

UNITED STATES DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

BIBLIOGRAPHY OF RECENT PAPERS IN THE BIOMEDICAL  
LITERATURE ON THE HEALTH IMPACTS  
OF GEOLOGIC PROCESSES AND MATERIALS

Compiled by

Nicklya M. Harris

Robert B. Finkelman

U.S. Geological Survey Open-File Report 99-521

This report is preliminary and has not been reviewed for conformity with U.S. Geological  
Survey editorial standards and stratigraphic nomenclature

## **Introduction**

This report contains abstracts describing recent research in the biomedical literature that deals with human health problems caused by geologic materials and processes. This report is intended to serve two purposes. The first purpose is to use the abstracts to illustrate the range of health issues caused by geologic materials and processes. The second purpose is to provide a sense of the relative level of interest of the biomedical community in these issues.

This report is not intended to be a comprehensive literature search, but rather to provide a recent snapshot of biomedical research on selected environmental health issues. The report also complements and augments a similar literature review (Gross and Finkelman, 1999, U.S. Geological Survey Open-File Report 99-9) that focused exclusively on the health impacts of coal and coal use.

## **Search Methods**

The source of the abstracts on human health issues was the MEDLINE database. It is readily accessed through the internet. The address of PubMed, the search vehicle used, is <http://www.ncbi.nih.gov/PubMed>. The order of investigation was to enter the phrases 'human health' into the search database, and then enter other combinations such as human health and mercury, human health and air pollution, human health and emissions, etc. We grouped the abstracts into 5 main categories: human health impacts of dust, volcanic emissions, arsenic, trace elements, and coal. The search was constrained to the past 10 years except for the health impacts of volcanic emissions for which we looked back over the past 15 years. Most of the studies deal with exposure to natural materials, however, we have included a few abstracts that discuss occupational and household exposure that we felt were relevant.

## **Comments**

We found 30 abstracts dealing with health impacts of dust. The concerns were primarily with quartz and asbestos. About one-third of the abstracts were concerned with problems in the U.S. There were 21 abstracts on the health impacts of volcanic emissions. About half were concerned with U.S. volcanoes (Mt. St. Helens, Alaska, and Hawaii). There were 13 abstracts on arsenic with about half dealing with arsenic exposure in the U.S. We found 16 abstracts discussing health impacts of trace elements other than arsenic with about half concerned with situations in the U.S.

## **Health Impacts of Dust**

Int J Biometeorol 1999 Apr;42(4):217-25

### **Characteristics of rural dust events shown to impact on asthma severity in Brisbane, Australia.**

Rutherford S, Clark E, McTainsh G, Simpson R, Mitchell C  
School of Public Health, Griffith University, Logan, Australia.

Wind erosion in arid inland Australia leads to dust plumes which can pass over populated coastal areas in Eastern Australia, such as Brisbane. Such events can lead to concerns about respiratory health problems because they significantly increase the fine particle component of atmospheric aerosols. This paper examines the particulate characteristics of 11 dust events in Brisbane and associations with daily diary records (peak expiratory flow, symptoms) of people with asthma, and hospital emergency attendances for asthma during a number of seasons between 1992 and 1994. These dust events are frequently, but not always, characterised by higher particulate levels and higher ratios of fine to coarse particulates. The results indicate that a number of dust events were significantly associated with changes in asthma severity, but general relationships could not be determined. Given that the phenomenon of wind-blown dust is not isolated to the Australian continent, these findings raise important questions about the effects of wind-blown dust in other parts of the world.

PMID: 10232058, UI: 99248840

Allergy 1999 Apr;54(4):320-9

### **Association of ambient air-pollution levels with acute asthma exacerbation among children in Singapore.**

Chew FT, Goh DY, Ooi BC, Saharom R, Hui JK, Lee BW  
Department of Paediatrics, National University of Singapore.

[Medline record in process]

**BACKGROUND:** Air-pollution levels have been shown to be associated with increased morbidity of respiratory diseases. **METHODS:** Data for ambient air-pollutant levels, meteorologic factors, and hospitalization or emergency room (ER) visits for acute asthma in Singapore children over a 5-year period (1990-4) were obtained and analyzed for associations by time-series methods. **RESULTS:** Throughout this period, the annual mean and 24-h mean levels for sulfur dioxide (SO<sub>2</sub>), nitrogen dioxide (NO<sub>2</sub>), and total suspended particles (TSP) and maximum 1-h daily average for ozone were generally within the air-quality guidelines established by the World Health Organization (WHO). However, positive correlation between levels of each of these pollutants and daily ER visits for asthma was observed in children aged 3-12 years, but not among adolescents and young adults (13-21 years old). The association with SO<sub>2</sub> and TSP persisted after standardization for meteorologic and temporal variables. An adjusted increase in 2.9 ER visits for every 20 microg/m<sup>3</sup> increase in atmospheric SO<sub>2</sub> levels, lagged by 1 day, was observed on days when levels were above 68 microg/m<sup>3</sup>. With TSP, an adjusted increase of 5.80 ER visits for every 20 microg/m<sup>3</sup> increase in its daily atmospheric levels, lagged by 1 day, was observed on days with levels above 73 microg/m<sup>3</sup>. Similar results were also obtained after controlling for autocorrelation by time-series analysis. **CONCLUSIONS:** These associations were observed even though the overall levels of all pollutants were generally within the air-quality guidelines established by the WHO. These findings suggest that asthmatic children are susceptible to increased levels of air pollutants, particularly SO<sub>2</sub> and TSP, although the ambient levels are generally within "acceptable" ranges.

PMID: 10371090, UI: 99297500

## Health effects of sulfur-related environmental air pollution: the pulmonary surfactant system is not disturbed by exposure to acidic sulfate and neutral sulfite aerosols.

Griese M, Winzinger G, Schams A, Josten M, Ziesenis A, Maier K

Lung Research Group, Ludwig-Maximilians-University, Munich, Germany. griese@pk-i.med.uni-muenchen.de

The goal of this study was to assess the impact of long-term exposure to environmental sulfur-related aerosols on the biochemical and biophysical properties of lung surfactant. Eight Beagle dogs were housed under clean air conditions for 450 days, followed by an exposure period of 400 days to 0.36 mg/m<sup>3</sup> of sulfite (16.5 h/d) and to 5.66 mg/m<sup>3</sup> of sulfate (6 h/d) equivalent to a pulmonary hydrogen burden of 15  $\mu\text{mol}/\text{m}^3$ . Other dogs kept in clean air for the whole study period were additional controls. Serial bronchoalveolar lavages (BALs) were analyzed for total phospholipid concentration, content and ratio of a surfactant-rich large aggregate (LA) fraction and a small aggregate (SA) fraction, in vitro surface area cycling of LAs into SAs as a measure of alveolar extracellular pulmonary surfactant aggregate metabolism, and surface activity of native and lipid-extracted LA. No significant changes over time and no differences between the clean air period and the exposure period were observed. Thus, long-term environmental exposure of dogs to the sulfur-related air pollution tested does not lead to alterations in the amount, extracellular metabolism, or surface-active properties of pulmonary surfactant.

PMID: 10351128, UI: 99225811

Environ Health Perspect 1999 Jun;107(Suppl 3):451-460

## Molecular Epidemiologic Research on the Effects of Environmental Pollutants on the Fetus.

Perera FP, Jedrychowski W, Rauh V, Whyatt RM

Joseph L. Mailman School of Public Health at Columbia University, New York, New York USA.

Evidence shows that fetuses and infants are more affected than adults by a variety of environmental toxicants because of differential exposure, physiologic immaturity, and a longer lifetime over which disease initiated in early life can develop. In this article we review data on the effects of (*in utero*) exposure to common environmental contaminants, including polycyclic aromatic hydrocarbons (PAH), particulate matter and environmental tobacco smoke (ETS). We then summarize results from our molecular epidemiologic study to assess risks from (*in utero*) exposures to ambient air pollution and ETS. This research study, conducted in Poland, used biomarkers to measure the internal and bioeffective dose of toxicants and individual susceptibility factors. The study included 160 mothers and 160 newborns. Ambient air pollution was significantly associated (*p* = 0.05) with the amount of PAH bound to DNA (PAH-DNA adducts) in both maternal and infant cord white blood cells (WBC). Newborns with elevated PAH-DNA adducts (greater than the median) had significantly decreased birth weight (*p* = 0.05), birth length (*p* = 0.02), and head circumference (*p* = 0.0005) compared to the newborns with lower adducts (*n* = 135). Maternal and infant cotinine levels were increased by active and passive cigarette smoke exposure of the mother (*p* = 0.01). An inverse correlation was seen between newborn plasma cotinine (nanograms per milliliter) and birth weight (*p* = 0.0001) and length (*p* = 0.003). Adducts were elevated in placental tissue and WBC of newborns who were heterozygous or homozygous for the cytochrome P4501A1 (*Msp*)I restriction fragment length polymorphism (RFLP) compared to newborns without the RFLP. Levels of PAH-DNA and cotinine were higher in newborns than mothers. These results document that there is significant transplacental transfer of PAH and ETS constituents from mother to fetus; that PAH-DNA adduct levels in maternal and newborn WBC were increased with environmental exposure to PAH from ambient pollution; and that the fetus is more sensitive to genetic damage than the mother. The study also provided the first molecular evidence that transplacental PAH exposure to the fetus is compromising fetal development. If confirmed, these findings could

have significant public health implications since a number of studies have found that reduction of head circumference at birth correlates with lower intelligence quotient as well as poorer cognitive functioning and school performance in childhood.

PMID: 10346993

Sci Total Environ 1999 Mar 9;227(2-3):145-54

### **Airborne lead and particulate levels in Semarang, Indonesia and potential health impacts.**

Browne DR, Husni A, Risk MJ

School of Geography and Geology, McMaster University, Hamilton, Ontario, Canada.

Spatial and temporal variation in airborne lead and total suspended particulates was examined in the city of Semarang, Indonesia, and surrounding area. Both airborne lead and TSP varied significantly with the type of urban development. Mean urban airborne lead levels were 0.35 microgram/m<sup>3</sup> in the highway zone, 0.95 microgram/m<sup>3</sup> in the residential zone, and 0.99 microgram/m<sup>3</sup> in the commercial zone. Airborne lead levels in the industrial zone were significantly higher than all other areas, with a mean of 8.41 micrograms/m<sup>3</sup>. Airborne lead concentrations of this magnitude have not been reported in Indonesia previously. Mean TSP levels ranged from 115.5 micrograms/m<sup>3</sup> to 165.8 micrograms/m<sup>3</sup> in urban areas. Increased levels of TSP were associated with areas adjacent to major transportation routes. On a seasonal basis, TSP levels were significantly lower during the rainy season, while mean airborne lead levels did not show a significant seasonal trend. Observed ambient pollution levels were translated into potential health impacts based on previously established relationships. Increased levels of TSP pollution near major roads was estimated to result in a 1.6% increase in mortality for all causes of death and a 7.9% increase in mortality due to respiratory disease. Estimated child blood lead levels indicated possible lead toxicity among Semarang children.

PMID: 10231980, UI: 99248762

Eur Respir J 1999 Feb;13(2):266-73

### **Fine particulate air pollution, resuspended road dust and respiratory health among symptomatic children.**

Tiittanen P, Timonen KL, Ruuskanen J, Mirme A, Pekkanen J

Unit of Environmental Epidemiology, Division of Environmental Health, National Public Health Institute, Kuopio, Finland.

The short-term association of particulate air pollution with peak expiratory flow rate (PEF) and respiratory symptoms was examined. Forty-nine children with chronic respiratory symptoms aged 8-13 yrs were followed daily for six weeks in spring, 1995, in Kuopio, Finland. Daily concentrations of particulate material with a 50% cut-off aerodynamic diameter  $\leq 10$  microm and  $\leq 2.5$  microm (PM<sub>10</sub> and PM<sub>2.5</sub>, respectively), black carbon, and the number concentrations of particles from 0.01-10 microm diameter were measured. During the study period, PM<sub>10</sub> were mainly resuspended soil and street dust, and the concentration was estimated using aluminum content of PM<sub>10</sub> samples. No consistent effect of particles was found as the associations varied by lag. Of the lags examined, only 1-day lagged PM<sub>2.5</sub> was statistically significantly associated with morning PEF ( $\beta = -1.06$ ,  $SE = 0.52$  (per interquartile increase in pollutant)). Evening PEF was significantly associated with the 1-day lagged number of particles in the size range 0.1-1.0 microm ( $\beta = -1.56$ ,  $SE = 0.72$ ). One-day lagged PM<sub>10</sub>, PM<sub>2.5-10</sub>, PM<sub>2.5</sub> and resuspended PM<sub>10</sub>, and 4-day average of PM<sub>2.5</sub> were significantly associated with increased risk of cough. Given the short duration of the study, separating the effects of different types of particles was difficult. The present study demonstrates the highly variable size and number distribution and chemical composition of particles in Finland, and underlines the importance of measuring the size and chemical composition of particles to determine which types of particles are associated with health effects.

PMID: 10065666, UI: 99163549

Proc Natl Acad Sci U S A. 1999 Mar 30;96(7):3396-403.

## **Long-range transport of mineral dust in the global atmosphere: impact of african dust on the environment of the southeastern United States.**

Prospero JM

University of Miami, Rosenstiel School of Marine and Atmospheric Science, 4600 Rickenbacker Causeway, Miami, FL 33149, USA.

Soil dust is a major constituent of airborne particles in the global atmosphere. Dust plumes frequently cover huge areas of the earth; they are one of the most prominent and commonly visible features in satellite imagery. Dust is believed to play a role in many biogeochemical processes, but the importance of dust in these processes is not well understood because of the dearth of information about the global distribution of dust and its physical, chemical, and mineralogical properties. This paper describes some features of the large-scale distribution of dust and identifies some of the geological characteristics of important source areas. The transport of dust from North Africa is presented as an example of possible long-range dust effects, and the impact of African dust on environmental processes in the western North Atlantic and the southeastern United States is assessed. Dust transported over long distances usually has a mass median diameter  $<10 \mu\text{m}$ . Small wind-borne soil particles show signs of extensive weathering; consequently, the physical and chemical properties of the particles will greatly depend on the weathering history in the source region and on the subsequent modifications that occur during transit in the atmosphere (typically a period of a week or more). To fully understand the role of dust in the environment and in human health, mineralogists will have to work closely with scientists in other disciplines to characterize the properties of mineral particles as an ensemble and as individual particles especially with regard to surface characteristics.

PMID: 10097049, UI: 99199196

Epidemiol Prev 1998 Oct-Dec;22(4):221-5

## **The mortality due to pulmonary silicosis in the Tuscany region in the last decade demonstrates that the health effects of work exposure to silica are still marked**

Epidemiol Prev. 1998 Oct-Dec;22(4):221-5. Italian.

Merler E, Barchielli A, Sorso B, Giovannetti L, Cardini CE

U.O. di Epidemiologia, Centro per lo Studio e la Prevenzione Oncologica, Azienda Ospedaliera Careggi, Firenze.

An analysis of death certificates from 1987 to 1996 among residents of the Tuscany Region identified 1518 deaths from pneumoconiosis, the large majority from silicosis, a disease explained by occupational exposure to silica dust. A dozen of deaths are from asbestosis, occurred at younger ages and are concentrated in a restricted area where a cement-asbestos factory was active. Deaths from pneumoconiosis occurred mainly among males, and the rates of the disease are decreasing only in the latest years. About 10% of deaths from silicosis are among subjects dying before 65 years of age. Mortality rates are very high in several areas of the Region, approximating those from lung cancer and ischaemic heart disease. For the above reasons the disease is still of concern from the point of view of public health and actions are suggested to obtain a description of prevalence and incidence of the disease.

PMID: 10052260; UI: 99161412

Occup Environ Med 1998 Nov;55(11):779-85

## **Crystalline silica and risk of lung cancer in the potteries.**

Cherry NM, Burgess GL, Turner S, McDonald JC

Centre for Occupational Health, Stopford Building, University of Manchester, UK.

**OBJECTIVE:** To evaluate crystalline silica as a human carcinogen. **METHODS:** A cohort of 5115 men, born 1916-45 and employed in the pottery, refractory, and sandstone industries of Stoke-on-Trent was identified from occupations subject to health surveillance by the local Silicosis Medical Board (now the Department of Social Security). Detailed occupational and smoking histories, and records of small parenchymal opacities on periodic radiographs were extracted from medical records. An exposure matrix was derived from some 1400 personal or static dust samples and tested against the presence of small parenchymal opacities in a subcohort of 1080 men employed for at least 10 years, who had started working in the industry before 1960. **RESULTS:** Standardised mortality ratios (SMRs) calculated against mortalities for Stoke-on-Trent, with 95% confidence intervals (95% CIs), were raised for all causes (1.15 (1.05 to 1.26)), lung cancer (1.28 (0.99 to 1.62)) and non-malignant respiratory disease (2.04 (1.55 to 2.65)). Average concentration and duration of exposure to silica were, taken together, significantly related to the presence of small opacities ( $> \text{ or } = 1/0$ ). In a nested case-referent analysis of 52 cases of lung cancer and 197 matched referents, conditional logistic regression gave a significantly increased odds ratio (OR) for average silica concentration (micrograms/m<sup>3</sup> 100), after adjustment for smoking, of 1.66 (1.14 to 2.41) but not for duration of exposure nor, in consequence, for cumulative exposure. **CONCLUSION:** The association between risk of lung cancer and quantitative estimates of silica exposure supports the SMR analysis and implies that crystalline silica may well be a human carcinogen.  
PMID: 9924456, UI: 99123531

Rev Mal Respir. 1998 Oct;15(5):615-21. French.

### **[Asbestos-associated occupational lung diseases. Role of the pneumology unit in screening and compensation].**

Bignon J, Housset B, Brochard P, Paireon JC

Service de Pneumologie et de Pathologie Professionnelle, CHI Creteil.

The application of new decrees concerning the protection of individuals against sanitary risks linked to the various possible expositions to asbestos dusts is leading to a growing involvement of pulmonologists in diagnosis procedures not only for active workers regularly examined via the occupational medicine healthcare system, but also for those who are no longer, the unemployed or retired previously exposed to asbestos fibres. The present chapter presents and comments the revised guidelines about the compensation procedures for occupational diseases, and provides useful recommendations for establishing the records leading to their medical assessment. It emphasises the importance of a close cooperation between pulmonologists and radiologists in order to avoid radiation overdosing, which could increase the risk of lung cancer, as much as possible.

PMID: 9834988; UI: 99052053

Am J Ind Med. 1998 Dec;34(6):547-58.

### **Surveillance of respirable crystalline silica dust using OSHA compliance data (1979-1995).**

Linch KD, Miller WE, Althouse RB, Groce DW, Hale JM

National Institute for Occupational Safety and Health, Division of Respiratory Disease Studies, Morgantown, WV 26505-2888, USA.

**BACKGROUND:** The objective of this work was to estimate the percentage of workers by industry that are exposed to defined concentrations of respirable crystalline silica dust. **METHODS:** An algorithm was used to estimate the percentage of total workers exposed to crystalline silica in 1993 at concentrations of at least 1, 2, 5, and 10 times the National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limit (REL) of 0.05 mg/m<sup>3</sup>. Respirable crystalline silica air sampling data from regulatory compliance inspections performed by the Occupational Safety and Health Administration (OSHA), for the years 1979-1995, and recorded in the Integrated Management Information System (IMIS) were used to estimate exposures. Therefore, this work does not include industries such as mining and agriculture that are not covered by OSHA. The estimates are stratified by Standard Industrial Classification (SIC) codes.

**RESULTS:** This work found that some of the highest respirable crystalline silica dust concentrations occurred in construction (masonry, heavy construction, and painting), iron and steel foundries (casting), and in metal services (sandblasting, grinding, or buffing of metal parts). It was found that 1.8% (13,800 workers) of the workers in SIC 174—Masonry, Stonework, Tile Setting, and Plastering—were exposed to at least 10 times the NIOSH REL. For SIC 162—Heavy Construction, Except Highway and Street Construction—this number is 1.3% (6,300 workers). SIC 172—Painting and Paper Hanging—which includes construction workers involved in sandblasting was found to have 1.9% (3,000 workers) exposed to at least 10 times the NIOSH REL. The industry that was found to have the highest percentage of workers (6%) exposed to at least the NIOSH REL was the cut stone and stone products industry. **CONCLUSION:** Not enough is being done to control exposure to respirable crystalline silica. Engineering controls should be instituted in the industries indicated by this work.  
PMID: 9816412; UI: 99033200.

J Occup Environ Med. 1998 Oct;40(10):855-61.

## **Occupational risk factors for cancer of the gastric cardia. Analysis of death certificates from 24 US states.**

Cocco P, Ward MH, Dosemeci M

Institute of Occupational Medicine, University of Cagliari, Italy.

We evaluated the risk of gastric cardia cancer by occupation and industry in a case-control study using information from death certificates for 24 US states in 1984-1992. One thousand fifty-six cases of gastric cardia cancer were identified among men aged 20 years or more, including 1,023 whites and 33 blacks. Controls were 5,280 subjects who died of nonmalignant diseases, 5:1 matched to cases by geographic region, race, gender, and 5-year age group. Among white men, occupations with elevated risk included financial managers (odds ratio [OR] = 6.1; 95% confidence interval [CI], 1.3-28.8), janitors and cleaners (OR = 1.7; 95% CI, 1.0-2.9), production inspectors (OR = 3.2; 95% CI, 1.5-6.9), and truck drivers (OR = 1.5; 95% CI, 1.0-2.2). Industries with elevated risk included pulp and paper mills (OR = 2.0; 95% CI, 1.0-3.7), newspaper publishing and printing (OR = 2.6; 95% CI, 1.0-6.3), industrial and miscellaneous chemicals (OR = 2.0; 95% CI, 1.0-3.9), water supply and irrigation (OR = 5.6; 95% CI, 1.6-19.9). Among black men, risks were nonsignificantly increased for subjects employed in railroads (3 cases, 2 controls) and for carpenters (3 cases, 0 controls). We created job-exposure matrices for asbestos, inorganic dust, metal dust, lead, polycyclic aromatic hydrocarbons, nitrogen oxides, nitrosamines, sulfuric acid, fertilizers, herbicides, other pesticides, and wood dust. Among white men, a consistent pattern of risk increase by level and probability of exposure was observed only for sulfuric acid mists, with a twofold excess (95% CI, 0.6-7.3) associated with high probability of high intensity exposure. A significant 30% increase in risk was observed for those subjects with a high probability of exposure (all levels combined) to lead, and a 60% increase was observed for subjects with high-level exposure to lead (all probabilities combined). However, crosstabulation of gastric cardia cancer risk by probability and level of exposure to lead did not show consistent trends. Asbestos exposure also showed an overall 50% increase but no consistent trends among white men. None of the 12 occupational hazards showed an association with risk for black men.  
PMID: 9800169; UI: 99016551.

Environ Health Perspect. 1998 Nov;106(11):A538-43.

## **Major issues in miner health.**

Joyce S

As recently as the last few decades, thousands of miners died in explosions, roof collapses, fires, and floods each year, and lung disease caused by inhaling mineral dusts was ubiquitous. Miners worked virtually unprotected, and were often treated as expendable bodies fulfilling critical roles in this important industry, which in the United States comprises about 5% of the gross domestic product.

PMID: 9799195; UI: 99016029.



Am J Ind Med. 1998 Oct;34(4):318-24.

### **Polymorphisms in the promoter of the tumor necrosis factor-alpha gene in coal miners.**

Zhai R, Jetten M, Schins RP, Franssen H, Borm PJ

Department of Health Risk Analysis and Toxicology, Maastricht University, The Netherlands.

Tumor necrosis factor-alpha (TNF) is recognized as a central mediator of mineral dust-induced lung fibrosis, and genetic polymorphisms of the TNF promoter have been reported to influence levels of TNF production. To assess whether polymorphisms within the TNF promoter gene are associated with susceptibility to coal workers' pneumoconiosis (CWP), the DNA of 78 coal miners was typed for G-to-A transitions at positions -238 and -308. Our results show that frequency of A-308 genotype (T2) is significantly overpresented in coal miners with CWP (50%), as compared with miners without CWP (25%) and controls (29%). After correction for cumulative dust exposure and smoking, the A-308 transition genotype is still associated with the presence of CWP (OR = 3.0, 95% CI = 1.0-9.0). Both A-238 and A-308 transition genotypes were related to TNF release from endotoxin-stimulated blood monocytes; only the A-238 transition and not the A-308 transition was associated to coal dust-induced TNF release. In summary, this study shows that the A-308 transition is related to CWP, but this relation is not paralleled by a different TNF release in this genotype. A larger number of patients coupled to frequent TNF release are required to evaluate genotype screening to estimate individual health risks for effects of coal mine dust exposure.

PMID: 9750937; UI: 98423511.

J Toxicol Environ Health. 1998 Sep 11;55(1):31-44.

### **Environmental particulate-mediated cytokine production in lung epithelial cells (A549): role of preexisting inflammation and oxidant stress.**

Stringer B, Kobzik L

Department of Environmental Health, Harvard School of Public Health, Boston, Massachusetts, USA.

Epidemiologic data show that air pollution particulates cause adverse pulmonary health effects, especially in individuals with preexisting lung disease. We sought to model in vitro preexisting lung inflammation in order to investigate the hypothesis that "primed" lung epithelial cells will exhibit enhanced phlogistic responses [e.g., interleukin-8 (IL-8) production] to particulate air pollution. Exposure of tumor necrosis factor alpha (TNF-alpha) primed or control A549 cells to the air pollution particulates, residual oil fly ash (ROFA), and the known pathogenic dust alpha-quartz, but not inert TiO<sub>2</sub>, caused increased IL-8 production in primed cells compared to normal cells in a concentration-dependent manner (particle concentration range 0-200 microg/ml).

We hypothesized that oxidant mechanisms may be involved in the cellular response to particulates. Addition of the antioxidant N-acetylcysteine (NAC, 1.0 mM) decreased ROFA and alpha-quartz-mediated IL-8 production by approximately 50% in normal and TNF-alpha-primed A549 cells. In addition, exposure of A549 cells to ROFA caused a substantial (and NAC inhibitable) increase in oxidant levels as measured by fluorometry (DCFH oxidation). These data suggest that (1) lung epithelial cells primed by inflammatory mediators can show enhanced cytokine production after exposure to air pollution particulates, and (2) oxidant stress is a key mechanism for this response.

PMID: 9747602; UI: 98418374.

Ann Occup Hyg. 1998 Jul;42(5):287-94. Review.

### **The quartz hazard: a variable entity.**

Donaldson K, Borm PJ

Department of Biological Sciences, Napier University, Edinburgh, U.K.

An IARC Working Group recently classified crystalline silica (quartz) into IARC's Group 1, i.e. a carcinogen. This classification is based on evidence of carcinogenicity in experimental animals

and in humans. However, the evaluation stated that in making the overall evaluation, the Working Group noted that carcinogenicity to humans was not detected in all industrial circumstances studied and that carcinogenicity may be dependent on inherent characteristics of the crystalline silica or on external factors affecting its biological activity. The present review seeks to put the apparently conflicting findings of cancer incidence in quartz-exposed industries into a unifying thesis, based on mechanistic studies. These mechanistic studies have enabled the events leading from deposition of quartz to silicosis and cancer to be partially elucidated and have demonstrated that the biological effects of quartz can be understood in terms of surface reactivity. We particularly emphasise the ability of quartz to generate free radicals and cause oxidative stress and the fact that this could be modified by a range of substances that affect the quartz surface; some of these modifying substances could originate from other minerals. We therefore propose that the hazard posed by quartz is not a constant entity, but one that may vary dramatically depending on the origin of the silica sample or its contact with other chemicals/minerals within its complex constitution. The mechanistic data described here could assist in the interpretation of epidemiological studies and pose further hypotheses that could be tested in order to help resolve the quartz carcinogenesis anomaly. The data suggest that quartz cannot be death with as a single hazard entity, as is the case with most other chemicals.  
PMID: 9729916; UI: 98399615.

### [Evaluation of health hazards of asbestos containing wastes in the mining industry and prospects of their utilization].

Dueva LA, et al.

Med Tr Prom Ekol. 1997;(9):9-13. Russian.

Dueva LA, Elovskaja LT, Kovalevskaja EV

NII meditsiny truda RAMN, Moskva.

The study covered asbestos-containing waste at a major mining enrichment enterprise—"Uralasbest" JSC. A set of methods were used to associate natural human compensatory mechanisms with experimental models simplifying possible routes of asbestos influence on humans and proved no toxic features of the dust studied. The results help to manage removal and storage of asbestos-containing waste, to use it for production of various building materials. However, variable asbestos (free and fixed) content of the waste and admixtures of chromium, nickel and other elements in it prevent from utilisation of asbestos waste at other enterprises and necessitate further hygienic evaluation.

PMID: 9440947; UI: 97478726.

J Expo Anal Environ Epidemiol. 1997 Jul-Sep;7(3):385-95. Review.

### The link between silica dust levels, risk assessments, and regulations.

Goldsmith DF

Public Health Institute, Berkeley, California 94704, USA. davegold@publichealth.org

Improvements in workplace health among silica exposed workers followed demonstrations of the severity of the risk of silicosis and means of controlling high dust levels on the job. Current ambient environmental analyses include either an adoption of air quality goals for reducing emissions of criteria pollutants or the conduct of risk assessments to determine if regulatory procedures are needed. Although silica has been regulated as a workplace hazard for most of the 20th century, only recently has it been considered for ambient control, and most of the thrust for this action has evolved from environmental regulatory work in California, where both state initiative (Proposition 65) and legislative law (Air Toxics Hot Spots Information and Assessment Act; Assembly Bill number 2588) have required risk assessments for silica dust emissions as carcinogens.

PMID: 9246600; UI: 97389418.

Mil Med. 1997 Jan;162(1):1-13. Review.

### **Al Eskin disease: Persian Gulf syndrome.**

Korenyi-Both AL, Korenyi-Both AL, Juncer DJ

Office of the State Surgeon, Pennsylvania National Guard, Department of Military and Veteran's Affairs, Commonwealth of Pennsylvania 17003-5003, USA.

This article examines the potential relationship between Al Eskin disease and the Persian Gulf syndrome. Al Eskin disease, reported in Military Medicine in 1992, is a novel and previously unreported condition triggered by the exceptionally fine sand dust of the Central and Eastern Saudi Arabian peninsula. We repeat our study of the pathogenesis of Al Eskin disease to include the ultrastructural and microanalytical study of the sand, aerobiological studies of the Kingdom of Saudi Arabia, and the etiology, symptoms, and prevalence of the disease. We conclude that immunodepression resulting from the continued presence of sand particles less than 1 micron in diameter in the lungs and bodies of Persian Gulf veterans explains not only the symptoms of the hyperegic lung condition of phase I and the symptoms of phase II of Al Eskin disease, but also provides an important clue to a common factor in most cases of Persian Gulf illnesses. We include a discussion of most of the commonly suspected agents in the Persian Gulf syndrome. In this case, we conclude that each of these factors, such as oil well fires, old-world diseases, or depleted uranium, are probably adjuvant or contributing causes. The only common exposure that would lead to recognition of the Persian Gulf syndrome as a single medical condition, rather than a catch-all phrase for unrelated conditions, appears to be exposure to the ubiquitous, fine sand of the area, and a resulting immunosuppression that is aggravated by opportunistic infections and other nonmicrobial ailments.

PMID: 9002695; UI: 97156267.

Przegl Lek. 1996;53(8):631-3. Polish.

### **[Consequences of exposure to asbestos dust].**

Kotela I, Laskowicz K, Plezia B

Przychodni Przyzakładowej Etemit w Szczucinie.

Mesotheliomas of pleura are neoplasms that rarely occur. Their etiology is connected with occupational exposure as well as environmental contact with asbestos dust. In this work, two cases of mesotheliomas of pleura are presented: first one with occupational exposure, the other one with environmental exposure. An increased number of mesothelioma diseases has been emphasised and endangerment of inhabitants health living closely to asbestos processing factory as well.

PMID: 8999467; UI: 97127903.

Med Pr. 1996;47(4):393-9. Review. Polish.

### **[Refractory ceramic fibers, kinds, health effects after exposure, TLVs].**

Wozniak H, Wiecek E

Zakładu Aerozoli Instytutu Medycyny Pracy, Łodzi.

Ceramic fibres are amorphous or crystalline synthetic mineral fibres which are characterised by refractory properties (i.e. stability in temperature above 1000 degrees C). In general, ceramic fibres are produced from aluminium oxide, silicon oxide and other metal oxides and less frequently from non-oxide materials such as silicon carbide, silicon nitride and boron nitride. In Poland, the production of ceramic fibres was begun in the Refractory Materials Plant, Skawina, during mid-eighties. The production capacity accounts for about 600 tons annually. It is estimated that approximately 3000 persons are exposed to the effect of ceramic fibres in Poland. During the production of ceramic fibres, concentrations of respirable fibres in the air at work places range from 0.07 to 0.27 f/cm<sup>3</sup>; during the manufacture of ceramic fibre products from 0.23 to 0.71 f/cm<sup>3</sup> and during the application of ceramic fibre products from 0.07 to 1.67 f/cm<sup>3</sup>. As published data depict, fibres longer than 5 microns are most common in the work environment, and the proportion of fibres with diameters below 1 micron accounts for 40-50%. Bearing in mind the present situation in Poland, namely combined exposure to asbestos (during removal of worn out heat-insulating

materials) and ceramic fibres (during installation of new insulation), as well as in view of own investigations and literature data which evidence a strong carcinogenic effect of certain fibres, the following MAC values have been adopted: Dusts of refractory ceramic fibres: total dust-2 mg/m<sup>3</sup>; respirable fibres-1 f/cm<sup>3</sup> (L > 5 microns; D < 3 microns; L: D < 3:1) Dusts of refractory ceramic fibres mixed with asbestos: total dust-1 mg/m<sup>3</sup>; respirable fibres-1 f/m<sup>3</sup>. Dusts of refractory ceramic fibres mixed with other man-made mineral fibres (MMMF): total dust-2 mg/m<sup>3</sup>; respirable fibres-1 f/m<sup>3</sup>. According to the IARC, ceramic fibres have been included into group 2B-suspected human carcinogen.

PMID: 8847986; UI: 96405600.

Toxicology. 1995 Apr 12;98(1-3):47-55.

### **Effect of heavy metal ions on the release of reactive oxygen intermediates by bovine alveolar macrophages.**

Schluter T, Berg I, Dorger M, Gercken G

Department of Biochemistry and Molecular Biology, University of Hamburg, Germany.

Short-term incubations of bovine alveolar macrophages (BAM) with metal-containing dusts induce the release of reactive oxygen intermediates (ROI). Incubations of BAM (90 min) with dissolved metal compounds (0.1-100 µM) combined with quartz dusts were performed to investigate the effects of single elements on BAM stimulation. As(III), as well as the calcium antagonists, Ni(II) and Ce(III), inhibited the secretion of superoxide anions (O<sub>2</sub><sup>-</sup>) and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>). O<sub>2</sub><sup>-</sup> concentrations were lowered by Mn(II) and Fe(II). Increased ROI concentrations were observed with V(IV) (O<sub>2</sub><sup>-</sup> and H<sub>2</sub>O<sub>2</sub>) and Fe(III) (O<sub>2</sub><sup>-</sup>). The addition of Cd(II), Cr(III) and V(V) showed no effect on the dust-induced respiratory burst.

The influence of insoluble heavy metal compounds on ROI secretion by BAM were studied with metal oxide-coated silica particles. In most cases the release of ROI was not affected by the chemical modification of the particle surface. Coating with CuO markedly lowered the concentrations of O<sub>2</sub><sup>-</sup> and H<sub>2</sub>O<sub>2</sub>, whereas vanadium(IV) oxide considerably increased both ROIs. Although most of the investigated metal compounds did not alter ROI secretion our present results with V(IV) and Fe(III) confirm our recent statistical evaluation of the effects of heavy metal-containing dusts on ROI secretion (Berg et al., 1993, J. Toxicol. Environ. Health 39, 341).

PMID: 7740553; UI: 95259072.

Przegl Epidemiol. 1995;49(4):407-16. Polish.

### **[Assessment of lung cancer risk due to environmental asbestos dust exposure in the general population].**

Szeszenia-Dabrowska N, Szymczak W, Wilczynska U

Zespół Środowiskowych Zarozn Zdrowia Instytutu Medycyny Pracy w Łodzi.

Assessment of lung cancer risk due to environmental asbestos dust exposure in the general population was based on the model of risk extrapolation from the occupational (in asbestos-cement plant) to the environmental concentrations. 24-h determinations of asbestos fibre concentrations in the air varied considerably, from 0.4 f/l to 4.6 f/l. The lung cancer risk due to environmental exposure of the general population to asbestos dust has been estimated to be 22 cases p.a. This seems to be very low, considering that the total number of deaths from lung cancer in Poland in 1992 was about 17.5 thousand. The environmental asbestos exposures and their health effects are limited mainly to the areas located in the vicinity of asbestos plants and are attributable primarily to improper utilization of the plant wastes (for example as the surface of local roads and sports grounds at schools) and their unauthorized disposal. The incidence of pleural mesothelioma among the inhabitants of those areas seems to be endemic. The endemic character of pleural mesothelioma occurrence has been recently revealed in the vicinity of one of major Polish asbestos and cement plant.

PMID: 8868201; UI: 97021841.

Med Pr. 1995;46(2):179-87. Review. Polish.

### **Amorphous silica. Types, health effects of exposure, NDS].**

Wozniak H, Wiecek E

Z Zakładu Aerozoli, Instytutu Medycyny Pracy im. prof. dra med. Jerzego Nofera w Łodzi.

Maximum allowable concentration (MAC) values for amorphous silica dust have not been identified in the Polish legal regulations up-to-date. In this work the authors review values of allowable (recommended) amorphous silica dust concentrations in other countries. Data on other types of amorphous silica (natural and synthetic) used in industry as well as data on health effects of exposure to these types of dust are presented. The work encompasses 42 entries in the references and one Table which includes the following proposed MAC values: Non-calciate diatomaceous earth (diatomite) and synthetic silica: Total dust—10 mg/m<sup>3</sup> Respirable dust—2 mg/m<sup>3</sup> Calciate diatomaceous earth (diatomite) and fused silica (vitreous silica): Total dust—2 mg/m<sup>3</sup> Respirable dust—1 mg/m<sup>3</sup>.

PMID: 7637638; UI: 95364699.

Ann Occup Hyg. 1994 Aug;38(4):477-87, 409-10.

### **The assessment of exposure in terms of fibres.**

Gibbs GW

The membrane filter (MF) method for evaluating asbestos fibre concentrations was introduced in the 1960s. Before that time the midget impinger (MI) was used in North America, while the long running (LRTP) and regular thermal precipitator (TP) were used in the U.K. All studies from which estimates of long-term health risks can be derived (i.e. those with individual cumulative lifetime exposure estimates) were based on the now obsolete methods. The reliability of converting these indices of exposure to MF equivalent concentrations was reviewed. It was concluded that no overall single factor could be derived for the Quebec mining and milling industry. However, it has been possible to derive conversion factors at the individual mill and work area level. Applying these in one Quebec mortality study analysis based on all jobs held by persons in the cohort gave an overall MF/MI ratio of 3.6. An examination of the confidence intervals surrounding the Quebec data, ratios derived for other chrysotile mines by other investigators, and measurements of fibre concentrations in the 1970s suggest that this was probably not unreasonable. Side-by-side and other measurements were used to convert MI concentrations in the U.S. textile industry to MF fibre concentrations. While conversions involve considerable uncertainty, independent measurements of fibres in the lung tissues of workers from the U.S. textile plant and Quebec mills show that in lungs the ratios of the concentrations of chrysotile to those of tremolite are quite consistent with the ratio of assessed exposures to these fibres in the two industries. There is an apparently higher risk of mesothelioma in one Quebec mining area (Thetford Mines) than in another (Asbestos). A high concentration of fibrous tremolite has been found in the lungs of workers in Thetford. A method of evaluating the extent to which mesothelioma risk in the chrysotile mining industry might be explained by tremolite exposures was proposed. The slope of the lung cancer dose-response relationship for the textile industry is approximately 50 times that for the mining and milling industry. Available data on the length distributions of fibres from Quebec mines and mills (up to 5% > 5 microns) and the Charleston textile plant (up to 21% > 5 microns) and some marginal indication of longer fibres in tissues from Charleston workers suggest that further work specifically addressing differences in the size distributions of long fibres in these industries is

PMID: 7978969; UI: 95069680.

Environ Health Perspect. 1994 May;102(5):478-82.

### **Characterization of air contaminants formed by the interaction of lava and sea water.**

Kullman GJ, Jones WG, Cornwell RJ, Parker JE

Division of Respiratory Disease Studies, National Institute for Occupational Safety and Health, Morgantown, WV 26505 USA.

We made environmental measurements to characterize contaminants generated when basaltic lava from Hawaii's Kilauea volcano enters sea water. This interaction of lava with sea water produces large clouds of mist (LAZE). Island winds occasionally directed the LAZE toward the adjacent village of Kalapana and the Hawaii Volcanos National Park, creating health concerns. Environmental samples were taken to measure airborne concentrations of respirable dust, crystalline silica and other mineral compounds, fibers, trace metals, inorganic acids, and organic and inorganic gases. The LAZE contained quantifiable concentrations of hydrochloric acid (HCl) and hydrofluoric acid (HF); HCl was predominant. HCl and HF concentrations were highest in dense plumes of LAZE near the sea. The HCl concentration at this sampling location averaged 7.1 ppm; this exceeds the current occupational exposure ceiling of 5 ppm. HF was detected in nearly half the samples, but all concentrations were <1 ppm. Sulfur dioxide was detected in one of four short-term indicator tube samples at approximately 1.5 ppm. Airborne particulates were composed largely of chloride salts (predominantly sodium chloride). Crystalline silica concentrations were below detectable limits, less than approximately 0.03 mg/m<sup>3</sup> of air. Settled dust samples showed a predominance of glass flakes and glass fibers. Airborne fibers were detected at quantifiable levels in 1 of 11 samples. These fibers were composed largely of hydrated calcium sulfate. These findings suggest that individuals should avoid concentrated plumes of LAZE near its origin to prevent over exposure to inorganic acids, specifically HCl. PMID: 8593853; UI: 96115314.

Environ Health Perspect 1990 Aug;88:277-86

### **Human occupational and nonoccupational exposure to fibers.**

Esmen NA, Erdal S

Graduate School of Public Health, University of Pittsburgh, PA 15261.

Human exposure to fibers in occupational and nonoccupational environments has been a health concern for nearly a century. In this review, selected results from the literature are presented to highlight the availability, limitations, and interpretive difficulties associated with the past and current human fiber exposure data sets. In the traditionally defined asbestos fibers, large amounts of the data available suffer from the diversity of sample collection and analysis methods. Two simple generalizations suggest that occupational exposures are several orders of magnitude higher than that of environmental exposures; and currently extant data and the current routine measurement practices present significant difficulties in the consistent interpretation of the data with respect to health effects. The data on the human exposures to man-made vitreous fibers are much more complete than the data on asbestos exposure, while exposure data on other man-made fibrous materials are lacking. The human exposure data to many minerals which, at times, exist in fibrous habit, are very scanty, and in view of the biological activity of some of these fibers, this lack may be of significant concern.

PMID: 2272324; UI: 91106377.

Int J Health Serv. 1986;16(2):253-63.

### **Asbestos and health in the Third World: the case of Brazil.**

Berman DM

Almost all of the asbestos used in Brazil is mined by an enterprise wholly owned by two European multinational companies, which also produce and market over two-thirds (by weight of asbestos) of the products made from asbestos. About 80 percent of the asbestos used in Brazil is finally consumed in the form of asbestos cement: for roof tiles and roofing panels, wall-board, and domestic and industrial water tanks. A survey of consumer literature and advertising printed by Eternit, S.A., and Brasilit, S.A., disclosed no mention of a potential danger from exposure to asbestos dust, and no recommendations for cutting down exposure to that dust. The situation at smaller, Brazilian-owned firms is reputed to be disastrous from the standpoint of workers' exposure to asbestos dust at the point of production. At a large asbestos-cement manufacturing plant owned by Eternit, however, exposure to asbestos dust (according to company records) seemed to be kept under 2.0 fibers per cc., the present standard for the United States.

PMID: 2939030; UI: 86194866.

Environ Health Perspect. 1985 Oct;62:319-28.

## **Health implications of environmental exposure to asbestos.**

McDonald JC

The health impact of environmental pollution resulting from the industrial use of asbestos can be assessed in three ways. First, there are the direct epidemiological surveys. These indicate that domestic exposure has been responsible for cases of mesothelioma and possibly lung cancer and radiological changes in family contacts of asbestos workers. Exposure in the neighborhood of crocidolite mines and factories has also resulted in cases of mesothelioma but no similar evidence exists for chrysotile or amosite. Neither air nor water pollution has been directly incriminated as a cause of either respiratory or digestive malignancies. Second, a few attempts have been made to extrapolate from exposure response findings in industrial cohorts. For several reasons, even for lung cancer, this approach is dubious: the observed gradients have a 100-fold range in slope; the equivalences of dust, fiber and gravimetric measures are largely guesswork; and the carcinogenic potential of mineral fibers, particularly for the pleura, varies enormously with fiber type and/or dimensions. No adequate exposure-response observations have been made for mesothelioma. A third approach makes use of the differing incidence of mesothelioma in men and women. Data from several countries indicate that, until the 1950s (i.e., 30-40 years after significant industrial use of asbestos began), the rates were similar in both sexes. Since then, the incidence in males has risen steeply—in the U.S. and U.K. at about 10% per annum. In females, on the other hand, there has been little or no convincing increase. These data suggest that the "background" level of mesothelioma in both sexes is and has been about 2 per million per annum and that—as at least some mesothelioma cases in females are directly or indirectly attributable to occupational exposure—there is little room left for any contribution from the general environment. It is recommended that mesothelioma surveillance, backed by appropriate epidemiological inquiries, offers an effective method of monitoring the health impact of asbestos air pollution.

PMID: 4085437; UI: 86108190

Ann Acad Med Singapore. 1984 Apr;13(2 Suppl):345-52.

## **Mineral fibres and cancer.**

McDonald JC

A synthesis is presented of the salient findings to date from laboratory and epidemiological research, on the health effects of asbestos and other natural and man-made mineral fibres. Experimental evidence suggests that all mineral fibres are capable of causing fibrosis and malignancy, with chrysotile at least as pathogenic as other fibres. However, penetration, retention and phagocytosis are affected by size and shape and reactivity and durability by physico-chemical properties. Thus it is not surprising that in man the results of exposure vary considerably with fibre type and industrial process. A considerable body of evidence suggests that chrysotile has seldom, if ever, caused peritoneal mesothelioma and that the great majority of pleural mesotheliomas are also attributable to crocidolite or amosite. Without more reliable information on intensity and duration of exposure by fibre type, the epidemiological evidence on this point cannot be wholly conclusive. There are stronger grounds from a limited number of cohort studies for believing that in relation to estimated exposure, the risk of lung cancer has been much higher in textile plants than in fibre production or in the manufacture of friction products, with asbestos-cement plants somewhere in between. The data on man-made fibre production remains equivocal. It is concluded that attempts to regulate asbestos without regard for fibre type, although perhaps adequate for lung cancer and fibrosis, may do little to reduce the risk of mesothelioma. The search for safe fibre substitutes for asbestos will remain difficult until the parameters of pathogenicity are better understood.

PMID: 6093677; UI: 85045368.



## **Health Impact of Volcanic Emissions**

Epidemiol 1999 Feb;9(1):27-31

### **Asthma-like disease in the children living in the neighborhood of Mt. Sakurajima.**

Uda H, Akiba S, Hatano H, Shinkura R

Department of Public Health, Faculty of Medicine, Kagoshima University, Japan.

We conducted self-administered questionnaire surveys of school children living in the vicinity of Mt. Sakurajima using ATS-DLD questionnaire. In this paper, we report the results of analysis comparing the proportion of children with asthma-like disease in the area exposed to the volcanic ash and gases released by Mt. Sakurajima and control areas. Asthma-like disease was ascertained using ATS-DLD questionnaire and the definition proposed by the study group established by Environmental Protection Agency in Japan. The proportion of children with asthma-like disease was not different between the exposed and control groups. The odds ratio of asthma-like disease comparing the exposed and control groups was 1.1 and its 95% confidence interval was 0.7-1.8 ( $P = 0.583$ ). When the exposed area was divided into Tarumizu city, Sakurajima town and Kagoshima city, none of them showed an elevated proportion of children with asthma-like disease when compared with the control area. In the entire study population including both the exposed and control groups, the proportion of children with asthma-like disease was 6 and 3% in boys and girls, respectively. These values were quite similar to those obtained from a survey of 45,674 school children in western districts in Japan in 1992. In conclusion, the present study indicates that the proportion of children with asthma-like disease is not elevated in the exposed area. Further investigations are necessary to confirm our conclusions.

PMID: 10098350, UI: 99198423

Aust N Z J Public Health 1997 Dec;21(7):773-8

### **The Mount Ruapehu eruption, 1996: a review of potential health effects.**

Weinstein P, Patel A

Ministry of Health, Wellington, New Zealand.

Literature search and consultation with New Zealand experts were used to review the potential health effects of explosive volcanic eruptions, and possibilities for their control, in the context of the 1996 eruption and possible future eruptions of Mount Ruapehu. Humans may be exposed to several types of hazardous ejecta during and after volcanic eruptions. Such exposure may cause health effects that could require surveillance and control, but health effects in New Zealand are unlikely to be detectable while eruptions remain small and infrequent. The existing health surveillance systems in New Zealand are adequate to monitor and help control the possible health effects of volcanic eruptions.

PMID: 10098350

Environ Health Perspect. 1994 May;102(5):478-82.

### **Characterization of air contaminants formed by the interaction of lava and sea water.**

Kullman GJ, Jones WG, Cornwell RJ, Parker JE

Division of Respiratory Disease Studies, National Institute for Occupational Safety and Health, Morgantown, WV 26505 USA.

We made environmental measurements to characterize contaminants generated when basaltic lava from Hawaii's Kilauea volcano enters sea water. This interaction of lava with sea water produces large clouds of mist (LAZE). Island winds occasionally directed the LAZE toward the adjacent village of Kalapana and the Hawaii Volcanos National Park, creating health concerns. Environmental samples were taken to measure airborne concentrations of respirable dust, crystalline silica and other mineral compounds, fibers, trace metals, inorganic acids, and organic and inorganic gases. The LAZE contained quantifiable concentrations of hydrochloric acid (HCl)



and hydrofluoric acid (HF); HCl was predominant. HCl and HF concentrations were highest in dense plumes of LAZE near the sea. The HCl concentration at this sampling location averaged 7.1 ppm; this exceeds the current occupational exposure ceiling of 5 ppm. HF was detected in nearly half the samples, but all concentrations were <1 ppm. Sulfur dioxide was detected in one of four short-term indicator tube samples at approximately 1.5 ppm. Airborne particulates were composed largely of chloride salts (predominantly sodium chloride). Crystalline silica concentrations were below detectable limits, less than approximately 0.03 mg/m<sup>3</sup> of air. Settled dust samples showed a predominance of glass flakes and glass fibers. Airborne fibers were detected at quantifiable levels in 1 of 11 samples. These fibers were composed largely of hydrated calcium sulfate. These findings suggest that individuals should avoid concentrated plumes of LAZE near its origin to prevent over exposure to inorganic acids, specifically HCl. PMID: 8593853; UI: 96115314.

Bull Pan Am Health Organ 1996 Sep;30(3):218-26

### **Public health surveillance after a volcanic eruption: lessons from Cerro Negro, Nicaragua, 1992.**

Malilay J, Real MG, Ramirez Vanegas A, Noji E, Sinks T

Division of Environmental Hazards and Health Effects, National Center for Environmental Health, Centers for Disease Control and Prevention, Atlanta, Georgia, USA.

The eruption of the Cerro Negro volcano near Leon, Nicaragua, on 9 April 1992 distributed an estimated 1.7 million tons of ash over a 200 square kilometer area. An assessment was conducted to evaluate the health effects on approximately 300,000 residents, using routine data obtained by the national epidemiologic surveillance system. It was found that rates of visits to health care facilities for acute diarrheal and respiratory illnesses increased in two study communities, one within and one near the disaster zone. Specifically, visits for acute diarrhea were nearly 6 times more numerous than before the eruption in both communities, while visits for acute respiratory diseases were 3.6 times more frequent in Malpaisillo (the community near the disaster zone) and 6.0 times more frequent in Telica (the community within it). Most of the visits were for infants and children less than 5 years old. Increased diarrheal disease morbidity, which commonly occurs after volcanic eruptions, demands detailed investigation of the type and quality of water supplies following heavy ashfall. Ash-related respiratory problems should be further examined to determine the spectrum of such diseases and the timing of illness onsets among infants and other special population subgroups. Data collected on health conditions before and after an eruption by passive surveillance can be used to detect eruption-related morbidity. Systems already in place, such as Nicaragua's national epidemiologic surveillance system, can be modified or extended so as to increase their sensitivity to new cases and hence their ability to provide appropriate notification to medical relief agencies.

PMID: 8897722, UI: 97053109

Environ Health Perspect 1996 Mar;104(3):290-7

### **Particulate air pollution and respiratory disease in Anchorage, Alaska.**

Gordian ME, Ozkaynak H, Xue J, Morris SS, Spengler JD

Department of Health and Human Services, Municipality of Anchorage, AK 99519-6650, USA.

This paper examines the associations between average daily particulate matter less than 10 microns in diameter (PM<sub>10</sub>) and temperature with daily outpatient visits for respiratory disease including asthma, bronchitis, and upper respiratory illness in Anchorage, Alaska, where there are few industrial sources of air pollution. In Anchorage, PM<sub>10</sub> is composed primarily of earth crustal material and volcanic ash. Carbon monoxide is measured only during the winter months. The number of outpatient visits for respiratory diagnoses during the period 1 May 1992 to 1 March 1994 were derived from medical insurance claims for state and municipal employees and their dependents covered by Aetna insurance. The data were filtered to reduce seasonal trends and serial autocorrelation and adjusted for day of the week. The results show that an increase of 10 micrograms/m<sup>3</sup> in PM<sub>10</sub> resulted in a 3-6% increase in visits for asthma and a 1-3% increase in visits for upper respiratory diseases. Winter CO concentrations were significantly associated with bronchitis and upper respiratory illness, but not with asthma. Winter CO was highly

correlated with automobile exhaust emissions. These findings are consistent with the results of previous studies of particulate pollution in other urban areas and provide evidence that the coarse fraction of PM10 may affect the health of working people.

PMID: 10098350

Hawaii Med J 1996 Mar;55(3):48-54

### **Emergency department visits and hospitalizations for respiratory disease on the island of Hawaii, 1981 to 1991.**

Mannino DM, Ruben S, Holschuh FC, Holschuh TC, Wilson MD, Holschuh T  
National Center for Environmental Health, Centers for Disease Control and Prevention (CDC), Atlanta, Georgia, USA.

This study examined trends in and patterns of emergency department visits and hospitalizations for respiratory disease on the island of Hawaii from 1981 to 1991. We found that emergency department visit rates and hospitalization rates for both asthma and COPD for 1987 to 1991 increased in all regions of the island in comparison with such rates for 1981 to 1986. Rates of emergency department visits and hospitalizations for chronic obstructive pulmonary disease or COPD, but not asthma, were significantly higher in the high-exposure Kona side of the island than in the intermittent-exposure Hilo side of the island during 1983 and 1988 to 1990. We also found that during the weeks that winds were from the west, blowing volcanic air pollution toward Hilo, emergency department visits for asthma increased 15%. Some of the results of our study support the hypothesis that volcanic air pollution affects respiratory health on the island of Hawaii, while other results do not. Any future studies should include measurements of air pollutant levels.

PMID: 8882554, UI: 97036907

World Health Stat Q 1996;49(3-4):204-8

### **The effects of volcanoes on health: preparedness in Mexico.**

Zeballos JL, Meli R, Vilchis A, Barrios L  
Pan American Health Organization, Mexico.

The article reviews the most important aspects of volcanic eruptions and presents a summary of the harmful materials they emit. The main health effects can be classified as either physical (trauma, respiratory diseases, etc.) or psychological (depression, anxiety, nightmares, neurosis, etc.). Popocatepetl, the most famous active volcano in Mexico, lies on the borders of the States of Mexico, Puebla and Morelos. In 1993, seismic activity intensified, as did as the emission of fumaroles, followed in December 1994 by moderate tremors and strong emissions of gases and ash. In 1996, a number of seismic events led to an unexpected explosion. A daily emission of 8,000 to 15,000 tonnes of sulfur dioxide has been measured. Popocatepetl is located in a densely populated region of Mexico. A complex network to monitor the volcano using sophisticated equipment has been set up, including visual surveillance, seismic, geochemical and geodesic monitoring. An early warning system(SINAPROC/CENAPRED) has been developed to keep the population permanently informed. The warning system uses colour codes: green for normal, yellow for alert, and red for warning and evacuation. An emergency plan has been prepared, including evacuation and preparation for medical centres and hospitals in the region, as well as intense public information campaigns.

PMID: 10098350

Arch Environ Health 1994 Sep-Oct;49(5):395-401

### **Evaluating a fluorosis hazard after a volcanic eruption.**

Rubin CH, Noji EK, Seligman PJ, Holtz JL, Grande J, Vittani F  
Epidemic Intelligence Service, Epidemiology Program Office, Atlanta, Georgia.

The August, 1991 eruption of Mt. Hudson (Chile) deposited ash across southern Argentina and contributed to the deaths of thousands of grazing sheep. Early ash analysis revealed high levels of fluoride, a potential ash constituent toxic to humans and animals. In order to evaluate fluorosis as the cause of sheep deaths and to examine the possibility that similar ash and airborne

toxins could also have an effect on the human population, we conducted an investigation that included health provider interviews, hospital record review, physical examination of sheep, determination of sheep urine fluoride levels, and complete constituent analysis of ash samples collected at proscribed distances from the volcano. Ash deposited farthest from the volcano had highest fluoride levels; all fluoride measurements were normal after rainfall. There were no signs or symptoms of fluorosis observed in sheep or humans. Sheep deaths resulted from physical, rather than chemical properties of the ash.  
PMID: 7944572, UI: 95031257

Prehospital Disaster Med 1994 Jan-Mar;9(1):58-66

### **In the shadow of El Chichon: an overview of the medical impact of the 28 March to 4 April 1982 eruptions of the Mexican volcano.**

Nania JM, Rodriguez Garcia M, Fruchter JS, Olsen KB, Hooper PR  
Deaconess Medical Center, Department of Emergency Medicine, Spokane, Wash., USA.  
PMID: 10155492, UI: 96021875

Arch Environ Health 1990 Nov-Dec;45(6):367-73

### **Health effects of volcanic ash: a repeat study.**

Yano E, Yokoyama Y, Higashi H, Nishii S, Maeda K, Koizumi A  
Department of Public Health, Teikyo University School of Medicine, Tokyo, Japan.  
The Mount Sakurajima volcano in Kyushu, Japan, is proximal to a large residential area, and it emits an enormous amount of volcanic ash during frequent eruptions. In our previous study, we investigated, for the first time, respiratory effects of chronic exposure to volcanic ash. The study demonstrated a low prevalence of respiratory symptoms, even in the area of highest exposure; only a slight excess prevalence of symptoms appeared to be associated with exposure to volcanic ash. To confirm the findings of our previous study, the prevalence study of chronic respiratory symptoms for residents was repeated in Kanoya and Tashiro, which are located 25 and 50 km, respectively, from the crater of Mt. Sakurajima. The concentration of suspended particulate matter in Kanoya frequently exceeded the national environmental quality standards and, during summer and winter, was 2-3 times higher than that found in Tashiro. Women who were 30-59 y of age and who had resided in Kanoya or Tashiro for more than 3 y completed a modified ATS-DLD questionnaire. The prevalence of nonspecific respiratory disease was low, i.e., 6.5% in Kanoya and 6.2% in Tashiro; similar prevalences were found in women who had never smoked. When we restricted the analysis to individuals without a history of occupational exposure to dusts and who had no exposure to passive smoking, there was a slightly higher prevalence of nonspecific respiratory disease in Kanoya than Tashiro, but the difference was not significant. Eye symptoms were equally prevalent in the two areas.  
PMID: 2270957, UI: 91103610

Lancet 1990 Jul 21;336(8708):176

### **Health hazards of volcanic gases.**

Baxter PJ, Tedesco D, Miele G, Baubron JC, Cliff K  
Publication Types:  
Letter  
PMID: 1973489, UI: 90318177

Res Nurs Health 1986 Dec;9(4):331-40

### **Status of natural disaster victims' health and recovery 1 and 3 years later.**

Murphy SA  
Bereaved, property loss, and control groups (N = 155) studied 11 months following the 1980 volcanic eruption of Mt. St. Helens were recontacted 35 months postdisaster to test the hypotheses that the greater the loss experienced, the higher the stress, and the poorer the

health. In general, the hypotheses were supported. Even though mental distress decreased between the two data collection periods, the mental health of the bereaved group remained poorer than both the property loss and control groups. At 3 years postdisaster, only 4% of the study participants reported complete recovery from disaster loss. Findings are compared with those of other recent disasters and clinical and theoretical implications are discussed.

PMID: 3643610, UI: 87119152

Am J Public Health 1986 Mar;76(3 Suppl):66-75

## **Evaluation of physical health effects due to volcanic hazards: human studies.**

Buist AS, Bernstein RS, Johnson LR, Vollmer WM

PMID: 3946729, UI: 86127866

Immediate public health concerns and actions in volcanic eruptions:  
lessons from the Mount St. Helens eruptions, May 18-October 18, 1980.

Bernstein RS, Baxter PJ, Falk H, Ing R, Foster L, Frost F

A comprehensive epidemiological evaluation of mortality and short-term morbidity associated with explosive volcanic activity was carried out by the Centers for Disease Control in collaboration with affected state and local health departments, clinicians, and private institutions. Following the May 18, 1980 eruption of Mount St. Helens, a series of public health actions were rapidly instituted to develop accurate information about volcanic hazards and to recommend methods for prevention or control of adverse effects on safety and health. These public health actions included: establishing a system of active surveillance of cause-specific emergency room (ER) visits and hospital admissions in affected and unaffected communities for comparison; assessing the causes of death and factors associated with survival or death among persons located near the crater; analyzing the mineralogy and toxicology of sedimented ash and the airborne concentration of resuspended dusts; investigating reported excesses of ash-related adverse respiratory effects by epidemiological methods such as cross-sectional and case-control studies; and controlling rumors and disseminating accurate, timely information about volcanic hazards and recommended preventive or control measures by means of press briefings and health bulletins. Surveillance and observational studies indicated that: excess in morbidity were limited to transient increases in ER visits and hospital admissions for traumatic injuries and respiratory problems (but not for communicable disease or mental health problems) which were associated in time, place, and person with exposures to volcanic ash; excessive mortality due to suffocation (76 per cent), thermal injuries (12 per cent), or trauma (12 per cent) by ash and other volcanic hazards was directly proportional to the degree of environmental damage—that is, it was more pronounced among those persons (48/65, or about 74 per cent) who, at the time of the eruption, were residing, camping, or sightseeing (despite restrictions) or working (with permission) closer to the crater in areas affected by the explosive blast, pyroclastic and mud flows, and heavy ashfall; and de novo appearance of ash-related asthma was not observed, but transient excesses in adverse respiratory effects occurred in two high-risk groups—hypersusceptibles (with preexisting asthma or chronic bronchitis) and heavily exposed workers. Laboratory and field studies indicated that: volcanic ash had mild to moderate fibrogenic potential, consisting of greater than 90 per cent (by count) respirable size particles which contained 4-7 per cent (by weight) crystalline free silica (SiO<sub>2</sub>).

PMID: 3946727, UI: 86127860

Am J Public Health 1986 Mar;76(3 Suppl):59-65

## **Evaluation of physical health effects due to volcanic hazards: the use of experimental systems to estimate the pulmonary toxicity of volcanic ash.**

Martin TR, Wehner AP, Butler J

Shortly after Mount St. Helens erupted in 1980, a number of laboratories began to investigate the effects of volcanic ash in a variety of experimental systems in attempts to predict effects that might occur in the lungs of humans exposed to volcanic ash. The published results are

remarkably consistent, despite the use of non-uniform ash samples and variability in the experimental approaches used. The data indicate that volcanic ash, even in high concentrations, causes little toxicity to lung cells in vitro and in vivo, as compared with effects of free crystalline silica, which is known to be highly fibrogenic. Volcanic ash does not appear to be entirely inert, however, possibly because of low concentrations of free crystalline silica in the ash. The published experimental studies suggest that inhaled volcanic ash is not likely to be harmful to the lungs of healthy humans, but the potential effects of volcanic ash in patients with pre-existing lung diseases are more difficult to ascertain from these studies.

PMID: 3080911, UI: 86127865

Am J Public Health 1986 Mar;76(3 Suppl):53-8

### **Evaluation of physical health effects due to volcanic hazards: crystalline silica in Mount St. Helens volcanic ash.**

Dollberg DD, Bolyard ML, Smith DL

This investigation has shown that crystalline silica has been identified as being present in the Mount St. Helens volcanic ash at levels of 3 to 7 per cent by weight. This identification has been established using X-ray powder diffraction, infrared spectrophotometry, visible spectrophotometry, electron microscopy, and Laser Raman spectrophotometry. Quantitative analysis by IR, XRD, and visible spectrophotometry requires a preliminary phosphoric acid digestion of the ash sample to remove the plagioclase silicate material which interferes with the determination by these methods. Electron microscopic analysis as well as Laser Raman spectrophotometric analysis of the untreated ash confirms the presence of silica and at levels found by the XRD and IR analysis of the treated samples. An interlaboratory study of volcanic ash samples by 15 laboratories confirms the presence and levels of crystalline silica. Although several problems with applying the digestion procedure were observed in this hastily organized supply, all laboratories employing the digestion procedure reported the presence of crystalline silica. These results unequivocally put to rest the question of the presence of silica in the volcanic ash from eruptions of Mount St. Helens in 1980.

PMID: 3004241, UI: 86127864

Lab Invest 1983 Jan;48(1):5-12

### **Health effects of Mount St. Helens volcanic dust.**

Craighead JE, Adler KB, Butler GB, Emerson RJ, Mossman BT, Woodworth CD

PMID: 6823090, UI: 83113385

Lancet 1982 Jul 17;2(8290):150-1

### **Volcanic gases and health: Masaya Volcano, Nicaragua.**

Baxter PJ, Stoiber RE, Williams SN

PMID: 6123853, UI: 82218765

JAMA 1981 Dec 4;246(22):2585-9

### **Mount St Helens eruptions, May 18 to June 12, 1980. An overview of the acute health impact.**

Baxter PJ, Ing R, Falk H, French J, Stein GF, Bernstein RS, Merchant JA, Allard J

Thirty-five known deaths were caused by the landslide and lateral blast of the May 18 eruption of Mount St Helens and at least 23 persons are missing. In 18 of 23 cases that reached autopsy, asphyxiation from ash inhalation was the cause of death. A rapidly established hospital surveillance system detected increases in the number of emergency room (ER) visits and admissions for asthma and bronchitis in communities with the heaviest ashfall after the May 18 eruption and the eruptions on May 25 and June 12. There were also increases in the number of ER visits for ash-related eye complaints in some areas. laboratory studies indicated that the May 18 ash was not acutely toxic, but the respirable portion contained 3% to 7% of crystalline free silica, a potential pneumoconiosis hazard to certain heavily exposed occupational groups.

Continuing volcanic activity of Mount St Helens and future eruption of other volcanoes in the Cascade Range may pose a variety of health hazards, including blast, ashfalls, flooding, damage to public utilities, and possible psychosocial effects.

PMID: 7029020, UI: 82055845

N Z Med J 1997 Mar 28;110(1040):90-1

### **Under the volcano: fire, ash and asthma?**

Bradshaw L, Fishwick D, Kemp T, Lewis S, Rains N, Slater T, Pearce N, Crane J

Department of Medicine, Wellington School of Medicine.

**AIMS:** To investigate the prevalence of respiratory symptoms in known asthmatics, following exposure to airborne volcanic ash particles caused by the eruptions of Mount Ruapehu, New Zealand, commencing September 1995. **METHOD:** A one page postal questionnaire was sent to 1392 previously identified asthmatics 2 months after the first major eruption. **RESULTS:** Two hundred and thirty seven subjects had moved from the area, died or gone overseas since the original contact 4 years previously; therefore the target population was 1155 subjects of whom 361 lived in the exposed area and 794 in the nonexposed areas. The response rates were 246 (68.1%) in the exposed group and 477 (60.1%) in the nonexposed group making a total of 723 individuals. The prevalence of nocturnal shortness of breath in the last two months was 29.3% in the exposed group and 24.7% in the nonexposed (OR = 1.26, 95% CI; 0.83-1.78). Similarly 30.9% of the exposed group had an asthma attack in the last 2 months compared to 31.9% of the nonexposed group (OR = 0.96, 95% CI; 0.69-1.33). Finally, 48.4% of the exposed group used asthma medication in the 2 months following the eruption in comparison to 53% of the nonexposed group (OR = 0.83, 95%, CI; 0.61-1.12). **CONCLUSIONS:** The study showed no association between living in an area exposed to volcanic ash particles and either asthma symptoms or the use of asthma medication. There was a small but nonsignificant increase in nocturnal shortness of breath in the exposed group.

PMID: 9137309, UI: 97283175

Arch Environ Health 1986 Mar-Apr;41(2):94-9

### **Chronic pulmonary effects of volcanic ash: an epidemiologic study.**

Yano E, Yokoyama Y, Nishii S

The chronic pulmonary effects of exposure to volcanic ash were investigated by conducting a cross-sectional epidemiological study of 2,006 women between 30 and 59 yr of age who lived in three areas subjected to different levels of airborne ash. In the three areas prevalences of chronic bronchitis and other respiratory symptoms were so low that volcanic ash did not seem to be a major cause of respiratory disease. In the highly exposed area, however, 9.9% of the women experienced symptoms of one or more respiratory diseases, while 6.4% of the women in the medium- and 5.4% of the women in the low-exposure area had these symptoms. Prevalences of each disease and symptom increased as total suspended particulate level increased, suggestive of an association of mild respiratory symptoms with volcanic ash.

PMID: 3718009, UI: 86240999

Am J Public Health 1986 Mar;76(3 Suppl):39-44

### **The development of a multidisciplinary plan for evaluation of the long-term health effects of the Mount St. Helens eruptions.**

Buist AS, Martin TR, Shore JH, Butler J, Lybarger JA

PMID: 3946728, UI: 86127862

## General Health

Lancet 1997 Nov 15;350(9089):1435-8

### Global assessment of El Nino's disaster burden.

Bouma MJ, Kovats RS, Goubet SA, Cox JS, Haines A

Department of Infectious and Tropical Diseases, London School of Hygiene and Tropical Medicine, UK.

**BACKGROUND:** Natural disasters have profound effects on health and require medical intervention as part of relief operations. The world's populations are becoming increasingly vulnerable to extreme weather events, which are responsible for most natural disasters. The El Nino Southern Oscillation (ENSO) is the most prominent global climate system associated with year-to-year weather variability and extreme events. We have estimated the burden on human health of natural disasters associated with ENSO. **METHODS:** We used time-series regression analysis of the relation between El Nino years and the annual rates of persons affected by natural disasters per 1000 population during 1964-93, globally and also by region and disaster type. Correlations between sea-surface temperature (SST) anomalies (index of ENSO) and the rates of persons affected by natural disasters per 1000 population were determined globally, by region and by disaster type. **FINDINGS:** The rate of persons affected by natural disasters worldwide is strongly associated with ENSO; rates are greater during the first El Nino year ( $p = 0.05$ ) and the following year ( $p = 0.01$ ) than in the pre-Nino year. The correlation between rates of persons affected by natural disasters and SST anomalies in the Eastern Pacific (a key ENSO indicator) is highest in the last quarter of the previous year ( $r = 0.53$ ,  $p < 0.01$ ). These associations are strongest in South Asia, the region where more than 50% of all disaster victims live. Worldwide, rates of persons affected by drought/famine (half of all disaster victims) and by volcanic eruptions show significant associations with the ENSO cycle, being highest in the post-Nino year and El Nino year, respectively, and being significantly associated with SST anomalies. **INTERPRETATION:** The strong relation between ENSO and populations affected by natural disasters can be described as a "natural disaster cycle". Determining the phase in this cycle, using SST from the Eastern Equatorial Pacific, could benefit disaster preparedness on a global scale, for South Asia in particular, and for all populations affected by drought/famine and volcanic disasters.

PMID: 9371167, UI: 98038505

## Health Impacts of Arsenic

Environ Health Perspect 1977 Aug;19:139-43

### Arsenic levels in Oregon waters.

Stoner JC, Whanger PD, Weswig PH

The arsenic content of well water in certain areas of Oregon can range up to 30 to 40 times the U.S.P.H.S. Drinking Water Standard of 1962, where concentrations in excess of 50 ppb are grounds for rejection. The elevated arsenic levels in water are postulated to be due to volcanic deposits. Wells in central Lane County, Oregon, that are known to contain arsenic rich water are in an area underlain by a particular group of sedimentary and volcanic rocks, which geologists have named the Fischer formation. The arsenic levels in water from wells ranged from no detectable amounts to 2,000 ppb. In general the deeper wells contained higher arsenic water.

The high arsenic waters are characterized by the small amounts of calcium and magnesium in relation to that of sodium, a high content of boron, and a high pH. Water from some hot springs in other areas of Oregon was found to range as high as 900 ppb arsenic. Arsenic blood levels ranged from 32 ppb for people living in areas where water is low in arsenic to 250 ppb for those living in areas where water is known to contain high levels of arsenic. Some health problems associated with consumption of arsenic-rich water are discussed.

PMID: 908291, UI: 78003235



Environ Health Perspect 1999 May;107(5):359-65

### **Drinking water arsenic in utah: A cohort mortality study.**

Lewis DR, Southwick JW, Ouellet-Hellstrom R, Rensch J, Calderon RL

U.S. Environmental Protection Agency, National Health and Environmental Effects Research Laboratory, Human Studies Division, Research Triangle Park, NC 27711 USA.

The association of drinking water arsenic and mortality outcome was investigated in a cohort of residents from Millard County, Utah. Median drinking water arsenic concentrations for selected study towns ranged from 14 to 166 ppb and were from public and private samples collected and analyzed under the auspices of the State of Utah Department of Environmental Quality, Division of Drinking Water. Cohort members were assembled using historical documents of the Church of Jesus Christ of Latter-day Saints. Standard mortality ratios (SMRs) were calculated. Using residence history and median drinking water arsenic concentration, a matrix for cumulative arsenic exposure was created. Without regard to specific exposure levels, statistically significant findings include increased mortality from hypertensive heart disease [SMR = 2.20; 95% confidence interval (CI), 1.36-3.36], nephritis and nephrosis (SMR = 1.72; CI, 1.13-2.50), and prostate cancer (SMR = 1.45; CI, 1.07-1.91) among cohort males. Among cohort females, statistically significant increased mortality was found for hypertensive heart disease (SMR = 1.73; CI, 1.11-2.58) and for the category of all other heart disease, which includes pulmonary heart disease, pericarditis, and other diseases of the pericardium (SMR = 1.43; CI, 1.11-1.80). SMR analysis by low, medium, and high arsenic exposure groups hinted at a dose relationship for prostate cancer. Although the SMRs by exposure category were elevated for hypertensive heart disease for both males and females, the increases were not sequential from low to high groups. Because the relationship between health effects and exposure to drinking water arsenic is not well established in U.S. populations, further evaluation of effects in low-exposure populations is warranted.

PMID: 10210691, UI: 99228656

Biol Trace Elem Res 1999 Mar;67(3):197-204

### **Trace elements in coal: environmental and health significance.**

Finkelman RB

US Geological Survey, Reston, VA 20192, USA.

Trace elements can have profound adverse effects on the health of people burning coal in homes or living near coal deposits, coal mines, and coal-burning power plants. Trace elements such as arsenic emitted from coal-burning power plants in Europe and Asia have been shown to cause severe health problems. Perhaps the most widespread health problems are caused by domestic coal combustion in developing countries where millions of people suffer from fluorosis and thousands from arsenism. Better knowledge of coal quality characteristics may help to reduce some of these health problems. For example, information on concentrations and distributions of potentially toxic elements in coal may help delineate areas of a coal deposit to be avoided. Information on the modes of occurrence of these elements and the textural relations of the minerals in coal may help to predict the behavior of the potentially toxic trace metals during coal cleaning, combustion, weathering, and leaching.

PMID: 10201327, UI: 99215510

Int J Occup Environ Health 1998 Oct-Dec;4(4):217-30

### **Human exposures to arsenic from consumption of well water in West Bengal, India.**

Subramanian KS, Kosnett MJ

Product Safety Laboratory, Health Canada, Ottawa, Ontario, Canada. s\_k\_subramanian@hc-sc.gc.ca

The authors visited the State of West Bengal, India, in August 1996, as consultants to the World Health Organization (WHO). The general mandate of the mission was to formulate recommendations to the Government of India regarding its efforts to assist the Government of



West Bengal in remedying health problems arising from the presence of arsenic in groundwater in excess of the WHO guideline limit of 0.05 mg/L in eight districts of the State. The authors held discussions with Government of India and Government of West Bengal officials, as well as scientists, engineers, and physicians studying the analytic, medical, engineering, and hydrogeologic facets of the problem. They conducted field visits to arsenic-affected villages; inspected health centers, including the laboratories conducting the analytic and clinical studies; and interviewed and examined local lay people, including many arsenic-poisoned patients.

This overview of the arsenic contamination problem in West Bengal is based upon a review of the scientific literature and government reports and the authors direct, firsthand assessment. The authors hope that their recommendations will assist in the development of a comprehensive infrastructure and plan of action, which are necessary to control the epidemic of chronic arsenic poisoning now afflicting West Bengal.

PMID: 9876630, UI: 99093910

Cad Saude Publica 1998;14 Suppl 3:193-8

### **Lung cancer and arsenic exposure in drinking water: a case-control study in northern Chile.**

Ferreccio C, Gonzalez Psych C, Milosavljevic Stat V, Marshall Gredis G, Sancha AM

Grupo para el Desarrollo de la Investigacion en Salud (GREDIS). Casilla 52750, Correo Central, Santiago, Chile.

In some Chilean cities, levels of arsenic (As) in drinking water reached 800 (g/L between 1950 and 1970, while current levels are 40 (g/L. To evaluate the causal role of this exposure in lung and bladder cancers, we conducted a case-control study in Regions I, II, and III of the country. From 1994 to 1996, cases diagnosed as lung cancer and two hospital controls were entered in the study; one control was a patient with a cancer, while the other was a patient without cancer, both conditions unrelated to As. Controls were matched with cases by age and sex. A standard survey containing questions about residence, employment, health history, was administered to study subjects. Data on As concentrations in water were obtained from records of the municipal water companies. A total of 151 lung cancer cases and 419 controls (167 with cancer and 242 without cancer) were enrolled. Median level of lifetime As exposure was significantly higher among cases, with a clear dose-response relationship between mean As exposure levels, with an OR (95% CI) of: 1, 1.7 (0.5-5.1), 3.9 (1.2-13.4), 5.5 (2.2-13.5), and 9.0 (3.6-22) for strata one to five respectively. This study provides new evidence that As in drinking water can cause internal cancers and gives an estimate of the form of this relationship.

PMID: 9819479, UI: 99051501

WMJ 1998 Oct;97(9):46-8

### **Never on a Saturday (or a Sunday): the case against using weekend urine specimens to assess arsenic exposure.**

Knobeloch L, Korthof S, Anderson H

Wisconsin Department of Health and Family Services, USA.

The Wisconsin Department of Health and Family Services Bureau of Public Health recently investigated two cases of suspected arsenic poisoning. These cases involved four adults whose urinary arsenic levels ranged from 340 to 1485 ug/L (normal 0-30 ug/L). These findings were initially interpreted as evidence of an ongoing exposure to a toxic form of arsenic, however follow-up investigations determined that all of the urine specimens had been collected on a weekend and that each of these individuals had consumed fish within 48-hours of urine collection. Most of the fish was consumed at "Friday night fish fries" which are a popular tradition at many local restaurants. Urine samples collected after these individuals eliminated fish from their diets contained normal arsenic levels. This report suggests the need for laboratories to differentiate non-toxic forms of arsenic that are present in fish and seafood products from other species of this element. Until more specific analytical methods become available, patients should be instructed to omit fish and seafood from their diets for several days prior to collecting urine for arsenic analysis. In addition, elevated urinary arsenic levels should be interpreted cautiously and

exposure to toxic forms should be confirmed before a diagnosis of arsenic poisoning is entertained.

PMID: 9810258, UI: 99027953

Cancer Causes Control 1997 May;8(3):292-308

### **Drinking water and cancer.**

Cantor KP

Occupational Epidemiology Branch, Division of Cancer Epidemiology and Genetics, National Cancer Institute, Bethesda, Maryland 20892, USA.

Epidemiologic evidence on the relation between contaminants in drinking water and cancer is reviewed. The reviewed studies cover exposure to: disinfection byproducts; nitrate; arsenic and other metals; volatiles and contaminants from hazardous waste sites; asbestiform fibers; radionuclides; and fluoride. Most investigations are ecologic, with some confirmation of elevated risk from individual-based studies. In the case of waterborne arsenic, and possibly chlorination byproducts, there is a consistent but small body of epidemiologic evidence of an association with one or more types of cancer. Nitrate in groundwater has increased greatly over the years, and the demonstration of endogenous nitrosation among highly exposed subjects raises concern of elevated cancer risk. However, the epidemiologic data are not yet sufficient to draw a conclusion. There is a diversity of studies among populations exposed to water contaminated with pesticides, volatile organics, or mixtures from hazardous waste sites. Studies of asbestiform fibers and radionuclides in water are not conclusive, but there are suggested elevations of several cancer sites in highly exposed populations. There is no suggestion that fluoride in drinking water is linked with elevated risk of cancer. As topics for epidemiologic evaluation, drinking water contaminants pose methodologic problems common to studies designed to detect relatively small elevations in risk, with the added challenge of assessing exposures for many years in the past. Nevertheless, epidemiologic assessment is valuable and clearly warranted, given the potential public health impact of small risk elevations among very large exposed populations, and the limitations of toxicologic experiments in assessing carcinogenic risk of complex mixtures or of compounds for which appropriate animal models are not available

PMID: 9498894, UI: 98141142

Sci Total Environ 1997 Dec 3;208(1-2):89-95

### **Arsenic intake by the adult population in Bombay city.**

Tripathi RM, Raghunath R, Krishnamoorthy TM

Environmental Assessment Division, Bhabha Atomic Research Centre, Bombay, India. Hydride generator atomic absorption spectrophotometry (HG-AAS) is employed for the determination of arsenic in air, duplicate diet and body fluids. The detection limit for arsenic is 0.02 ppb. The reliability of the analysis is assessed through analysis of Standard Reference Materials (SRMs) of soil and fish tissue obtained from IAEA. The concentration of arsenic in atmospheric air particulates collected from different suburbs showed geometric means in the range of 1.9-5.6 ng/m<sup>3</sup>. The total intake of arsenic through air and duplicate diet is approximately 10 micrograms/day for the adult population of Bombay (Mumbai) City. The dietary intake through food is the major contributor to the total intake. The turnover time of arsenic in blood is estimated to be approximately 33 days based on the observed mean concentration of arsenic in blood of 1 microgram/dl. The daily intake of arsenic by the adult population of Bombay is much lower than the WHO recommended value of 140 micrograms.

PMID: 9496652, UI: 98157737

Cent Eur J Public Health 1996 Dec;4(4):246-9

### **Model of multiple exposure to contaminants in monitoring the environmental impact on population health.**

Kliment V

National Institute of Public Health, Prague, Czech Republic.

The model study is focused on possibilities of comprehensive evaluation of the multiple exposure of humans to selected inorganic contaminants (arsenic, cadmium, lead, zinc) monitored within the subsystems of the monitoring the environmental impact on population health (inhalation and ingestion exposure from air, drinking water and foodstuffs and biological monitoring). The mean daily intake of contaminants of average adults is assessed using the monitoring and literature data. The exposure balance showed that the total intake of individual contaminants studied did not exceed the limit values given by the exposure standards (acceptable daily intake). The highest value of exposure reaching 28% of the limit was reported for cadmium. The prevailing pathway of exposure is ingestion of foodstuffs: more than 95% in all contaminants under study. Information on the intake of contaminants is used as input in a linear multicompartamental model describing their kinetics and retention in the human organism. The results of the model computation are compared with the laboratory data obtained in the biological monitoring of adult urine. The model and monitoring sets of results were found to conform well for cadmium and zinc. For arsenic and lead the model values are roughly one order of magnitude lower than the monitored ones which should be considered as acceptable for the model studies of this type. The model study of contaminant monitoring data processing and evaluation suggests further applications of health risk assessment representing one of the basic outputs of monitoring the environmental impact on population health.

PMID: 8997533, UI: 97151551

Published erratum appears in Science 1996 Nov 29;274(5292):1451

### **India's spreading health crisis draws global arsenic experts.**

Bagla P, Kaiser J

Comment in: Science 1996 Nov 22;274(5291):1287

PMID: 8927976, UI: 97017485

Wis Med J 1996 Feb;95(2):100-4

### **Health effects of ingesting arsenic-contaminated groundwater.**

Hauptert TA, Wiersma JH, Goldring JM

Department of Natural and Applied Science, University of Wisconsin, Green Bay, USA.

Approximately 4% of private drinking water wells in central Outagamie and Winnebago counties contain naturally occurring arsenic at concentrations exceeding the present Environmental Protection Agency (EPA) standard of 50 parts per billion (ppb). This cross-sectional study assessed health status via a self-administered survey. Questions concerned water consumption and resulting neurological, gastrointestinal, and dermatological symptoms. Participants were recruited through a public information campaign recommending water testing through local health departments; the survey was distributed at the time the water sample was submitted. Participants were unaware of their arsenic water concentration before completing the survey. Surveys from 637 families—64% of all surveys distributed—representing 1,836 individuals were completed. Of those respondents, 452 (25%) consumed between 5 and 50 micrograms of arsenic per day through water consumption; 47 (3%) consumed more than 50 micrograms of arsenic per day. This sample size had 80% power to detect a two-fold difference in the prevalence of the health effects studied. At this power level, no significant associations between arsenic intake, estimated through drinking water consumption and water arsenic concentrations, and the health effects studied were established.

PMID: 8819705, UI: 96416914

Br J Cancer 1995 Jan;71(1):109-14

### **Multiple risk factors associated with arsenic-induced skin cancer: effects of chronic liver disease and malnutritional status.**

Hsueh YM, Cheng GS, Wu MM, Yu HS, Kuo TL, Chen CJ

Department of Public Health School of Medicine, Taipei Medical College, Taiwan, Republic of China.

In order to evaluate the prevalence and multiple risk factors of arsenic-induced skin cancer among residents in Taiwanese villages in which chronic arseniasis is hyperendemic, a total of 1571 subjects aged 30 or more years were recruited between September 1988 and March 1989. All of them were interviewed personally by a public health nurse using a structured questionnaire, and 1081 interviewed study subjects, including 468 men and 613 women, participated in physical examination, giving a participation rate of 68.8%. The overall prevalence of skin cancer was as high as 6.1%, showing an increase with age in both men and women. There was a significant dose-response relation between skin cancer prevalence and chronic arsenic exposure as indexed by duration of residence in the endemic area, duration of consumption of high-arsenic artesian well water, average arsenic exposure in parts per million (p.p.m.) and cumulative arsenic exposure in p.p.m.-years. Chronic carriers of hepatitis B surface antigen with liver dysfunction had an increased prevalence of skin cancer. Undernourishment, indexed by a high consumption of dried sweet potato as a staple food, was also significantly associated with an increased prevalence of arsenic-induced skin cancer. All these risk factors remained statistically significant in the multiple logistic regression analysis. Consistent with animal experiments, the findings imply that liver function and nutritional status may affect the metabolism of inorganic arsenic and the development of subsequent skin cancers.

PMID: 7819025, UI: 95118778

J Air Waste Manage Assoc 1991 Jun;41(6):827-31

### **Ambient air arsenic levels along the Texas-Mexico border.**

Shields J

University of Texas School of Public Health, San Antonio.

The Texas-Mexico border region is one of the most rapidly developing areas in the state. Unprecedented economic and demographic growth is placing stress on a system already overburdened with air, water, waste, and public health problems. This paper reports the results of an initial survey of the past and present ambient air levels of arsenic along the Texas side of the border. Ambient air arsenic levels have increased over time, exhibit seasonal variations, and are higher in specific areas when compared to the rest of the state. Five of the 20 areas in Texas having the highest 24-hour levels of arsenic are found along the border. In areas where emissions have been significantly reduced at the source, arsenic levels remained high in the environment for over two years. This provides a potential continuum for human exposure. The results of this study emphasize the need for bi-national development and implementation of air quality control programs along the Texas-Mexico border.

PMID: 1910749, UI: 92000607

### **Health Impacts of Trace Elements**

Nickel, Chromium, Copper, Mercury, etc. (No reports found on thallium and selenium)

Am J Public Health 1983 Dec;73(12):1366-9

### **Lead concentrations in inner-city soils as a factor in the child lead problem.**

Mielke HW, Anderson JC, Berry KJ, Mielke PW, Chaney RL, Leech M

Soil samples were randomly collected from 422 vegetable gardens in a study area centered in downtown Baltimore, Maryland, and having a radius of 48.28 km (30 miles). The levels of lead, four other metals (cadmium, copper, nickel, and zinc), and pH were measured for each location. The application of multi-response permutation procedures, which are compatible with mapping techniques, reveals that lead (as well as cadmium, copper, nickel, and zinc) is concentrated and ubiquitous within the soils of the inner-city area of Metropolitan Baltimore. The probability values that the concentration of metals occurred by chance alone vary from about 10(-15) to 10(-23) depending on the metal considered. Our findings pose environmental and public health issues, especially to children living within the inner-city.

PMID: 6638229, UI: 84049832

## **Lead, nickel and vanadium in seafood: an exposure assessment for Kuwaiti consumers.**

Bu-Olayan AH, al-Yakoob S

Chemistry Department, Faculty of Science, Kuwait University, Safat, Kuwait.

Human exposure to lead (Pb), nickel (Ni) and vanadium (V) through the ingestion of six species of fish and two species of shrimp in Kuwait are determined. The study on seafood consumed by the Kuwaiti residents was analyzed by conducting a survey in five districts of the country, namely, Kuwait city (Capital), Farwaniya, Jahra, Hawaly and Ahmedi. Samples consisting of fish and shrimp were purchased from the local fish market during November 1995 and June 1996. Based on the survey, three major factors were investigated: (i) Pb, Ni and V concentration in the fish of locally consumed fish and shrimp; (ii) daily dietary intake of these elements in humans through consumption of seafood; and (iii) characterizing potential health risks associated with the estimated daily intakes. The risk associated with Pb, Ni and V in seafood was estimated based on a Hazard Index (HI). Although the highest HI (using the 95th percentiles of the daily intake of the element as the dose of concern) was observed for zobaidey, hamoor and shrimp, it is always < 1. This indicated that no serious health threats are associated with oil-related elements in fish and shrimp.

PMID: 9861729, UI: 99078722

Toxicology. 1995 Apr 12;98(1-3):47-55.

## **Effect of heavy metal ions on the release of reactive oxygen intermediates by bovine alveolar macrophages.**

Schluter T, Berg I, Dorger M, Gercken G

Department of Biochemistry and Molecular Biology, University of Hamburg, Germany.

Short-term incubations of bovine alveolar macrophages (BAM) with metal-containing dusts induce the release of reactive oxygen intermediates (ROI). Incubations of BAM (90 min) with dissolved metal compounds (0.1-100 microM) combined with quartz dusts were performed to investigate the effects of single elements on BAM stimulation. As(III), as well as the calcium antagonists, Ni(II) and Ce(III), inhibited the secretion of superoxide anions (O<sub>2</sub><sup>-</sup>) and hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>). O<sub>2</sub><sup>-</sup> concentrations were lowered by Mn(II) and Fe(II). Increased ROI concentrations were observed with V(IV) (O<sub>2</sub><sup>-</sup> and H<sub>2</sub>O<sub>2</sub>) and Fe(III) (O<sub>2</sub><sup>-</sup>). The addition of Cd(II), Cr(III) and V(V) showed no effect on the dust-induced respiratory burst.

The influence of insoluble heavy metal compounds on ROI secretion by BAM were studied with metal oxide-coated silica particles. In most cases the release of ROI was not affected by the chemical modification of the particle surface. Coating with CuO markedly lowered the concentrations of O<sub>2</sub><sup>-</sup> and H<sub>2</sub>O<sub>2</sub>, whereas vanadium(IV) oxide considerably increased both ROIs. Although most of the investigated metal compounds did not alter ROI secretion our present results with V(IV) and Fe(III) confirm our recent statistical evaluation of the effects of heavy metal-containing dusts on ROI secretion (Berg et al., 1993, J. Toxicol. Environ. Health 39, 341).

PMID: 7740553; UI: 95259072.

Rev Environ Health 1996 Oct-Dec;11(4):191-203

## **Assessment of potential health risks associated with ingesting heavy metals in fish collected from a hazardous-waste contaminated wetland in Louisiana, USA.**

Tchounwou PB, Abdelghani AA, Prammar YV, Heyer LR, Steward CM

Department of Basic Pharmaceutical Sciences, Xavier University College of Pharmacy, New Orleans, Louisiana 70125, USA.

Significant adverse effects on environmental quality, ecosystem integrity, and human health have often been associated with improper disposal of hazardous materials. This study ascertains the levels of eight heavy metals in various fish species that were collected from a local hazardous-

waste-contaminated wet-land and estimates the potential health risk that may be associated with consuming such fish. We examined a total of 53 fish samples representing 12 different species. The respective mean concentrations (ng/g) of arsenic, cadmium, chromium, copper, iron, lead, mercury, and nickel found in edible tissues were as follows: 72.5 +/- 103.1, 55.4 +/- 34.6, 97.4 +/- 111.7, 177.3 +/- 328.3, 2711.0 +/- 4469.6, 26.0 +/- 119.0, 32.7 +/- 75.3, and 81.5 +/- 178.9. For a 10-kg child eating 6.5 g of fish per day, the computed combined hazard index was 0.475 ; for 70-kg adults with a daily consumption of 6.5 g (general population), 30 g (sport fishermen), and 140 g (subsistence fishermen), the respective computed hazard indices were 0.068, 0.313, and 1.462. The results indicate that subsistence fishermen had the highest risk for systemic effects, with an exposure exceeding the Environmental Protection Agency (EPA) Reference Dose value. In a 10-kg child, such excess exposure would be reached—even with such single metals as arsenic and mercury—when applying the EPA-approved maximum fish consumption rate of 54 g/day to the general population. The cancer risk for arsenic, the only metal with an established cancer potency factor from oral exposure, varied from  $8 \times 10^{-6}$  to  $253 \times 10^{-6}$ , indicating an exposure exceeding the widely accepted risk level of  $1 \times 10^{-6}$  (one excess cancer per 10<sup>6</sup> population). PMID: 9085435, UI: 97239774

Regul Toxicol Pharmacol 1997 Aug;26(1 Pt 2):S23-34

### Urinary chromium as a biological marker of environmental exposure: what are the limitations?

Paustenbach DJ, Panko JM, Fredrick MM, Finley BL, Proctor DM

McLaren/Hart Inc.-ChemRisk, 1135 Atlantic Avenue, Alameda, California 94501, USA.

Public concern has mounted recently about environmental exposures to chromium in soil, tap water, and ambient air. In response, agencies charged with protecting public health have attempted to study exposure by monitoring urinary chromium levels among potentially exposed populations. While urinary biomonitoring of occupationally exposed workers has been successfully used to assess high-level inhalation exposures in the workplace, evaluating low-level environmental exposures has been problematic. Due to these problems, before an extensive biological monitoring study is conducted of those exposed to low levels of environmental chromium, several issues must be resolved. First, exposures to chromium must occur at the same time as sampling, because the biological half-life of chromium in urine is very short (less than 2 days). Second, reduced bioavailability and bioaccessibility via the oral and dermal routes of exposure limit the capacity of urinary monitoring to measure environmental exposures (e.g., systemic dose is too small to be measured). Third, the dose of chromium must be sufficient such that it may be reliably measured above background levels in urine (range of 0.2 to 2 &mgr;g/liter) and above the analytical limit of detection (0.2 &mgr;g/liter). Fourth, the inter- and intrapersonal variability in background levels of urinary chromium is known to be significant and influenced by food and beverage intake, smoking, and exercise. Thus, the role of each factor must be carefully understood. Finally, it is imperative to have developed a complete understanding of the clinical significance of elevated urinary chromium levels before a study is performed, because higher than background levels, in and of themselves, are not indicative of a significant health concern. The route of exposure, valence of chromium to which people were exposed, exposure time, and duration must all be understood before the biological data can be implemented. We have conducted a total of nine human exposure studies over the past 3 years in an attempt to understand the kinetics of chromium and the impact on urinary, red blood cell (RBC), and plasma biomonitoring programs. The results of these studies are described here and our recommendations are offered for how to design and implement a urinary chromium biomonitoring study. In our view, given some evidence that the dose of hexavalent chromium [Cr(VI)] is sufficient to be measurable above background concentrations of total chromium [Cr(III) and Cr(VI)], duplicated measurements of chromium in plasma and RBCs are, in most cases, a more definitive gauge of environmental exposure than urinary biomonitoring. Copyright 1997 Academic Press.

PMID: 9380834, UI: 98025736

J Air Waste Manag Assoc 1997 Aug;47(8):905-10

### **Airborne hexavalent chromium in southwestern Ontario.**

Bell RW, Hipfner JC

Ontario Ministry of Environment and Energy, Science and Technology Branch, Toronto, Canada.

This study reports the first field measurements of airborne hexavalent chromium (Cr(vi)) in southwestern Ontario. Hexavalent chromium was identified as an inhalation carcinogen and an air toxic of concern during the 1991-93 Windsor Air Quality Study. The results of that study indicated that approximately 20% of the routinely monitored ambient airborne chromium (Cr) was in the hexavalent form. In addition, the range of carcinogenic health risks attributable to airborne Cr(vi) was determined to be between  $1.4 \times 10^{-5}$  and  $3.0 \times 10^{-4}$  for people living in the Windsor area. During the summer of 1993, analyses of concurrent indoor and outdoor 24-hour air quality samples taken at 33 residences in Hamilton resulted in geometric mean Cr(vi) concentrations of 0.20 ng/m<sup>3</sup> and 0.55 ng/m<sup>3</sup>, respectively, and little or no relationship between the indoor and outdoor sample sets. During the summer of 1994, an airborne Cr(vi) size-fraction study was conducted in Hamilton, the results of which suggested that the majority of the Cr(vi) was in the inhalable fraction.

PMID: 9269134, UI: 97414441

Rev Environ Health 1996 Oct-Dec;11(4):179-89

### **Health risks from exposure to metals in household dusts.**

Lemus R, Abdelghani AA, Akers TG, Homer WE

Department of Environmental Health Sciences, Tulane University School of Public Health and Tropical Medicine, New Orleans, Louisiana 70112, USA

The levels of arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), iron (Fe), lead (Pb), mercury (Hg), and nickel (Ni) were determined in a total of 315 indoor and outdoor dust samples collected from 53 households in Louisiana. Inductively coupled plasma analysis revealed that in many samples, the metal content exceeded the United States Environmental Protection Agency (EPA) Risk-Based Concentration (RBC) guidelines. For example, the number of dust samples above the EPA-RBC included 64 for Cd, 52 for Hg, 43 for As, 4 for Fe, 4 for Cu, 3 for Cr, and 2 for Ni. One-hundred fifty-two samples exceeded the street-dust level for Pb published by the U.S. Agency for Toxic Substances and Disease Registry. The results of this study indicate that exposure to indoor and/or outdoor dust presents a potential health risk for Louisiana residents.

PMID: 9085434, UI: 97239773

J Cardiovasc Risk 1996 Feb;3(1):18-25

### **Trace elements and cardiovascular diseases.**

Houtman JP

Interuniversity Reactor Institute, Delft, The Netherlands.

The relation between trace elements and human health has been scarcely studied. With respect to cardiovascular diseases and hypertension attention has mostly focused on arsenic, cobalt, copper, chromium, fluorine, manganese, vanadium, zinc, selenium, silicon, cadmium, and lead. Environmental contamination can influence organ concentrations through long-term, low-level effects. This article reviews the present knowledge obtained by epidemiological, biochemical and cell biological studies. Attention is paid to interpretation problems due to the complexity of biochemical interactions with proteins of various sorts which determine metabolic processes and to the occurrence of detoxification mechanisms in which trace elements interact. This can also lead to strong variations in individual vulnerability. In general, the elements selenium, copper, zinc, chromium, and manganese seem to counteract the development of cardiovascular diseases, whereas cadmium and may be lead seem to stimulate it. Effects of arsenic, silicon and fluorine are unclear and for cobalt absent. The intensity of these effects on public health is difficult to measure, but is as yet probably limited except in extra-ordinary situations.

PMID: 8783027, UI: 96377179



J Toxicol Environ Health 1993 Dec;40(4):555-83

## **Designing a biological monitoring program to assess community exposure to chromium: conclusions of an expert panel.**

Anderson RA, Colton T, Doull J, Marks JG, Smith RG, Bruce GM, Finley BL, Paustenbach DJ  
Industrial Health Foundation, Pittsburgh, Pennsylvania.

The possible benefits of biological monitoring of large groups of people potentially exposed to environmental contaminants has become an area of much interest in recent years. Because chromite-ore processing residue has been found in some soils in northern New Jersey, urinary chromium monitoring of people in the community was evaluated as a potentially useful tool. In an attempt to identify those who could be exposed and to quantify the magnitude of exposure to the chromium in these soils, the New Jersey Department of Health (NJDOH) initiated a public health screening project. In 1992, the NJDOH proposed to evaluate over 4000 people who lived or worked near these sites. Volunteers were administered a questionnaire and were given a limited physical examination, and a single spot urine sample was collected. Because of the difficulties in using urinary chromium to assess low-level exposure and the potential implications of any regulatory decisions that could be based on the results of this project, a panel of experts was convened to evaluate the protocol. The panel consisted of five scientists and physicians with expertise in toxicology, dermatology, epidemiology, biological monitoring, and analytical chemistry. Like a World Health Organization group, the panel concluded that although urine biomonitoring can be useful in evaluating high levels of exposure to chromium, it is not reliable for assessing low-level exposure similar to that which may have occurred in northern New Jersey. The panel also noted that when urinary biomonitoring is to be used to assess the public's possible exposure, a large number of precautions must be taken to ensure the accuracy and usefulness of the results. The single most important recommendation was to collect a second, and perhaps a third, spot urine (or 24-h urine) sample before concluding that a person may be routinely overexposed. These suggestions are applicable to designing a biomonitoring program for nearly any environmental contaminant to which a community may be exposed. A review of scientific literature associated with biological monitoring of chromium is provided.

PMID: 8277519, UI: 94104035

Environ Res 1998 Feb;76(2):114-9

## **Incidence of heavy metal contamination in water supplies in northern Mexico.**

Wyatt CJ, Fimbres C, Romo L, Mendez RO, Grijalva M

Centro de Investigacion en Alimentacion y Desarrollo, Hermosillo, Sonora, Mexico.

Contaminants in drinking water present public health risks. The objective of this study was to analyze water samples taken from wells or storage tanks, direct sources for domestic water in Northern Mexico, for the presence of lead (Pb), copper (Cu), cadmium (Cd), arsenic (As), and mercury (Hg). The samples were analyzed by atomic absorption coupled with a hydride generator or a graphite furnace. High levels of Pb (0.05-0.12 ppm) were found in Hermosillo, Guaymas, and Nacozari. Forty-three percent of the samples in Sonora exceeded the action level (0.015 ppm) established by the EPA for Pb. For As, 8.92% exceeded the limit with a range of 0.002-0.305 ppm. Several studies have indicated a possible link between As and fluoride (F) in drinking water. This study showed a positive correlation between F and As ( $r = 0.53$ ,  $P = 0.01$ , and  $n = 116$ ). One location in Hermosillo had 7.36 ppm of F and 0.117 ppm of As, 3.5 times the recommended F levels in drinking water and 2 times higher than the level permitted for As. Hg contamination was found in 42% of the samples. Based on the results of this study, it appears that As, Hg, and Pb contamination in the drinking water for some areas of the state of Sonora is a major concern.

PMID: 9515066, UI: 98190510

Public Health 1996 May;110(3):175-7

## **Copper in drinking water—an investigation into possible health effects.**

Fewtrell L, Kay D, Jones F, Baker A, Mowat A

Centre for Research into Environment and Health, Crewe, Cheshire, UK.



A study was carried out to examine the possible relationship between levels of copper in drinking water and the incidence of specified childhood liver complaints presenting at a major UK paediatric liver unit. Public drinking water supplies were generally found to have levels of copper which were well below the EC standard of 3,000 micrograms/l. In private supplies, a slightly greater number of samples were found to exceed the prescribed concentration; in one instance a value of 26,000 micrograms/l was recorded. Data describing infant patients reporting to Kings College Hospital, London with specified liver complaints were examined. Where the address of patients could be determined (220 out of 240 cases), all patients were found to live in areas served by public drinking water supplies and were, thus, unlikely to have experienced elevated drinking water copper concentrations.

PMID: 8668764, UI: 96268015

Environ Health Perspect 1999 Jun;107(6):441-446

## Daily Intake of Copper from Drinking Water among Young Children in Sweden.

Pettersson R, Rasmussen F

Department of Pediatrics, Central Hospital, Skovde, Sweden.

[Record supplied by publisher]

Copper is an essential trace element that may cause intoxication if intake becomes excessive. Young children are at risk of intoxication because of high consumption of drinking water and immature copper metabolism. The aims of this prospective study were to estimate concentrations of copper in drinking water, volumes of drinking water consumed by children, and children's daily intake of copper. Concentrations of copper in unflushed drinking water were analyzed for 1,178 children living in Uppsala and Malmo, Sweden, and concentrations and amounts of copper consumed from drinking water were estimated for 430 of these children, 9-21 months of age. The study children were from Swedish families, were not enrolled in publicly provided day care, and were not breast-fed more than three times a day. In the initial population, the 10th percentile for copper concentration in unflushed drinking water was 0.17 mg/L, the median was 0.72 mg/L, and the 90th percentile was 2.11 mg/L. In the subpopulation of 430 children, the 10th percentile for daily intake of copper from drinking water was 0.03 mg/L, the median was 0.32 mg/L, and the 90th percentile was 1.07 mg/L. The median daily intake of copper from drinking water was higher in Uppsala, at 0.46 mg, than in Malmo, at 0.26 mg. For groups of children whose families took part in a later prospective diary study, the copper concentration in consumed water could, to some extent, be predicted from the concentration of copper in unflushed drinking water. The lowest concentrations of copper in drinking water were found in households with old water-pipe systems and in those living in detached houses. A large proportion of the young children satisfied their daily requirement of copper solely from drinking water. About 10% of the children had a copper intake above the level recommended by the World Health Organization.

PMID: 10339444

Cent Eur J Public Health 1998 Nov;6(4):274-9

## Air pollution by particulate matter in the industrialized city of Leoben, Austria.

Wippel R, Kock M, Kosmus W, Pichler-Semmelrock FP, Marth E

Institute for Analytical Chemistry, University of Graz, Austria.

At seven sites in Leoben, Austria, aerosol particles were sampled in two size fractions by a dichotomous sampler using virtual impaction: the fine fraction (alveolar aerosol) with an aerodynamic diameter  $d_{ac} < 2.5$  microns (PM<sub>2.5</sub>), and the coarse fraction (tracheobronchial aerosol) with an  $d_{ac}$  between 2.5 and 10 microns. It is believed that these particles are able to reach the lower regions of the human respiratory tract, and thus be responsible for most of the adverse health effects associated with suspended particulate pollution. A second sampling procedure was made collecting the PM<sub>2.5</sub> fraction and after leaching with nitric acid, lead, zinc, cadmium, copper, chromium and vanadium were determined with an inductively coupled plasma mass spectrometer (ICP-MS). For one sample point a third sampling was carried out and both

fractions were subsequently leached with water and dilute hydrochloric acid. Pb, Zn, Mn, Fe, Cd, Ni, Cu, Rb, Sr, Mo, Cs, Ba and Tl were determined by ICP-MS.  
PMID: 9919376, UI: 99118020

Sci Total Environ 1999 Mar 9;227(2-3):249-56

## **Monitoring of mercury pollution in Tanzania: relation between head hair mercury and health.**

Harada M, Nakachi S, Cheu T, Hamada H, Ono Y, Tsuda T, Yanagida K, Kizaki T, Ohno H  
Institute of Molecular Embryology and Genetics, Kumamoto University School of Medicine, Japan.

Through 1996 into 1997, a spot investigation on mercury contamination was conducted three times in Tanzania, especially around the Lake Victoria. A total of 150 goldminers, 103 fishermen and their families, and 19 residents of Mwanza City volunteered for the current study. A high total mercury level of 48.3 ppm (near to 50 ppm, a critical level of Minamata disease) and over in the head hair was observed in six goldminers (highest value, 953 ppm), four fishermen and their families (highest value, 416 ppm), and four Mwanza people (highest value, 474 ppm). With the exception of these 14 subjects, however, each mean total mercury level was well within the normal range (below 10 ppm). Out of the goldminers examined, 14 cases were diagnosed as a mild form of inorganic-mercury poisoning according to their clinical symptoms (such as polyneuropathy mercurialis, neuroasthenia, or tremor mercurialis) and the low ratio of methylmercury to total mercury, whereas neither inorganic-mercury poisoning nor methylmercury poisoning (Minamata disease) was noted in the fishermen and their families or in the Mwanza people. In addition, some subjects who showed a high total mercury level made habitual use of toilet soap containing much mercury. The findings obtained suggest that the mercury pollution in Tanzania is not very serious, however, it should be observed continuously.

PMID: 10231987, UI: 99248769

Environ Health Perspect 1999 May;107(5):343-7

## **Neuropsychological and stress evaluation of a residential mercury exposure.**

Fiedler N, Udasin I, Gochfeld M, Buckler G, Kelly-McNeil K, Kipen H  
UMDNJ-Robert Wood Johnson Medical School, Piscataway, New Jersey 08855 USA.

Residents of a former factory building converted to apartments were exposed to mercury over a 2-year period. The neurobehavioral and emotional health effects of this exposure and subsequent evacuation are presented. Urine mercury levels were measured before (urine1) and 3-10 weeks after evacuation (urine2) of the building, when neurobehavioral and psychological measures were also completed. Performance on neurobehavioral and psychologic measures were compared between subjects above and below the median for urine1 ( $\geq 19$  microg/g creatinine) and were correlated with urine1 mercury levels. The high urine mercury group made more errors on a test of fine motor function and 84% of the residents reported clinically significant elevations in somatic and psychologic symptoms. Although subclinical tremor from mercury exposure may have affected subtle hand-eye coordination, other tests of motor function were not affected. Therefore, the observation of reduced hand-eye coordination may be due to chance. Significant levels of psychosocial stress were more closely associated with the evacuation necessitated by mercury exposure rather than a direct effect of mercury exposure.

PMID: 10210689, UI: 99228654

Alaska Med 1998 Oct-Dec;40(4):75-7, 89

## **Regional health assessment relating to mercury content of fish caught in the Yukon-Kuskokwim Delta rivers system.**

Duffy LK, Rodgers T, Patton M  
Department of Chemistry and Biochemistry, University of Alaska Fairbanks 99775, USA.

Seven species of fish were surveyed for muscle tissue mercury content across a broad area of western Alaska. Total mercury levels were determined by cold vapor atomic fluorescence spectroscopy in 66 fish sampled during 1997. Methylmercury in sampled fish amounted to 97 to 100% of total mercury values. Using mercury consumption risk levels derived from U.S. Environmental Protection Agency hazard assessment models, mean total mercury was determined to be above the human critical value of 0.2 g/g (ppm) in 29% of the fish species, and 62% of the fish species contained mercury exceeding the wildlife critical value for piscivorous mammals. Overall, 24% of the fish exceed the critical value for human consumption and 58% the wildlife critical value. Similarly 31% of sites sampled exceeded the human consumption critical value. Based on the mean of all fish sampled and a small number of river otters, a biomagnification factor of 12 was calculated for the Yukon-Kuskokwim Delta Region of Alaska. PMID: 10202403, UI: 99218681

Drug Chem Toxicol 1999 Feb;22(1):129-42

## **Mercury. Top of the hit parade for eight years.**

Nickle RA

Agency for Toxic Substances and Disease Registry, Atlanta, Georgia 30333, USA.

The Agency for Toxic Substances and Disease Registry (ATSDR) is the lead agency within the U.S. Department of Health and Human Services (HHS) for providing support to the federal response to releases of hazardous substances in the environment. Since the Comprehensive Environmental Response .Compensation and Liability Act was passed and amended, ATSDR has represented HHS on the National Response Team (NRT). The NRT role, and the subsequently established National Response .System, are described in the National Contingency Plan for Oil and Hazardous Substances Releases (Title 40 Code of Federal Regulations, Section 300). As part of the National Response System, ATSDR can be called when a hazardous substance is released. Consistently, one of the most common substances ATSDR is called about is mercury, usually elemental mercury. This presentation will provide some background statistics on these calls and some general response options. Several specific cases that have occurred in the last few years will be reviewed. These reviews will deal less with remedial options than with describing common issues that arose, issues unique to the specific case, and the impact of that case on the community. A brief discussion of risk communication issues and ATSDR's response to those issues concludes the presentation.

PMID: 10189574, UI: 99205572

## **Health Impacts of Coal**

Borm PJAnn Occup Hyg. 1997 Dec;41(6):659-76. Review.

## **Toxicity and occupational health hazards of coal fly ash (CFA). A review of data and comparison to coal mine dust.**

Department of Health Risk Analysis & Toxicology, University of Maastricht, The Netherlands.

Coal fly ashes (CFA) are complex particles of a variable composition, which is mainly dependent on the combustion process, the source of coal and the precipitation technique. Toxic constituents in these particles are considered to be metals, polycyclic aromatic hydrocarbons and silica. The purpose of this review was to study the in vitro and in vivo data on coal fly ash and relate the studied endpoints to the role of (crystalline) silica, considering its recent classification as a human carcinogen. For most of the effects coal mine dust was chosen as a reference, since it contains up to 10% of crystalline silica (alpha-quartz) and is well studied both in vivo and in vitro. Most studies on fly ash toxicity were not designed to elucidate the effect of its silica-content nor did they include coal mine dust as a reference. Taking this into account, both in vitro and in vivo experimental studies show lower toxicity, inflammatory potential and fibrogenicity of CFA compared to silica and coal mine dust. Although in vitro and in vivo studies suggest genotoxic effects of fly ash, the data are limited and do not clarify the role of silica. Epidemiological studies in fly ash exposed working populations have found no evidence for effects commonly seen in coal

workers (pneumoconiosis, emphysema) with the exception of airway obstruction at high exposure. In conclusion, the available data suggest that the hazard of coal fly ash is not to be assessed by merely adding the hazards of individual components. A closer investigation of 'matrix' effects on silica's toxicity in general seems an obligatory step in future risk assessment on fly ashes and other particles that incorporate silica as a component.  
PMID: 9375525; UI: 98043154.Born PJ

Isr J Med Sci. 1992 Aug-Sep;28(8-9):509-12. Review.

## **Occupational and environmental exposures and nonspecific lung disease--a review of selected studies.**

Saric M

Institute for Medical Research and Occupational Health, University of Zagreb, Croatia.

Selected studies show that nonspecific lung diseases are a major occupational and environmental health hazard. Exposure to mineral dusts (such as cement and brown coal) and organic dusts (cotton, hemp and flour) as well as manganese and gaseous irritants causes significant upper respiratory tract injury. Possible additive effects of mixed exposures, combined exposure to dusts and gaseous irritants of the upper respiratory tract, individual susceptibility, and mechanisms of nonspecific respiratory effects of exposures are considered. Interpretation of the results is difficult due to uncontrolled confounding. Measures for preventing lung impairments include exposure reduction and preemployment examination of workers.

PMID: 1428803; UI: 93053533.

Nurs Stand 1999 Mar 17-23;13(26):39-41

## **Pneumoconiosis: a study of its effect on miners' health in South Wales 1900-1980.**

Howells G, Rees C

University of Wales NHS Healthcare Trust, Cardiff.

Since its discovery in the late 19th century, pneumoconiosis has shaped the lives of thousands of miners. In some ways it became inextricably linked to the South Wales coal field and was a major public health threat to the men who worked in those mines. The disease was caused by the conditions of work and worsened the situation of many who were already living in poverty. This historical research account traces the miners' plight and touches on some of the public health issues raised by the disease.

PMID: 10347463, UI: 99276811

Am J Ind Med. 1998 Oct;34(4):318-24.

## **Polymorphisms in the promoter of the tumor necrosis factor-alpha gene in coal miners.**

Zhai R, Jetten M, Schins RP, Franssen H, Born PJ

Department of Health Risk Analysis and Toxicology, Maastricht University, The Netherlands.

Tumor necrosis factor-alpha (TNF) is recognized as a central mediator of mineral dust-induced lung fibrosis, and genetic polymorphisms of the TNF promoter have been reported to influence levels of TNF production. To assess whether polymorphisms within the TNF promoter gene are associated with susceptibility to coal workers' pneumoconiosis (CWP), the DNA of 78 coal miners was typed for G-to-A transitions at positions -238 and -308. Our results show that frequency of A-308 genotype (T2) is significantly overpresented in coal miners with CWP (50%), as compared with miners without CWP (25%) and controls (29%). After correction for cumulative dust exposure and smoking, the A-308 transition genotype is still associated with the presence of CWP (OR = 3.0, 95% CI = 1.0-9.0). Both A-238 and A-308 transition genotypes were related to TNF release from endotoxin-stimulated blood monocytes; only the A-238 transition and not the A-308 transition was associated to coal dust-induced TNF release. In summary, this study shows that the A-308 transition is related to CWP, but this relation is not paralleled by a different TNF release in this genotype. A larger number of patients coupled to frequent TNF release are required to

evaluate genotype screening to estimate individual health risks for effects of coal mine dust exposure.

PMID: 9750937; UI: 98423511.

Biol Trace Elem Res 1999 Mar;67(3):197-204

### **Trace elements in coal: environmental and health significance.**

Finkelman RB

US Geological Survey, Reston, VA 20192, USA.

Trace elements can have profound adverse effects on the health of people burning coal in homes or living near coal deposits, coal mines, and coal-burning power plants. Trace elements such as arsenic emitted from coal-burning power plants in Europe and Asia have been shown to cause severe health problems. Perhaps the most widespread health problems are caused by domestic coal combustion in developing countries where millions of people suffer from fluorosis and thousands from arsenism. Better knowledge of coal quality characteristics may help to reduce some of these health problems. For example, information on concentrations and distributions of potentially toxic elements in coal may help delineate areas of a coal deposit to be avoided. Information on the modes of occurrence of these elements and the textural relations of the minerals in coal may help to predict the behavior of the potentially toxic trace metals during coal cleaning, combustion, weathering, and leaching.

PMID: 10201327, UI: 99215510

Proc Natl Acad Sci U S A 1999 Mar 30;96(7):3427-31

### **Health impacts of domestic coal use in China.**

Finkelman RB, Belkin HE, Zheng B

U.S. Geological Survey, Mail Stop 956, Reston, VA 20192, USA. rbf@usgs.gov

Domestic coal combustion has had profound adverse effects on the health of millions of people worldwide. In China alone several hundred million people commonly burn raw coal in unvented stoves that permeate their homes with high levels of toxic metals and organic compounds. At least 3,000 people in Guizhou Province in southwest China are suffering from severe arsenic poisoning. The primary source of the arsenic appears to be consumption of chili peppers dried over fires fueled with high-arsenic coal. Coal samples in the region were found to contain up to 35,000 ppm arsenic. Chili peppers dried over high-arsenic coal fires adsorb 500 ppm arsenic on average. More than 10 million people in Guizhou Province and surrounding

PMID: 10097053, UI: 99199200

Am Ind Hyg Assoc J 1999 Jan-Feb;60(1):105-10

### **Assessment of coke oven emissions exposure among coking workers.**

Chen ML, Mao IF, Wu MT, Chen JR, Ho CK, Smith TJ, Wypij D, Christiani DC

Department of Public Health, College of Medicine, National Yang-Ming University, Taipei, Taiwan. Coking workers are regularly exposed to coke oven emissions, which consist primarily of polycyclic aromatic hydrocarbons and volatile organic compounds. This study measured the workers' exposure to the benzene soluble fraction of total particulates (BSF). The study population consisted of 88 coking workers as an exposure group and 59 referents. Personal breathing-zone samples of BSF and total particulates were taken from all study subjects for 3 consecutive days. The highest BSF concentrations were found among the topside oven workers (geometric mean; range) (microgram/m<sup>3</sup>): lidman (515; 72-18, 181), tar chaser (432; 51-4334), and larry car operator (185; 55-649). The lowest was 7 micrograms/m<sup>3</sup> in the referents. Among the samples at the topside oven 84% exceeded the Occupational Safety and Health Administration standard (150 micrograms/m<sup>3</sup> BSF). The percentage of BSF in total particulates varied across job classifications, ranging from 0.3% in wharfmen to 24% in tar chasers. Area sampling indicated that the BSF concentration at the topside area was sixtyfold higher than that at the administrative area, which was approximately 2 km from the coke oven plant. areas suffer

from dental and skeletal fluorosis. The excess fluorine is caused by eating corn dried over burning briquettes made from high-fluorine coals and high-fluorine clay binders. Polycyclic aromatic hydrocarbons formed during coal combustion are believed to cause or contribute to the high incidence of esophageal and lung cancers in parts of China. Domestic coal combustion also has caused selenium poisoning and possibly mercury poisoning. Better knowledge of coal quality parameters may help to reduce some of these health problems. For example, information on concentrations and distributions of potentially toxic elements in coal may help delineate areas of a coal deposit to be avoided. Information on the modes of occurrence of these elements and the textural relations of the minerals and macerals in coal may help predict the behavior of the potentially impact of air pollution on prevalence of rhinitis in Istanbul.  
PMID: 10028622, UI: 99152976

Arch Environ Health 1999 Jan-Feb;54(1):48-51

### **Impact of air pollution on prevalence of rhinitis in Istanbul.**

Keles N, Ilicali OC, Deger K

Istanbul University, Istanbul School of Medicine, Department of Ear, Nose and Throat, Turkey. The effects of air pollution on health are of concern worldwide. There are several pollutants of concern, among which are sulfur dioxide, total suspended particulates, nitrogen dioxide, carbon monoxide, and volatile organic chemicals. In several studies, researchers investigated the effects of those pollutants on lung and nasal functions, although in very few studies has nasal function been addressed. We evaluated the effects of air pollution on the prevalence of rhinitis in a metropolitan of Turkey, Istanbul. Until 1994, coal was used for both domestic heating and industrial processes in the city. Consequently, sulfur dioxide and total suspended particulate concentrations in the ambient air exceeded limits of air-quality standards. In recent years, especially during the early 1990s, hazardous air pollution levels were reached in Istanbul. In this study, we evaluated the incidence of rhinitis before and after installation of a natural-gas network in a polluted area of the city. In 1994, 62.5% of the individuals studied suffered from rhinitis, compared with 51% of the sample in 1996 ( $p < .05$ ). Age, gender, smoking status, heating source, nor household crowding significantly affected this outcome. The findings strengthened the role of pollutant levels as risk factors for rhinitis.  
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### **Occupational and Environmental Risk Factors for Asthma in Rural Communities in China.**

Xu X, Niu T, Christiani DC, Weiss ST, Chen C, Zhou Y, Fang Z, Jiang Z, Liang W, Zhang F  
Department of Environmental Health, Harvard School of Public Health, 655 Huntington Avenue, Boston, MA 02115, USA.

Respiratory allergens such as dust, gases/fumes, and hay smoke, which are frequently present in agricultural settings, can cause or aggravate asthma. The purpose of this study was to examine the relationships between occupational and environmental exposures and asthma in Chinese rural communities. The study population consisted of 28,946 people 15 years old or older, living in rural areas of Anhui province, China. A modified Mandarin translation of the ATS-DLD questionnaire was administered by trained interviewers to request information about exposures to specific occupational/environmental agents and respiratory disorders. In Huaining, the prevalence of wheezing was 3.8% for men; 2.1% for women; the prevalence of asthma was 1.6% for men; 1.8% for women. In Zongyang, the prevalence of wheezing was 2.7% for men; 1.9% for women; the prevalence of asthma was 1.7% for men; 1.2% for women. With control for potential confounders such as gender, age, residential area, education level, and smoking status, the pooled adjusted odds ratios (ORs) of wheezing and asthma for the group exposed to wood/hay smoke were 1.36 (95% CI: 1.14-1.61) and 1.27 (95% CI: 1.02-1.58), respectively. For coal-stove users, the pooled adjusted ORs were 1.47 (95% CI: 1.09-1.98) for wheezing and 1.51 (95% CI: 1.05-2.17) for asthma. After stratification of the subjects by dust type, the estimated ORs for wheezing were 1.58 (95% CI: 1.02-2.44) among the group exposed to inorganic dust and 3.03 (95% CI: 1.25-7.33) among the group exposed to metal dust. Asthma was not shown to be



significantly associated with any specific dust type. Findings of the present study are consistent with previously reported adverse respiratory health effects related to occupational/environmental exposures to wood/hay smoke and dust, and indicate the need for further occupational disease surveillance in rural communities.

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### **Pneumoconiosis problem among the Vietnamese coal mine workers.**

Nguyen AL, Matsuda S

National Institute of Labour Protection, Hanoi, Vietnam.

In this report, the authors present the pneumoconiosis problem among Vietnamese coal mine workers. As coal is one of the most important products for export, its production has been intensified recently. With the strong incentive for rapid economic development, health problems of miners tend to take second place. As shown in the present report, miners' working conditions are very bad, and health protection measures are not sufficiently implemented. It is apparent that official statistics underestimate the actual situation because of the inadequacy of the reporting system. Because the financial barrier to establishing a sufficient reporting system for pneumoconiosis is enormous, an epidemiologic study is the most effective way to assess the actual situation. It is also useful to conduct epidemiologic studies as part of an international collaborative project, in order to transfer necessary knowledge and epidemiologic skills from the developed countries to Vietnam.

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### **The toxicology and prevention of the risks of occupational exposure to aromatic polycyclic hydrocarbons. III. The effects: epidemiological evidence, early effects. Individual hypersusceptibility. Health surveillance**

Porru S, Assennato G, Bergamaschi E, Carta P, Foa V, Forni A, Gabbani G, Mastrangelo G, Sartorelli P Cattedra di Medicina del Lavoro, Università di Brescia.

Adverse effects following occupational exposure to polycyclic aromatic hydrocarbons (PAH) are mainly carcinogenic. The available epidemiological data suggest that some substances and industrial processes, in which PAH exposure is frequent, are classified as carcinogenic to humans: primary aluminium industry, coal gasification, coke production, iron and steel foundry, coal tar, pitch, creosote, untreated mineral oils, asphalt, soot. The target organs are mainly lung, bladder, skin. Other relevant effects are skin lesions such as folliculitis. The studies on early biological effects (chromosomal aberrations, sister chromatid exchanges, micronuclei) have shown contradictory results, mainly because of differences in exposure intensity. The metabolic polymorphism may account for a higher susceptibility to lung and bladder cancer following exposure to risk factors; the role of PAH occupational exposure is however to be examined, and the use of indicators of genetic susceptibility is currently limited to research programs. Health surveillance for PAH exposed workers is funded on the Italian laws (DPR 303/56 and D.Lgs.

626/94) and it is mainly dedicated to prevention of carcinogenic effects. Preventive examinations should consider PAH target organs (skin, lung, bladder, larynx) and look for early signs and symptoms. Particular attention will be paid to life habits such as tobacco smoking or diseases which could represent condition of susceptibility. Periodical examinations (every six months) will similarly evaluate PAH target organs. Health surveillance is also programmed for formerly exposed workers and the institution of exposure and cancer registries is mandatory. On the basis of the current scientific data, it is not advisable the use of tumor markers or cytogenetic tests at the individual level as well as the screening of asymptomatic PAH exposed workers for early diagnosis of lung or bladder cancer. Information and formation activities will be part of medical examinations and will be included in specific programs in cooperation with other company functions.

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