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HEALTH, WORK AND SOCIAL RESPONSIBILITY

The occupational hygienist and the integration of environment, health and safety

BOOK OF ABSTRACTS

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RESULTS
A total of nine papers were found reporting airborne arsenic measurement data from maintenance workers or maintenance areas in semiconductor chip-making plants. The highest exposure level (TWA during exposure = 3,200 ug/m^3, 8-hour exposure = 258 µg/m^3) was reported during maintenance of ion implantation using grinding and bead blasting. Personal arsenic levels on maintenance engineers (TWA = 53 µg/m^3 as GSD, 8-h TWA = 13 µg/m^3 as GSD, n = 10) with dry cleaning techniques were higher than those (TWA = 1.4 µg/m^3 as GSD, 8-h TWA = 0.12 µg/m^3 as GSD, n = 5) using wet techniques. When arseniccontaminated parts were worked on and cleaned inside properly-exhausted hoods and blasters, and parts were kept wet during
hand cleaning inside implanters, the exposure level assessed from 45 maintenance engineers was found to be 0.32 µg/m^3 (0.10 µg/m^3 of TWA). A total of 40 statistical summaries from seven articles were identified that represented a total of 423 airborne arsenic measurements. WAMs for arsenic levels are compared according to several categories, such as the year, sampling type, location sampled, operation type and cleaning technique. There is no classification showing significant differences in arsenic levels. Most of the measurements (86%) were from two papers published after the year 2000, with another 14% from six papers published prior to 2000. Arsenic exposure levels (WAM = 1.56 µg/m^3, no. of samples = 77, no. of observations = 2) taken during normal operating activities in implantation operations were found to be below the OEL. In contrast, arsenic exposure levels of engineers (7.7 µg/m^3, no. of samples = 181, no. of observations = 19) who were involved in maintenance works were found to exceed the REL of the NIOSH.
CONCLUSION
We conclude that workers who are regularly or occasionally involved in maintenance work have higher potential for occupational exposure than other employees who are in charge of routine production work. In addition, fabrication workers can be classified into two groups based on the reviewed arsenic exposure levels; operators and maintenance engineers

[ABSTRACT ID: 475]

AEROTOXIC SYNDROME. HOW UNIONS OF OIL WORKERS, AIRLINE PILOTS AND CABIN CREWS WORK TOGETHER

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Aircrafts turbine engines are modified and used in the oil and gas industry and as marine propulsion systems (aeroderivative gas turbines). The engines use the same lubricants, which must be in accordance to MIL-SPEC- 23699.
Exposure to especially organophosphates is of great concerns around the world. In aviation the symptoms from turbine and hydraulic oil exposure have been named "aerotoxic syndrome". Due to similar chemical exposure, Norwegian oil workers and airline pilots has formed an unusual alliance to have the exposure documented and symptoms mapped.
The presentation will try to show the importance that labour unions have their own occupational hygienist, and show the importance of international networking in industries very reluctant to handle new concerns in the working environment. The presentation will show different exposure situations from the lubricant system on aeroderivative turbines, and give an overview of the research works that have been done both on cabin air quality and on offshore oil installations.

T22 - NANOTECHNOLOGIES, NANOMATERIALS AND ULTRAFINE PARTICLES

[ABSTRACT ID: 320]

VEM AS A PART OF A STRATEGY TO ASSESS EXPOSURE TO NANOPARTICLES

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OBJECTIVES
There's a growing awareness of the potential risks for human health of exposure to ultrafine particles or nanoparticles. In that context, workplace air measurements become important and various strategies have been developed to monitor exposure. In addition, observations and time/activity registrations are part of the exposure assessment strategy in many studies.
Video exposure monitoring (VEM), can be of added value in these strategies. VEM simultaneously combines video pictures and exposure data synchronically.
METHODS
The PIMEX-method (Picture Mix Exposure) was used as a method for VEM. The possibility to combine PIMEX and measurement instruments for nanoparticles was object of this study. Starting point was an inventory of all instruments for workplace air measurements of nanoparticles. Also publications of strategies to assess exposure to nanoparticles were studied to review whether observations were part of these strategies. Finally technical realization of coupling PIMEX and the identified measurement instruments was tested and various other strategies were explored, for exposure assessment and interventions in single workplaces as well as research on nanomaterials and production of training material.
RESULTS
A lot of instruments are used to measure nanoparticles. They can be divided into (near) real-time monitoring instruments, which determines numbers and particle size distribution or surface area concentration and collection of samples in order to characterize the nanoparticles chemically and physically by microscopic analyses and/or elemental analyses. Only some of these instruments can be technically combined with PIMEX.
With the PIMEX2008 version 1.02 software it is possible to synchronise up to four different measuring instruments simultaneously with the video recording.
CONCLUSIONS
PIMEX as a VEM method can be a useful tool as a part of the strategy to assess exposure to nanoparticles. It can also be of value for other purposes like training, education and risk communication. The possibility to synchronize more than one measuring instrument can be useful to simultaneously monitor different targets on the workplace, for example worker exposure in the breathing zone and background concentration.

[ABSTRACT ID: 386]

INTEGRATION AND GAP ANALYSIS OF EXISTING DATA CONCERNING ENVIRONMENTAL, CONSUMER, AND ENVIRONMENTAL EXPOSURE TO ENGINEERED NANOMATERIALS: METHODS USED IN THE NANEX PROJECT

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The rapid growth in nanotechnology over the last decade has led to questions and concerns regarding the risks to human health and the environment posed by engineered nanomaterials (ENMs). As the market for ENMs continues to grow, it is imperative that scientists and regulators have knowledge of both the toxicity and potential exposures to these materials. To date, there is little generalizable knowledge about the magnitude and routes by which humans and the environment will be exposed to ENMs over their lifecycle. The NANEX project is a one year project that integrates the expertise of leading scientists from 11 institutions and/or companies in Europe, with the goal of developing

generic and specific exposure scenarios for three relevant categories of ENMs. The project involves predicting ways in which consumers, workers and the environment will be exposed to ENMs, cataloguing studies on ENM exposure into a publicly available database, evaluating and integrating the results of the studies, identifying and prioritizing gaps in the existing data, and issuing recommendations for future exposure research. Due to the collaborative nature of this project, and the necessity to simultaneously incorporate expert judgment, qualitative data, and quantitative data, a pre-defined system for evaluating information is needed to maintain consistency throughout the project. Further, the identification of data gaps requires some pre-determined definitions of what makes an informative study, which includes consideration of study relevance, overall design, analytical tools, and statistical techniques. Here, we describe the systems by which studies and reports were evaluated for the characteristics described above, specifically considering the unique properties of nanomaterials. These methods are broadly applicable to any field in which large amounts of data need to be integrated.

This work was funded by the European Commission. We acknowledge the coordinated effort of the entire NANEX Consortium for the work described herein. The final report for this project will be disseminated in November, 2010.

[ABSTRACT ID: 327]

MULTI WALLED CARBON NANOTUBES (MWCNTS). RISK ASSESSMENT IN UNIVERSITY LABORATORY

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OBJECTIVE
The material safety data sheets (MSDS) of commercial carbon nanotubes indicates the risk of irritating to eyes and respiratory system and following safety phases S22 and S25 (avoid contact with eyes and do not breathe dast) and risk phrases R36 (irritant for eyes) R37 (irritant for respiratory system). Aim of this article is the application of an assessment risk safety model in a university laboratory where multi-wall carbon nanotubes (MWCNTs) are grown by catalytic chemical vapor deposition (CCVD).
METHODS
This method has been structured keeping in mind the European strategy defined by the European Commission for a responsible approach. While waiting for further information on associated toxicological effects of exposure to nanomaterials, it is opportune to operate with the maximum caution. Nanoparticle toxicity factors are: surface chemistry (composition, charge, reactivity, energy/wettability, adsorbed species, contamination), chemical composition (spatially averaged (bulk), spatially resolved heterogeneous composition), porosity (nonporous, microporous, mesoporous), trace impurities/contaminants (e.g., metal catalysts, PAHs, etc). Factors to be considered include: materials, equipment, technology adopted, type probability-frequency-length of exposure to various dangers, procedures, and organization of work. This risk assessment is based on ten factors such as the toxicological characteristics of substances, the exposure and direct handling frequency, the effectiveness of the personal protection devices (PPD) used. This method quantifies the health and safety risks in three increasing levels: "low", "middle" and "high".
RESULTS
The researchers work wearing protection devices during the manipulation of the MWCNTs (e.g., gloves and masks) and, on average, their exposure time is about 2 hours/day, not particularly significant on base of the present knowledge. Three working conditions have been examined: normal, anomalous and in emergency. Taking in consideration the normal working conditions it is possible to highlight the following more critical parameters: free access to the workplaces; possible irritation to eyes, respiratory system and skin caused by the nanotubes; use of nanotubes in powder (characterized by high tendency dispersion); manual operations without using dry boxes.
CONCLUSIONS
The conclusive results of the application of this assessment risk model are that all the study cases are classified as "low risk level". The only study case with the classification "middle risk level" is the manual removal of the MWCTNs, grown over Fe catalyst supports. Consequently, in the point of view of improvement, it is important to activate specific training for the staff of the laboratory and also for the students, in order to make them aware about hazards on workplace concerning nanomaterials. The drawing up of safety procedures on good work practices is also considered a further positive strategy.

[ABSTRACT ID: 124]

MORPHOCHEMICAL AND STRUCTURAL CHARACTERISTICS OF FINE AND ULTRAFINE PARTICLES FROM CAST IRON FOUNDRIES

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Foundry operations of cast iron production involve numerous sources of potentially harmful particles including crystalline silica, metal particles, and carbonaceous compounds. The mode of interaction and the degree of toxicity of these particles when in contact with biological fluids mostly depend on the surface reactivity which, on turn, is the result of the structure and texture of the constituent materials. In this work combined single particle and bulk chemical analysis methods were employed to characterize airborne dusts from different working stations in two distinct foundry plants in Umbria (Central Italy). Particles in 15 aerosol dust samples were analyzed by scanning and transmission electron microscopy coupled with image analysis, EDS microanalysis, electron diffraction and phase contrast imaging. The concentration and the solubility degree of Fe and other metals of potential health effect (Mn, Ni, Zn, Cr and Pb) in the bulk samples was determined by inductively coupled plasma atomic emission spectrometry (ICP-AES). Particle number size distributions showed significant occurrence of fine quartz and a main contribution of fine to ultrafine metal particles in the airborne dusts. Metal particles evidenced high Fe and variable contents of Mn, Si, Zn, and Pb. A trend of relative Mn, Si, Zn and Pb enrichment for decreasing particle size was also evidenced. TEM structural determinations revealed the metal particles be represented by randomly oriented, highly crystalline, magnetite nanocrystals while the carbonaceous compounds consist of poorly crystalline carbon soot with embedded Mn, Ni, Zn, and Cr bearing phases. Results of ICP-AES revealed remarkably different solubility degree of magnetite and metal bearing particles. This complex array of features points to the necessity of a deep evaluation of any possible synergistic effects of the constituent phases when evaluating occupational exposure to foundry dusts. The necessity of employing surface area instead of gravimetric threshold limit values is also evidenced.

[ABSTRACT ID: 198]

THE EXPOSURE TO NANOPARTICLES IN CEMENT PRODUCTION PLANTS

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Recently it has been developed a cement containing titanium dioxide (TiO_2) for photoactive building elements, capable of abating the organic and inorganic pollutants via photocatalysis. Although TiO_2 is chemically inert, recent in vitro and in vivo studies have demonstrated that TiO_2 nanoparticles can cause negative health effects. For these reasons the aim of our study was to evaluate the airborne level of nanoparticles during the packaging activity of this specific cement. Stationary particle measurements were carried out by an electrical low pressure impactor (ELPI) at a position during the packaging. The results of environmental monitoring