

## 10113 - Lower Respiratory Symptom-Based Outcome Definitions to Assess Risk Factors for Microbiologic Contamination in Office Buildings

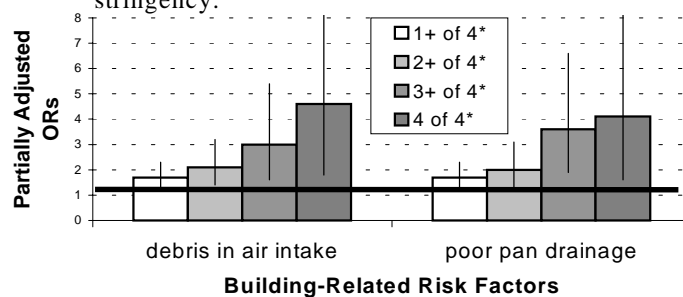
Mendell, MJ<sup>1,2</sup>, Naco, GM<sup>1</sup>, Wilcox, TG<sup>1,3</sup>, Sieber, WK<sup>1</sup>

<sup>1</sup>National Institute for Occupational Safety and Health, <sup>2</sup>Lawrence Berkeley National Laboratory, <sup>3</sup>U.S. Food and Drug Administration

We assessed relationships between a variety of lower respiratory symptom-based outcome definitions and risk factors for microbiological contamination in office buildings, in order to explore evidence for indoor contaminant-related respiratory disease. The National Institute for Occupational Safety and Health collected data in 1993 from 80 office buildings and 2,435 occupants, in workplaces requesting indoor environmental health investigations. The present analysis evaluated 20 outcome definitions constructed from four lower respiratory symptoms (wheeze, shortness of breath, chest tightness, cough), and 20 building-related risk factors plausibly related to microbiologic contamination. Outcome definitions were ordered by mean rank for association with all 20 risk factors. Multivariate-adjusted regression models identified key risk factors for the highest-ranked outcomes. Adjusted associations of outcomes with risk factors for microbiologic contamination were consistently stronger for outcome definitions requiring multiple symptoms (Figure 1) and improving away from work, and somewhat stronger among those with history of physician-diagnosed asthma. For the two highest ranked outcomes –

“work-related wheeze, shortness of breath, and cough” and “at least three of four work-related lower respiratory symptoms” -- multivariate-adjusted odds ratios (95% confidence intervals) were: for debris in ventilation air intake, 3.6 (1.4-9.4) and 2.0 (1.0-3.9); for poor pan drainage under cooling coils, 2.8 (1.1-7.4) and 2.6 (1.3-5.2). These findings, adjusted for personal and building-related confounders, show strong associations between combinations of work-related lower respiratory symptoms and indoor workplaces. Increased response to these risk factors among diagnosed asthmatics is consistent with prior susceptibility or causation of asthma. Data from more representative buildings are needed to confirm these findings. Research assessing multiple work-related lower respiratory symptoms, particularly within susceptible subgroups, may help identify risks for building-related respiratory disease.

**Figure 1.** Odds Ratios and 95% confidence intervals for the association of building-related risk factors with frequent work-related lower respiratory symptom-based outcome definitions of increasing stringency.



\* of four possible symptoms: wheeze, shortness of breath, chest tightness, cough

**10133 - THE IMPACT OF COMBINATIONS OF BUILDING MATERIALS AND  
MECHANICAL VENTILATION SYSTEM OPERATION ON PERCEIVED AIR  
QUALITY**

**Fariborz Haghighat, ASHRAE Member,  
Department of Building, Civil and Environmental Engineering, Concordia  
University, Montreal, Canada**

**Abstract**

Systematic studies conducted over the last few years suggest that many building materials and consumer products are important sources of indoor air pollution and consequently they affect the perceived indoor air quality in buildings. Because of the diversity of the sources and types of contaminants, it has been suggested that the best technique to improve indoor air quality is to ventilate the building. However, no systematic study has shown to what extent this solution can be useful and when this solution is impractical.

Currently, the required ventilation rate in non-industrial buildings is determined per human occupant and the level of occupant's activity, regardless of the pollutant emissions from building materials, ventilation systems and other sources. With the intention of saving energy, the ventilation system in many office buildings is turned off during the night. This practice may reduce the quality of indoor air during the daytime, because of the accumulation of contaminants at the reduced average ventilation as well as the sorption process when the air pollutants absorbed by surfaces at night are re-emitted during the day.

This paper reports the results of a series of experimental studies on the impact of operation of ventilation systems and the combinations of several building materials on perceived air quality. Experiments were performed in test chambers as well as in office buildings. Untrained panels of 29-50 subjects assessed the air quality in terms of acceptability and odor intensity. Experiments were performed using test chambers to determine air quality under intermittent and continuous ventilation conditions and to

establish the exposure–response relationships for each of the tested building materials. These relationships were used to quantify the impact of different operation strategies in terms of changes in ventilation rate requirement.

The results of the ventilation strategy experiments indicate that intermittent ventilation reduces the daytime air quality. Thus, in order to maintain the same level of acceptability of the air as for continuous ventilation, the ventilation rates during the day must be increased. The exposure-response relationship was then used to quantify the required increase in ventilation rate in order to maintain a certain level of acceptability of the indoor air. It was also shown that the perceived air quality may improve when two materials are presented at the same time in a chamber. This is probably due to interaction between the sources involving emission from one material being adsorbed by the other. However, to achieve the same level of acceptability with the two ventilation strategies, a higher ventilation rate is required when the intermittent ventilation strategy is used. It was found that the exposure-response curve is flatter for combined materials than for a single material.

**111122 - The California Portable Classrooms Study:  
2. Formaldehyde Exposure Assessment**

Peggy L. Jenkins, Thomas J. Phillips, *California Air Resources Board*  
Jed Waldman, Kai-shen Liu (1946-2002), *California Department of Health Services*  
Gerry Akland, Roy Whitmore, *Research Triangle Institute*

In Phase I of the California Portable Classrooms Study, formaldehyde levels were measured for 7-10 days in 911 classrooms in 320 schools statewide. Passive DNPH tube samplers were mailed to randomly selected schools, along with questionnaires on facility and classroom characteristics. The samplers had been previously tested by the California Air Resources Board and the method refined to achieve a relatively consistent LOD of 6 ppb, and precision of 10%-13% median RSD. Portable (relocatable) classrooms had higher levels (mean=32 ppb) than did traditional classrooms (mean=24 ppb). These average classroom concentrations were greater than the mean level of 13 ppb found in the U.S. EPA's BASE study of office buildings. Measurements were compared to the Acute Reference Exposure Level (REL) established by the California Office of Environmental Health Hazard Assessment (OEHHA) for formaldehyde of 76 ppb, the level at which a one-hour exposure may result in eye irritation and immune response. Concentrations in 4% of the portable classrooms, but only 0.4% of the traditional classrooms, exceeded the Acute REL. Similarly, 50% of the portables and 29% of the traditional classrooms exceeded 27 ppb, OEHHA's draft Acute IREL (8-hour indoor REL). Like most indoor environments, nearly all of the classrooms exceeded OEHHA's Chronic REL of 2.4 ppb, and the California Proposition 65 cancer risk level ( $10^{-5}$ ) of 1.6 ppb. Elevated formaldehyde levels were associated with factors such as warmer season and geographic location; age of the room; presence of new carpet and flooring; presence of pressed wood products; presence of vinyl tackable wallboard; and other factors. Preliminary calculations will be presented that indicate that California children are likely to be subject to a higher risk from formaldehyde than are adults, due to their in-school exposures.

*Disclaimer: The opinions expressed in this document are those of the authors and do not necessarily reflect the positions of their respective organizations.*

## 10899 - Volatile Organic Compounds in a Newly Constructed Home

David Olson<sup>1</sup>, Elena McDonald-Buller<sup>2</sup>, Maria Morandi<sup>2</sup>, Richard Corsi<sup>1</sup>

1 – The University of Texas at Austin

2 –University of Texas Health Science Center of Houston

A study was completed to investigate the composition, levels, decay, and spatial variation of volatile organic compounds (VOCs) in a newly constructed, 2,850 square foot, two-story home in Austin, Texas. Sampling was initiated immediately prior to occupation and continued for an approximate five-month period after occupation, ending in January 2002. Activity logs were maintained by the two adult occupants of the home. Preliminary tests involving sulfur hexafluoride injection and decay indicated that the home was of “tight” construction, with an air exchange rate of only 0.32/hr with all windows and doors closed and the HVAC system switched on. During the course of the study, weekly five-day composite samples were collected at three locations within the home and one outdoor location using passive personal sampling badges. Eight-hour flux chamber measurements were also made on a monthly basis to identify possible emissions from three flooring materials: carpet, wood, and ceramic tile. Flux measurements were completed in conjunction with eight-hour active sorbent tube (Tenax-TA) sampling on the first and second floors of the house, as well as outside of the house. Analyses of all gas samples was carried out using either solvent extraction (passive badges) or thermal desorption (active sorbent tubes) followed by GC/MS. Concentrations much higher than those typically reported for homes that are not new were determined for several VOCs, including ethylbenzene, d-limonene,  $\alpha$ -pinene, B-pinene, toluene, and xylene (all isomers). Benzene was also consistently detected in indoor air samples. The concentrations of most VOCs was markedly greater, by a factor of approximately two or more, on the second floor of the house; the second floor was extensively carpeted and the first floor was not, which may have led to higher concentrations on the second floor for some VOCs. Ratios of indoor-to-outdoor concentrations ranged from approximately 10 to several hundred, depending on specific VOCs and time after occupation, generally decaying over time. The median ratio over all VOCs varied from approximately 20 to 50. While VOC concentrations declined significantly for the first two months, a trim-painting even occurred at approximately three months after occupation and, based on sampling completed days after the event, led to concentrations for some VOCs that exceeded pre-occupancy values. Data for this study are continuing to be analyzed to ascertain potential source contributions and the effects of occupant activities on VOC concentrations. This additional information will be presented in the accompanying poster.

10863 - Indoor aldehydes : ambient concentrations and determinants.

B. Clarisse<sup>1</sup>, A.M. Laurent<sup>2</sup>, N. Seta<sup>1</sup>, Y. Le Moullec<sup>2</sup>, A. El Hasnaoui<sup>3</sup>, I. Momas<sup>1</sup>.

<sup>1</sup>Laboratoire d'Hygiène et de Santé Publique, Faculté de Pharmacie. 4, avenue de l'Observatoire, 75006 Paris, France

<sup>2</sup>Laboratoire d'Hygiène de la Ville de Paris. 32, rue George Eastmann 75013 Paris, France.

<sup>3</sup>Laboratoires Pharmaceutiques Glaxo-Wellcome, Marly-le-Roi. France.

Since people spend most of their time indoor (80%), it is of interest to study indoor air quality. While the association between indoor allergens and respiratory diseases is well established, the role of chemical pollution remains less studied. To test the impact of chemical pollution on health effects, exposure of the general population needs to be evaluated, especially for poorly explored pollutants, such as the aldehyde family.

The aim of this investigation is to measure indoor aldehydes levels and to identify their determinants in order to elaborate a questionnaire evaluating individual indoor exposure to aldehydes.

In 60 Parisian dwellings of non occupationally exposed non smokers and, for each of them, in 3 different rooms, after a 72 hours passive sampling (Radiello), six aldehydes were measured using high performance liquid chromatography. A questionnaire about potential indoor sources was answered when measuring aldehydes and ambient parameters. Statistical identification of the aldehyde determinants was performed using a multiple regression model.

Formaldehyde, acetaldehyde, pentanal and hexanal were the major compounds compared to propionaldehyde and benzaldehyde. On average, aldehydes levels did not differ between rooms, in the same dwelling. As observed in experimental studies, ambient parameters were correlated with aldehydes levels. CO<sub>2</sub> levels, indicating ventilation household, and relative humidity, increasing release from urea-formol sticks, as well as indoor temperature, were positively correlated with aldehyde concentrations. Covering characteristics were also associated with higher aldehydes levels. Thus, less than one year old wall or floor coverings were positively associated with aldehydes concentrations. Moreover, different kinds of covering, like glass fibre wall paper, wall paper, varnished parquet floor, stuck wall-to wall carpet or stuck linoleum floor, were positively correlated with some aldehydes levels. Gas appliance as use of household cleaning products during measurements tended to be associated with higher acetaldehyde levels. Although we studied non smokers dwellings, some measurements were made during occasional smoking. Environmental tobacco smoke is positively associated with different aldehydes concentrations. To our knowledge, our study is one of the first to describe six different aldehydes levels in dwellings without complaining history, whereas most of publications deal with formaldehyde concentrations when inhabitants complain. The measurement is easy to perform since sampling and analytical method are common to the six aldehydes. We have been able to confirm in environmental conditions the ambient parameters effects. In addition, we have evidenced suggested determinants as potential sources of aldehydes. In conclusion, we put forward the indoor determinants of aldehydes emissions which should be included in a questionnaire usable in epidemiological surveys.

### **10843 - Measuring Inhalation Exposure to Polycyclic Aromatic Hydrocarbons**

Prince, D<sup>1</sup>, Schopflocher, D<sup>2</sup>, Gabos, S<sup>2</sup>, MacKenzie, A<sup>2</sup>, Robb, J<sup>2</sup>, Shaw, S<sup>2</sup>, Meager, J<sup>3</sup>

<sup>1</sup>DS Prince Consulting, <sup>2</sup>Alberta Health and Wellness, <sup>3</sup>Mistahia Regional Health Authority

Health Surveillance, a branch of Alberta Health and Wellness, has undertaken a pilot study to measure exposure to Polycyclic Aromatic Hydrocarbons (PAHs). These compounds are of public health concern because of their demonstrated carcinogenic effects in humans and the numerous sources both outdoors and indoors. Understanding personal exposures to PAHs is important to adequately address public health concerns associated with the emission of these pollutants. There were two main study objectives: 1) to evaluate techniques for measuring exposures to PAHs; and 2) to gather preliminary data on the levels of PAHs in Grande Prairie, Alberta. The study involved measuring PAH levels indoors, outdoors, and in the personal breathing zone of 14 individuals for a consecutive 7-day period between April and September 2000. Two measurement techniques were used, integrated samples (personal, indoor, and outdoor) and real-time monitoring (indoor and outdoor). Integrated samples with laboratory analysis (GC-MS) provided concentrations of individual PAH compounds, but the short-term fluctuations in the levels could not be identified. Real-time monitoring identified short-term fluctuations in a group measure of PAHs but no information on individual PAH compounds was provided and the measure was site specific. The study showed that the real-time PAS 2000 CE PAH monitor demonstrated the potential to be an effective tool in monitoring PAHs. This real-time monitor differentiated between outdoor and indoor sources of PAHs and characterized the temporal variations in air quality. The monitor effectively differentiated between relative levels changing over time at one site but was only predictive of absolute measures compared at different sites when high PAH levels, due to indoor smoking, were encountered. Integrated samples were effective in comparing 7-day average absolute levels indoors, outdoors, and personally. The impact of indoor and outdoor levels on the personal exposure to PAHs was characterized by using the “fingerprint” of individual PAH compounds in the integrated samples. The results showed the levels of PAHs measured in this study were similar to or lower than levels reported in other similar studies. The study showed outdoor levels and sources drive exposure to the heavier (larger molecular weight) PAHs when there is no apparent or known contact with cigarette smoking. Smoking was the only indoor source of the heavier group of PAH compounds identified in the study. Indoor levels and sources drive exposure to the lighter group of PAH compounds and while smoking appears to be a source of these compounds, there are other unidentified sources that appear to be more significant. Significant impacts of regional sources of PAHs on the city of Grande Prairie were not found, however, this result is based on limited data.

## **10798 - Suspected illness associated with flooding and mold growth- Turtle Mountain Band of Chippewa, Belcourt, North Dakota, 2001**

A. L. Stock<sup>1</sup>, C. Brown<sup>1</sup>, S. Redd<sup>1</sup>, J. Sarisky<sup>2</sup>, R. D. Comstock<sup>2</sup>, and H. Mainzer<sup>2</sup>

<sup>1</sup> National Center for Environmental Health/ Air Pollution and Respiratory Health Branch

<sup>2</sup> National Center for Environmental Health/ Environmental Health Services Branch

Molds are ubiquitous with >1,000 different types in indoor air. Mold growth is exacerbated by flooding and dampness. Between 30-50% of the structures in the northern US and Canada can be classified as damp. People spend almost 90% of their day indoors and no standards for indoor air concentrations of molds exist. Health effects, including asthma, hypersensitivity pneumonitis, upper respiratory ailments, and skin rashes are associated with indoor mold exposures but are not well-understood. The Belcourt area has had flooding since 1997 most recently in March 2001. We conducted a cross-sectional survey to assess whether Native Americans who lived in 617 chronically flooded, government-subsidized homes in Belcourt, North Dakota were experiencing respiratory problems due to mold growth. In July 2001, 138 homes were randomly selected for a questionnaire based health survey. The questionnaire collected information on demographics, smoking status, pet ownership, mold exposures, standing water, and illness from each family member including proxy interviews for children <12. Analysis is restricted to individual questionnaire data. By August 2001, 96 families (n=237; aged <1 to 78, median =17) participated, 16 families (14%) refused, and 26 families (19%) moved, were migrant workers, or their homes had fires. Among persons who reported seeing visible mold in areas excluding their basements, bathrooms, or around windows/doors (72.2%), increased prevalence rates of skin rash or itch (PRR= 1.19, 95% CI= 1.03-1.39) (adjusted for smoking (APRR)= 1.55 95% CI=1.02-2.36) and runny noses, stuffy noses, and irritated noses (PRR= 1.3, 95% CI=1.14-1.51; APRR=2.64, 95% CI=1.34-5.22) were seen. Asthma prevalence increased, but not significantly (PRR= 1.13 95% CI= 0.95-1.32; APRR=1.43 95% CI= 0.85-2.40). Reported mold exposures were associated with skin and upper respiratory symptoms. Further research is needed to assess the occurrence of respiratory symptoms and illness with household mold exposures to determine the natural history of mold-related illness and to evaluate intervention strategies.

**Keywords:** mold, flooding, respiratory symptoms, skin rash, public housing

## 10778 - Characterization of Mosquito Coil Emissions

Weili Liu<sup>1</sup>, Junfeng Zhang<sup>1</sup>, Jamal H. Hashim<sup>2</sup>, Juliana Jalaludin<sup>3</sup>, Zailina Hashim<sup>3</sup>, and Bernard D. Goldstein<sup>4</sup>

<sup>1</sup> UMDNJ-School of Public Health and Environmental and Occupational Health Sciences Institute, Piscataway, NJ, USA

<sup>2</sup> National University of Malaysia, Department of Community Health, Kuala Lumpur, Malaysia.

<sup>3</sup> Universiti Putra Malaysia, Department of Community Health, Serdang, Malaysia.

<sup>4</sup> University of Pittsburgh, Graduate School of Public Health, Pittsburgh, PA, USA

Mosquito coil is one of the well-known efficient mosquito repellents in Asia, Africa and South America. When a mosquito coil is burnt in a room, the active insecticide (d-allethrin) evaporates with the smoke, which repels the mosquito. However, the smoke may contain pollutants of health concern. This study is conducted to characterize the emissions from several types of widely used mosquito coils in China and Malaysia. Simulated experiments were conducted in a well-mixed plastic chamber with a volume of 0.15 m<sup>3</sup>. Clean air purified by charcoal filter was pumped into the chamber at the flow rate of 5.6 L/min. A lit mosquito coil was placed in the chamber near the air inlet. An eight-channel optical particle counter was used to measure fine particle number concentrations throughout an entire burning experiment. During the steady burning stage, samples of PM<sub>2.5</sub> mass and gas phase carbonyl compounds were collected. After the coil was burnt out, sulfur hexafluoride (SF<sub>6</sub>) tracer gas was injected to determine the air exchange rate in the chamber using a real time SF<sub>6</sub> monitor. The experiments were also conducted in a real room condition. We burned the mosquito coils in a garage. The particle number concentrations from 0.01µm to 10 µm in diameter were measured by an ultra-fine particle counter and the eight-channel optical particle counter. Mass balance models were used to determine pollutants emission rates based on our experiment data. The emission rates of PM<sub>2.5</sub> are 62.79±3.01 mg/hr, 85.04±8.64 mg/hr, 116.52±14.12 mg/hr and 114.80±11.61 mg/hr for 4 types of mosquito coils respectively. The emission rates of formaldehyde and acrolein, both of which are suspected human carcinogens, are in the ranges of 1434-7515 µg/hr and 165-1562 µg/hr respectively. Under the same combustion condition, the Malaysian mosquito coils generated more measured pollutants than the Chinese mosquito coils. We applied these measured emission rates to predict exposures under realistic room conditions and found that such exposures can pose significant acute and chronic health risks. The results indicate that in realistic room conditions, the pollutants concentrations generated by burning mosquito coil can be substantially higher than health-based air quality standards.

10702 - An international community-based study on non-industrial indoor workers and asthma

Kogevinas M<sup>1</sup>, Zock JP<sup>1</sup>, Jarvis D<sup>2</sup>, on behalf of the ECRHS-II occupational asthma Working Group. <sup>1</sup>Municipal Institute of Medical Research, Barcelona, Spain; <sup>2</sup>King's College, London, United Kingdom.

Studies in Finland, Sweden and US have shown that incidence rates of asthma in office workers vary considerably and could be related to the work environment. Non-industrial indoor exposures potentially related to asthma include moisture, mold and other microbial exposures, passive smoking, office equipment, paint and other construction materials, and indoor allergens. Although a significant proportion of the population in industrialized countries work in an office environment the association of non-industrial indoor environments and asthma has hardly been studied. In addition, indoor workers are often used in epidemiological studies as a non-exposed reference group which approach may reduce the asthma risks for other occupations. Analysis of the European Community Respiratory Health Survey (ECRHS-I) has already identified an increased asthma risk for several predominantly manual occupations compared to a large group of indoor workers. We aimed to assess the variation in asthma risk among indoor workers in ECRHS-I and to estimate the bias introduced when high-risk indoor occupations are included in the “non-exposed” reference group. We performed analyses of 9523 men and 10702 women aged 20 to 44 years from a random population sample from 41 centers in 19 industrialized countries. Information on respiratory symptoms suggestive of asthma and current or last held occupation was collected by an interview-led questionnaire. Occupation was categorized in 350 codes, and grouped into 30 wider occupational sets including a large group classed as ‘office workers’ comprising 159 specific professional, administrative and clerical type occupations. The association of occupation with asthma was assessed using unconditional logistic regression adjusting for age, gender, smoking and study center. An analysis of the 350 occupations separately (each compared to the remaining 349) showed an asthma risk above unity for 72 of the 159 ‘office occupations’. These jobs at increased risk of asthma included credit controllers (OR 4.4), importers, exporters, commodity brokers (OR 3.3), hotel porters (OR 2.5), non-domestic housekeepers (OR 2.3), aircraft flight deck officers (OR 2.0), chefs (OR 1.9) and others. In 26 office occupations the OR was above 1.5. Exclusion of these 26 occupations from the reference group increased the ORs for asthma of recognized high-risk occupations (e.g. spray painters, bakers, cleaners, agricultural workers) between 5% and 7%. We conclude that ‘office workers’ constitute a heterogeneous group in terms of both exposures and asthma risk. Some of the office occupations could share exposures with those of manual occupations and people may work in closed and contaminated environments while others do not have obvious asthma-related exposures. Our findings suggest that exclusion of ‘high risk’ office workers from the reference group increases the estimated risks associated with other occupations but in the ECRHS-I magnitude of change are relatively small.

*Conclusion:* Cigarette smoking is very prevalent in Turkey, particularly among adult males, and in more than 60% of the homes there is at least one individual who smokes cigarettes. Being more prevalent in slum areas, coal and firewood are common means of heating. The study implied that the direct exposure of the child to smoking, rather than the presence of smoking at home, is a significant predictor of ARI among young children. Even when the quality of indoor air could not be improved, parents should be educated of the importance of avoiding children's direct exposure to cigarette smoking and/or other indoor pollutants. The cooperative efforts of the health personnel and media against indoor air pollution, cigarette smoking in particular, will increase the awareness, and assist in the education of the public in this matter.

# 10485 - DISTANCE CONSEQUENCES OF FLUORINE AND ITS COMPOUNDS INTOXICALION

## Introduction:

On extraction and dressing of fluorine, the treating of apatites and phosphorites, in the production of acid and fluorine hydrogen NF, etc, and also aerosols of fluorine salts may be discharged out into the air of industrial premises.

In the conditions of production and pollution of the environment with industrial fluorine containing ejections, fluorine can get into our organism with air and through unimpaired skin. Fluorine is accumulated in the highly mineralized tissues.

Chronic professional fluorine intoxication – professional fluorosis: teeth decaying, bones impairment, hemorrhagic syndrome, broncho spasm, defeat of a myocardium, liver changes in the blood pattern.

Purpose : learning of the distant consequences of an intoxication of fluorine and fluorine compounds.

Methods:

Experts opinion:

Therapeutist

Neuropathologist

Traumatologist

Dermatologist

Hematologist

Clinical and biochemical analyses;

Functional diagnostic;

FVD

EEG

ECHO – EEG

ECG

Roentgen changes

Statistical data and archive materials.

Outcomes:

More than 200 patients with fluorine intoxication get regular medical check-up in the clinic of occupational diseases. These patients have been suffering from absence

of link between fluorine and fluorine compounds in their organism for 10-20 years. The examination of these patients revealed 99,9 % of deepened osteal changes, almost 100% gastro-intestinal disorder, 60% of broncho-pulmonary pathology, 43% of central nervous system impairment, 1% is parkinsonism of the unknown etiology, cardiovascular pathology, fluorine in these patients, urine averages in limits from 0,16 up to 0,9 mg/l.

Thus, as a result of the researches we can come to a conclusion that fluorine influence the organism unfavorably even after it stoppes its affection on it. The sick persons, condition doesn't improve but even becomes worse as they get old and their occupational diseases are complicated by the aged diseases in a severe from.

## 10465 - Differences in possible risk factors for allergic diseases between children living on farms and other children

CG Bornehag<sup>1,2</sup>, J Sundell<sup>2</sup>

<sup>1</sup> SP Swedish National Testing and Research Institute, Sweden

<sup>2</sup> Technical University of Denmark

Several recent studies have shown that children living on a farm with animals report fewer allergic symptoms than do other children. The aim of this study was to investigate differences in lifestyle factors and dwelling characteristics between farming and non-farming children. The study was performed as a cross-sectional questionnaire study including 14 077 children aged 1-6 years in the county of Värmland, Sweden. Data on 10 851 children - of which 880 children lived on a farm with animals - corresponding to a response rate of 79%, were collected. The study showed that farming life was associated with less allergic symptoms among children (OR 0.39-1.00). However, the investigation identified several significant differences between farmers and non-farmers (i.e. non-farming children and country living non-farming children) concerning background and lifestyle factors, as well as building characteristics. Farmers had less atopy in the family, they were breastfed for a longer period and they started with solid food later in life. The families of farmers were larger and day-care attendance was less common among them. There was no difference in the use of antibiotic treatment. However, of those who used antibiotics during the first year of life, non-farmers used more than one treatment more often. Farming children were less exposed to ETS from a smoking mother. There were large differences in pet-keeping. Both current pet-keeping and pet-keeping at the time of the child's birth was more common among farmers and avoiding pets because of allergy in the family or getting rid of pets for the same reason was less common among farmers. Farmers live more often in single-family houses, in older houses and in dwellings of greater size. Wood as floor-covering material in the child's bedroom was more common among farmers and PVC was less common. Concerning type of ventilation system in the dwelling, farmers had more natural systems. Farmers also had more vacuum cleaners, more ionizing of indoor air and more photocopying machines. There were no reported differences between farmers and others with regard to dampness problems. However, complaints on indoor air quality and odour were less common among farmers. Stuffy air and perception of dry air were less common among farmers. An unpleasant smell, pungent smell, mouldy odour, earthy smell and tobacco smell were less common among farmers. Finally, farmers rebuild their homes more often than do other groups. However, rebuilding caused by dampness-related problems and change of floor covering material was less common among farmers. In conclusion, the investigation has shown that farming life differs in many aspects compared with non-farming life except for animal exposure. Such differences can be of interest when searching for causal factors in the etiology of allergy, which will be investigated in a forthcoming step of the study.

## **10421 - APPLICATION OF THE RANDOM COMPONENT SUPERPOSITION (RCS) MODEL TO PM<sub>2.5</sub> PERSONAL EXPOSURE AND INDOOR AIR QUALITY MEASUREMENTS IN DIFFERENT CITIES**

L.A. Wallace, U.S. Environmental Protection Agency, Reston, VA, USA; W.R. Ott, Stanford University, Palo Alto, CA, USA

The RCS model allows us to estimate the distribution of population exposure to air pollutants in any city given only the outdoor measurements in that city. Since outdoor measurements are made in many cities, but personal exposures are measured in few, the model could conceivably be very useful. The fundamental assumption of the model is that the distribution of exposures to pollutants emitted by personal and indoor sources is invariant across cities. Although of course cities have somewhat different levels of smoking, frequency of open windows, etc., it is at least testable whether these differences significantly affect the observed distribution of exposures. To test the model, it is necessary to have probability-based studies of personal exposure, including outdoor measurements, in two cities. From these measurements, one can separate the outdoor from the non-outdoor (indoor and personal) components of personal exposure. One can then use the outdoor measurements in one city to estimate the total personal exposure measurements in the other, by simply adding the invariant distribution of non-outdoor exposures to the measured outdoor concentrations in the second city. This predicted distribution of total exposures can then be compared to the observed distribution to test the adequacy of the model. Besides estimating personal exposures, the model can also estimate indoor concentrations given the proper probability-weighted fixed indoor measurements. The RCS model has been applied with success to PM<sub>10</sub> indoor and personal exposure measurements from field studies conducted in 3 cities – Toronto, Canada; Phillipsburg, NJ, and Riverside, CA. Until recently, only one probability-based personal exposure study of PM<sub>2.5</sub> was available (Toronto, Canada), but the completion of a second probability-based personal exposure study in Indianapolis has made it possible to test the model for PM<sub>2.5</sub> as well as PM<sub>10</sub>. Indoor PM<sub>2.5</sub> measurements made in Riverside, CA; Toronto, Canada; and Indianapolis will also be explored in this paper. Regression analysis is useful for applying the RCS model to personal and indoor air measurements, because the physically based superposition model of indoor concentrations and personal exposures yields the same basic equation used in the standard linear regression model. Thus, regression approaches, when applied in RCS modeling, yield parameter values that have an important physical interpretation, such as the particle exposure attenuation factor  $\alpha = pa/(a + k)$ , where  $p$  is the penetration factor,  $a$  is the air exchange rate, and  $k$  is the particle deposition rate. This abstract has been subjected to Agency review and approved for publication.

## **10379 - COMBINED EFFECT OF CHLORINE AND MERCURY ON ORGANISM**

### Introduction:

In series of programs of World Organization of Public Health Service the major attention was given to an estimation of potential hazard of chemical and some other environmental factors for the health of people.

In most cases common effect of the given agent on an organism of the man was not determined. The data on production and application of the substance and also the level of contamination of the environment with it are given for the characteristic of sales and importance of an investigated problem.

The purpose of this activity – search of the most informative biochemical changes in the organism of the workers exposed to combined influence of mercury and chlorine.

Constantly growing extraction of mercury and its wide application in modern production causes the increases in the number of people who are in contact with it, that is one of the main reasons for studying mercuryism in the whole world.

In conditions of chlorine production by mercury – electrical method, the workers expose to the effect of the mercury vapour, gaseous chlorine, chloride hydrogen.

When toxic substances of small intensity influence the organism, nonspecific shifts in the organism comes out first and that is characterized by change of its reactivity and causes the rising a level of a common case rate with temporary loss a working capacity, an the system of immunity there can be disorder of maturing, functional activity and the number of cells participating in the immune reaction, immune deficiency can be primary and secondary.

Primary immune deficiency in genetically determinated and can be shown by failure of humoral and cell like immunity. Primary immune deficiency don't have clearly evident clinical manifestations and apper as infections, allergic, auto immune, oncologic and other syndromes.

Secondary immune deficiency is not genetically determinated and develops as a result of pathologies of different kinds and other exposures.

We examined 200 people at the age from 25 to 55 with the experience of work from 5 to 30 years who has been working in conditions of chlorine productions by the mercurial method.

## Methods

Experts opinion

Therapeutist

Neuropathologist

Stomatologist

Otologist etc.

Clinical and biochemical analyses Functional diagnostic X-ray examination

## Outcomes:

On the basis of the investigations performed deviations in the functional condition of the nervous system have been found out 80-85% of the workers suffer from anemia and stomatitis, 60% suffer from pathology of the upper respiratory tubes of the pulmonary pathology, 90% gastro-intestinal, and urino-genital impairments.

In the urine of 20% of workers  $50\mu\text{g}/\text{m}^3$  and more mercury have been revealed.

The main harmful factors of industrial medium is the chemical factor, among which the dominating role belongs to Hydrargyrum and chlorine.

## **10260 - The Nervous System Effects of Indoor Environmental Quality in a New Constructed General Hospital in Taipei, Taiwan.**

Jane-Yane Shieh<sup>1</sup> \*Chih-Hung Ku<sup>2</sup>, Chien-Yeh Shen<sup>1</sup>., Shung-Tai Ho<sup>1</sup>, Tri-Service General Hospital<sup>1</sup>, School of Public Health<sup>2</sup>, NDMC, National Defense University, Taipei City, TAIWAN 114, ROC

**Objectives:** To evaluate the nervous system effects (NSE) of indoor environmental quality (IEQ) in a new constructed hospital in Taipei, an investigation was conducted after the workers occupied the new building for 6 months.

**Methods:** Except for the physicians, workers in this general hospital were the study base. 50% of the workers in each department were randomly selected to enroll in this study (548 workers). A modified questionnaire from Indoor Air Quality and Work Environment Symptoms Survey (NIOSH), and sick building syndrome was used to access the interests, including working environments, home environment, transportation, previous health records, and recent symptoms. Nervous system effects included: (1) headache, (2) unusual tiredness, fatigue or drowsiness, (3) tension, irritability, or nervousness, (4) pain or stiffness in back, shoulders, or neck, (5) difficulty remembering things or concentrating, (6) dizziness or lightheadedness, (7) feeling depressed, (8) nausea or upset stomach, and (9) carpus numbness. Multiple logistic regressions were performed to access the associations, with adjusting for possible confounders.

**Results:** After adjust for potential confounders, male workers have lower risk (OR=0.29, 95%CI=0.16~0.54) of having a NSE than those of female workers. With increasing in one year of age, workers will increase 1-fold risk (OR=0.96, 95%CI=0.94~0.98) to have a NSE. Workers who were exposed to strong- smelling chemical several times per day have 1.6 times higher risk of reporting a NSE than those of never. Workers who felt "too little air movement for 1~3 days per week" (OR=1.56, 95%CI=1.00~2.43), or felt "too little air movement daily" (OR= 3.66, 95%CI=2.04~ 6.60) had significantly more NS effects than those who did not report too little air. Workers who were sensitive to the smoking (OR=1.6, 95%CI=1.03~2.51), have higher risks of NS effects than those not reporting reactions to cigarette smoke. In addition, NS effects were positively correlated with the days of decreasing working efficient (OR=1.3, 95% 1.14~1.48).

**Conclusions:** We concluded that age, gender, ventilation, and sensitive to smoking were the risk factors for workers to have a nervous system effects. The hospital ventilation system should be reevaluated and smoking area should be reassigned.

10232 - AGE OF DWELLING AND HOSPITAL ADMISSION WITH RESPIRATORY ILLNESS IN CHILDREN, 0-15 YEARS: A CASE CONTROL STUDY

Megan Landon, Paul Wilkinson

London School of Tropical Medicine and Hygiene, Keppel Street, London WC1E 7HT

**BACKGROUND.** There is evidence that dampness in the home may be associated with an increase in respiratory symptoms in children. There are a number of mechanisms put forward for this relationship including the presence of mould and house-dust mites. This study explores the relationship with other physical characteristics of the dwelling.

**METHOD.** Analyses were based on emergency hospital admissions, 1997-2000, in England for children aged 0-15 years. These were linked by postcode of residence (approximately 14 households per postcode) to the 1996 English House Condition Survey (EHCS). The 1996 EHCS was a national survey which provided data on housing conditions, including age, type and physical condition of a sample of 28,770 residential dwellings. Admissions with respiratory disease (ICD-10 J00-J99) and asthma (ICD-10 J45 ) as a proportion of all emergency admissions were analysed in relation to property age by tabulation and logistic regression.

**RESULTS.** A decrease in asthma and respiratory disease (see table) in the 5-15 age group is observed in pre 1980 dwellings. The results for asthma in pre1919 dwelling vs. post 1980 is an of odds ratio 0.78 (95%CI 0.65-0.93) in the fully adjusted model. In the 0-4 age group the point estimates for asthma are smaller, although the confidence interval includes 1. There is no evidence of any effect of dwelling age on respiratory disease in this age group. The effect of dwelling age remains for both age groups when other known risk factors are included in the model - deprivation, dwelling type, region and distance from hospital (via a population density proxy). Further adjustment of the model for dampness and the presence of double glazing decrease the point estimates slightly.

Hospital admission with respiratory illness: 5-15 age group		
Age of dwelling	Odds ratio (95% confidence interval)	
	Adjusted for age and sex	Adjusted for age, sex, dwelling type, socio-economic deprivation, population density and region
Post 1980	1	1
1945-1979	0.83 (0.74 to 0.82)	0.83 (0.74 to 0.93)
1919-1944	0.88 (0.77 to 0.99)	0.85 (0.75 to 0.96)
Pre 1919	0.90 (0.80 to 1.02)	0.84 (0.73 to 0.95)

**CONCLUSIONS:** The risk of hospital admission with asthma and respiratory disease in the 5-15 age-group appears to be lower among children living in older dwellings. This is independent of socio-economic status. The reason for this is unclear, but older dwellings tend to have greater air exchange and lower and more variable indoor temperatures which might lower burdens of indoor allergens.

10225 - The “healthy pet-keeping effect”. Pet-keeping in early childhood as a risk for or a protection against allergic symptoms later in life

CG Bornehag<sup>1,2</sup>, J Sundell<sup>2</sup>

<sup>1</sup> SP Swedish National Testing and Research Institute, Sweden

<sup>2</sup> Technical University of Denmark

It is discussed whether exposure to pets during childhood is a risk or a protective factor for sensitization and allergic symptoms. The aim of this study was to investigate the association between pet-keeping and allergic symptoms among young children in Sweden. A questionnaire was sent to 14 077 children (1-6 y) with focus on health, home environment and other background factors. Data on 10 851 children, corresponding to a response rate of 79%, were collected. More than 40% of the families had a pet at the time of the questionnaire study (“current” pet) or at the time of the birth of the index child (“past” pet). Analysis on the association between reported pet-keeping and symptoms among children show, in general, that furred pets in the “current” dwelling are significantly associated with a reduced risk of symptoms, with an adjusted Odds Ratio of 0.23 (CI: 0.15-0.34) to 0.82 (CI: 0.71-0.95). However, nearly one tenth of the total population has got rid of pets because of allergy in the family, and 27.3 % reported an avoidance behaviour (i.e. “Got rid of pets due to allergy in the family” or “Avoid getting pets due to allergy in the family”). Pet-keeping at the time of the child’s birth was significantly associated with symptoms among children with no “current” pet and among children in families with an “avoidance” behaviour. The association was most pronounced for “rhinitis on pet exposure” (OR 1.80 and 1.77). Nearly half of the children had never had any furred pet (44.5%) and 7.9% do have “current” pets but no pet at the time of birth. Furthermore, 14.5% reported that they did have pets at the time of birth or later but not today and, finally, about a third of the children (31.1%) had had furred pets all the time. Children that had pets at the time of birth or later but not “current” have the highest prevalence of symptoms. The second highest prevalence was in the group of children that never had any pets at home. In the group of children with furred pets all the time, the prevalence was lowest for all symptoms. However, these groups of families differ in many respects. Families without “current” pet report significantly more “avoidance” (39.7% versus 7.7%), more atopy in the family (65.1% vs. 45.0%), and they are less exposed to pets elsewhere (70.7% vs. 90.2%) compared to the group of families with current pets. This means that those who have pets in general are those that can stand pets, i.e. a “healthy pet-keeping effect”. Thus cross-sectional or cohort studies cannot be used to investigate associations between pet-keeping and allergic symptoms without a thorough analysis of the role of selection bias.

10209 - Relationship between HVAC system operation, air exchange rate, and indoor-outdoor particulate matter ratios.

Jonathan Thornburg<sup>1</sup>, Charles Rodes<sup>1</sup>, Elizabeth Rodes,<sup>1</sup> and Ron Williams<sup>2</sup>

<sup>1</sup>RTI, RTP, NC 27709, <sup>2</sup>U.S. EPA, National Exposure Research Laboratory, RTP, NC 27711

Measurements of duty cycle, the fraction of time the heating and cooling (HVAC) system was operating, were made in each participant's home during the spring season of the RTP Particulate Matter Panel Study. A miniature temperature sensor/data logger combination placed on the return air vent monitored changes in temperature as the HVAC system cooled or heated the residence. The temperature data were compiled into a database, and the duty cycle assessed from step changes in temperature using a series of macros and subjective analyses. The duty cycle measurements will provide insight into the relationship between 24-hr integrated air exchange rate (AER) and indoor particulate matter concentrations. The mild climate conditions during the Spring season created large variability in the duty cycle data due to the large number of days the HVAC did not operate or operated in both heating and cooling modes. The group average HVAC duty cycle was 0.061 (operational only 6.1% of the time) with a standard deviation of 0.054. The median number of days the HVAC system operated during a sampling week was 2.5 days, and the maximum and minimum 24-hr duty cycles were 45% and 0%, respectively. Almost 31% of the participants kept their HVAC off 6 or more days during their 7 days of sampling. A significant relationship between the 24-hr duty cycle means and air exchange rates existed only if the HVAC system operated for 6 or more days per week and the range in the 24-hr duty cycles exceeded 0.10. In those cases, an increase in duty cycle caused an increase in the 24-hr average duty cycle. The magnitude of the increase depended on the outdoor-indoor temperature differential. The duty cycle correlated with 24-hr indoor-outdoor particulate matter ratios only if there was a significant relationship between duty cycle-AER and there were not any strong indoor particle sources. The usefulness of the duty cycle data in interpreting particulate matter indoor-outdoor ratios would be improved if HVAC system particle removal efficiency, air flow recirculation rates, and integrity (leak assessments) were characterized in detail for both heating and cooling mode. Also, the infrequency of HVAC system use during the mild Spring and Fall "transition" seasons limited the effect on the indoor particle concentrations. However, the HVAC system should have a larger influence on indoor particle concentrations in Winter (heating) and Summer (cooling) seasons when the system operates more than 10% of the time.

This work has been funded wholly by the United States Environmental Protection Agency under contract #68-D5-0040 and 68-D-99-012 to RTI. It has been subjected to Agency review and approved for publication.

**10198 - Indoors Air Pollution and Respiratory Health of the Peoples in Beijing:  
a community-based pilot study.**

**Xiao-chuan Pan Wang Linggu Wang Lihua**

Dept. of Occupational and Environmental Health, Peking University School of Public  
Health,  
Beijing 100083, P.R. China

**Background and objective:** Lots of studies around the world indicated that indoor air pollutants play an important role on the human health. But few such studies were conducted in china and the relationship between indoor air pollution and the human health is not very clear. In this study, we attempt to investigate the level of indoor air pollution and to assess its effects on the residents' health in Beijing. **Methods:** 270 houses were selected randomly in three municipal districts (90/per district) as the subjects for indoor air monitoring and represented respectively industrial, old urban and cultural/educational areas of Beijing. The concentrations of indoor air pollutants, including particulate matter [less than/equal to] 10/2.5 micro in aerodynamic diameter (PM10/PM2.5) and SO<sub>2</sub>, were measured in the bedrooms and the kitchens of the subjects. At the same time, more than 1,500 residents living in these houses were investigated with the questionnaire for their respiratory health and other confounding factors. **Results:** The levels of indoor air PM10/PM2.5 were quite vary(22 μ g/m<sup>3</sup> for bedroom~1469 μ g/m<sup>3</sup> for kitchen)in winter of Beijing. The concentrations of indoor air PM10 and PM2.5 in the houses with coal stove for heating were much higher than that in houses with central heating system (P<0.01), but not for SO<sub>2</sub>. From the graphs of 24-hours real time monitoring, we have found that the peaks of the curves for indoor air PM10/PM2.5 emerged often in the cooking time. It suggested that the coal stove using for heating or cooking is major source of indoor air pollution in winter of Beijing. **Conclusions:** More attention should be paid to the indoor air pollution and residents' health in Beijing and the work in this area should be continued.

### **11143 - Reducing indoor air pollution and build up of greenhouse gases in India**

Uma R<sup>a</sup>, Smith KR<sup>b</sup>, Kishore VVN<sup>a</sup>,

a. Tata Energy Research Institute, Delhi, b. University of California, Berkeley

Emissions from biomass use in household stoves can contribute to greenhouse gas (GHG) and adverse health impacts. In India, more than 75% of household energy consumption is met by traditional biomass fuels (wood, crop residues, and animal dung). These fuels are used in inefficient stoves, which emit substantial amount of fuel and carbon as products of incomplete combustion which include green house gases (GHGs) such as methane and total non methane organic compounds, as well as health damaging pollutants (HDP) such as respirable particles carbon to monoxides (CO), benzene, and formaldehyde. Measured levels of health damaging pollutants from biomass stoves are more than 10 times higher than the standards. This leads to serious health implication such as acute respiratory infection, Chronic obstructive lung disease, adverse pregnancy outcomes and eye irritation. Children and women are most affected population, as their level of exposure is high. It has been estimated that in India, about 500,000 premature deaths per year are caused by indoor air pollution. Interventions like efficient improved stoves and biogas can reduce indoor air pollution and Greenhouse gases. This implies that current household fuel situation in India and other developing countries offer potentially attractive opportunities for true win-win interventions that achieve important global benefits in the form of cost-effective GHG reductions while providing even greater local benefits in the form of healthier environment.