Weller®

OCCUPATIONAL ASTHMA

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Occupational asthma
Fumes and gases in industry are very often dangerous to the workers. Some of these products are visible, while others are not visible or even not noticeable. Many of these fumes and gases are toxic and lead to Occupational Asthma and allergic reactions.

Occupational asthma is a major issue in electronics manufacturing because it leads to higher rates of absence and employee turnover. In some countries occupational asthma due to flux fumes/isocyanate has already lead to legal claims from employees.

Weller, as a manufacturer of fume extraction/ filter systems, presents with this article information about Occupational Asthma and the needed precautions for prevention.

Definition
Occupational Asthma is a disease characterized by variable air flow limitation and/or airway hyper-responsiveness due to causes and conditions attributable to a particular occupational environment and not to stimuli encountered outside the workplace (Bernstein et al 1993).

Its diagnosis depends on four requirements being fulfilled. 1) A sensitizing agent is present; 2) the individual is exposed to the agent, 3) symptoms improve when away from the workplace; and 4) symptoms recur when further exposure occurs.

Occupational asthma can be categorized into two types:

- The appearance of chest tightness, wheezing, shortness of breath, dry cough, etc. after a latent period of occupational exposure.
- When occupational asthma is associated with an exposure to high concentrations of irritants. The symptoms may somewhat differ from that of asthma that follows a latent period. This is often referred to as RADS (Reactive Airways Dysfunction Syndrome).

Lung structure and function
The airways of the lung derive from the trachea (wind pipe) downwards by progressive division into two (or more) branches. Those airways beyond the trachea that contain cartilage are called *bronchi*. The airways lacking in cartilage beyond the bronchi are the *bronchioles*. These lead into hollow spaces called *alveoli* which have a diameter of about 0.1 mm each.

There are approximately 300 million alveoli and their total surface is about 140 m^2. The conducting airways are lined with cells with cilia (small motile surface projections). Interspersed between these cells are mucus secreting cells. Secreted mucus spreads over the cilia which direct it upwards to the larger airways by rhythmic undulating movements, thus helping to clear deposited dust particles.

The respiratory units i.e. the alveoli and the smallest bronchioles called respiratory bronchioles are responsible for the exchange of gases. They are lined mainly by flat, extremely thin cells which permit easy diffusion of oxygen through them from the air in the alveolar spaces to the blood in the capillaries and easier diffusion of carbon dioxide in the opposite direction.

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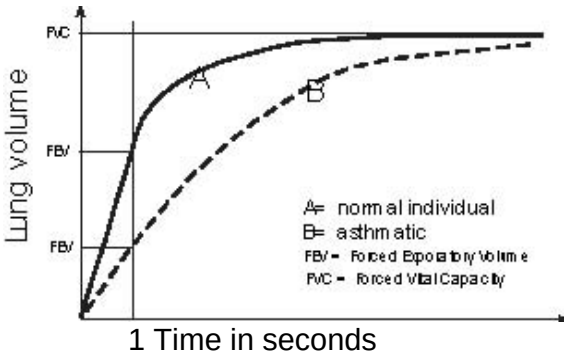

It can be seen from the graphic above that trace B rises more slowly in the case of an asthmatic, so that after one second much less air has been exhaled, or it will take a longer period of time for the same amount of air.

Imagine the lung as a series of tubes along which air flows in and out. When the tubes are narrowed, the same amount of air can flow along the tubes but it will take longer and in addition the airflow will become noisy. This is the effect of asthma because the tubes are narrowed and the breathing process takes a longer period for the same amount of air.

Symptoms
There is a latent period between first exposure and the onset of symptoms. This is the period required for sensitization and may range from a few months to 20 years but an average is four years. The sensitizing agent therefore has been in use some time before symptoms develop.

Asthmatic reactions of workers with occupational asthma show different forms:

Immediate asthmatic reaction. This starts within minutes of exposure and lasts 1-2 hours after exposure has ended.

Late asthmatic reaction. This is the most common reaction and due to the fact that it starts some hours after exposure (max. 6-18 hours afterwards), the occupational cause can be overlooked. In the majority of the cases the symptoms appear in the evening and at night.

Recurrent asthmatic reactions. Cases have been known where a single exposure has lead to continuing symptoms for days or weeks even when not being present at the workplace. This is due to the fact that the sensitizing agent was spread with the central ventilation system. When being exposed for a longer period the asthmatic reactions can be more prolonged.

Sensitizing agents
A very wide range of chemicals and agents of biological origin have been described as causes for occupational asthma. Workers may be unaware of the possible relationship between their symptoms and their work.

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Another important causal agent is flux within the electronics industry containing colophony (rosin/resin which contain abietic acid) and other acids. Both di-isocyanates as colophony fumes are low-molecular-weight substances and are likely to be more persistent with their symptoms to occupational asthma even after exposure to these materials has ended for a longer period.

On both coated wires and printed circuit boards solderable enamels are found. They are basically polyurethanes and therefore contain isocyanates. The problem with polyurethane is that when it is heated to soldering temperatures (above 150 °C), toluene di-isocyanate (TDI) is evolved. It is known that soldering on polyurethane coatings without adequate extraction can exceed the maximum allowed exposure levels istantly.

Di-isocyanate exposure, TDI, MDI, from exposures in occupations such as work involving polyurethane varnishes (repair of electronics with coatings) or foams, certain waterproofing agents, etc. has shown in the UK as the major causative agent of occupational asthma (Meredith and MacDonald 1994).

Four recognizable medical effects of flux fumes are known. These are lacrymation and rhinorrhoea (running eyes and nose), irritation of the throat, asthma and skin irritation. The first two symptoms i.e. running eyes and nose and irritation of the throat are acute irritations due to high level of fumes. As such, these are self-limiting symptoms which disappear when the exposure to the fumes ceases

Preventions
Low molecular weight gases such as aldehydes and isocyanates are dangerous as they form amines in the human body.

Local extraction at the source where the fumes occur in combination with a filtering system which removes these gases from the airflow is the only correct solution. Low-molecular-weight gases can be filtered through chemical adsorption.

Weller manufactures fume extraction systems which are standard equipped with a gas filter containing a chemical adsorption process. All of our systems have been tested by independent institutes for efficiency of gas filtration of gases such as aldehydes and isocyanates.

More information can be found at:
www.cooperhandtools.com/weller
www.agius.com Website of Dr Raymond Agius MD, DM, FRCP (Edin & Lond), FF OMDepartment of Community Health Sciences,The University of Edinburgh Medical School,Teviot Place, Edinburgh EH8 9AG*arts of this brochure have been made with the courtesy of Dr. Raymond Agius.*

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