

## Session: A. Exposure assessment I

## 1 EXPOSURE TO CCA TREATED WOOD AMONGST FOOD CATERERS AND RESIDENTS IN INFORMAL AREAS OF CAPE TOWN

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**Objectives** The study investigated if wood usage by street food caterers and household residents from informal settlements in Cape Town resulted in the absorption of Cr, Cu and As due to release of these metals from wood stocks treated with Chromated Copper Arsenate (CCA).

**Methods** Participants (n = 78) selected included an equal number of food caterers and household residents from two informal settlement, one each located in an urban and a peri-urban area. All participants answered an exposure questionnaire and were tested for urinary Cr, Cu and As, while the urines of 29 participants were also tested for toxic As [As (tox)].

**Results** Urinary Cr and As exceeded the environmental exposure limit in 12% and 30% of participants respectively. As (tox) was detected in 30% of samples and 20.7% of As (tox) levels exceeded the environmental exposure limit of 6.4 g/g creatinine. Urinary Cr, Cu, As and As (tox) levels were not significantly different in the two areas and amongst caterers and household residents after controlling for confounding (age, gender, education, smoking, eating fish and eating and drinking while cooking). The time spent on using wood as well as the quantity of wood used for catering and household use was weakly positively associated with urinary levels of As, Cr and the sum of As, Cr and Cu after controlling for confounding.

**Conclusions** This study provides evidence of Cr and As exposure amongst both street caterers and household residents and that usage of wood stocks likely to contain CCA treated timber as a fuel for food catering and household purposes may increase absorption of inorganic As and Cr.

## 2 PREDICTING FACTORS FOR LEAD ACCUMULATION IN MEXICAN LITHOGRAPHY PRESS WORKERS

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**Objectives** Bone lead level is a good indicator of cumulative exposure. Aim research paper was to characterize lead exposure and identify main predictors of bone lead in workers at a lithography press.

**Methods** The study population consisted of 90 active workers. Their bone lead levels were determined using the X - K fluorescent rays method. Measurements were in micrograms lead per gram mineral bone (µgPb/gmb) in patella (PbP), tibia (PbT), blood (PbB), air (PbA), and lead present on hands before (PbBe) and after washing (PbAf). Two multiple linear regression models were constructed for each bone, because colinearity.

**Results** Mean, standard deviation (SD), and [range] were as follows. Age: 45 years (13) [20, 75]; seniority at the lithography press: 10.6 years, (9.3) [1, 40]; seniority at both printing presses:

20 years (15.5) [1, 65]; PbB: 12.3 mg/dL + 5.2, [3.4, 30.3]; PbP: 43.3 µgPb/gmb + 28.5 [-4.82, 136.9], PbT: 25.9 µgPb/g + 18.8 [-20.1, 74.2]; PbA 0.54 (mg/m<sup>3</sup>). GM (geometric mean): PbBe: 848.1 mg/m<sup>2</sup> [27, 158 537] and PbAf 73 mg/m<sup>2</sup> [3, 1463]. The PbP and PbT models explain 44% and 55% of accumulated lead variability, respectively; their predictors were: PbB = 1.24 (p = 0.020) and = 0.93 (p = 0.003); the seniority total years sum at both presses, = 0.76 (p<0.001) and = 0.34 (p = 0.007); the exposure categories: medium = -1.60 (p = 0.83) and = 2.79 (p = 0.52); high, = 12.5 (p = 0.16) and = 16.9 (p = 0.004); and very high, = 15.4 (p = .048) and = 18.0 (p<0.001), respectively, using low exposure as a reference.

**Conclusions** Although air lead exposure was low, bone lead concentrations were high, similar to those found in workers with greater exposure. In both models the PbP and PbT accumulation is determined by the intensity of exposure (PbB) and the seniority sum years with lead exposure, as well as various exposure levels, according to the workplace, and working an additional shift at a similar press.

## 3 FRACTIONAL AND CHEMICAL COMPOSITION OF DUST IN THE WORKING AREA OF MACHINE BUILDING ENTERPRISE

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**Objectives** The purpose of the research is the study of dust fractional and chemical composition and exposure assessment in workplaces of the machine building enterprises.

**Methods** Research carried out on the example of one of the largest machine building enterprise of Perm. Sampling was carried out at the workplaces, directly at the emission sources. Dusts fractional composition was determined using a laser particle analyser Microtrac S3500 (covering the particle size range from 20 nm to 2000 microns). Based on the determined fractional composition was the mass concentration of TSP calculated, and then the mass of PM2.5 and PM10. Dusts microscopy was conducted using a scanning electron microscope with high resolution X-ray fluorescence attachment S3400N «HITACHI».

**Results** The results showed that the composition of the dust emissions in different technological processes is heterogeneous. In workplace air of welders, turners, millers the PM10 fraction reaches 2 - 50%, PM2.5 - 1 - 13%. Median diameters size: 50-300 mkm. By microscopy of dust from welding in carbon dioxide were identified nanoscale dust particles. Dust contains iron oxides, manganese, chrome, vanadium and fluoride compounds, while also established the presence of silicon, carbon, sodium, magnesium, aluminium, calcium.

**Conclusions** - dust pollution workplace air for welders, turners, millers and the other employees characterised by high proportion of fine particles, indicating the threat to health of employees;

- for some technological processes established presence of the nanoparticles in the dusts of the work area air. Hygienic characteristics of the nanoparticles are poorly understood, that requires close attention to the quality of the working area air when performing technological operations;

- the results confirm the relevance of the determination of fractional and chemical composition of dust in the workplaces air pollution. Such data will allow to evaluate the employees

personal exposure and hygienic characteristics of working conditions correctly.

#### 4 NIGHT SHIFT WORK AND EXPOSURE TO HAZARDOUS AGENTS PRESENT AT THE WORK ENVIRONMENT IN LODZ, POLAND

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**Objectives** In 2007, shift work involving circadian disruption was classified as probably carcinogenic to humans (Group 2A) by the International Agency for Research on Cancer. In most instances, the exposure in the occupational settings is complex and rarely only one hazardous occupational factor is present. Little is known so far about industrial exposures occurring in the manufacturing plants where night shift work system operates.

**Methods** We collected data on the night shift work systems and hazardous agents present in 44 enterprises, based on a short survey filled in by the inspectors of safety and hygiene employed at the manufacturing plants. All identified hazardous factors were classified according to the IARC list of carcinogens and the European classification of carcinogens.

**Results** The most common system of work employs 3 (8-hour) shifts within a 5-day cycle. Altogether, as many as 153 occupational exposures occurring in the environment of the plants were identified, with noise, carbon oxide, and formaldehyde recorded among the most common exposures. Night shift work was not noted as the sole hazardous occupational factor present at the work environment in the plants. We identified 20 factors that have been evaluated by IARC, 11 of them classified to Group 1 - carcinogenic to humans. 10 factors have been classified as carcinogens according to the regulation of the European classification of carcinogens.

**Conclusions** Our study shows that in most instances, real life exposure circumstances at work places are complex and involve a variety of factors that may affect human response to night shift work involving circadian rhythm disruption.

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#### 5 DESCRIPTIVE ANALYSIS OF THE FRENCH OCCUPATIONAL EXPOSURE DATABANKS COLCHIC AND SCOLA

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**Objectives** Knowledge of historical exposures conditions in the workplace plays an important role in occupational health. Several countries have built databases of occupational hygiene measurements from prevention or compliance activities conducted over the years. The aim of this work was to describe the contents of two French databanks, COLCHIC and SCOLA, started respectively in 1987 and 2007.

**Methods** COLCHIC data results from prevention activities conducted by hygienists from laboratories related to governmental occupational health insurance. Its initial aims included, among others, support for epidemiological studies and

implementation of prevention policies. On the other hand, SCOLA was created to store data collected in the context of mandatory verification of compliance to legal occupational exposure limits in France. Despite different objectives, COLCHIC and SCOLA share the same structure. Ancillary information includes industry, occupation, task, local and general ventilation, as well as representativeness and sampling strategies. Extracts from these two databases were obtained for the period until November 2012.

**Results** COLCHIC and SCOLA contain respectively 830 000 and 119 000 records. Data in COLCHIC cover 40 substances with more 4 000 measurements, 48 607 sampling visits in 24 520 factories. Data in SCOLA include 11 substances with more 1 000 measurements, 33075 sampling visits in 4384 factories. The 5 most frequent substances in COLCHIC are respirable dust (62876), toluene (31766), acetone (28763), lead (24614), xylene (21768). The 5 most frequent substances in SCOLA are asbestos (63886), wood dust (12625), crystalline silicate (4353), lead (3135) and toluene (2505). The main industrial activities in both databanks are manufacturing, construction, and waste management and remediation.

**Conclusions** COLCHIC and SCOLA both represent important sources of information on occupational exposures. However they do not result from probabilistic sampling and their representativeness of historical exposure in France is unknown.

#### 6 SIGNIFICANCE OF OCTANOL-WATER PARTITION COEFFICIENT AND MOLECULAR WEIGHT AS MOLECULAR DESCRIPTORS IN PREDICTING SKIN PERMEABILITY OF CHEMICAL SUBSTANCES

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**Objectives** The occupational hazard of chemical absorption via dermal route was frequently assessed by evaluating the skin permeability (Kp) of chemical. In addition to *in vitro* testing using human skin, the quantitative structure-activity relationship (QSAR) has been employed as an alternative source to providing Kp. In the early Kp QSARs the octanol-water partition coefficient (log K<sub>OW</sub>) and molecular weight (MW) were commonly applied as dominant properties to describe transdermal transport of chemical. This study examined the efficacy of log K<sub>OW</sub>/MW-based QSARs in Kp prediction.

**Methods** One hundred and fifty-eight chemicals of known Kp determined *in vitro* using human skin were used to evaluate the goodness of fit (R<sup>2</sup>) of the model estimates approximating the measured Kp for six log K<sub>OW</sub>/MW-based Kp QSARs reported in Wilschut *et al.* (1995) and Mitragotri (2002). A new Kp QSAR consisting of additional descriptors for the same compounds was developed by identification of key descriptors from a pool of 3,224 descriptors supported by Dragon<sup>®</sup> followed by stepwise regression.

**Results** For the log K<sub>OW</sub>/MW-based Kp QSARs, the regression of model estimates against experimentally determined Kp yielded R<sup>2</sup> of 0.314 to 0.744, with the lowest value observed for the model employing log K<sub>OW</sub> alone. In the new QSAR, in addition to log K<sub>OW</sub> the electrostatic distribution in the molecular space appeared to be a significant factor affecting Kp, while the MW exerted its influence as a sub-domain, thus under constraints, of antineoplastic properties.

**Conclusions** As the Kp QSAR continues to evolve, attention may be required of on interpreting the limitations of MW as a