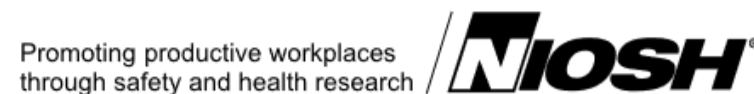




The National Institute for Occupational Safety and Health (NIOSH)



Alice B. Hamilton Awards 2007

Educational Materials Category

Winner:

- **Title:** Roof bolting machine operator skills training for a walk-thru roof bolter: trainer's guide
- **Authors:** Wiehagen WJ, Robertson SB, Urban CW, Dickerson JP, Peters RH, Vaught C, Mallett LG, Brnich MJ Jr., Conkle R, Cooper D, Thomas D
- **Source:** 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.2006-135, IC 9489, 2006
- **Description:** Roof bolting is one of the higher-risk jobs in underground coal mines. This training program is designed to help experienced workers (roof bolting machine operators, mechanics who service the bolter, front-line supervisors, and safety professionals) transfer knowledge and skills about good roof bolting techniques using the Fletcher Walk-thru Roof Bolter. The material is based on a job training analysis conducted at the mine site with subject-matter experts. These experts were from Twentymile Coal Co., J. H. Fletcher, the Mine Safety and Health Administration, and NIOSH. This material is designed as one potential model for skills training that integrates health and safety with production and maintenance. It is designed to be easily customized by mining companies to include mine- and company-specific roof bolting practices, policies, and working conditions. The purpose of structured job training is to accelerate learning and reduce variability in job performance. This guide is based on an on-the-job training model (Assess-Train-Evaluate) whereby experienced workers transfer skills and knowledge to new machine operators. The materials are designed to aid these experienced workers in how they train those who are new to the roof bolting task.



[Link to full publication](#)

Biological Sciences Category

Winner:

- **Title:** Arsenic induces NAD(P)H-quinone oxidoreductase I by disrupting the Nrf2/Keap1/Cul complex and recruiting Nrf2.Maf to the antioxidant response element enhancer
- **Authors:** He X, Chen MG, Lin X, Ma Q
- **Source:** J. Biol. Chem. 281(33):23620-23631, 2006
- **Description:** Arsenic (AS) is a major toxic metal element and a proven carcinogen in humans. Moreover, AS is a ubiquitous contaminant and has become a major health concern worldwide because millions of people are at risk of drinking water contaminated with arsenic that is associated with multiple human diseases or lesions. Major sources of arsenic contaminating soil and water include mining, industrial metallurgical activities, and the manufacture and agricultural use of pesticides and herbicides. Although the toxic and carcinogenic effects of AS have been well documented, a major obstacle in the understanding of AS toxicity is the lack of molecular insights into AS action in cells, in particular, the protein target(s) of AS and the molecular interaction of AS with the target proteins, which ultimately limits the effectiveness of the prevention and treatment against the toxicity and cancer caused by AS. This paper demonstrated, for the first time, that toxic metal element AS induces phase II detoxification genes by activating Nrf2.

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Honorable Mention:

- **Title:** Accelerated ovarian failure induced by 4-vinyl cyclohexene diepoxide in Nrf2 null mice
- **Authors:** Hu X, Roberts JR, Apopa PL, Kan YW, Ma Q
- **Source:** Molecular and Cellular Biology 26(3):940-954, 2006
- **Description:** Premature ovarian failure (POF), characterized by secondary infertility with persistently elevated gonadotropin levels before the age of 40, is a common cause of infertility and premature aging in women with an incidence of approximately 1%. Although some POF cases have been associated with certain genetic factors, the etiology of the majority of POF cases remains unknown. In the present study, we assessed the role of Nrf2 in VCD-induced ovarian damage. The study demonstrated that exposure of mice lacking Nrf2 (gene-targeted knockout) to VCD caused age-dependent decline in reproduction leading to secondary infertility accompanied by hypergonadotropic hypogonadism after 30 weeks of age compared with 50 weeks of age in wild type, mimicking POF in humans. VCD was shown to selectively destroy small ovarian follicles, resulting in early depletion of functional follicles. Mechanistically, VCD caused oxidative damage and apoptosis in follicular cells. Loss of Nrf2 function leads to the loss of the basal and inducible expression of microsomal epoxide hydrolase, a key enzyme in the detoxification of VCD, and increased oxidative damage, as well as the induction of Foxo3a, a repressor critical in the early stages of follicle activation. This study revealed that Nrf2 serves as an essential sensor and regulator of chemical homeostasis in ovarian follicle cells, protecting the cells from toxic chemicals by controlling metabolic detoxification, ROS defense, and Foxo3a expression.

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Engineering and Physical Sciences Category

Winner:

- **Title:** Validation of a standardized portable fluorescence method for determining trace beryllium in workplace air and wipe samples
- **Authors:** Agrawal A, Cronin J, Tonazzi J, McCleskey TM, Ehler DS, Minogue EM, Whitney G, Brink C, Burrell AK, Warner B, Goldcamp MJ, Schlecht PC, Sonthalia P, Ashley K
- **Source:** J. Environ. Monit. 8:619-624, 2006
- **Description:** This study investigated agriculture worker-tractor interfaces for safe tractor operation, using three dimensional human and tractor-scan information. The reported research presents an innovative approach to study how human body shape and dimensions interact with tractor cab layout to affect safe tractor operation. It also provides practical solutions for tractor manufacturers to assess their current tractor-cab accommodation and for a national standards committee to revise current tractor-cab dimension standards.

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Honorable Mention:

- **Title:** Frequency weighting derived from power absorption of fingers-hand-arm system under zh-axis



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disorders. According to a recent BLS report (2004), it is estimated that more than 1.5 million US workers are occupationally exposed to HTV; this figure is close to that reported by NIOSH in 1989. According to NIOSH's documents (1989; 1997), the average prevalence of HAVS is 50% among intensively-exposed workers. Troubling prevalence figures have also been reported in Europe. Thus, European Union (EU) countries have set forth a Directive intended to control HAVS (EU Directive, 2002) and started to implement it since 2005. This study developed a novel method to derive new frequency weightings based on VPA or the biodynamic response of the hand-arm system and that the weighting derived from the palm VPA is also consistent with the ISO weighting. It also suggests that the frequency weighting derived from the VPA measured at the fingers is superior to the ISO weighting because it partially overcomes the deficiencies of the total VPA method. However, the VPA measured at the fingers at low frequencies may also be further transmitted to other parts of the hand-arm system. This study further suggests that a method that can separate the VPA actually absorbed in the fingers from that flowing through the fingers is required to improve the finger VPA method. Therefore, this study also provided a clear direction for further study of the VPA.

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Human Studies Category

Winner:

- **Title:** Evaluation of Flavorings-Related Lung Disease Risk at Six Microwave Popcorn Plants
- **Authors:** Kanwal R, Kullman G, Piacitelli C, Boylstein R, Sahakian N, Martin S, Fedan K, Kreiss K
- **Source:** J Occup Environ Med. 48:149-157, 2006
- **Description:** This paper provides information on the risk factors for severe, irreversible lung disease from exposures to butter flavoring chemicals in microwave popcorn production. Widespread risk in this industry from these chemicals is emphasized by the finding of affected workers at 5 of 6 plants evaluated by NIOSH investigators. Medical survey findings among mixers of butter flavorings and oil showed a dose-response effect. Compared to all other workers, mixers also had the highest respiratory symptom prevalences and the most evidence of lung function impairment. The exposure data suggest that workers are likely at risk from brief intense exposures even when average exposures are low. This information is extremely important for prevention efforts. Based on the investigative findings, the paper's discussion section includes appropriate exposure control information based on the hierarchy of controls. The discussion section also points out the limitations of respirators and the need to monitor exposed workers with regular spirometry tests. The information presented in this paper is an important contribution to the occupational scientific literature. Its availability to occupational safety and health professionals and physicians may allow the earlier identification of lung disease risk in workers exposed to butter flavoring chemicals in the production of other food products. Information from this paper is being considered by the Federal Occupational Safety and Health Administration as it prepares its response to a request from organized labor for an exposure limit for diacetyl.

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Honorable Mention:

- **Title:** Urinary Bromide and Breathing Zone Concentrations of 1-Bromopropane from Workers Exposed to Flexible Foam Spray Adhesives
- **Authors:** Hanley K, Petersen M, Curwin B, Sanderson W
- **Source:** Annals of Occupational Hygiene 50(6):599-607, 2006
- **Description:** Bromopropane (1-BP) has been marketed as an alternative for ozone depleting solvents and suspect carcinogens and is in aerosol products, adhesives, vapor degreasing, and liquid cleaning solvents. The toxicity of 1-BP in humans is poorly understood because there is limited research available in the published literature. There is concern, however, that 1-BP may produce neurotoxic, reproductive, and hematopoietic effects based on chemical analogy to other brominated-propane compounds, animal toxicity studies, and a limited number of case studies. Sparse exposure information prompted NIOSH to conduct this exposure assessment study using air sampling and measurement of urinary metabolites. Methods for biomonitoring occupational exposure to 1-BP are in early stages of development, with only a few references reported in the literature. Some of 1-BP that is absorbed is metabolized through conjugation with glutathione which releases free bromide (Br) ion. One objective of this field study was to investigate the utility of urinary Br analysis for evaluating worker exposure to 1-BP. Bromide ion analysis in urine is appealing because it is based on well established methodology, is non-invasive, and it is an inexpensive, commercially available method. Urinary Br levels are variable in the general population, however, and may be influenced by diet and pharmaceuticals, including over-the-counter medications. Hence, prior to this study, it was difficult to determine if urinary Br analysis would be useful for evaluating occupational exposure to 1-BP. Complete 48-hour urine specimens were obtained from 30 workers at facilities using 1-BP adhesives to construct polyurethane foam seat cushions and from seven unexposed control subjects. There was a strong association of 48-hour urinary Br concentration with 1-BP TWA exposure which was statistically significant ($r^2 = 0.89$) for all jobs combined. This study demonstrates that urinary elimination of Br is an important excretion pathway for 1-BP metabolism. Moreover, urinary Br is useful and practical index of 1-BP exposure particularly when exposures are high, because it is an inexpensive, commercially available method. Furthermore, dermal exposure to 1-BP can greatly add to a workers' absorbed dose because it appreciably penetrates intact skin. Urinary Br is a practical biological monitoring tool which allows investigators to assess the impact of dermal exposure to the overall absorbed dose.

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