

**Results** A 28-year-old female experimental animal trainer was referred for suspected occupational asthma. She worked with rhesus monkeys for about 6 years, as a lab technician in a university neurophysiology lab, performing mainly cognitive testing. She had daily contact with the test animals. The animals were living on sawdust.

The patient experienced respiratory symptoms 2 years after she started working on the experimental lab. She had progressive wheezing and non-productive cough. The respiratory symptoms were accompanied by irritation of eye and nose mucosa, itching papules on forearms with accidental blood splashes or scratch injuries by the monkeys, spontaneously disappearing after 10 min.

Specific IgE test to rhesus monkey was not available; screening to other possible (extra-) professional exposed allergens was negative. Her total serum IgE was not elevated (55 kU/L), blood eosinophil count was elevated ( $0.3 \times 10^9$ ; 6.9%). Spirometry showed supra-normal volumes and normal exhaled nitric oxide (FENO 16.40 ppb at flow of 50 ml/sec). Histamine provocation test showed a mild bronchial hyper-reactivity ( $PC_{20}=1.47$  mg/ml). Serial peak expiratory flow recordings performed were suggestive of occupational asthma (OASYS-score=3.67).

We did not perform skin prick testing with rhesus monkey saliva, blood, urine or hairs (epithelium) because of ethical reasons (possibility of infectious contaminated material). So we decided to perform *ex vivo* testing (basophil activation test).

**Conclusion** This is the first case demonstrating the possible role of rhesus monkey exposure in the development of occupational asthma.

## 71 RESPIRATORY DISORDERS IN HOME DELIVERY SERVICE EMPLOYEES

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**Introduction** Air pollution in developing countries is causing respiratory disorders and is especially affecting health of persons who are on the road for longer period due to their occupation. Objective of this study was to find the extent of air pollution on road leading to respiratory disorders in two wheeler riders employed in home delivery service.

**Methods** Permission from concerned authorities and consent from volunteers was taken. Automobile exhaust emission was tested in 100 vehicles, 25 in each group of (above 10 years old) cars, buses, trucks and auto rickshaws. Clinical findings were recorded for 100 two wheeler riders employed in home delivery service and PFT was done for them. PFT results were compared with 100 PFT reports of employees in office work, as control. In control group only PFT reports were checked as employees were not involved.

**Results** 28% vehicles had higher than standard emission readings. PFT reports of home delivery service employees showed 24 of them had mild/moderate obstructive pathology. 36 persons had symptoms of allergic bronchitis, 31 persons had irritation in nose and throat and 18 persons had irritation in eyes. Control group showed abnormal findings in 8 PFT reports.

**Conclusion** Creating awareness and educating public about air pollution on road due to automobiles exhaust is necessary.

Implementation of strict administrative engineering controls for regular maintenance of vehicles and enforcement of rules, regulations on vehicle emission standards and fuel quality standards will make a great difference in reducing air pollution. Encouraging mass transport, pooling of cars and electric vehicles will reduce air pollution in developing countries. These measures will change the scenario to a pollution free road to produce a positive effect on health of people who are on the road for a longer time due to their occupation and also on health of the general public.

## 195 A BENCHMARK/SAFETY FACTOR APPROACH FOR SETTING OELS FOR NANOMATERIALS

Tee Guidotti. *Occupational + Environmental Health and Safety, Washington, DC, USA*

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Uncertainty over the best way to evaluate the risks of engineered nanomaterials (ENMs) is causing delay in regulation despite their rapidly growing use by industry and in consumer products. Because of their enormous diversity in size, composition, configurations and properties, it seems clear that ENMs cannot be regulated as a single class. Occupational exposure levels (OELs) for engineered nanomaterials may however be usefully set using proposed benchmark/safety factor approach. In the proposed approach, a benchmark OEL would be used for ENMs considered to be 'relatively inert' (such as TiO<sub>2</sub>). As a precaution, the recognised benchmark OEL would be based on an existing standard for fine particulate air pollution, which is highly biologically active and includes modes of particles in relevant size ranges. For ENMs which cannot be presumed to be relatively inert, additional uncertainty factors (e.g., 0.1 or 0.3) would be applied for toxicologically significant properties, such as metal or semimetal content, fibrous shape, biological activity, structure-activity relationships suggesting greater potency, and resemblance to known hazards. OELs set in this manner could be used as provisional regulatory standards until data become available to support more definitive standards. An illustration of the approach is given based on the Canada-wide ambient air quality standard for fine particulate matter (PM<sub>2.5</sub>). The Canadian standard and the proposed benchmark OEL are mass-based, of necessity. While mass may not be the most relevant dose metric for evaluating the biological effects of ENMs, mass-based measurement techniques are the only practical means for routine workplace exposure monitoring at the present time.

## 1153 EFFECTS OF SULFUR DIOXIDE ON FRACTIONAL EXHALED NITRIC OXIDE CONCENTRATION IN THE CHILD RESIDENTS OF MIYAKEJIMA ISLAND

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**Introduction** In 2000, all residents were forced to evacuate the island of Miyakejima in Japan, due to a volcanic eruption following massive amounts of volcanic gas emission including sulfur dioxide (SO<sub>2</sub>). As a high concentration of SO<sub>2</sub>

continuously emitted, annual health checkups focusing on the respiratory system were performed from February 2006. Since 2008 health checkups, a fractional exhaled nitric oxide concentration (FeNO) was measured. The present study aims to investigate the relationship between SO<sub>2</sub> exposure and FeNO by comparing FeNO of the Miyakejima students with FeNO of reference students in another island in Japan, where SO<sub>2</sub> concentration is far lower than the Japanese Environmental Standards.

**Methods** All subjects aged 13–14 years. Total number of Miyakejima and reference students were 83 and 31. From SO<sub>2</sub> concentration measured at the fixed-point monitoring stations, we calculated the average SO<sub>2</sub> concentration (ppb) during the 3 month periods prior to the health checkups. Based on the clinical practice guidelines of the Official American Thoracic Society, 35 ppb was used as a cutoff point of FeNO.

**Results** The average SO<sub>2</sub> concentrations from 2008 to 2014 were 17.6, 17.5, 9.6, 7.3, 8.4, 4.2, and 5.0, respectively. The prevalence (%) of Miyakejima students with abnormal FeNO at 2008 to 2014 health checkups 50.0, 27.3, 18.2, 57.1, 46.2, 32 38.5, and 50.0, respectively. These prevalence were not statistically higher than the prevalence of the reference students (41.9%).

**Discussion** No clear dose-response relationship was observed in this study. In addition to this study, we also examined the medical records of patients at the Chuo-Clinic between 2005 and 2010. Totally 4586 medical records were examined. Of these, 2594 patients developed a disease potentially caused by SO<sub>2</sub> concentration. Therefore, further studies with regards to the relationship between the incidence of disease and SO<sub>2</sub> should be conducted.

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## BERYLLIUM IN GOLF CLUBS: CASE REPORT

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**Introduction** Beryllium Sensitisation (BeS) is a delayed-type hypersensitivity to beryllium that can develop in susceptible workers exposed to beryllium. In some cases BeS progress to Chronic Beryllium Disease (CBD), which is marked by lymphocytic alveolitis and epithelioid granuloma in the lung parenchyma.

**Case description** A 53-year-old non-smoker male with medical history of diabetes mellitus type II and hyperlipidemia presented to his physician with progressive fatigue, weakness, and persistent cough. Three months later he developed dyspnea and a fifteen pounds unintentional weight-loss, prompting his physician to order a chest x-ray showing extensive bilateral interstitial and airspace infiltrates. A pulmonary function test (PFT) with poor test quality showed FEV<sub>1</sub> 11% predicted and FEV<sub>1</sub>/FEV<sub>2</sub> 72% predicted. A positive IgG test for coccidioides prompted a pulmonary coccidioidomycosis diagnosis. Referred to a pulmonologist and a computed tomography (CT) scan showed chronic extensive interstitial, air space, and ground-glass densities with granulomatous disease in the mediastinum

and hilar regions. A bronchoscopy with a lung biopsy was performed with negative results. Short after, he was admitted with worsening dyspnea on exertion and had a right thoracoscopy with lung wedge resections. He was diagnosed with disseminated pulmonary coccidioidomycosis and was treated appropriately. Pathology report showed acute on chronic lung injury with fibrosis, microscopic honeycombing and foreign body reaction. During hospital stay he mentioned to his physician that he worked for seventeen years in a golf clubs factory that used beryllium to make lightweight golf clubs, including nine years of working with beryllium. He did not wear a respirator or receive training about beryllium. A revision of the lung pathology histological examination showed interstitial pneumonitis with numerous Schaumann bodies and occasional non-necrotizing granulomas, consistent with berylliosis. A Beryllium Lymphocyte Proliferation Test (BeLPT) showed abnormal lymphocyte transformation to beryllium sulfate, confirming the diagnosis. A follow up PFT showed severe obstructive lung defect. His respiratory symptoms continued to worsen requiring him to use continuous oxygen of 2–4 litres. Two years later he had to get lungs transplant due to pulmonary system failure with good results. After finding out his disease was work-related, his brother-in-law, a 50-year-old male who is symptoms-free and with no significant medical history, and had worked in the same factory in the putter grinding department for six years, reported his occupational history to his personal physician. He had the BeLPT performed with positive result, diagnosis him with BeS. CT scan showed residual of old granulomatous disease with multiple calcified small pulmonary nodules and calcified nodes. The patient is with no symptoms related to BeS.

**Discussion** In this report, we describe two beryllium golf clubs manufacturing workers who developed BeS and CBD. Beryllium is a metal that is extremely light and strong with high melting point and a high thermal and electrical conductivity making it suitable for a wide range of industries, including defense, aerospace, nuclear, and electronics. Its lightweight makes it fitting for producing lightweight golf clubs. About 62 000 workers in the U.S. are exposed to beryllium in their workplaces and the risk of developing BeS and/or CBD from occupational beryllium exposure has been recognised for a long time. The risk factors include individual genetic susceptibility and the amount of beryllium exposure. The proportion of workers with BeS that progress to CBD varies widely, ranging from 9% to 100% with CBD developing approximately 10–20 years after first exposure. The importance of protecting workers from beryllium exposure is evident with OSHA's recent lowering of the permissible exposure limit (PEL) for beryllium to 0.2 mcg/m<sup>3</sup> air, averaged over 8 hours in hope to save workers from BeS and CBD. With several case reports showing BeS development after a brief or opportunistic exposure to beryllium in administrative staff, it is important to minimise or eliminate beryllium exposure. Workers with Beryllium exposure need ongoing medical screening and surveillance for BeS.

**Conclusion** These two cases underline the critical need to protect workers from harmful exposure to beryllium, using engineering and work practice controls along with personal protective equipment. For BeS and CBD, it is recommended to eliminate or minimise further exposure to beryllium.