




The National Institute for Occupational Safety and Health (NIOSH)

Promoting productive workplaces
through safety and health research / 

Alice B. Hamilton Awards 2012

2012 Awards, Honorable Mentions, Finalists, and Updates

Education and Guidance Category

Winner:

- **Title:** When do you take refuge? Decisionmaking during mine emergency escape: instructor's guide and lesson plans
- **Authors:** Kosmoski CL, Margolis KA, McNelis KL, Brnich MJ Jr, Mallett L, Lenart P
- **Source:** Pittsburgh, PA: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2011-177, 2011
- **Description:** This two-part training was developed by a multidisciplinary team of NIOSH researchers to improve decision making during an underground mine emergency. The first part is an instructor's guide and lesson plan that includes discussion questions. The second part is a computer-based training (CBT) module that can be run online or by CD-ROM. CBT is interactive and self-paced, and can be used to simulate dangerous situations that cannot be replicated for training purposes. The training was developed in response to the Mine Improvement and New Emergency Response (MINER) Act that mandated that every underground coal mine in the United States have refuge chambers in place by 2009. The use of these chambers has raised psychosocial questions including if, and when, miners should forego escape attempts and enter a refuge chamber. While escape should always be the first priority in an emergency, in the event that miners cannot escape it is important that they know when to enter a refuge chamber. Providing refuge chamber training is difficult because coal miners must consider several factors before making decisions during an emergency. In addition, there is no one set of prescriptive guidelines outlining how a miner should react, because every mine emergency is unique. Therefore, it is vital that miners practice decision making skills, including how to evaluate mine conditions, escape options, and possible outcomes in the event of an emergency. This training makes a substantial contribution to the safety and health of the approximately 42,000 men and women who are currently employed as underground coal miners in the United States.

Link to abstracts in NIOSHTIC-2

- [Book](#)
- [CD-ROM](#)

[Link to full publication](#)

Honorable Mention:

- **Title:** An official American Thoracic Society statement: work-exacerbated asthma
- **Authors:** Henneberger PK, Redlich CA, Callahan DB, Harber P, Lemièrre C, Martin J, Tarlo SM, Vandenplas O, Torén K
- **Source:** Am J Respir Crit Care Med 184(3):368-378, 2011
- **Description:** Work-related asthma is the most common lung disease treated in occupational health clinics in the United States. It includes both occupational asthma and work-exacerbated asthma (WEA), in which pre-existing or concurrent asthma is worsened by workplace conditions. While WEA is often attributed to irritant exposures, it has also been associated with sensitizing agents and other exposures such as emotional stress, extremes in temperature, and physical exertion. WEA occurs in a variety of occupations and industries. Interventions to prevent it are important to the progression of disease, since the occurrence of severe exacerbations has been associated with an accelerated decline in pulmonary function. A variety of general care and pulmonary physicians could potentially identify cases of WEA, but first they need to be aware of the importance of the condition, and then understand how to diagnose and manage it. Therefore, in 2005, Dr. Paul Henneberger of NIOSH obtained approval from the American Thoracic Society (ATS) to convene a committee that would critically review WEA studies to inform research and public health agendas. He enlisted experts from several countries and directed the committee for 5 years. ATS methodologists provided guidance on identifying and reviewing references, and summarizing the evidence. The review determined that WEA was common among adults with asthma, with a median prevalence of 21.5%. WEA cases with persistent work-related symptoms were similar to occupational asthma cases in terms of disease severity, medication requirements, and socioeconomic factors such as unemployment and loss of income. Compared to asthma cases that were unrelated to work, WEA cases had more symptomatic days, greater utilization of health-care resources, and lower quality of life. The Statement provides guidance for the diagnosis and management of WEA, and identifies specific needs for further research. NIOSH has published more articles on WEA than any other organization worldwide. Through this official ATS statement, NIOSH helps to further the goal of informing those who can make a difference in occupational health and provides leadership that benefits workers in the United States and beyond.

[Link to abstract in NIOSHTIC-2](#)

Engineering and Control Category

Winner:

- **Title:** Evaluation of microwave steam bags for the decontamination of filtering facepiece respirators
- **Authors:** Fisher EM, Williams JL, Shaffer RE
- **Source:** PLoS ONE 6(4):e18585, 2011
- **Description:** N95 Filtering Facepieces Respirators (FFRs) are an important non-pharmaceutical intervention. During the 2009-10 H1N1 influenza pandemic FFRs were recommended for use by healthcare workers during encounters with symptomatic patients. The recommendations were to discard these single-use FFRs after each patient encounter. As predicted by the Institute of Medicine and others, many hospitals reported shortages of these devices in the late summer and fall. This article addresses a concern posed in a recently published manuscript that demonstrated that microwave generated steam was effective against H1N1. However, the decontamination vessel lacked a defined headspace, potentially resulting in portions of the FFR not being exposed to adequate steam. The use of a steam bag as described in our paper provides a decontamination vessel with a defined headspace which ensures that the FFR will be enveloped in steam. The contributions in this manuscript are unique. It addresses several key knowledge gaps identified in the recent peer-reviewed literature. This manuscript discusses the use of an accessible and very practical decontamination technology suitable for use by the general public, infection control specialists, or healthcare workers themselves. Microwave steam bags, used for home decontamination of infant feeding accessories, are available for purchase in many retail stores. The instructions are written for the general public and are based on the operation of a microwave oven, which are readily available in home and healthcare environments. This is in contrast to previously examined decontamination methods which used scarcely available and complex equipment such as laboratory grade UV-C lamps, vaporous hydrogen peroxide generators, and incubators. Previously examined methods also described detailed chemical decontamination protocols not suitable for the untrained.

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Honorable Mention:

- **Title:** Performance evaluation of 26 combinations of chemical protective clothing materials and chemicals after repeated exposures and decontaminations
- **Authors:** Gao P, Tomasovic B, Stein L
- **Source:** J Occup Environ Hyg 8(11):625-635, 2011
- **Description:** Decontamination of chemical protective clothing (CPC) is an important occupational safety and health issue. To reduce the cost of CPC replacement while protecting American workers from skin injury, the demand for CPC decontamination for reuse purposes has been increasing, especially by small businesses that have to struggle to survive in the current economic environment. Although OSHA has required decontamination of protective clothing under two regulations (29 CFR 1910.132 and 29 CFR 1910.120), it does not define how CPC should be decontaminated to ensure safe reuse. In this study, 14 commonly used CPC materials for constructing gloves, boots, and suits were selected along with 12 liquid chemicals to challenge the materials, which resulted in evaluating a total of 26 material-chemical combinations. Two decontamination methods, thermal and water-detergent, were used for comparison for a total of 1,500 permeation tests. This study investigated decontamination efficacy of up to 11 exposure and decontamination cycles for each of the combinations. It provided not only a statistical comparison of the breakthrough time (BT) and steady-state permeation rate (SSPR) between the beginning and the ending cycles, but also the changes in BT and SSPR of each cycle. Previous evaluations by other researchers had not assessed cycles beyond the first. The significant finding of this study further confirms our previous findings: if the BT and SSPR remain virtually unchanged after the first exposure and decontamination cycle, they are not likely to change in subsequent cycles. This finding fills an important knowledge gap, which indicates that multiple reuses (up to 10 times) of some CPC could be safe. We also demonstrated that the thermal method had higher decontamination efficacy than the detergent method. For instance, gloves in the glove/chemical combination #25 could be reused for as many as 10 times. This means that during a ten-day use, the cost could be reduced from \$960 (one pair every day) to no more than \$100 as each pair of gloves costs about \$96. The thermal decontamination method is unique and uncomplicated, requiring only an explosion proof oven. The method is cheap and easily applied by placing the CPC into an oven that was pre-heated to 100 °C and leaving it in overnight.

[Link to abstract in NIOSHTIC-2](#)

Epidemiology and Surveillance Category

Winner:

- **Title:** A meta-analysis of leukaemia risk from protracted exposure to low dose gamma radiation
- **Authors:** Daniels RD, Schubauer Berigan MK
- **Source:** Occup Environ Med 68(6):457-464, 2011
- **Description:** Leukaemia, excluding the chronic lymphocytic subtype, is considered to be among the cancers most susceptible to induction by ionizing radiation. Our understanding of leukaemia radiogenicity stems largely from studies of radiation therapy patients and survivors of the atomic bombings of World War II. Although these studies provide information on the risk following high dose exposures, they cannot be used to assess risks to working populations. In addition, most epidemiologic studies have individually lacked sufficient statistical power to precisely estimate risks because of the relatively small effect size of most outcomes and the low doses accrued in a typical working population. Assembling large cohorts, however, is difficult and potentially prohibitively expensive. Meta-analysis is a very active area of evidence-based research that has been widely used in medical studies to summarize results from randomized controlled trials. These methods have not been widely used to condense information from epidemiologic observational studies, especially when examining occupational radiation exposure and cancer. Our study was the first to use meta-analysis to synthesize information on leukaemia risk obtained from available occupational and environmental studies. We found that leukaemia was significantly associated with exposure to protracted, low-level ionizing radiation. The precision of the aggregate estimate was better than that of the estimates from single studies. Our results were in reasonable agreement with the leukaemia risk observed in atomic bomb survivors, thereby strengthening our confidence in the current understanding of leukaemia risk. Furthermore, we demonstrated that meta-analysis of radio-epidemiologic studies is a useful tool for assessing health effects from exposures of workers to radiation. This study is part of continued research that collectively will play an important role in the development of recommended exposure limits and appropriate worker protection strategies.

[Link to abstract in NIOSHTIC-2](#)

Honorable Mention:

- **Title:** Shiftwork duration and the awakening cortisol response among police officers
- **Authors:** Wirth M, Burch J, Violanti J, Burchfiel C, Fekedulegn D, Andrew M, Zhang HM, Miller DB, Hebert JR, Vena JE
- **Source:** Chronobiol Int 28(5):446-457, 2011
- **Description:** This study presents a detailed analysis of associations between shift work, using an extensive work history database, and hypothalamic-pituitary-adrenal axis function, based on measurement of salivary cortisol awakening response in a sample of police officers. It is an integrative and systems level study of aspects of workplace exposure to environmental stressors and a biological outcome related to the hormonal system that helps mobilize energy for, and manage consequences of, environmental challenges. It is one of the first detailed studies with work history data and high quality laboratory measurements leading to accurate characterization of hypothalamic-pituitary-adrenal axis function. As an occupational group, police officers are exposed to various organizational and environmental stressors. They are often required to work long, irregular hours, which can induce stress, fatigue, and sleep disruption, and they have higher than the average rates of chronic disease and mortality. Cortisol is a well-known "stress hormone" produced via activation of the hypothalamic-pituitary-adrenal axis. An abnormal secretion pattern has been associated with immune system dysregulation and may serve as an early indicator of disease risk. This study examined the effects of long- and short-term shiftwork on the cortisol awakening response among officers in the Buffalo Cardio-Metabolic Occupational Police Stress pilot study (2001–2003). The waking cortisol response was lower among officers working short-term night or afternoon shifts than among officers working day shifts, with maximal differences occurring after 5 days of shiftwork. The duration of long-term shiftwork was not associated with the cortisol awakening response, although values were attenuated among officers with more career shift changes. These results indicate that short-term night work and possibly long-term shift changes may lead to dysregulation of the hypothalamic-pituitary-adrenal axis in police officers, and potentially in other populations. This is important because dysregulation of the hypothalamic-pituitary-adrenal axis has been implicated in the development of chronic cardiovascular and metabolic disease.

[Link to abstract in NIOSHTIC-2](#)

Exposure and Risk Assessment Category

Winner:

- **Title:** Asbestos fibers and other elongate mineral particles: state of the science and roadmap for research
- **Authors:** Middendorf P, Zumwalde R, Castellan R, Harper M, Wallace W, Stayner L, Castranova V, Hearl F, Sullivan P
- **Source:** Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, DHHS (NIOSH) Publication No. 2011-159, 2011
- **Description:** Since the mid-20th century, many advances have been made in the scientific understanding of worker health effects from exposure to asbestos fibers and other elongate mineral particles (EMPs). A vast number of articles has been written about asbestos, and it is now well documented that asbestos fibers can cause serious diseases in exposed workers. However, many fundamental questions and areas of scientific uncertainty remain that limit the ability to develop new, more effective recommendations for worker protection. Also, the patterns and types of exposures have changed since NIOSH recommendations were first developed. Asbestos in manufacturing is now limited. Exposures in maintenance activities are likely short, and intermittent worker exposures are anticipated to dominate in the future. The Roadmap uncovers the fundamental questions which need to be answered and develops technological approaches and research pathways to address them. An added benefit of this work is that it addresses similar issues for other minerals. The Roadmap was developed in a milieu of intense political, legal, and scientific scrutiny, and generated a high level of interest among professionals and the public because of its innovative recommendations. One piece of evidence for the interest in the document comes from the American Industrial Hygiene Association (AIHA) that ranked it as its top story of 2011, based on reader responses. A

significant outcome from the extensive review of this document was the request by stakeholders for NIOSH to reevaluate its cancer classification policy. Subsequently, the Institute has undertaken this review and the development of recommended exposure limits (RELS) for carcinogens. This evaluation is the first major policy reassessment made by NIOSH in over 30 years.

[Link to abstract in NIOSHTIC-2](#)

[Link to full publication](#)

Honorable Mention (Jointly submitted):

- **Title:** Risk of brain tumours in relation to estimated RF dose from mobile phones: results from five Interphone countries
- **Authors:** Cardis E, Armstrong BK, Bowman JD, Giles GG, Hours M, Krewski D, McBride M, Parent ME, Sadetzki S, Woodward A, Brown J, Chetrit A, Figuerola J, Hoffmann C, Jarus-Hakak A, Montestruq L, Nadon L, Richardson L, Villegas R, Vrijheid M
- **Source:** Occup Environ Med 68(9):631-640, 2011

[Link to abstract in NIOSHTIC-2](#)

- **Title:** Estimation of RF energy absorbed in the brain from mobile phones in the Interphone Study
- **Authors:** Cardis E, Varsier N, Bowman JD, Deltour I, Figuerola J, Mann S, Moissonnier M, Taki M, Vecchia P, Villegas R, Vrijheid M, Wake K, Wiart J
- **Source:** Occup Environ Med 68(9):686-693, 2011
- **Description:** These two papers are a dramatic demonstration of an epidemiologic study which was improved by incorporating biophysical principles and additional data into the exposure assessment. A 13-nation Interphone Study of cell phones and brain cancer had originally reported a puzzling U-shaped dose-response of the risks related to the time of cell phone use reported at interviews. Since the radio-frequency (RF) energy absorbed in the brain is determined by many factors beyond cell phone usage time, a novel biophysical model was developed of the RF dose at the tumour site from the cell phones used by the Interphone subjects. This model incorporated all the cell phone types mentioned during the subject interviews, laboratory dosimetry data on these cell phones, present-day measurements of a phone's average output power in the subject's cellular network, and the tumour's coordinates from radiologists. The model then calculated the cumulative specific RF energy absorbed at the tumour's center. When this RF dose model was used to reanalyze the brain cancer risks with data from 5 of the 13 Interphone countries, a significant dose-response was found with gliomas for phone use of more than 7 years. This outcome would be expected if the probability of tumorigenesis progressing through one or more stages was proportional to the RF power absorbed by a glia cell. Confirming a biologically-based hypothesis with a well-designed epidemiologic study provided some evidence that the RF emissions from cell phones could be a causal factor in brain cancer. A recent working group of the International Agency for Research on Cancer (IARC) found RF electromagnetic fields, including radiation from cell phones, to be a possible human carcinogen. In justifying this decision, IARC's summary report cited the Risk paper's dose-response from more than 7 years of phone use. In addition to providing evidence for cell phone carcinogenesis, the findings of these two papers also help identify preventive measures. Effective preventions would include reducing the time talking on the phone and the amount of RF radiation reaching the head by using hands-free devices, the speaker-phone mode, or text messaging.

[Link to abstract in NIOSHTIC-2](#)

Laboratory and Methods Category

Laboratory and Methods Category

- **Title:** Blood gene expression profiling detects silica exposure and toxicity
- **Authors:** Sellamuthu R, Umbright C, Roberts JR, Chapman R, Young SH, Richardson D, Leonard H, McKinney W, Chen B, Frazer D, Li S, Kashon M, Joseph P
- **Source:** Toxicol Sci 122(2):253-264, 2011
- **Description:** A major challenge in occupational safety and health research is to develop simple, practical tests that are capable of detecting potential adverse health effects of human exposure to toxic agents well before the onset of irreversible organ toxicity. Because it is not feasible to obtain human internal target organ samples to determine adverse health effects resulting from exposure to toxic agents, non-invasive or minimally invasive surrogate approaches have been developed such as the measurement of enzyme activities in body fluids (for example, blood) to circumvent this limitation. However, many of the currently available non-invasive or minimally invasive techniques are not sensitive enough to detect sub-clinical target organ toxicity such as those occurring following occupational exposure to very low concentrations of toxic agents. We used an animal model that is relevant to human silicosis, a preventable disease with no known treatment, and demonstrated for the first time the potential application of peripheral blood gene expression profiling as a highly sensitive and practical surrogate approach to detect sub-clinical pulmonary toxicity in rats exposed to crystalline silica. Our finding has potential application in the early detection and prevention of silicosis among workers. Since small quantities of blood can be obtained from workers by a minimally invasive procedure, the capability to detect preclinical silicosis based on the expression of specific genes in the blood appears to be a practical approach to monitor workers for pre-clinical silicosis and other pulmonary effects associated with silica exposure. In addition since small quantities of blood required for gene expression studies can be drawn repeatedly by minimally invasive procedures from the same animal there is no need to sacrifice the animal to investigate target organ toxicity.

[Link to abstract in NIOSHTIC-2](#)

Honorable Mention:

- **Title:** Comparative proteomics and pulmonary toxicity of instilled single walled carbon nanotubes, crocidolite asbestos, and ultrafine carbon black in mice
- **Authors:** Teeguarden JG, Webb Robertson BJ, Waters KM, Murray AR, Kisin ER, Varnum SM, Jacobs JM, Pounds JG, Zanger RC, Shvedova AA
- **Source:** Toxicol Sci 120(1):123-135, 2011
- **Description:** Nanomaterials represent a new and emerging field where new particles with unique physico-chemical, electrical, and mechanical properties are developed for use in electronics, aerospace devices, computers and pharmaceuticals. Among those, single-walled carbon nanotubes (SWCNT) are important in many industries. Due to the unusual characteristics and very high surface area of SWCNT, their biological effects have been viewed as largely unpredictable. The objectives of this study were to assess and compare the pulmonary response to repeated exposure to SWCNT, crocidolite asbestos, and ultrafine carbon black (UFCB) in mice. Both conventional toxicological assays and high-throughput, high information content, global proteomics, and multiplexed protein micro ELISA analyses were applied and integrated. An additional goal of this integrated research was to enable the identification of unique protein bio-signatures of each of the three test compounds. This would in turn enable the development of rapid screening tools for application to the toxicological and risk assessment of emerging fiber nanoparticles. This study was the first global proteomic comparison lung response to respirable SWCNT, ultrafine carbon black and asbestos following exposure in vivo. Conventional histopathological and biochemical endpoints were also assessed providing tissue-level context for the observed protein changes. The results of the study are important for fingerprinting early biomarkers of exposure to fibrous carbonaceous nanomaterials, hazard identification, and risk assessment applicable to human studies. This paper has been a catalyst for a project aiming to assess health outcomes in workers at two major SWCNT production plants by Kazan Medical University (Russian Federation), NIOSH, and major academic and government institutions in the US and Europe. The aim of this ongoing project is to develop sensitive and specific biomarkers employing micro RNA and epigenetics techniques based on fundamental results of the global proteomic study providing new tools for risk assessment of carbonaceous nanomaterials in humans.

[Link to abstract in NIOSHTIC-2](#)

Finalists

Names are not necessarily listed in the order in which they were ranked.

Education and Guidance

Henneberger PK, Redlich CA, Callahan DB, Harber P, Lemièrre C, Martin J, Tarlo SM, Vandenplas O, Torén K. An official American Thoracic Society statement: work exacerbated asthma. *Am J Respir Crit Care Med* 184(3):368-378, 2011.

Kosmoski CL, Margolis KA, McNelis KL, Brnich MJ Jr., Mallet L, Lenart P. NIOSH Report of Investigation (RI) 9682: When Do you Take Refuge? Decisionmaking During Mine Emergency Escape: Instructor's Guide and Lesson Plans. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, *DHHS (NIOSH) Publication No. 2011-177*, 2011.

Jointly submitted:

- Stephenson CM, Stephenson MR. Hearing loss prevention for carpenters: Part 1—using health communication and health promotion models to develop training that works. *Noise Health* 13(51):113-121, 2011.
- Stephenson MR, Shaw PB, Stephenson CM, Graydon PS. Hearing loss prevention for carpenters: Part 2—demonstration projects using individualized and group training. *Noise Health* 13(51):122-131, 2011.

Engineering and Control

Bugarski AD, Janisko SJ, Cauda EG, Noll JD, Mischler SE. NIOSH Report of Investigation (RI) 9687: Diesel Aerosols and Gases in Underground Mines: Guide to Exposure Assessment and Control. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, *DHHS (NIOSH) Publication No. 2012-101*, 2011.

Fisher EM, Williams JL, Shaffer RE. Evaluation of microwave steam bags for the decontamination of filtering facepiece respirators. *PLoS ONE* 6(4):e18585, 2011.

Gao P, Tomasovic B, Stein L. Performance evaluation of 26 combinations of chemical protective clothing materials and chemicals after repeated exposures and decontaminations. *J Occup Environ Hyg* 8(11):625-635, 2011.

Epidemiology and Surveillance

Charles LE, Gu JK, Andrew ME, Violanti JM, Fekedulegn D, Burchfiel CM. Sleep duration and biomarkers of metabolic function among police officers. *J Occup Environ Med* 53(8):831-837, 2011.

Daniels RD, Schubauer Berigan MK. A meta-analysis of leukaemia risk from protracted exposure to low dose gamma radiation. *Occup Environ Med* 68(6):457-464, 2011.

Wirth M, Burch J, Violanti J, Burchfiel C, Fekedulegn D, Andrew M, Zhang HM, Miller DB, Hebert JR, Vena JE. Shiftwork duration and the awakening cortisol response among police officers. *Chronobiol Int* 28(5):446-457, 2011.

Exposure and Risk Assessment

Jointly submitted:

- Cardis E, Armstrong BK, Bowman JD, Giles GG, Hours M, Krewski D, McBride M, Parent ME, Sadetzki S, Woodward A, Brown J, Chetrit A, Figuerola J, Hoffmann C, Jarus Hakak A, Montestruq L, Nadon L, Richardson L, Villegas R, Vrijheid M. Risk of brain tumours in relation to estimated RF dose from mobile phones: results from five Interphone countries. *Occup Environ Med* 68(9):631-640, 2011.
- Cardis E, Varsier N, Bowman JD, Deltour I, Figuerola J, Mann S, Moissonnier M, Taki M, Vecchia P, Villegas R, Vrijheid M, Wake K, Wiart J. Estimation of RF energy absorbed in the brain from mobile phones in the Interphone Study. *Occup Environ Med* 68(9):686-693, 2011.

Middendorf P, Zumwalde R, Castellan R, Harper M, Wallace W, Stayner L, Castranova V, Hearl F, Sullivan P. Current Intelligence Bulletin 62: Asbestos Fibers and Other Elongate Mineral Particles: State of the Science and Roadmap for Research. U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, *DHHS (NIOSH) Publication No. 2011-159*, 2011.

Nakata A, Takahashi M, Irie M. Effort reward imbalance, overcommitment, and cellular immune measures among white collar employees. *Biol Psychol* 88(2?3):270-279, 2011.

Smith JP, Biagini RE, Johnson BC, Olsen LD, Mackenzie BA, Robertson SA, Sammons DL, Striley CAF, Walker CV, Snawder JE. Assessment of exposure to PACs in asphalt workers: measurement of urinary PACs and their metabolites with an ELISA kit. *Polycycl Aromat Compd* 31(4):270-285, 2011.

Laboratory and Methods

Diwakar P, Kulkarni PS, Birch ME. New approach for near real time measurement of elemental composition of aerosol using laser induced breakdown spectroscopy. *Aerosol Sci Tech* [Epub ahead of print, 2011 Oct].

Sellamuthu R, Umbright C, Roberts JR, Chapman R, Young SH, Richardson D, Leonard H, McKinney W, Chen B, Frazer D, Li S, Kashon M, Joseph P. Blood gene expression profiling detects silica exposure and toxicity. *Toxicol Sci* 122(2):253-264, 2011.

Teeguarden JG, Webb Robertson BJ, Waters KM, Murray AR, Kisin ER, Varnum SM, Jacobs JM, Pounds JG, Zanger RC, Shvedova AA. Comparative proteomics and pulmonary toxicity of instilled single walled carbon nanotubes, crocidolite asbestos, and ultrafine carbon black in mice. *Toxicol Sci* 120(1):123-135, 2011.