

organs, and can ultimately lead to death. Benzene is associated with irritation of the skin, eyes, and airways; vomiting, dizziness, etc.; and it is a known human carcinogen. Concentrations of these pollutants were quantified using a chip measurement system (CMS) from Draeger Safety, Inc. Analysis was conducted at six different locations in four major cities in Ghana, where animal carcasses are processed for human consumption. Four locations (slaughterhouses) use tire-derived fuel, the fifth (mechanized abattoir) uses LPG, while the sixth uses firewood (with a small piece of tire to start the fire) for meat singeing. Overall, the average CO levels emitted via tire-derived smoke (128.67 ± 18.23 ppm; $p < 0.0001$) and firewood smoke (130.86 ± 21.71 ppm; $p < 0.0001$) were significantly higher compared to LPG-based smoke (control). No significant difference was detected between the level of CO in tire-derived smoke versus that of firewood ($p < 0.8915$). Also, the average benzene levels emitted via scrap tire-derived smoke (3.50 ± 0.95 ppm; $p < 0.2163$) and firewood (1.30 ± 1.14 ppm; $p < 0.8712$) were higher than that of LPG-based smoke (control) but not statistically significant. Also, there was no significant difference between level of benzene in tire-derived smoke versus that of firewood ($p < 0.1053$). While this is a pilot study, results suggest that slaughterhouse operators and residents in close proximity to these facilities may be at high risk of experiencing the health effects of CO and benzene. Further studies are needed to confirm these results and work with stakeholders to create data-driven, safe, economically viable, and culturally appropriate alternatives for processing meat in Ghana and other developing countries.

PS 1686 Factors Affecting Hydrocarbon Gas and Vapor Exposure of Upstream Oil and Gas Workers during Completion and Production Activities at Unconventional Shale Oil and Gas Wells

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The National Institute for Occupational Safety and Health is conducting research to assess chemical exposure hazards to upstream oil and gas workers. Activities in each segment may present chemical exposure hazards inherent to that activity and vary based on well type, geologic basin and the age of the producing well. Worker exposures were determined by personal breathing zone (PBZ) sampling during the full-shift or for specific tasks. Exposure assessments included: low molecular weight gas and vapors, benzene, toluene, ethylbenzene, xylenes (BTEX), and polyaromatic hydrocarbons (PAHs). Identification of exposure sources and patterns of exposure were evaluated through collection of whole air samples (grab and time integrated samples), direct reading instruments including flame and photoionization detectors, colorimetric methods and infrared videography. Predictably, alkanes, alkenes, BTEX and PAHs (particularly naphthalene) were detected in many PBZ samples; however, the composition and concentration of different hydrocarbons varied greatly. Well completion activities presenting the greatest hydrocarbon exposures included flowback, production testing and produced water management; production activities included tank gauging and sample collection during fluid transfers, well inspection and maintenance. Geologic basin, well type, age or stage of production were determined to be predictors of both the composition and concentration of hydrocarbon exposures. Higher concentrations of BTEX were detected in worker samples from oil and gas wells in DJ, Piceance, San Juan, and Bakken formations, followed by wet gas wells in Utica and Marcellus basins. Worker samples from dry gas wells in Fayetteville and Marcellus basins had low concentrations of the measured hydrocarbons and when detected were often from sources other than the well. Geologic formation, worker activities, age of the well and design of the production equipment were all factors that effected exposures. Greater understanding of where, when and how exposures occur can allow for better risk assessments and targeted interventions and controls to improve worker safety and health.

PS 1687 Impact on the Respiratory System Due to Travel to Cities Abroad—A Focus on Changing Air Pollution Levels

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Many large cities in the world are known to have many sources of air pollution and thus elevated pollutant levels, especially during certain environmental conditions. These higher levels of air pollution have been shown to have adverse respiratory impacts on residents living in such cities. Although previous studies have looked at health effects of change in air pollution on residents, no studies have looked into the impact

on the respiratory and cardiovascular system when individuals travel to cities abroad with air pollution levels different to their residing city. Therefore, this study's goal is to understand the impact on the respiratory system due to a change in the environment when traveling to a new city in another country, with a main focus on changing air pollution levels. The study recruited students traveling from NYC to cities abroad, mainly those who are enrolled in the NYU Study Abroad program. Three main cities where students traveled - Geneva, Prague and Mexico City were selected as study sites in this pilot study. Participants were pre-trained to use a portable spirometer which recorded FEV1 and PEF measurements before departure, during the stay and after returning from the city abroad. Participants also carried a portable PM2.5 monitoring instrument, an 'Airbeam', to measure their personal exposure levels. Results from the pilot study have shown that in students who traveled to Geneva and Prague, there was no major change in lung function - with the change in exposure. The pollution level changes were not significant for either city vs NYC. In students who traveled to Mexico City there was a noticeable decrease in lung function with increasing pollution. The average reduction in FEV1 was 6–9% during the initial week in Mexico City while upon return to NYC an increase of 11–15% was recorded in average FEV1 values. The significant change in PM2.5 levels between the two cities was correlated with the change in lung function. Therefore, the results of this pilot study show that travel to cities with higher pollution can have acute impacts on the respiratory system and support a concern for the potential for adverse impacts due to exposure to varying air pollution in travel to cities abroad.

PS 1688 Relationships Between Number, Surface Area, and Mass Concentrations of Different Nanoparticles in Workplaces

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No consistent metric for measuring exposure to nanoparticles has yet been agreed upon internationally. This study seeks to examine the relationship between number concentration (NC), surface area concentration (SAC), and mass concentration (MC) of nanoparticles in workplaces. Real-time NC20-1000nm, SAC10-1000nm, and respirable MC100-1000nm were determined for different nanoparticles. Concentration ratio (CR, activity: background), exposure ranking (ER), and between-metric correlation coefficients (R) were used to analyze the relationships between the three metrics. The ratio of cumulative percentage by number (APN) and cumulative percentage by mass (APM) was used to analyze whether nanoparticle number is predominant, as compared with nanoparticle mass. The CRs of NC20-1000nm and SAC10-1000nm for different nanoparticles at the corresponding work sites were higher than those of respirable MC100-1000nm. The ERs of NC20-1000nm for nano-Fe2O3 and nano-Al2O3 were the same as those of SAC10-1000nm, but were inconsistent with those of respirable MC100-1000nm. The order of correlation coefficients between NC20-1000nm, SAC10-1000nm, and respirable MC100-1000nm was: RSAC and NC > RSAC and MC > RNC and MC. The ratios of APN and APM for nano-Al2O3 and grinding-wheel particles (less than 100 nm) at the same work site were 2.03 and 1.65, respectively. NC and SAC metrics are significantly distinct from MC in characterizing exposure to airborne nanoparticles. Simultaneous measurement of NC, SAC, and MC should be conducted as part of nanoparticle exposure assessment strategies and epidemiological studies. Keywords: Nanoparticles; Exposure metric; Exposure assessment; Workplace

PS 1689 Assessment of Indoor Formaldehyde Concentrations Following the Installation and Removal of Laminate Flooring

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Objective: Concerns have been raised regarding formaldehyde emissions from laminate flooring. Given the limited sampling data available, an investigation of the potential formaldehyde emissions resulting from the installation, use, and removal of laminate flooring was conducted. Methods: Two laminate flooring products were purchased and installed in separate study rooms. Passive 24-hr diffusive badge samples (n = 79) for formaldehyde were collected over 63 days, including during a pre-installation period, an acclimation period, during which the packaged products were stored in the study rooms, and following installation and removal. The concentrations were compared to exposure limits and guidelines that exist in the U.S. for indoor air. Results: Mean background

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Preface

This issue is devoted to the abstracts of the presentations for the Continuing Education courses and scientific sessions of the 55th Annual Meeting of the Society of Toxicology, held at the New Orleans Ernest N. Morial Convention Center, March 13–17, 2016.

An alphabetical Author Index, cross referencing the corresponding abstract number(s), begins on page 603.

The issue also contains a Keyword Index (by subject or chemical) of all the presentations, beginning on page 629.

The abstracts are reproduced as accepted by the Scientific Program Committee of the Society of Toxicology and appear in numerical sequence. Author names which are underlined in the author block indicate the author is a member of the Society of Toxicology. For example, J. Smith.

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