Health Hazards and Biological Particles

Repeated exposure to organic dust of biological origin may result in respiratory problems sometimes leading to mucosal irritation or general symptoms or allergy such as :

1. Type I allergy (asthma, rhinitis).
2. Type III allergy (extrinsic allergic alveolitis).
3. Sick Building Syndrome (headache, fatigue, mucosal complaints).
4. Organic Dust Toxic Syndrome (tightness of the chest, bronchitis, asthma).

Examples of organic airborne particles relevant in this context are pollen grains, fungal spores, animal and human dandruff, bacteria, mites and fragments of the above (Løwenstein *et al.*, 1986). The impact on human health of non-industrial biological pollution in the outdoor and indoor climate will be discussed on the following pages.

The following cases are mentioned as an attempt to : « Make people aware of the unwanted consequences of their own activities » (Spieksma, oral communication, Ravello, Dec. 1989). But also the inevitable sources — the natural exposure to outdoor airborne pollen and fungal spores are mentioned.

Category 1

During inhalation, airborne particles of biological origin — bioaerosols — liberated in the ambient air may be deposited on the mucosal surface of the respiratory tract. In cases of allergic predisposition — atopy — individuals can develop an IgE-mediated allergic response to the protein (antigen) fraction of the bioaerosol following repeated exposure. The body's response will generate reactions from the eye (conjunctivitis), the nose (rhinitis) or the lung (asthma).

Inevitable sources

Asthma and rhinitis may occur in predisposed persons out of doors during the pollen season in response to pollen grains or microfungal spores. Table I lists the pollen from trees and herbs and the spores regarded as the most important aeroallergens in Europe.

Man-induced sources

The offending indoor bioaerosols at home causing Type I-allergy are primarily house dust mites. Even in homes where mite growth seems unlikely, the patient may be exposed to house dust mite allergens from mite faeces and dead mites in the furniture, bedding and carpets that have previously been stored where mites could flourish (Svendsen, 1990).

In private homes house dust mites are often a bioindicator — together with the growth of microfungi — of dampness problems. These problems can be due to inadequate ventilation or to construction faults in the dwelling. The occurrence of house dust mites in carpet-dust from non-industrial workplaces such as offices is extremely rare, possible exceptions being kindergartens and nurseries. Pets are another source of possible harmful biological particles. Cats, dogs and other furry animals such as guinea pigs or gerbils liberate huge amounts of skin scales which can cause severe asthma when inhaled by humans. Particles from laboratory animals, especially mice, rats and guinea pigs may create similar problems (Longbottom, 1983). The highly efficient insulation of new houses or the improvement in the insulation of older houses leading to insufficient ventilation — natural or mechanical — increases mould growth which, again, may create problems for people, especially children, with allergic predisposition (Gravesen, 1979).

A report from the Danish Building Research Institute together with English and Dutch studies demonstrates the multiple health problems occurring in damp houses (Brunekreff, *et al.*, 1987 ; Platt *et al.*, 1989 ; Waegemaekers *et al.*, 1989).

Category 2

Extrinsic allergic alveolitis — the delayed IgG-mediated allergic reaction — is one of the oldest work-related diseases in the world. It is also known as Farmer's Lung Disease. Reactions occur following exposure to mouldy materials in industry or agriculture or to mouldy humidifiers. Type III allergy following exposure to mouldy houses is also described. Infected humidifiers exhibit a good example of the unwanted consequences of human activities. Exposure to bioaerosols from contaminated humidifiers may lead to the inhalation of both microbial antigens and toxic products from the growing microorganisms. Endotoxins which are wall-components from gram-negative bacteria often occurring in humidifiers are now known to strengthen the immune response (Norn *et al.*, 1986).

Category 3

The impact of airborne particles in the *Sick Building Syndrome* (WHO, 1983) is currently under investigation. In many western countries carpeting and fleecy surfaces are widely used in non-industrial workplaces such as

public offices, schools and kindergartens. Heavy personal traffic combined with reduced cleaning creates an opportunity for the accumulation of dust and where under humid conditions, also for microbial growth (Gravesen *et al.*, 1986).

TABLE 1. — POLLEN AND MICROFUNGAL SPORES REGARDED AS THE MOST IMPORTANT OUTDOOR AEROALLERGENS IN EUROPE

SPRING (TREES)			
Latin	English	German	French
Alnus	Alder	Erle	Aulne
Betula	Birch	Birke	Bouleau
Corylus	Hazel	Haselnuss	Noisetier
Fagus	Beech	Buche	Hêtre
Olea	Olive	Olivenbaum	Olivier
Platanus	Plane	Platane	Platane
Quercus	Oak	Eiche	Chêne
Ulmus	Elm	Ulme	Orme
SUMMER (GRASSES)			
Latin	English	German	French
Anthoxanthum	Sweet Vernal Grass	Ruchgrass	Flouve
Avena	Oats	Hafer	Avoine
Dactylis	Orchard Grass	Knäuelgras	Dactyle
Festuca	Meadow Fescue	Schwingel	Fétuque
Holcus	Velvet Grass	Honiggras	Houque
Lolium	Ryegrass	Weidelgras	Ivraie
Phleum	Timothy	Lieschgras	Fléole
Secale	Cultivated Rye	Roggen	Seigle
LATE SUMMER AND AUTUMM (HERBS AND MOULDS)			
Latin	English	German	French
Artemisia	Mugwort	Beifuss	Armoise
Chenopodium	Lamb's Quaters	Gänsefuss	Chénopode
Parietaria	Pellitory	Glaskraut	Pariétaire
Plantago	Plantain	Spitzwegerich	Plantain
MICROFUNGAL SPORES			
Alternaria			
Cladosporium			

General symptoms such as headache and fatigue as well as mucosal symptoms such as itching eyes, tightness of the nasal passages and hoarseness are the most frequent complaints in these types of building. Recent studies of the quality of air related to indoor climate complaints support the hypothesis that the repeated exposure to organic dust components of biological origin plays a significant role in the Sick Building Syndrome (Skov *et al.*, 1987). Again the unwanted consequences of human activities are demonstrated.

Intervention, such as the use of hard floors instead of carpets in rooms with heavy personal traffic and the reduction in the number of surfaces which act as dust depots has proved an encouraging development in the perception of indoor climate (Gravesen, 1987).

Category 4

Symptoms due to industrial exposure to high concentrations of microorganisms, fragments of microbial particles and their volatile components represent a recently described problem, called Organic Toxic Dust Syndrome (OTDS). This is connected with work in rubbish dumps and waste deposits with automatic sorting of the categories of refuse. Silo work and grain handling may also evoke symptoms ranging from tightness behind the nose to severe asthma (Malmberg *et al.*, 1988).

Problems with the disposal and recycling of refuse, industrial as well as household, are becoming worldwide (Sigsgaard *et al.*, 1990). In the natural environment there is no possibility to « throw away ». Recycling and re-use with the proper protection of those people occupied in the processes will be a vital future task for both technical experts and ecologists.

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