HC	6	Taormina, Deborah / Univ of CA SF	Occupational Health Nurses and Respiratory Protection Competency
HC	7	Vo, Evany / NIOSH NPPTL	Development and Characterization of a New Test System to Challenge Personal Protective Equipment with Virus-Containing Particles
HC	8	Yarbrough, Mary / Vanderbilt University	6-Year Trends in Healthcare Personnel Exposures to Respiratory Infectious Hazards
HC	9	Yarbrough, Mary / Vanderbilt University	Metrics for Use in Evaluation of Hospital Respirator Programs
HC	10	Zhuang, Ziqing / NIOSH NPPTL	Laboratory Study to Assess Causative Factors Affecting Temporal Changes in Filtering-Facepiece Respirator Fit: Part III – Two Year Assessment of Fit Changes
MN	1	Kilinc-Balci, F. Selcen / NIOSH NPPTL	Mine Rescue Ensembles for Underground Coal Mining
MN	2	Kyriazi, Nick / NIOSH NPPTL	Comparison of current versus proposed SCSR regulations
MN	3	Metzler, Rich / NIOSH NPPTL	Closed-Circuit Escape Respirator (CCER) breathing gas capacity - uses and limitations
MN	4	Murray, David / NIOSH NPPTL	Advancing Respiratory Protective Device Technology through Breathing Gas Chemical Research
MN	5	Srinivas, Girish / TDA Research, Inc	CO Oxidation Catalysts for Respiratory Protection
PH	1	Blando, James / Old Dominion Univ	Utilization of Poison Control Center data and local health department infrastructure to address improper use of PPE among migrant workers: A proposed approach
PH	2	Cooke, Garnet / Oregon OSHA	Oregon OSHA's Pesticide Emphasis Program: Personal Protective Equipment for Pesticide Handlers
PH	3	Fong, Harvard / CA Dept. of Pesticide Regulation	Respiratory Protection Regulation for Pesticide Handlers: The California Model
PH	4	Hoffman-Richards, Kerry / Penn St	Promoting pesticide applicator exposure reduction through outreach education.

Sector	#	Name	Poster Topic
PH	5	Rivers, Ann / USDA	Emphasizing the need to select different PPE for different pesticide products and their uses during training
PH	6	Roy, Natalie / AgriSafe Network	Predictors of Personal Protective Equipment Compliance among Farm Youth
PH	7	Tharp, Cecil / Montana state Univ. Extension	Pesticide Safety on the Farm: Montana Private Applicator Behavioral Trends
PH	8	Tutor, Robin / NC Agromedicine Institute	Current Pesticide Education Trends Across North Carolina
PH	9	Tutor, Robin / NC Agromedicine Institute	Personal Protective Technology Use Among North Carolina Farms Applying Soil Fumigants
PH	10	Wyckoff, Sherry / NEC	Fit Testing of Pesticide Applicators Respiratory Protection
PS	1	Browne-Barbee, Latoya / RKB FEMA	Responder Knowledge Base – The Emergency Responder Decision Support Tool For PPE
PS	2	Cloonan, Terrence / NIOSH NPPTL	NIOSH Assistance to the FEMA Center for Domestic Preparedness
PS	3	Coca, Aitor / NIOSH NPPTL	Thermal manikin testing and thermal model predictions as tools to assess the physiological impact of the Total Heat Loss Test
PS	4	Delaney, Lisa / NIOSH OD	Update on Personal Protective Equipment Recommendations for Responses to Bacillus anthracis (anthrax)
PS	5	Delaney, Sheli / NIOSH EID TREB	Web-based Marketing of Alternative-sized PPE for a Diverse Workforce
PS	6	Gao, Pengfei / NIOSH NPPTL	A Magnetic Passive Aerosol Sampler for Measuring Particle Penetration through Protective Clothing Materials
PS	7	Hsiao, Hongwei / NIOSH DSR	Firefighter Anthropometry for Fire Apparatus and Equipment Design
PS	8	Lofin, Murrey / NIOSH DSR SFIB	NIOSH Fire Fighter Fatality Investigation and Prevention Program
PS	9	Roberge, Raymond / NIOSH NPPTL	Limitations of Current NIOSH/OSHA Decompression Tables For Caission and Tunnel Workers
PS	10	Shepherd, Angie / NIOSH NPPTL	The Effects of Flow Rate, Back Pressure, and Cell Design on Permeation Testing Result
PS	11	Sublet, Virginia / NIOSH OD	Assessing Safety Behaviors in Florida Firefighters
PS	12	Turner, Nina / NIOSH NPPTL	Physiological Evaluation of Air-Fed Ensembles during Treadmill Exercise
PS	13	Srinivas, Girish / TDA Research, Inc	Cooling System for Hazmat Suits

Sector ID: **HC** = Healthcare / **MN** = Mining / **PH** = Pesticide Handler / **PS** = Public Safety

# PPT Stakeholder Meeting Mar 20, 2012 (Poster Locations)



## PPT Stakeholder Meeting Mar 20, 2012 (Healthcare Poster Abstracts)

### HC# 1: Relationship between safety climate, demographics and respiratory protection policies and practices in acute care hospitals

**Authors and Organization:** K. Cline,<sup>1</sup> L.M. Brosseau,<sup>1</sup> L.M. Conroy<sup>2</sup>, M. Sietsema<sup>2</sup>; University of Minnesota<sup>1</sup> / University of Illinois at Chicago<sup>2</sup>

#### Abstract

As part of a 6-state NIOSH-funded investigation of respiratory protection programs for infectious diseases in acute healthcare settings, a total of 363 healthcare workers (HCW), 82 unit managers (UM) and 88 hospital managers (HM) in 28 acute care hospitals in Minnesota and Illinois were interviewed about respirator policies and practices. Each participant was also asked to complete a short written survey with 11 safety climate questions. Contingency tables and chi-square analyses were used to examine whether differences existed in responses between each group, as well as to examine the relationship between safety climate and respirator policies and practices. Responses to the 11 safety climate questions were generally very positive, with means ranging from 1.01 (almost total agreement) to 1.53. Safety climate was not found to be associated with any demographic variable; HCW and HM had statistically significantly lower attitudes toward safety than UM. For all personnel combined, the safety climate score was worse for people who said that employees were not trained in how or when to wear a respirator, employees could wear respirators without training, employees were not asked to provide input on policies and respirators were not located near the point of use. These results suggest that the following actions will improve safety climate measures in a hospital: 1) ask personnel for their input on respirator policies, 2) locate respirators near where they will be needed, 3) provide training in how and when to wear a respirator, and 4) require training before respirators can be worn.

### HC# 2: Know It's NIOSH Approved

**Authors and Organization:** Judi Coyne and Jackie Krah, NIOSH NPPTL

#### Abstract

NIOSH NPPTL initiated a public service campaign to inform / alert healthcare workers to the issues of misleading advertising, counterfeit respirators, and false claims of certification for filtering face piece respirators.

Materials created include a video made in conjunction with OSHA, a brochure outlining what to look for on a respirator, packaging, and where to verify certification as well as learn what other brands / labels products may have been marketed under.

### HC# 3: Developing the Nonrespiratory Personal Protective Equipment Conformity Assessment Framework for the Nation

**Authors and Organization:** Maryann D'Alessandro, NIOSH NPPTL

#### Abstract

There is no nationally recognized central authority for certifying or overseeing the certification of non-respiratory personal protective technologies (PPT). The National Academies (NA) in its 2008 review of the NIOSH PPT Program defines this as one of the most significant weaknesses of the national efforts concerning worker health and safety protection. One of the report's primary recommendations specifically addressed this situation. It recommended that NIOSH oversee all PPT certification in order to ensure a minimum uniform standard of protection and wearability. The expansion of NIOSH's responsibilities to overseeing certification activities of non-respiratory PPT through development of a conformity assessment consensus standard and/or an audit/oversight function are feasible options to provide safer and healthier workplaces across the nation. This poster will describe the strategy underway to address Personal protective equipment conformity assessment for the nation.

## PPT Stakeholder Meeting Mar 20, 2012 (Healthcare Poster Abstracts)

### HC# 4: Respiratory Protection and Influenza-laden Cough Aerosols in a Simulated Medical Examination Room

**Authors and Organization:** WG Lindsley, JD Noti, WP King, FM Blachere, CM McMillen, RE Thewlis, JS Reynolds, JV Szalajda and DH Beezhold; NIOSH

#### Abstract

A closed environmental chamber was equipped to simulate a patient coughing aerosol particles into a medical examination room and a healthcare worker breathing while exposed to these particles. In our first study, the penetration of cough aerosol particles through 9 models of surgical masks and respirators was measured at 32 and 85 L/min flow rates. Our results showed that cough aerosol particles spread rapidly and that within 5 minutes a worker anywhere in the room would be exposed. The aerosol exposure is highest with no personal protective equipment, followed by surgical masks, and the least exposure is seen with N95 FFRs. In our second study, NIOSH aerosol samplers collected cough aerosols containing influenza virus for 60 minutes at the mouth of the breathing manikin, beside the mouth, and at 3 other locations in the room. Infectious influenza was recovered in all three aerosol size fractions. Tightly sealing a surgical mask to the manikin's mouth blocked entry of 94.5% of total virus and 94.8% of infectious virus. A tightly sealed N95 respirator blocked 99.8% of total virus and 99.6% of infectious virus. Poorly fitted N95 respirators blocked 64.5% of total virus and 66.5% of infectious virus. An unsealed surgical mask blocked entry of 68.5% of total virus and 56.6% of infectious virus. These results support the hypothesis that aerosol particles may play an important role in influenza transmission and represent the first reported laboratory study of the efficacy of surgical masks and respirators in blocking inhalation of influenza in cough-generated aerosols.

### HC# 5: Scoring hospitals using written respiratory protection programs and survey responses based on the OSHA respiratory protection standard

**Authors and Organization:** M. Sietsema,<sup>1</sup> L.M. Conroy<sup>1</sup>, L.M. Brosseau,<sup>2</sup> K. Cline<sup>2</sup>; University of Illinois at Chicago<sup>1</sup> / University of Minnesota<sup>2</sup>

#### Abstract

The respirator evaluation in acute care hospitals (REACH) study provided the opportunity to survey hospital managers, unit managers, and healthcare workers in 13 hospitals in Illinois. Using the survey data and the written respiratory protection programs provided by the hospitals we were able to score hospitals on how well they follow the OSHA respiratory protection standard (1910.134). Written programs were scored looking at 11 characteristics (presence of a written program, program administrator, risk assessment, medical evaluation, fit testing, maintenance and use, training, information, availability, recordkeeping, and program evaluation). Survey data was scored based on 7 categories that had clear answers based on the OSHA standard. Using the scores hospitals could be compared with regard to their implementation of their respiratory protection program as well as on their policies. It was also possible to identify best practices and opportunities for improvement. Results: All of the hospitals scored above 70% overall from the survey data. All hospitals scored lowest in program evaluation and highest in knowledge that a written policy exists. Written hospital scores ranged from 3-16 out of 22 possible points. There was no correlation between hospital score and score of the hospital's written respiratory protection program. Conclusions: The implementation of respiratory protection procedures in hospitals seemed to better reflect following of the OSHA standard than a hospital's written policy. On average, hospital managers scored higher than unit managers and healthcare workers.

## PPT Stakeholder Meeting Mar 20, 2012 (Healthcare Poster Abstracts)

### HC# 6: Occupational Health Nurses and Respiratory Protection Competency

**Authors and Organization:** Deborah Taormina,<sup>1</sup> Barbara Burgel,<sup>1</sup> Candace Burns,<sup>1</sup> Annette Byrd,<sup>1</sup> Holly Carpenter,<sup>1</sup> Mary Ann Gruden,<sup>1</sup> Anne Lachat,<sup>1</sup> Patty;Quinlan,<sup>1</sup> Novak, Debra,<sup>2</sup> Ed Fries,<sup>2</sup> University of California San Francisco School of Nursing<sup>1</sup> / NIOSH NPPTL<sup>2</sup>

#### Abstract

The Institute of Medicine (IOM) report, Occupational Health Nurses (OHNs) and Respiratory Protection: Improving Education and Training (2011) outlined seven recommendations to improve the competency of OHNs in respiratory protection. An advisory board was convened in December 2011, with stakeholder representation from the CDC/NIOSH/NPPTL, American Association of Occupational Health Nurses, American Board for Occupational Health Nurses, Association of Occupational Health Professionals in Healthcare, the American Nurses Association, and the Institute of Medicine Standing Committee on Personal Protective Equipment for Workplace Safety and Health. Two recommendations are guiding the initial work of the advisory committee, including a) conducting focus groups and administering a survey to assess current OHN roles and responsibilities relevant to respiratory protection, and education and training needs; and, b) determining how OHNs achieve and maintain knowledge and skills in respiratory protection, and how OHNs motivate employees to use respirators appropriately. Strategies for addressing the letter report will be presented as well as preliminary survey development. The work of the advisory group will be used to develop innovative curricular materials to augment the education of OHNs regarding all aspects of a respiratory protection program. Future goals include a) educating all levels of nurses in respiratory protection, and b) developing interdisciplinary core competencies in respiratory protection for occupational health and safety professional education.

### HC# 7: Development and Characterization of a New Test System to Challenge Personal Protective Equipment with Virus-Containing Particles

**Authors and Organization:** Evanly Vo and Ronald Shaffer, NIOSH NPPTL

#### Abstract

The aims of this study were to develop and characterize a new test system to challenge personal protective equipment (PPE) with virus-containing particles (VCPs). The new system was designed to achieve two specific research objectives: 1) to be capable of delivering VCPs uniformly onto air permeable PPE such as filtering facepiece respirators (FFRs) and surgical masks (SMs) and 2) to be capable of performing simple VCP filtration tests. The test system consists of two aerosol generators, an exposure chamber, a breathing simulator/head form, and several aerosol detection systems.

The test system was validated against the two objectives using two experimental scenarios involving "dry" and "wet" VCPs (for simplicity, termed droplet nuclei and droplets, respectively). The size distribution of the viral droplet nuclei was 0.02-10.3  $\mu\text{m}$ , with 96% of particles between 0.2-4.0  $\mu\text{m}$ . The size distribution of the viral droplets was 0.54-100  $\mu\text{m}$ , and 88% of droplets centered in 0.73-18.5  $\mu\text{m}$ . The amount of viable MS2 deposited on the respirators met ASTM E2720 and E2721 requirements, with > 97% found on the outer and middle filtering layers of the N95 FFR models. Average filtration efficiencies were highest for the P100 FFRs (99.91-99.94%), followed by N95 FFRs (96.57-98.18%) and SMs (78.69-80.43%). These data indicate that the test system was able to meet the study objectives and will serve as a versatile tool for standards development and for research studies related to PPE reuse and handling.

## PPT Stakeholder Meeting Mar 20, 2012 (Healthcare Poster Abstracts)

### HC# 8: 6-Year Trends in Healthcare Personnel Exposures to Respiratory Infectious Hazards

**Authors and Organization:** Mary Yarbrough,<sup>1</sup> Michele Bruer,<sup>1</sup> Paula McGown,<sup>1</sup> Melanie Swift,<sup>1</sup> Charles Oke,<sup>2</sup> Vanderbilt University<sup>1</sup> / NIOSH NPPTL<sup>2</sup>

#### Abstract

**Objective:** In order to evaluate the efficacy of respiratory protective interventions for healthcare personnel (HCP), it is necessary to understand the types of hazards endemic to the medical work environment, and the disease outcomes related to those hazards. In this paper, we assess the frequency and outcomes of occupational exposures to respiratory infectious illnesses in a large academic medical center. **Methods:** Vanderbilt University Medical Center HCP Exposure Events to respiratory infectious hazards were analyzed over a six year period for frequency and disease outcomes.

**Results:** There were 1844 HCP exposed to tuberculosis, with 9 tuberculosis outcomes; 17 HCP exposed to measles, with 0 disease outcomes; 1434 HCP exposed to varicella, with 0 disease outcomes; and 818 exposed to pertussis, with 2 disease outcomes. **Conclusion:** Tuberculosis remains the most common respiratory infectious hazard for healthcare personnel, and the only hazard with significant risk of disease development secondary to a known patient exposure. HCP with unprotected exposures to measles, varicella and pertussis are the next most common, but the risk of secondary disease development is low.

### HC# 9: Metrics for Use in Evaluation of Hospital Respirator Programs

**Authors and Organization:** Mary Yarbrough,<sup>1</sup> Michele Bruer,<sup>1</sup> Paula McGown,<sup>1</sup> Melanie Swift,<sup>1</sup> Charles Oke,<sup>2</sup> Vanderbilt University<sup>1</sup> / NIOSH NPPTL<sup>2</sup>

#### Abstract

**Objective:** The respirator is used in the hospital setting as a component of the master occupational infection prevention and control programs that protect healthcare personnel from workplace hazards. These multi-tiered programs address the hazards at all levels through administrative policies, engineering controls and PPE. This study asks what information to gather: (1) to monitor respirator use in hospitals as part of a national pandemic response, and (2) from a broader perspective, to create a foundation for PPE systems research for the purpose of informing policy, certification, and standard setting. **Methods:** To provide the context for data recommendations hospital respirator surveillance activities were superimposed upon patient care and healthcare personnel workflow. Data was identified from associated systems. Metrics were then created from the data that were representative of selection, availability, training, fitting, use, disease outcomes, and confounding factors. Recommendations for the surveillance metrics most representative of respirator programming are made based upon data quality, availability, and representativeness. **Results:** The sample data set recommended as a starting point for national surveillance of hospital respirator use is presented. For hospitals, metrics to serve as a foundation of a surveillance system are recommended that would answer questions regarding agents, respirators, healthcare personnel, organizational factors and work tasks. **Conclusion:** A national system of respirator surveillance capable of monitoring respirator utilization should be created with the capability monitoring respirator activities and confounders necessary to evaluate respirator program effectiveness and therefore inform policy.



## PPT Stakeholder Meeting Mar 20, 2012 (Healthcare Poster Abstracts)

### HC# 10: Laboratory Study to Assess Causative Factors Affecting Temporal Changes in Filtering-Facepiece Respirator Fit: Part III – Two Year Assessment of Fit Changes

**Authors and Organization:** Ziqing Zhuang, Andy Palmiero, Michael Bergman, and Raymond Roberge; NIOSH NPPTL

#### Abstract

NIOSH is conducting a three year study to assess changes in respirator fit and facial dimensions as a function of time to improve the scientific basis for the periodicity of fit testing. This poster will present some preliminary results through year two. A sample of 229 subjects was initially enrolled and tested every six months. On each visit, subjects performed nine fit tests from the same filtering facepiece respirator model and anthropometric data (height, weight, 3-D head/face scans, and 13 traditional facial measurements) were obtained. Inward leakage and filter penetration were measured for each donned respirator to determine face seal leakage (FSL). To date, 130 subjects have completed their fifth visit.

The mean FSL for Visit 1 (baseline) was 0.69% (SD=0.36) with a range of 0.11% to 2.13%. The mean FSL for Visit 3 (one year visit) was 0.90% (SD=0.86) with a range of 0.05% to 7.7%. The mean FSL for Visit 5 (two year visit) was 0.64% (SD=0.80) with a range of 0.06% to 7.7%. The mean change in FSL between Visits 1 and 3 was 0.21% (SD=0.78), and between Visits 1 and 5 (one year later) was -0.04% (SD=0.67). For Visit 3, 10.2% of the subjects had unacceptable fit (90th percentile FSL > 0.05%). For Visit 5, 2.3% of the subjects had unacceptable fit.

However, it is too early to draw any conclusions from this work as the anthropometric data from the five visits are still being analyzed to better understand why subjects had unacceptable fit.

## PPT Stakeholder Meeting Mar 20, 2012 (Mining Poster Abstracts)

### MN# 1: Mine Rescue Ensembles for Underground Coal Mining

**Authors and Organization:** F. Selcen Kilinc, William D. Monaghan, Jeffery B. Powell, Angie M. Shepherd, Nina L. Turner, Raymond J. Roberge, and Edward J. Sinkule; NIOSH NPPTL

#### Abstract

The mining industry is among the top ten industries nationwide with high occupational injury and fatality rates. While improved technology such as wireless warning and communication systems, lifeline pulleys, and lighted vests have been developed for mine rescuers over the last 100 years, very little research in the area of personal protective ensembles has been conducted. Personal protective ensembles used by mine rescue teams consist of helmet, cap lamp, hood, gloves, protective clothing, boots, kneepads, facemask, breathing apparatus, belt and suspenders. Today, mine rescue teams perform several tasks, such as, exploration, rescue, recovery, and firefighting. It is vital that members of the teams have the capability and proper protection to immediately respond to a wide range of hazardous situations. Currently, there are no minimum requirements, best practice documents, or nationally recognized consensus standards for some ensemble components such as the protective clothing (e.g., coveralls or pants and jacket), boots, hoods, and gloves used by mine rescue teams in the United States. The lack of these requirements results in individual teams entering into an emergency situation while wearing significantly different levels of protection. NPPTL has undertaken a laboratory-based research project to test the performance characteristics of key mine rescue ensemble components to assess possible minimum design and performance requirements. Expected outcomes of the project include the use of project outputs by mine rescue teams to select ensembles; use of project data by manufacturers to improve designs; and use of recommended performance requirements by consensus standards development organizations and government agencies to develop standards and/or guidance documents.

## PPT Stakeholder Meeting Mar 20, 2012 (Mining Poster Abstracts)

### MN# 2: Comparison of current versus proposed SCSR regulations

**Authors and Organization:** Nicholas Kyriazi, NIOSH NPPTL

#### Abstract

This poster contrasts the differences between the present and proposed regulations listing the technical reasons for the changes and why they will result in superior respiratory protection equipment. In addition, since currently approved apparatus will be permitted to remain in use for the natural lifetime of the units, the users should know if and why their apparatus would fail the new regulations as an incentive to buy apparatus certified under the new regulations. A listing is given of the technical failures for each apparatus.

### MN# 3: Closed-Circuit Escape Respirator (CCER) breathing gas capacity - uses and limitations

**Authors and Organization:** Richard Metzler,<sup>1</sup> Jon Szalajda,<sup>1</sup> Tim Rehak,<sup>1</sup> N. Kyriazi,<sup>1</sup> J. Kravitz,<sup>2</sup> NIOSH NPPTL<sup>1</sup> / MSHA<sup>2</sup>

#### Abstract

NIOSH is in the process of updating the requirements of Title 42 CFR Part 84 which it will employ to test and approve closed-circuit escape respirators (CCER) used to escape from atmospheres considered to be immediately dangerous to life and health, including such respirators required by the Mine Safety and Health Administration (MSHA) for use in underground coal mines. CCERs are presently approved as providing a specified duration of breathing gas based on test subjects performing specific laboratory exercises known as Man test 4. This can be misleading since the actual durations of breathing gas required by users during escapes can differ substantially depending on the user's weight, physical condition, and activity. It is important to remember that a CCER contains a fixed quantity of oxygen; the duration of the oxygen it ultimately supplies will be inversely proportional to its rate of use. The new regulations will replace the measurement of the duration of breathing gas supplied with the measurement of the volume of breathing gas supplied (in liters of oxygen) as a principal approval parameter.

This poster provides information which will enable respirator users to protect themselves during an emergency escape by informing them of the CCERs breathing gas capacity rating; its uses and limitations. This information will enable employers to readily compare differences in respirator capacity; more closely match a respirator model to their particular needs, and choose the respirator model that best serves their needs to plan to select a CCER for their specific escape plan.



## PPT Stakeholder Meeting Mar 20, 2012 (Mining Poster Abstracts)

### MN# 4: Advancing Respiratory Protective Device Technology through Breathing Gas Chemical Research

**Authors and Organization:** David K Murray,<sup>1</sup> Crystal Forester,<sup>1</sup> Ziqing Zhuang,<sup>1</sup> Rohan Fernando,<sup>2</sup> NIOSH NPPTL<sup>1</sup> / OMSHR<sup>2</sup>

#### Abstract

Closed-circuit respiratory protection devices incorporate chemical cartridges or canisters that provide oxygen, remove expired carbon dioxide and/or remove uncomfortable heat and moisture from recycled breathing air. The chemical performance of these components has a direct bearing on the device size, weight, comfort, and the length of time they can be safely used, which are critical metrics in evaluating overall device performance. These devices are essential to miners and mine rescue personnel involved in escape, rescue, and firefighting activities in mine emergencies. In addition, filtering self-rescuer devices used mainly in metal/non-metal mines contain cartridges or filters that remove particulates as well as hazardous mine gases such as CO, CH<sub>4</sub>, or H<sub>2</sub>S. Escape type devices currently provide 10-60 minutes of safe breathing air and canisters for CO<sub>2</sub> absorption, while rescue (or entry) breathing devices provide up to 4 hours safe breathing air. The Mine Improvement and New Emergency Response (MINER) Act of 2006 requires that every miner working underground is provided with not less than two hours breathing protection for self-rescue.

This poster will provide an overview of a new 2012 proposed chemical research program at NPPTL to address breathing device improvements to meet MINER Act requirements. The program will focus on two areas- (1) demonstrating improved chemical performance using newly developed catalysts/ molecular sieves or distributed adsorbents in a bench scale test system, and (2) standardizing analytical test methods for evaluating breathing gas chemical processing to enable development or improvement of products that conform to Miner Act requirements.

### MN# 5: CO Oxidation Catalysts for Respiratory Protection

**Authors and Organization:** Girish Srinivas, Rita Dubovik, Drew Galloway, Steve Gebhard  
TDA Research, Inc.

#### Abstract

TDA Research Inc. has developed a low temperature CO oxidation catalyst for personal protection from carbon monoxide poisoning in atmospheres containing up to 4000 ppm CO. The catalyst is very active at 0oC and below, making it a good choice for CO protection in all but the coldest environments.

During the past year TDA has scaled up catalyst synthesis to the multi-kilogram level. We now have the ability to load and test full-size gas filters. The ability to load and test cartridges allows TDA to test its catalysts under NIOSH/NFPA certification test conditions and take advantage of the cartridge configuration.

We have begun to work with companies in the respiratory protection sector to schedule field tests to demonstrate the excellent activity and low pressure drop of TDA's CO oxidation catalyst.

## PPT Stakeholder Meeting Mar 20, 2012 (Pesticide Handler Poster Abstracts)

### PH# 1: Utilization of Poison Control Center data and local health department infrastructure to address improper use of PPE among migrant workers: A proposed approach

**Authors and Organization:** James D. Blando, Mark Robson, Daniel Yacykewych; Old Dominion University, School of Community and Environmental Health

#### Abstract

It has been recognized that migrant workers represent a difficult to reach population that experiences many barriers to effective public health interventions. These barriers make instruction and awareness about the proper use of personal protective equipment (PPE) among pesticide applicators especially difficult to implement. Standard surveillance methods were used to identify occupationally-related pesticide poisoning cases. We identified 260 sentinel occupational pesticide poisoning cases using poison control center data and 49 cases using Uniform Billing (UB) data. The data were also broken down into broad categories of pesticides used. However, the data represented a fragmented picture of pesticide poisonings because the state of NJ did not have a systematic pesticide surveillance system within the state health department. Furthermore, these data sources did not include any detail or information about PPE usage among these poisoned workers. Therefore, we propose to build on this approach to identifying sentinel cases of migrant workers and use this information about migrant workers on the Eastern Shore of Virginia. The VA Eastern Shore is unique in that migrant worker camps are readily identified and accessed. We propose to further develop the approach used in NJ by conducting fieldwork among identified migrant worker labor camps along the Eastern Shore of VA. The approach will allow the targeting of PPE interventions among this group of workers. We will assess knowledge, attitudes, and beliefs among migrant workers with regard to proper PPE usage when applying pesticides.

### PH# 2: Oregon OSHA's Pesticide Emphasis Program: Personal Protective Equipment for Pesticide Handlers

**Authors and Organization:** Garnet R. Cooke, Oregon OSHA

#### Abstract

In a concerted effort to reduce pesticide exposures in Oregon, Oregon OSHA launched the Pesticide Emphasis Program (PEP) in FY 2000. Oregon administers a state-run OSHA plan and has promulgated its own regulations for Agriculture. These regulations address personal protective equipment under Oregon Administrative Rules 437, Division 4. Oregon OSHA is unique as an OSHA state plan in that it also has full enforcement authority of the EPA's Worker Protection Standard, which includes personal protective equipment requirements specific to pesticides. This enforcement authority was coordinated through Memorandums of Understanding with the Oregon Department of Agriculture. EPA Region 10, Pesticides Division has oversight authority over the pesticide program through an unfunded agreement with Oregon OSHA.

Oregon OSHA's PEP applies the following regulations which address the various ways in which pesticide exposures can occur: the Worker Protection Standard, Hazard Communication, Respiratory Protection, personal protective equipment, pesticide storage, emergency eyewash, fumigation requirements, Thiram requirements, and supervision. This poster highlights the findings of 11 years of enforcement activity on the specific component of personal protective equipment. It addresses selection, use, care and storage, as well as the subsequent outreach efforts made as a result of those findings.

## PPT Stakeholder Meeting Mar 20, 2012 (Pesticide Handler Poster Abstracts)

### PH# 3: Respiratory Protection Regulation for Pesticide Handlers: The California Model

**Authors and Organization:** Harvard R. Fong, California Department of Pesticide Regulation

#### Abstract

With respiratory protection; as Yoda said, there is another.

In most cases, the regulatory approach on pesticide labels dealing with respiratory protection when handling pesticides has been either unmoored from any recognized standard (“Wear a full face respirator when using this material”); insufficiently detailed and/or obsolete (“Wear a respirator approved for pesticides.”); or simply dumped into the OSHA Standard 29 CFR 1910.134. The major problem with using the OSHA Standard is that it was designed for “...general industry, construction, shipyard, longshoring, and marine terminal workplaces (Fed. Reg. V63 No5, pg 1152) and specifically exempted agricultural operations governed under FIFRA (ibid, pg 1157). The California Department of Pesticide Regulation reviewed 1910.134 and developed respiratory protection regulations specific to the pesticide-handling industries (primarily agricultural and structural treatment) that take into account the nature of the use environments, the diversity of the potential users and the variability and unknowns of the pesticides themselves.

### PH# 4: Promoting pesticide applicator exposure reduction through outreach education.

**Authors and Organization:** Kerry Richards, William Riden, Jim Harvey; Penn State Pesticide Education Program

#### Abstract

The poster will highlight the efforts of the Penn State Pesticide Education Program and the Pennsylvania Rural Health Farm Worker Protection Safety Program to educate growers, pesticide handlers. Special emphasis will focus on efforts to reach and those who work in areas treated with pesticides to encourage use of personal protective equipment and other safety practices. This will include, but is not limited to Worker Protection training, Anabaptist training, and related training materials developed and distributed by these programs.

### PH# 5: Emphasizing the need to select different PPE for different pesticide products and their uses during training

**Authors and Organization:** Ann Rivers, US Department of Agriculture

#### Abstract

The US EPA Worker Protection Standard requires that pesticide labels list the types of personal protective equipment that must be worn with each product. Because there are many pesticide products with varied toxicity levels, each with specific PPE requirements, proper selection of protective equipment can be difficult. Proper training for pesticide handlers should emphasize there is no single assembly of personal protective equipment that can be used for all pesticides or all applications of a single pesticide, rather PPE should be selected based on the requirements of a specific product label and how the product will be used.

While many pesticide labels require the use of chemical-resistant PPE, some fumigants prohibit the use of chemical-resistant PPE. Methyl bromide and other fumigant gases can become trapped inside chemical protective gloves or boots and can cause chemical burns to the skin. Since some pesticide handling activities increase the chance of exposure, such as mixing and loading, the label may require higher levels of protection during these activities. Levels of respiratory protection also vary among different pesticides and different levels of exposure for a single pesticide. Wearing inappropriate PPE can lead to overexposure. Adequate training is needed to ensure pesticide handlers properly select the PPE that must be worn with each product and each product use.

## PPT Stakeholder Meeting Mar 20, 2012 (Pesticide Handler Poster Abstracts)

### PH# 6: Predictors of Personal Protective Equipment Compliance among Farm Youth

**Authors and Organization:** Natalie Roy, Carolyn Sheridan, AgriSafe Network

#### Abstract

**Purpose:** It is well documented that pesticide handlers do not consistently use Personal Protective Equipment (PPE). Young farmers commonly handle pesticides on their farm even if they are not certified as “pesticide handlers”. Therefore, they are considered an important population to target at an early age with accurate information on preventing pesticide poisoning. AgriSafe is a national non-profit that advances the delivery of occupational health care to farm families. Strategies to increase use of PPE are an important component of AgriSafe’s efforts to protect those working in agriculture. **Methods:** The AgriSafe Network collected quantitative data to assess PPE compliance among 930 FFA farm youth during the 2007 FFA convention. The survey tested PPE knowledge, PPE usage, and predominate high exposure farm tasks. The survey also assessed PPE usage in relation to stages of behavior change as described in the Transtheoretical Model. The data includes exposures to various farm hazards in addition to pesticides. Among the youth who stated they mix and apply agricultural pesticides, only 51% stated they always wear chemical protective gloves.

### PH# 7: Pesticide Safety on the Farm: Montana Private Applicator Behavioral Trends

**Authors and Organization:** Cecil I. Tharp, Montana State University Extension

#### Abstract

The goal of this investigation was to assess the behavioral trends of certified Montana private (farm) applicators when applying pesticides. By understanding these behaviors, the MSU Pesticide Education Program has catered programs and developed tools to address fundamental deficiencies to promote better pesticide stewardship. A total of 474 applicators were asked various pesticide drift and/or pesticide safety questions within 21 pesticide education programs throughout Montana from 2009 - 2011. Audience members were polled using the Turning Point Technologies Audience Response System (TARS). This system was selected due to ease of use, anonymity, and instantaneous results which increased dialogue by audience members. Results of this study may be used to stimulate audience participation.

### PH# 8: Current Pesticide Education Trends Across North Carolina

**Authors and Organization:** Robin Tutor-Marcom, Annette Greer, Esther Musu SeisayAdam-Samura, NC Agromedicine Institute

#### Abstract

In 2009, the NC Department of Agriculture formed an Interagency Pesticide Workgroup to address recommendations from the North Carolina Governor’s Task Force on Preventing Agricultural Pesticide Exposure. The Workgroup initially identified two key areas on which to focus: pesticide education and knowledge of farm labor contractors relative to pesticide regulations and resources for ensuring farmworker safety and health. For the purposes of this poster, we will focus on findings from a survey conducted with pesticide educators across North Carolina to determine current trends in pesticide education. Specifically, the Pesticide Education subcommittee sought to determine: 1) who pesticide educators are; 2) who is receiving pesticide education; 3) in what languages education is being delivered; 4) what educational materials and/or strategies are being used; 5) what key messages are being included; 6) which materials and/or strategies are felt to be most or least effective; and 7) what if anything is needed to make delivery of pesticide education easier and more effective. Results of the survey will be used to develop recommendations, materials, and strategies that can be used across the state to ensure that pesticide education meets the needs of both pesticide educators and recipients while also ensuring that information being shared is in compliance with state and federal regulations and shares important health messages.

## PPT Stakeholder Meeting Mar 20, 2012 (Pesticide Handler Poster Abstracts)

### PH# 9: Personal Protective Technology Use Among North Carolina Farms Applying Soil Fumigants

**Authors and Organization:** Robin Tutor-Marcom, Fred Wright, NC Agromedicine Institute

#### Abstract

On December 31, 2010, the United States Environmental Protection Agency issued new risk mitigation measures (RMMs) for soil fumigants. RMMs require that individuals who are applying and/or handling soil fumigants be medically cleared and fit tested to use respiratory protection in the event they have a sensory detection of fumigant exposure. In 2011, the NC Agromedicine Institute, with funding from the NC Tobacco Trust Fund Commission and in conjunction with community partners, coordinated medical clearance, fit testing and respirator education with more than 700 farmers across North Carolina. Following completion of these activities, a follow-up survey was sent to participants to determine current practices and future plans for using respiratory protection and other personal protective equipment necessary for fumigant use. This poster will discuss survey results and similarities/differences to nationally identified barriers to personal protective equipment use as well as to risk mitigation measure requirements.

### PH# 10: Fit Testing of Pesticide Applicators Respiratory Protection

**Authors and Organization:** Sherry Wyckoff, Samantha Park, John May, Northeast Center for Agricultural and Occupational Health (NEC)

#### Abstract

Inhalation of particulate and mist is a common entry route of pesticides into the body. In addition to modifications of work practices, inhalation exposure can be prevented by use of personal protective equipment.<sup>1</sup> Disposable dust respirators and cartridge/canister respirators can provide adequate respiratory protection in these situations. Both of these models require a proper fit for maximum protection. OSHA respiratory standard 1310.134 Appendix A outlines accepted fit test protocols for qualitative fit testing. This poster will present the results of a survey of select NY pesticide applicators. Among the data gathered are: knowledge of OSHA requirements; extent of quantitative fit testing in this population; alternative approaches to fit testing in these applicators; medical clearance obtained by equipment users; types of respirators used for specific tasks; and maintenance of this equipment.

1. <http://www.cdc.gov/niosh/topics/respirators> accessed 1/11/12

## PPT Stakeholder Meeting Mar 20, 2012 (Public Safety Poster Abstracts)

### PS# 1: Responder Knowledge Base – The Emergency Responder Decision Support Tool For PPE

**Authors and Organization:** Latoya Browne-Barbee, Responder Knowledge Base/FEMA

#### Abstract

The Responder Knowledge Base's (RKB) mission is to provide emergency responders, purchasers, and planners with a trusted, integrated, online source of information on products, standards, certifications, grants and other equipment-related information. The poster will depict what type of information RKB provides regarding personal protective equipment and how all of it is linked and found in one place. Some examples of the information provided include certified PPE products, relevant standards, FEMA Preparedness Grants, AEL, SEL, and safety notices.

## PPT Stakeholders Meeting Mar 20, 2012 (Public Safety Poster Abstracts)

### PS# 2: NIOSH Assistance to the FEMA Center for Domestic Preparedness

**Authors and Organization:** Terrence K. Cloonan, NIOSH NPPTL

#### Abstract

On May 12, 2011, NIOSH and National Center for Environmental Health (NCEH), CDC, entered into a federal inter-agency agreement with the U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA)'s, Center for Domestic Preparedness (CDP). The purpose of the agreement was to assist the CDP in the development of guidelines applicable to three areas of personal protective technology applications: 1) use and reuse of NIOSH-approved chemical, biological, radiological, and nuclear (CBRN) air-purifying respirators (APR) and accompanying personal protective equipment (PPE), 2) increase the CDP analytical laboratory analytical capacities and 3) support the enhancement of worker and trainee public safety protection in support of the training objectives of the CDP emergency responder live-agent facility known as the chemical, ordnance, biological, and radiological training facility or "COBRA TF" located in Anniston, Alabama. NIOSH's NPPTL serves as the NIOSH signatory authority in the CDC-FEMA agreement and is charged with providing assistance to the FEMA CDP in technical areas such as NIOSH respirator selection criteria, review of test data, addressing procedures that are expected to/may result in the development of FEMA CDP-NIOSH concept and final standard test procedures for the decontamination and reuse of pristine NIOSH-approved CBRN APR. This academic poster will provide a snapshot on the progress achieved in addressing the tasks and projected needs of the inter-agency agreement.

### PS# 3: Thermal manikin testing and thermal model predictions as tools to assess the physiological impact of the Total Heat Loss Test

**Authors and Organization:** Aitor Coca, Jung-Hyun Kim, Jeff Powell, NIOSH NPPTL

#### Abstract

The National Fire Protection Association sets requirements in their standards for the certification of protective ensembles (PE) based on testing of the thermal characteristics of the fabric (thermal resistance and vapor permeability). A typical method to determine the thermal characteristics of fabric is the Total Heat Loss (THL) test using a sweating hot plate (SHP). The overall aim of this project is to assess if the SHP test-determined THL value is a valid predictor of human thermo-physiological responses to working while wearing PE. In this sub-task of the project, we compare the results of the SHP test with two other methodological approaches (sweating thermal manikin and thermal model predictions) using two PE with the same design, but made of fabrics with different THL values. The two PE fabrics were first tested by an independent laboratory to acquire the SHP THL test value. Then the two PE constructed with each of the two fabrics were tested using a sweating thermal manikin (STM) to predict THL values. Finally, the responses of humans working while wearing the PE were estimated with a thermal simulation model. The SHP test showed a 78% difference between the two PE, the STM showed a 54% difference and the simulation showed a 28% difference for similar environmental conditions. Based on these preliminary results, STM testing and thermal model simulation could help explain the real physiological impact of the THL value measured by the SHP test. Future experiments will include actual human subject testing of the two PE.



## PPT Stakeholders Meeting Mar 20, 2012 (Public Safety Poster Abstracts)

### PS# 4: Update on Personal Protective Equipment Recommendations for Responses to Bacillus anthracis (anthrax)

**Authors and Organization:** Lisa J. Delaney, Chad Dowell, NIOSH/OD/EPRO

#### Abstract

During the anthrax response in 2001-2002, NIOSH issued guidance on selection and use of protective clothing and respirators against biological agents and provided specific PPE recommendations to responders conducting environmental sampling for Bacillus anthracis. General NIOSH guidance for the selection and use of PPE against biological agents was updated in 2009 to include NFPA and CBRN certification standards but the 2001 anthrax-specific guidance was never updated. Currently, NIOSH recommends environmental samplers wear a full facepiece air purifying respirator or a full facepiece powered air purifying respirator, both equipped with P100 or N100 filters. Disposable hooded coveralls, gloves, and foot coverings are also recommended. Higher levels of protection, such as CBRN rated self-contained breathing apparatus, were only recommended when there may be an ongoing release using an aerosol-generating device or when the agent is unknown. Additionally, a Federal inter-agency working group is currently developing broader responder protection guidance for a wide area anthrax attack that will include recommendations on a variety of protective measures including medical countermeasures (i.e., drugs, vaccine), PPE, and other work practices. Once this inter-agency document is cleared, NIOSH intends to update its anthrax responder PPE guidance to reflect current standards and guidance. It will also be expanded to apply to all responders performing highest risk tasks during an event.

### PS# 5: Web-based Marketing of Alternative-sized PPE for a Diverse Workforce

**Authors and Organization:** Sheli C. DeLaney, MA  
NIOSH/EID/TREB

#### Abstract

Women's and unisex PPE is now widely available on the market, but it is still not reaching all of the workers who need it. One theory proposes that alternative-sized PPE is not well marketed to the people with purchasing authority. A web-based review of ten brand-name PPE distributors investigated how alternative-sized PPE was advertised on websites and online product catalogues. The criteria used to evaluate the websites included 1) if alternative-sized PPE was offered by the distributor, 2) if the products were clearly labeled as unisex or women's, and 3) if models pictured on the website represented a diverse array of people. Results found that women's and unisex products were offered by most distributors, but rarely featured prominently or displayed on a model. Many items were not labeled as a women's product, but were simply marked "W" or labeled with taglines such as "ideal for smaller faces." In order to increase the use of alternative-sized PPE for women workers and workers of small stature, it is recommended that PPE distributors feature these products more prominently in their catalogs and websites, label them clearly, and use models that represent a diverse workforce.

## PPT Stakeholders Meeting Mar 20, 2012 (Public Safety Poster Abstracts)

### PS# 6: A Magnetic Passive Aerosol Sampler for Measuring Particle Penetration through Protective Clothing Materials

**Authors and Organization:** Pengfei Gao, Tony Rozzi, and Peter Jaques, NIOSH NPPTL

#### Abstract

Particle penetration through moderately porous non-woven fabrics was measured with a magnetic passive aerosol sampler (MPAS) housed in a bench-scale cone-shaped penetration cell (P-Cell) that was 20 mm high with a fabric-air inlet diameter of 40 mm. The MPAS is a 8.6 mm high 28 mm disc that consists of 186 small square magnets, arranged in an alternating N and S pole pattern to collect magnetically susceptible iron oxide particles. The P-Cell was designed with smooth internal and external surfaces with sufficient annular space (6 mm) to allow air to pass freely around the MPAS. A 60 mm (axial length) shrouded exhaust unit with a 10 mm diameter outlet was attached behind the P-Cell to prevent entrance of particles carried by the exterior air stream into the outlet-end by eddies. The P-Cell was collocated with several others across a multi-cell holder and placed in a recirculation aerosol wind tunnel for exposure to the Fe<sub>3</sub>O<sub>4</sub> aerosol. 20,000 particles/cc, between 0.1 and 0.8 μm, were continuously recirculated for ~20 minutes. Both, the effect of wind speed and distance between the fabric and the MPAS on penetration were evaluated. A P-cell without fabric served as the control. A computer controlled scanning electron microscope was used to quantify size-dependent particle penetration. Preliminary results show that penetration ranged from less than 10% to greater than 90%. The test method simulates the conditions under which protective garments operate in the work place.

### PS# 7: Firefighter Anthropometry for Fire Apparatus and Equipment Design

**Authors and Organization:** Hongwei Hsiao, NIOSH DSR

#### Abstract

This poster reports a comprehensive national survey of firefighter anthropometry for updating fire apparatus design criteria and standards, conducted by NIOSH through partnership with firefighter associations, fire apparatus manufacturers, and other stakeholders.

The survey used a stratified sampling plan (3-age x 3-race/ethnicity x 2-gender combinations) to collect anthropometric data across the U.S. It took into account the geographic density of racial/ethnic distributions calculated from U.S. Census 2000. A total of 951 subjects participated in the study to complete traditional anthropometry data and 3-dimensional face scans while they were seated and standing with and without protective gear. One hundred ninety-five firefighters, representing the various combinations of body size and shape of the 951-subject pool, were identified to participate in the second-phase study which involved 3-dimensional whole body scans and digitization for cab workspace, seat belt, and bunk gear design applications.

Preliminary results suggest (1) minimum seat cushion width of 498 mm (currently 460 mm in the National Fire Protection Association 1901 standard), (2) back cushion width of 663 mm at shoulder height (currently 460 mm), and (3) seat height adjustment range of 415~516 mm to accommodate 95% of the current firefighters. Minimum seating space (including seat cushion width) of 678 mm and back cushion space of 796 mm at shoulder height is suggested. More detailed results for various fire apparatus and equipment design applications, such as respirator, seat belt, and egress step, will be discussed.

## PPT Stakeholders Meeting Mar 20, 2012 (Public Safety Poster Abstracts)

### PS# 8: NIOSH Fire Fighter Fatality Investigation and Prevention Program

**Authors and Organization:** Tim, Merinar, Paul Moore, Matt Bowyer, Virginia Lutz, Murrey Loflin, Steve Miles, Jay Tarley, Stacy Wertman, NIOSH DSR SFIB

#### Abstract

The United States depends on approximately 1.1 million career and volunteer fire fighters to protect its citizens and property from losses caused by fire and other disasters. On average, 100 fire fighters die each year in the line-of-duty. In 1998 Congress recognized the need to address this significant occupational issue and directed NIOSH to implement a fire fighter safety initiative.

The NIOSH Fire Fighter Fatality Investigation and Prevention Program (FFFIPP) conduct investigations of fire fighter line-of-duty deaths to formulate recommendations for preventing future deaths and injuries. The FFFIPP is a public health practice investigation program. NIOSH investigations are not conducted to enforce compliance with State or Federal occupational safety and health standards and do not determine fault or place blame on fire departments or individual fire fighters. Recent FFFIPP investigations in Houston, TX; Baltimore County, MD; and other locations have identified concerns that SCBA facepiece lenses can degrade under expected fire-fighting conditions. The facepiece lens currently represents the weakest component of a fire fighter's protective ensemble in high heat conditions. Also, the FFIPP has identified uncontrolled SCBA emergency issues as another contributing factor in recent fire fighter fatality cases in Shawnee, KS; Asheville, NC; and other locations.

The FFFIPP has worked with National Fire Protection Association (NFPA) standards making committees and testing laboratories to develop and implement changes for performance requirements as well as use requirements for NFPA-certified SCBA facepieces. These enhanced test and certification requirements will result in better respiratory protection for fire fighters.

### PS# 9: Limitations of Current NIOSH/OSHA Decompression Tables For Caisson and Tunnel Workers

**Authors and Organization:** Ray Roberge, NIOSH NPPTL

#### Abstract

Compressed air tunneling and caisson (tunnel) workers engage in work activities at ambient pressures that can be many times that of atmospheric pressure. This work environment results in breathing air at higher pressures that subsequently causes an increase in the partial pressure of the body's dissolved gases (oxygen, carbon dioxide, nitrogen). At the work shift's end, if decompression back to atmospheric pressure occurs too rapidly, there is not enough time for body tissues saturated with gases to off-gas in a normal fashion through exhalation. Gas molecules can then coalesce to form bubbles that can impinge on tissues or cause blood vessel obstruction. These physiological effects of bubbles lead to various disorders such as decompression illness ("the bends"), cardiorespiratory decompression syndrome ("chokes"), arterial emboli leading to strokes or cardiac malfunction, dysbaric osteonecrosis (bone infarction), etc. To ameliorate the occurrence of these pressure-related disorders, tables have been developed in industrialized nations that incorporate timed periods at specified pressures of gradual decompression for workers to allow for "off gassing". The mandated Occupational Health and Safety Administration (OSHA) Decompression Tables were first introduced in 1971 and continue (unchanged) in use today. However, the OSHA Tables only allow a maximum pressure of 50 psi (modern tunnel-boring equipment can utilize pressures > 110 psi) and are considered outdated in that they do not employ stepped decompression or use of oxygen and have been shown to be associated with an unacceptable degree of dysbaric osteonecrosis at pressures >36 psi. The National Institute for Occupational Safety and Health (NIOSH) has previously funded research projects that resulted in the development of improved tables, but these have not been put into effect. There is a clear need in the U.S. construction industry for updated OSHA decompression tables that better address the protection of current compressed air tunneling and caisson workers. The purpose of this poster is to provide an overview of the deficiencies in the current OSHA decompression tables and present alternate decompression tables that have been developed with NIOSH funding.

## PPT Stakeholders Meeting Mar 20, 2012 (Public Safety Poster Abstracts)

### PS# 10: The Effects of Flow Rate, Back Pressure, and Cell Design on Permeation Testing Result

**Authors and Organization:** Angie Shepherd,<sup>1</sup> Chris Mekeel,<sup>2</sup> and Matt Horvatin,<sup>2</sup> NIOSH NPPTL / URS<sup>2</sup>

#### Abstract

Permeation testing is used to evaluate the protection afforded by chemical protective equipment (CPE). Current permeation test methods require strict specifications for temperature and relative humidity. Changes in either of these environmental conditions can greatly impact testing results. This project aims to reduce these effects by precisely holding temperature and humidity constant. In addition to temperature and humidity, other variables were investigated to show their effects on permeation testing results. Back pressure caused by high flow rates as well as the sorbent tubes used in the collection of permeant, attribute to material distention which increases the total testing surface area. Such an increase in surface area decreases the challenge density specified in the test method. Also, conventionally designed permeation cells may affect permeation results by not effectively removing permeant from the collection side of the test material. Such ineffectiveness decreases the concentration gradient across the test material, directly impacting permeation results. A new cell was designed to efficiently collect permeant at lower flow rates, thus maintaining a proper concentration gradient across the test material while simultaneously decreasing back pressure. Preliminary results from the new cell design will be presented.

### PS# 11: Assessing Safety Behaviors in Florida Firefighters

**Authors and Organization:** Virginia Sublet, Sunshine Education and Research Center (ERC) at the University of South Florida (USF)

#### Abstract

There are over 1,000,000 firefighters in the United States (U.S.). One of the serious conditions that can develop for firefighters is heat stress due to extreme heat exposure on-the-job. Heat stress can result in heat rash, progress to exhaustion, cardiac effects and ultimately death. Although this condition is largely preventable, it remains a serious problem in the fire service. The objective of the study described here was to assess the safety behaviors of firefighters in Florida. It is well known that the percent of high humidity and elevated temperatures experienced in Florida may put these firefighters at greater risk of heat stress than fire professionals in other regions of the U.S.

The methodological approach for this study was qualitative and used focus groups as the data collection method. The focus groups concentrated on the perceptions, opinions, behaviors and attitudes of firefighters in 4 fire departments in north, central and south Florida. One of the groups was a volunteer fire department and the other three were composed of paid firefighters. The size of fire departments ranged in size from small (10 firefighters) to medium (60 firefighters) to large (1500 firefighters).

Study findings indicated that many firefighters do not fully comprehend the seriousness and potential lethal effects of heat stress, are significantly influenced by the opinions of fellow firefighters and management, and tend to ignore symptoms of heat stress until they are so severe they are forced to leave the hot environment. This poster will describe the design, methods, and future direction of the research. (The author would like to acknowledge NIOSH for funding this research.)

In this project, a prototype Real-Time Ensemble Inward Leakage (REIL) testing system was developed to replace the Overall Ensemble Inward Leakage Test from National Fire Protection Association (NFPA) 1991 and the Man In Simulant Test from NFPA 1994. The system uses a sensor array to measure the concentration of the challenge analyte (Methyl Salicylate) within the interior of a test ensemble. The REIL testing system employs real-time, wireless telemetry for the transfer of sensor data. The data is then expressed both numerically and graphically. By not requiring any posttest analysis and limiting required consumable supplies, the REIL testing system has the potential to reduce the cost of evaluating Chemical, Biological, Radiological, Nuclear (CBRN) ensembles against inward leakage. This poster will describe the design of the REIL testing system and preliminary data demonstrating proof-of-concept for this application.

## PPT Stakeholders Meeting Mar 20, 2012 (Public Safety Poster Abstracts)

### PS# 12: Physiological Evaluation of Air-Fed Ensembles during Treadmill Exercise

**Authors and Organization:** N Turner, J Powell, D Novak, E Sinkule and A Shepherd, NIOSH NPPTL

#### Abstract

An air-fed ensemble (AFE) is an encapsulating suit with an external source of breathing air which provides respiratory protection without the use of a tight-fitting face piece. These ensembles were originally developed in the 1960's to protect nuclear plant workers from respiratory and dermal hazards. Today they are being sold as replacements for suits which include airline respirators with face pieces and are being advertised as providing a high degree of comfort, mobility, visibility, and respiratory protection. They are currently worn by government employees at the Department of Defense, Department of Energy, and the Centers for Disease Control and Prevention, as well as by workers in the nuclear, chemical, and pharmaceutical industries. However, human subject test data from currently available AFEs are needed for updating/revising NIOSH certification requirements for these types of devices.

The goal of this study was to evaluate the respiratory and metabolic stresses of AFE use in wearers during rest, low-, and moderate-intensity treadmill exercise. Subjects wore two different AFEs and one two-piece supplied-air suit at rest and while walking for six minutes at two treadmill settings (low and moderate). Inhaled O<sub>2</sub>, CO<sub>2</sub>, pressure and temperature were measured continuously breath-by-breath. In a previous presentation, we reported preliminary data from 14 male subjects. Preliminary results show that inhaled O<sub>2</sub> is decreased and inhaled CO<sub>2</sub> is elevated in AFEs during low- and moderate-intensity treadmill walking. In this presentation, updated results, which include 6 additional female subjects, will be discussed.

### PS# 13: Cooling System for Hazmat Suits

**Authors and Organization:** Girish Srinivas, Bob Copeland, Joe Fredrickson, Drew Galloway, Georgia Mason, Steve Gebhard, TDA Research, Inc.

#### Abstract

When responding to a chemical spill or other hazardous cleanup operation, first responders must frequently wear a level A hazardous materials (HAZMAT) suit. These suits protect the first responder from chemical exposure by completely sealing the wearer against external vapors and liquids. Along with the SCBA, the impermeable suit provides contaminant free air and a barrier to the chemical hazard. Unfortunately, because the suits are sealed, they quickly get very hot and humid because the water vapor from sweating is trapped inside the suit. Given the fact that a first responder can be in the suit from 30-60 min, overheating is not just a source of discomfort, but is dangerous because of the risk of heat exhaustion.

TDA Research, Inc. (TDA) is developing a lightweight, portable system that will both cool and dehumidify the air that is circulated through a level A HAZMAT suit. Breathing air is supplied to the first responder inside the suit by the usual SCBA. To cool the wearer, TDA's system circulates clean, dry, breathable air. Evaporation of perspiration is the main heat transfer mechanism that cools the first responder in the suit. The water vapor generated by sweat evaporation is removed using a lightweight bed of desiccant. The dry air exiting the bed is then cooled using a specially designed heat exchanger that rejects heat to the outside environment. The heat exchanger transfers heat from the inside of the suit to the dirty environment, while keeping the clean and contaminated air streams completely separate.