determined using specific assays. Finally, the potential of 3-NBA to alter the cellular metabolism was assessed by gas chromatography-mass spectrometry.

Result RT4 cells were capable of bioactivation of 3-NBA within 30 min, whereas the main contributor for bioactivation of 3-NBA was NAD(P)H:quinone oxidoreductase (NQO1). Cytotoxicity assessment revealed an activation of adaptive mechanisms at low dosages, which diminished at higher doses.

The metabolomic analysis of the cells showed elevated levels of various antioxidants at low concentrations of 3-NBA. At higher exposure concentrations, it appeared that the cells reprogrammed their metabolism to maintain the pentose phosphate pathway (PPP) aiding in cell protection.

Discussion Starting from a relevant environmental dose of 0.0003 µM up to 80 µM, we described the driving mechanism behind the different cellular states – in particular an activation of adaptive mechanisms at low dosages, which diminished at higher doses. The metabolomic data suggested that the PPP and the folate metabolism play a leading role in this transition. Moreover, there was evidence for an additional carbon flux into PPP via the gluconate metabolism to support the formation of NADPH, which in term is an important determinant of the defence system against oxidative stress.

771 HEART RATE VARIABILITY IN SMELTER FURNACE WORKERS

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Introduction Exposure to fine particulate matter in urban air has been associated with increased risk of hospitalisation and death from cardiovascular diseases. One hypothesis suggests a direct influence of particles on the autonomic nervous system. Some studies have shown an association between particle exposure and reduced heart rate variability (HRV). Furnace workers in metal smelters are occupationally exposed to fine and ultrafine particles. The aim of this study was to examine the association between exposure to particulate matter in metal smelters and HRV.

Methods We examined 64 workers in three Norwegian metal smelters on a working day, and on a day off after at least two days since last exposure. On the working day, exposure to different particle size fractions was assessed by personal sampling, using respirable cyclones and five-stage Sioutas cascade impactors. The workers carried Holter monitors for 24 hours' heart rate registration during the working day and the day off. HRV indices were analysed by exposure for each hour of the day, using mixed model regression, adjusted for relevant covariates.

Results There were 58 male and 6 female workers. Their mean age was 34 years (range 19–64). The mean exposure to respirable particulate matter was 2.36 mg/m^3, while 0.88 mg/m^3 was below 250 nm. Standard deviation of normal-to-normal intervals (SDNN) was reduced during working hours on the working day relative to the day off, whereas in the afternoon and night hours there were no significant differences. Low frequency/high frequency (LF/HF) ratio was higher during working hours on the working day, but in the afternoon and evening hours the LF/HF ratio was significantly higher on the day off compared to the working day.

Conclusion HRV indices differ between working day and day off. Analyses are in progression, and further results on the effects of particle exposure will be presented.

780 CONTRIBUTIONS OF DERMAL VS AIR EXPOSURE TO BIOMONITORING FOR SOLVENT EXPOSURE

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Introduction Dermal exposure assessment is becoming increasingly important in occupational settings, but its contribution to the overall body burden is not yet well-established. Therefore, we evaluated the contribution of dermal exposure to the total body burden as reflected by biomonitoring, by simultaneous quantitative assessment of dermal, and air exposure in combination with bio- monitoring, in workers exposed to solvent.

Methods Exposure to the volatile organic compounds, styrene, acetone and toluene on the skin was evaluated using activated charcoal cloth patches; inhalation exposure was measured using passive organic vapour monitors, and systemic exposure was assessed by quantification of mandelic acid, acetone and hyppuric acid in urine, as biomarkers for styrene, acetone and toluene, respectively. Exposure was measured in 40 workers performing different tasks: hydraulic press (HP) workers, sheet moulding composite (SMC) workers, mechanics and office workers in a thermoplastic panels factory.

Results For styrene, the dermal exposure levels found were higher for HP workers (1532±450 µg/cm^2) than for the other workers (e.g. SMC 179±50). Inhalation exposure levels for HP and SMC workers were similar (58±11 mg/m^3 and 60±8 mg/m^3, about 70% TLV), but urinary concentrations of mandelic acid were higher for HP (549±85 µg/mL) then SMC (331±21 µg/mL) workers. In addition, a good correlation between dermal, air and urinary levels of acetone was found. Unlike for styrene and acetone, toluene levels in air were less than 1% TLV, regardless of the tasks performed by the workers. No relevant dermal or inhalation exposure was found for mechanics and office workers.

Discussion This study shows that for solvents, high dermal exposure substantially contributed to the increased concentrations of urinary metabolites. Therefore, the contribution of dermal exposure to the overall body burden is as important as the respiratory exposure, especially for less-volatile solvents, such as styrene.

832 ORGANOPHOSPHATES IN THE WORKPLACE: A 20-YEAR PROSPECTIVE STUDY

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