PS 514 Benzene Concentrations in Working Environment of Workers at Gasoline Stations

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The aim of this study was to investigate benzene concentrations in the working environments of workers at gasoline stations. Benzene samples were collected by personal air sampling (n=101) and area sampling (n=20) in the city of Muang Khon Kaen, Thailand using sorbent tubes connected to a personal pump and analyzed with gas chromatography (GC-FID). Data records were also kept of the amounts of various petroleum products sold. The results of the personal sampling showed that the mean concentration of benzene was 23.85 ppb (ranged 0.03 - 65.71 ppb) and that the highest concentration was found in suburban zone (35.55 ppb), followed by urban zone (18.19 ppb), and rural zone (2.52 ppb). These concentrations were significantly different between each zone ($p<0.05$). Additionally, results of area sampling showed that the mean concentration of benzene was 42.62 ppb (ranged 7.50 - 50.00 ppb) that the highest concentration was found in urban zone (45.55 ppb) and the lowest was in rural zone (34.24 ppb). Regarding different job functions, the mean benzene concentration in inhaled air of fuelling workers (27.29 ppb) was significantly higher than that of cashiers (0.56 ppb). In addition, the positive trend of correlation between benzene concentrations and the amount of petroleum product sold with a type of high benzene content was found and identified by the significant difference between suburban and rural zones of gasohol 91 sold ($p<0.05$). In conclusion, although the finding of inhaled air concentration of benzene was not higher than the standard, some workers in urban and suburban zone had a potential risk for benzene exposure in long term. Therefore, training on safe working practice to protect gas station employees from benzene exposure should take into account to the different risks associated with their job functions, locations of gasoline stations and the amounts of different petroleum products sold at gasoline stations.

PS 515 The Naphthalene Dosimeter—Vanguard Technology for Improved Health Protection

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Modern real-time radiation dosimeters translate ionizing radiation, a physical entity, into an electrical charge using a variety of technologies. They are calibrated using well-established biological models of radiation-induced health effects and display dose-rate rather than exposure-rate. The newly developed Naphthalene Dosimeter is the first real-time chemical dosimeter. The technology is wearable, measures naphthalene air concentrations with laboratory quality. Miniaturization of deep UV light emitting diodes and photo-detectors are among the technological advancements that enable development of the naphthalene dosimeter. Independent laboratory validation experiments determined that the dosimeter is capable of meeting NIOSH standards for direct-read instrument over a range of naphthalene in air from 0.005 to 120 parts per million. In field validation studies involving military fuel handlers, prototype naphthalene dosimeters have detected individual exposures over the low end of this range, with concentrations being measured every three minutes. Compared to conventional methods for monitoring chemicals in the workplace, the naphthalene dosimeter also delivers increased precision in measurement of exposure rate and location. As data accumulate, PBPK models will be used to generate dosimetrics that when applied, will increase the reliability of naphthalene health risk assessments. In this regard, the naphthalene dosimeter is on the leading edge of real-time chemical monitors that will deliver more reliable risk assessments, real-time health protection, and improved sustainability, all at lower cost.

PS 516 Volatile Organic Compounds Released from Spreading Ground Coffee during a Simulated Industrial Task

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Exposure to flavoring chemicals has been suggested by some scientists to cause respiratory disease in food and flavoring workers. We previously demonstrated that naturally-occurring diacetyl and 2,3-pentanedione are released during roasting and grinding of coffee beans in an industrial setting. However, there are no published data on exposure to these diketones and other potential respiratory irritants, such as acetaldehyde and methanol, from coffee processing workers spreading large volumes of roasted, ground flavored coffee. We conducted an exposure study to determine the concentrations of diacetyl, 2,3-pentanedione, acetaldehyde, and methanol released from spreading ground flavored coffee in two plywood bins representing industry-sized coffee silos. Personal and area samples were collected for 15 min during and after spreading coffee; samples were analyzed for diacetyl and 2,3-pentanedione, acetaldehyde, and methanol using OSHA 1012, NIOSH 2016, and NIOSH 2000 methods, respectively. Headspace measurements were also taken from the coffee delivery tote and bins. Personal sampling mean concentrations for diacetyl, 2,3-pentanedione, and acetaldehyde ranged from 0.083-0.23, 0.086-0.23, and 0.17-0.88 ppm, respectively. Area mean concentrations for diacetyl, 2,3-pentanedione, and acetaldehyde ranged from 0.039-0.088, 0.037-0.085, and 0.03-0.17 ppm, respectively. Headspace concentrations for diacetyl, 2,3-pentanedione, and acetaldehyde ranged from 0.76-4.9, 0.55-4.6, and 5.1-12 ppm, respectively. Methanol was not detected in any samples. Our findings suggest that diacetyl and 2,3-pentanedione are released from ground flavored coffee at concentrations that may exceed proposed occupational exposure limits; acetaldehyde did not exceed occupational exposure limits. These results may be useful in understanding the potential risks of respiratory disease from volatile organic compounds at coffee processing facilities.

PS 517 Inverse Correlation of Urinary Phenol with Key Micronutrients of the Haem Pathway in Nigerian Gasoline Dispensers: Potentiation of Myelotoxicity and Myelodysplasia

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Benzene is a common component of petrochemicals (PTCs), with Phenol, a principal metabolite used as biomarker of exposure. Benzene is implicated in myeloproliferative disorders; with mode of action incompletely elucidated. The role of key micronutrients of the haem pathway (HP); Cu, Fe, and Zn is poorly explored, particularly in regions where these nutrients are limited and exposure to PTCs is rising. One hundred age-matched subjects, comprising 50 gasoline dispensers (GDs) & 50 occupationally unexposed (M &F), were selected from Oye–Ekiti, Nigeria. Duration of occupational exposure was 2-10 yrs. GDs were classified into 3 groups based on duration of occupational exposure; I, 2–4 yrs., II, 5-7 yrs. & III, > 10 yrs. Phenol was determined in urine by HPLC, haem in whole blood by spectrophotometry. Levels of Cu, Fe, and Zn were assayed in serum using AAS. Phenol levels were very significantly higher in GDs than in control ($p<0.000$). Phenol also increased with duration of exposure ($p>0.05$). In contrast haem was significantly lower in the exposed than in control ($p<0.05$). The micronutrients, Cu, Fe and Zn, key modulators of HP were all very significantly decreased in GDs than in controls ($p <0.000$) in all cases). Phenol and Fe demonstrated significant negative correlations ($r = - 0.557$, $p= 0.00$). Haem and Zn also exhibited inverse correlations to phenol ($r = - 0.38$, $p = 0.01$; $r= - 0.37$, $p= 0.01$) respectively. Findings suggest intense perturbation of the haem pathway, arising from benzene toxicity. Explanation in part, is drain of Cu, Fe & Zn; vital in the antioxidant system; CuZnSOD; Cytochrome P450 CYP 2E1 and molecular activities. Low Zn level particularly causes cell cycle derangement, impaired p53 function (guardian of the genome), faulty DNA repair, alteration of transcription, (Zn fingers) increased replication errors and genome instability; potentiating myelotoxicity and myeloproliferative disorders.

PS 518 Monitoring Agricultural Workers Exposed to ChE-Inhibiting Pesticides

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California's Medical Supervision program, mandated by law in 1974, is intended to protect workers who regularly mix, load, or apply Category I and II organophosphate (OP) and N-methyl carbamate (CB) pesticides. Exposure to OPs or CBs may lower the level of available cholinesterase (ChE), and ChE activity in blood serves as a biomarker of exposure. The program is designed to detect excessive exposure prior to the onset of illness and identify work practices that lead to exposure. Since 2011, the six clinical laboratories performing ChE analysis have been required to report test results electronically to the Department of Pesticide Regulation, allowing for statewide evaluation of the program. Data collected from 2011 through 2013 were analyzed using statistical and geospatial software. Over 80,000 records

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