

**International Symposium**

# **ACHIEVING HEALTHY AND PRODUCTIVE BUILDINGS**

**Towards the design and management of productive, healthy and efficient indoor  
environments**

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## **Implication of Moulds & Health in the Indoor Environment**

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# **Implication of Moulds & Health in the Indoor Environment**

## **Summary**

### **Building Health**

Building affects the health of occupants in many ways, for example building related illnesses (BRI), Sick Building Syndrome (SBS) and allergy and environmental health problems (AEHP). The most common building health problems in buildings relates to dampness and condensation resulting in mould growth, respiratory problems and allergies.

### **Occupational Exposure to Moulds in Buildings**

Airborne moulds are ubiquitous and have evolved to exploit the man-made spatial ecosystems of our built environment, where they manipulate the microclimates and ecological niches of our buildings and feed on a variety of substrates. The problems of occupational exposure to moulds are not new but are gaining new prominence because

- Of demands for better standards of living to improve the health, comfort and productivity of the occupants.
- Increase in the incidence of allergic reactions to susceptible individuals
- Energy conservation measures leading to sealed buildings

In the last century the management of mould problems in buildings has largely relied on misunderstanding and misdiagnosis of the biology, ecology and physiology of the causal organisms.

### **Monitoring and Risk Assessment**

A range of instrumentation is available for monitoring moulds in the indoor environment. The choice of sampler requires careful consideration of the purposes of the investigation, the information required, and the characteristics of the moulds in the environment being studied and the sampling and trapping efficiencies of the available samplers. Other methods include sampling airborne allergens, airborne mycotoxins, sampling volatile metabolites and endotoxins.

### **Environmental Management**

Much damage has been inflicted in last Century by dealing with the symptoms of the problems and not with the causes. By proper understanding of the courses, its repetition should be avoided in this Century. The environmental approach is beneficial to the building fabric, occupants and to the wider environment.

## **Introduction**

Exposure to moulds and indoor allergens is a risk factor for the development of allergic reactions and the incidence of the problem is increasing at an alarming rate. Most common microorganisms in the indoor air are as follows; *Cladosporium herbarum*, *Eurotium herbariorum*, *Penicillium spp.*, *Aspergillus spp.*, *Wallemia spp.* The other micro-organism include are Bacteria, Viruses, Actinomycetes and Pollens.

Most common moulds from Dust Indoors are as follows; *Alternaria alternata*, *Aspergillus versicolor*, *Aureobasidium pullulans*, *Mucor spp.*, *Phoma spp.* and Yeasts and Bacteria, Actinomycetes, House dust mite.

Allergy problems in buildings reflect on the health, comfort and productivity of the occupants and also increases in the rate of sickness at work places. The fundamental understanding and close dialogue between employees & human resources; facilities managers & health & safety officers; architects, engineers and building health specialists is essential, in order to identify, evaluate, monitor and remedy allergic reactions in buildings.

Allergic reactions in buildings is a complex issue and allergic signs & symptoms, types of allergies, indoor allergens & their management is a growing concern to employers and it requires a multidisciplinary integrated approach

## **Moulds and Microorganisms**

### **Most common in the indoor air**

*Cladosporium herbarum*  
*Eurotium herbariorum*  
*Penicillium spp.*  
*Aspergillus spp.*  
*Wallemia spp.*

Bacteria  
Viruses  
Actinomycetes  
Pollens

### **Most common from Dust Indoors**

*Alternaria alternata*  
*Aspergillus versicolor*  
*Aureobasidium pullulans*  
*Mucor spp.*  
*Phoma spp.*  
Yeasts

Bacteria  
Actinomycetes  
House dust mite

Photograph 1



***Mould growth on wall***

Photograph 1



***Mould monitoring in a tunnel of a Castle***

**Allergic Reactions**

Signs and symptoms of Allergic Reactions

Nose: itching, soreness, blocked, running, sneezing;

Eyes: dryness, itching, redness, soreness, swelling of the lids, weeping

Chest: discomfort, tightness, wheeze, breathlessness, and cough;

Skin: itching, redness, wheezing, blistering, scaling, and oozing.

Possible allergic reactions are from Irritative, toxic and immunological influences from different types of component such as fungal allergens, mycotoxins, endotoxins (components from gram-negative bacterial) and microbial volatiles (1,2,3 &6).

## **Most common Signs and symptoms**

Most common symptoms are:

- Itching eyes
- Headache
- Difficulties with contact lenses
- Extreme fatigue
- Blocked nose
- Lack of concentration
- Sore throat
- Lack of memory
- Hoarseness
- General malaise
- Burning sensation of the skin
- Lethargy
- Recurrent sinusitis
- Dizziness

## **True Allergic Reaction**

A true allergic response to a substance can be defined as signs and symptoms of disease produced by specific immunological mechanisms initiated by that substance. 'Allergy' is commonly defined as a hypersensitivity to a substance that causes the body to react to any contact with it. However, the term is also used increasingly and more widely to describe signs and symptoms of disease for which there is no specific immunological mechanism. The exposure to allergic substances in the indoor environment may be an immediate response or a delayed reaction. Certain individuals are hyper-susceptible to becoming allergic to commonly occurring materials (e.g. pollen, fungi, house mites, and domestic animals) and they are referred to as 'atopic'. These individuals are also found to be more susceptible to becoming sensitized and allergic to a range of materials met at work (2).

## **Moisture Saturated Dwellings**

Buildings which suffer from dampness (Rising or penetrating dampness), moisture problems due to condensation, fire and flood damage can significantly higher the number of micro-organisms in the indoor environment.

This creates problems for allergic patients. A prolonged residual moisture problem may also cause troubles for nonallergic people, who may develop several of the mucosal and general symptoms.

## Indoor Allergens

There are more than 100,000 species of fungi. The genera and species that cause human disease involve a wide array of fungi. The most common fungi in both adult and pediatric populations in descending order of frequency were *Alternaria*, *Helminthosporium*, *Cladosporium*, *Fusarium*, *Aspergillus*, *Phoma* and *Penicillium* (2,3 & 4)

Other moulds of allergenic importance include, for example, *Botrytis*, *Rhizopus* and *Trichoderma*. Fungi for example both moulds and yeast; moulds have hyphae and yeast's are unicellular fungi that reproduce by budding or fission. A clinically important yeast allergen is *Candida*, which forms pseudohyphae.

Fungi produces large numbers of spores and when these spores liberated from infected buildings to the indoor air, it can be regarded as organic dust. These spores can, like other types of dust, sediment on surfaces or it could be inhaled by occupants and deposited on the mucosal surface of the upper airways and in the eyes. Repeated exposure to large amount of fungal propagule risks the development of specific allergic reactions.

The house dust mites, moulds and, less commonly, amoebae that can colonise building structures, services & furnishing & finishes and can cause allergic and other diseases. House dust mites, fungi and yeast's are potent sensitizers, and they flourish in an environment of high relative humidity and low ventilation. Fragments of these organisms or their decayed material or their metabolites, becoming airborne, can be inhaled and cause allergic disease.

## Management

### Allergen Avoidance

Removal of a household pet or total enclosure of industrial processes releasing sensitizing agents can lead to cure of rhinitis and, indeed, asthma.

The house-dust mite infests most areas of the house, and is not confined to the bedroom. Mite counts are extremely low, where carpets are absent, floors are cleaned frequently and mattresses and pillows are covered in plastic sheeting that can be wiped down. Similar conditions may be reproduced if mite counts are to be reduced. Where there is risk of exposure to a known material with a record for causing allergy, the management of that material can be achieved by the principles of substitution, containment, local exhaust ventilation and finally personal protection.

### Environmental Control of Allergens

Environmental control of allergens consists of three possible treatment methods that can be used singly or in combination: avoidance, pharmacotherapy, and immunotherapy. For example, elimination of allergen reservoirs, control of humidity, exposure to heat or cold and air filtration. Air filtration and vacuum cleaning have long been recommended for control of dust mites, their efficacy has been variable. If filtration is to be recommenced, high-efficiency particulate air (HEPA) filters are probably most effective.

## **Environmental Control of Dust mite**

Eliminate mite reservoirs:

Cover pillows, mattress with Plastic

Wash bedding weekly

Remove carpets

Reduce upholstered furniture to a minimum

Air filtration:

Portable HEPA filters

Vacuum cleaning with HEPA filters

Exposure to heat or cold

Allergy and environmental health problems in buildings have generally been neglected because the effects are mostly chronic and long-term and not directly and immediately life threatening. People are increasingly dissatisfied with the air quality in their work places and this is costing employers millions of pounds every year in loss of business. Healthy and comfortable environment requires multi-disciplinary scientific input from those involved in building construction, services and controls, design, use and maintenance of buildings.

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## **Dr Jagjit Singh**

### **Director of Environmental Building Solutions Ltd**

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### **Biography**

Dr Jagjit Singh BSc, MSc, PhD, FIBiol, AIWSc, FRSA, FRSH, is a Director of Environmental Building Solutions Ltd and specialises in building health problems, heritage conservation and environmental issues. He has more than 15 years' experience as a building pathologist and expertise in heritage conservation, indoor air quality & health in the UK and abroad in both academic and commercial environments.

Dr Singh has published in excess of 200 technical papers and communications, contributed to books and lectured widely on conservation, building pathology and building health problems. He has edited several books including Building Mycology, Management of Decay and Health in Buildings, Environmental Preservation of Timber in Buildings and Allergy Problems in Buildings.

His current research focuses on interrelationships of building structures and materials with their environment and occupants. Dr Singh is BBC Expert on matters of dampness and timber decay in buildings and has appeared twice in the "Raising the Roof" series.