913 NANOPARTICLE EMISSION DURING CUTTING OPERATION OF CARBON NANOTUBE REINFORCED POLYCARBONATE COMPOSITES AND RECYCLING EFFECT

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Introduction Carbon nanotubes (CNTs) are widely used as a nanofiller in polymer composites to improve the quality of neat polymers. However, the use of CNT are threatened by concerns over its toxicology. The purpose of this study was to investigate the potential emissions of NPs and CNTs during cutting CNT polycarbonate composites (CNT/PC) and evaluate the impact of recycling CNT/PC (up to 20 cycles) on the emission during cutting operation.

Methods Cutting CNT/PC bars was conducted using a saw with a diamond coated blade at 1600 rpm in an enclosing chamber. Particle number concentration and size distribution emitted from cutting were measured using real time instruments: a fast mobility particle sizer and an aerodynamic mobility particle sizer. Particles were also collected using an electrostatic precipitator and examined by a transmission electron microscope for particle morphology.

Result After saw's motor background correction, cutting of CNT/PC released airborne nanoparticles with geometric mean of particle concentrations from 4.01×10^4 to 1.47×10^5 particles/cm³, but we did not find the effect of recycling CNT/PC on nanoparticle emission during cutting operation. The count median diameter of particles varied from 21 to 24 nm. Free CNTs were not observed during cutting CNT/PC; however, particles with extruding fibres or CNTs, and respirable fibres were found.

Discussion Our findings were consistent with several studies which investigated and characterised airborne particles generated from cutting CNT composites. Although free CNTs were not observed, we did find particles with CNTs embedded in the PC matrix, particles with CNTs or fibre extrusions, and respirable fibres produced during cutting CNT/PC. The health risk and hazard profile of these particles is limited and need for future research. In the meanwhile, exposure controls should be implemented during finishing CNT composites.

1580 FACTORS INFLUENCING THE INCREASE OF CONCENTRATION OF AIRBORNE ENDOTOXIN, MOUSE AND RAT ALLERGENS IN AN ANIMAL FACILITY

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Introduction Researchers and technicians who work with laboratory animals are exposed to animal allergens and endotoxin in the workplace. Inhalation of these bio-contaminants has

been identified as a risk factor for respiratory and allergic diseases resulting in impaired lung function and laboratory animal allergy. The objective of this study was to assess the exposure to environmental endotoxin and rodent allergens to propose the control and preventive measures.

Methods This study was conducted in an animal research facility. Stationary inhalable dust samples were collected using airChek2000 pumps equipped with IOM sampler and glass filter for endotoxin detection (Kinetic LAL assay) and with closed cassette and MCE filter for rat and mouse allergens ELISA analysis. Data were analysed by means of the statistical software R; the influence of changing cages on environmental contamination was assessed by multivariate statistical approaches (mixed effect linear regression models).

Results The concentration of endotoxin during changing cages increases significantly on average by a factor 1.8 with respect to the levels before or after this task ($p=0.0414$). Moreover, the highest concentration of endotoxin was measured during the preparation of bedding and distribution of feed. The level of Mus m 1 allergen was the most represented (mean=7.4 ng/m³, $\sigma=16.5$ ng/m³). During the changing cages was found a significant increasing of Rat n 1 and Mus m 1; Rat n 1 was also found in mouse rooms showing a contamination probably transported by the operators themselves.

Conclusion The environmental monitoring represents a powerful tool for assessing the determinant factors influencing the increase of endotoxin and animal allergen concentrations as well as underline the role of workers as passive sources of allergens. Furthermore, the identification of exposure peaks may represent an important information for the evaluation of appropriate engineering and preventive control measures particularly for workers employed in specific working tasks.

881 ASBESTOS IN THE FRENCH NAVY: JOB-EXPOSURE MATRIX

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Introduction Asbestos exposure is a concern for the Navy. 94% of the compensated French soldiers belong to the Navy. While employment-exposure matrices exist for the civilian environment, none are available to the military. Our work aims at creating the first employment-exposure matrix in the French Navy, in order to optimise post-occupational medical surveillance, according to the French health authority.

Method We conducted a bibliographic search for asbestos in naval repair, naval embarking and foreign navies. From databases such as Medline, Pubmed, we used the following **Key-words**: Navy, Asbestos, Shipyards and Military and we have extended ourselves to the registers of existing theses on the subject.

Results Epidemiological and bibliographic data confirm the increased risk in the French Navy. Three variables are important in the proposal of this employment-exposure matrix: employment, year of arming the ship and duration of embarkation. Risk is important for personnel whose work is in direct contact with asbestos, in particular machine personnel, irrespective of their duration of exposure. For embarked

personnel who do not have direct contact with asbestos in their jobs, the increase in risk depends essentially on the ship's year of arming and the presence of asbestos, whether or not on board, as well as the duration of exposure of seafarers.

Conclusion These results allow us to recommend a classification of the risk in accordance with the recommendations of the french health authority and to propose an adequate post professional follow up for soldiers of the French Navy.

1197 HORSE STABLES AS POTENTIAL SOURCE OF FUNGAL EXPOSURE TO OFFICE WORKERS

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Introduction Workers spend considerable time in office buildings which are generally considered to be low risk environments. However, under favourable conditions (e.g. poor housekeeping, inadequate ventilation, poorly regulated temperature and relative humidity; nutrient substrates), indoor microbial levels may increase. Therefore indoor air quality (IAQ) becomes an important factor for workers health. This investigation examined air quality in offices situated one floor above the horse stables and evaluated the association with reported respiratory symptoms among office workers.

Methods Air sampling by impaction method onto agar plates was done for fungal detection. Fungi were identified using microscopy and BIOLOG system (metabolic fingerprinting). Environmental parameters (temperature, relative humidity, carbon dioxide) were measured using the IAQ monitor. Sampling was repeated (before and after cleaning intervention) in the offices near the horse stables (vaccine production). Employees completed a questionnaire on medical and occupational history.

Results Air measurements showed high concentrations (155–1720 cfu/m³) of allergenic fungi. The most common genera isolated were *Aspergillus*, *Penicillium*, *Fusarium*, *Trichoderma* and *Paecilomyces*. The average fungal counts after cleaning the offices were threefold (954 cfu/m³) than before the rigorous cleaning process (303 cfu/m³). Office occupants complained of bad odour which worsened during the day. Symptoms reported by workers were nose irritation (60%), sinus congestion and headache (40%); and eye irritation and dry throat (30%). Symptoms worsened at work but improved when away from the office.

Conclusion Increased viable concentrations of airborne fungi in offices and high counts after cleaning indicated stables as a source of fungal contamination. The movement of horses between the stable and the paddock creates a lot of dust which is the likely mode of transmission to the offices. Some employees reported symptoms suggestive of those caused by the fungal genera identified. No complaints were received after the horse stables were relocated in keeping with local by-laws.

274 CHEMICAL INTOLERANCE IS NOT A GOOD PREDICTOR OF WORK RELATED SYMPTOMS AMONG FINNISH OFFICE WORKERS

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Introduction Chemical intolerance (CI) is a condition characterised by series of symptoms that affected persons attribute to exposure to low levels of several identifiable or unidentifiable substances commonly present in environment. Many of the symptoms are general symptoms, such as dizziness, fatigue, headache and difficulties to concentrate that are present in many medical conditions and illnesses. Similar symptoms are attributed to poor indoor air quality, for instance. In this study we evaluate:

- occurrence of CI among Finnish office workers and
- whether identified CI individuals have work related symptoms.

Methods The study population comprises 174 office workers recruited in connexion with our Multispace Office (MOSI) project. The participants work in six different workplaces, of which none had known abnormal sources of indoor air impurities. The Chemical exposure-section of Quick Environment Exposure Sensitivity Inventory (QEESI) questionnaire was employed to identify CI individuals and modified MM-40 (Örebro) questionnaire to evaluate their work related symptoms.

Results We identified altogether 52 (30%) CI individuals as indicated by their QEESI questionnaire score (score ≥ 40). Of them 21 (40% versus 18% in individuals with QEESI score < 40 , $p < 0.002$) reported that they have had irritation symptoms in throat, nose or eyes at work and 29 (56% vs 39%, $p = 0.511$) had general symptoms, such as fatigue, headache, feeling heavy head or difficulties in concentrating. Probability of irritation symptoms among CI individuals is 40%.

Discussion Our findings are in line with earlier observations that prevalence of chemical intolerance may be up to 33%. Occurrence of IC was associated with irritation symptoms but not general symptoms. However, its positive predictive value (i.e. proportion of irritation symptoms among CI individuals, 40%) was not much better than prevalence of irritation symptoms among office workers (25%) suggesting that CI is not very good predictor of work related symptoms among Finnish office workers.

408 IMPROVEMENT OF DETERMINATION METHOD FOR ETHYLENE GLYCOL IN THE AIR OF WORKPLACE BY CAPILLARY GAS CHROMATOGRAPHY

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Introduction Ethylene glycol, which is colourless and odourless, is widely used in the field of manufacture of coolant,