[124.3 (3.9)] compared to the non-Mn miners [113.1 (5.1)] (p = 0.11). Mn miners had lower mean (standard error) neuron density in the caudate [203.1 (24.9) cells per high powered field (hpf)] compared to non-Mn miners [276.9 (22.3) cells per hpf] (p = 0.016). Mn miners also had lower astrocyte density in the caudate [181 (22.0) cells per hpf] and putamen [225.6 (28.5) cells per hpf] than non Mn miners [caudate 252.9 (19.6) cells per hpf and putamen 300.9 (25.4) cells per hpf] (p = 0.011 and p = 0.024, respectively). There were no significant differences in microglial cell density or in astrocyte, microglia or neuron cell counts in the globus pallidus between the two groups. There were no HIV-defining pathologies and no microglial nodules in any of the miners.

Conclusions This study demonstrates that chronic Mn exposure is associated with selective toxicity to striatal astrocytes and caudate neurons. We speculate that the initial neurotoxic injury in humans with chronic Mn exposure involves the astrocytes and that neuronal injury may be secondary to loss of astrocytes.

Conclusions Exposure to threats and non-serious violence predicted anxiety symptoms. The risk increased with increasing number of episodes. The same pattern was found for depression though not significant. The results indicate the importance of considering the less serious but more frequent episodes when planning prevention.

Session: 2. Exposure assessment I

234 CHARACTERISATION OF WORK TASKS AND EXPOSURES TO CLEANING AND DISINFECTING CHEMICALS IN HEALTHCARE OCCUPATIONS

Objectives Cleaning and disinfecting products have been identified as important risk factors for asthma, and are used extensively in healthcare; however, quantitative measurements of these etiologic agents are not well characterized. The objective of this study was to characterize personal exposure to cleaning and disinfecting compounds and quantify the frequency and duration of cleaning tasks performed in healthcare occupations.

Methods Exposure assessments were conducted for volatile organic compounds (VOCs) at 5 hospitals targeting 13 healthcare occupations. A wide range of specific VOCs (n = 15) were quantified and an additional 97 VOCs were identified but not quantified.

Results The geometric mean (GM) concentrations for total VOCs were highest among nursing assistants, licensed practical nurses and medical equipment preparers (GM range: 4367–3809 ppb), followed by respiratory therapists, pharmacy technicians, registered nurses, floor strippers/waxers, dental assistants and housekeepers (GM range: 2119–1501 ppb); the geometric standard deviations (GSD) varied from 1.8 to 7.5 across occupations. The GM and GSD of specific VOCs were also variable across occupations. The average amount of time per day spent on cleaning tasks using cleaning and disinfecting products also varied by occupation with medical equipment preparers, housekeepers, floor strippers/waxers and licensed practical nurses spending the most time (range: 165–110 minutes/day); followed by endoscopy technicians and dental assistants (range: 70–60 minutes/day); the remaining occupations spent on average <15 minutes/day on cleaning tasks.

Conclusions The chemical agents, levels of total and specific VOCs, and cleaning-task durations varied between- and within-occupations indicating that task may be an important exposure determinant.

235 AIRBORNE AND INTERNAL EXPOSURE TO CHROMIUM AMONG WELDERS

Objectives The objective of this analysis was to investigate levels and determinants of exposure to respirable and urinary...
chromium (CrR, CrU), and chromium in whole blood and in erythrocytes (CrBl, CrEry) in welders.

Methods Respirable welding fume was collected in 241 welders during a working shift. Blood samples and spot urine samples were collected after the working shift. The content of Cr in the welding fume was determined using inductively coupled plasma mass spectrometry. CrU, CrBl and CrEry were measured by means of graphite furnace atom absorption spectrometry. Linear regression models were applied to model exposure to chromium. A multiple imputation approach was chosen to account for values below the limit of quantitation (LOQ).

Results Median concentrations of CrR were <3.80 µg/m³, with about 23% below LOQ. Major determinants of the CrR were the chromium content in the electrodes or base material in addition to the type of welding. Airborne exposure was higher when welding was performed under inefficient ventilation. CrR correlated strongly with CrU (Pearson’s correlation r = 0.61). Median concentrations of CrU were <1.20 µg/m³, and 44% of CrU measurements were below LOQ. CrU exposure decreased by a factor of 0.66 when a respiratory mask was used. Most measurements of CrBl and CrEry were below LOQ. All 15 welders with a measurable concentration of CrEry had high chromium content in the materials (above 5%).

Conclusions CrR was mainly influenced by the chromium content in the materials and the welding process. Welding in confined space increased exposure to CrR. Efficient local exhaust ventilation and the use of respirators decreased exposure. Airborne Cr concentration was a good predictor of urinary Cr exposure.


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Objective Description of current exposure levels of benzene and other organic compounds among workers in the petroleum industry.

Materials A total of 2578 air measurements taken by 12 oil- and service companies were evaluated and summarised in a database. The data includes personal full-shift samples and measurements on specific tasks.

Results Most samples were from offshore installations (70%). 93 chemical agents were detected in the samples. Of these, 11 agents were measured in 100 or more samples including aromatic hydrocarbons (benzene n = 853, toluene n = 1014, xylene isomers n = 987, and ethylbenzene n = 939) and alkanes (n-hexane n = 856, oil vapour n = 130, oil mist n = 132). 66% of the chemical agents were measured in less than 11 samples. In total, 299 work tasks were described in the reports.

Generally, personal exposure levels of full-shift samples of benzene (median = 0.005 ppm), toluene (median = 0.005 ppm), ethylbenzene (median = 0.001 ppm), xylene (all isomers) (median = 0.005), and n-hexane (median = 0.003) were low compared to Norwegian 12-hour time-weighted average occupational exposure limits of 0.6 ppm, 15 ppm, 3 ppm, 15 ppm, and 12 ppm, respectively.

The highest personal air levels were reported when performing tasks such as cleaning of tanks, opening of processing units, changing of filters, and sampling from the petroleum stream.

Conclusion Although much of the monitoring data has been conducted for control evaluation and compliance, they provide a basis for industrial hygienists and exposure assessors to identify work tasks and jobs where exposures are likely, and provide an overview of current exposure levels. This work also shows that for most agents the exposure data is extremely sparse and therefore there is a need to measure chemical exposures in this industry.