

# Indoor Air Problems

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Three approaches to the investigation of building related complaints.

- First approach focuses on health problems - classify syndromes and identify diseases -then identify a cause if possible.
- Second approach focuses on environmental control, identifying deviations from good design, operations and maintenance.
- Third an industrial hygiene approach model focusing on precise measurements.

Using the first model we can hypothetically divide medical problems between well defined and correlated medical diseases and syndromes termed building related illness (BRI) and non-specific complaints ranging from headaches, concentration problems, ocular, respiratory and skin irritation, fatigue and dizziness, to odor and taste complaints. These result in the sick building syndrome. (SBS)

## Building Related Illnesses

### Allergic respiratory diseases

Sinusitis

molds

Rhinitis

molds, photoduplicating chemicals

Tracheobronchitis

molds

Asthma

molds, dust mites, chemicals, carbonless paper (formaldehyde and phthalates)

Hypersensitivity pneumonitis

chemicals, wood dust, bacteria, molds

Humidifier fever

chemicals, bacteria, endotoxin, molds\*

### Infectious Diseases

Legionnaires Disease

Legionella pneumophila

Pontiac's disease

Legionella pneumophila

Tuberculosis

Mycobacterium tuberculosis

Upper respiratory tract diseases

variety of viruses

Q fever, Measles, chicken pox other communicable diseases.

### Dermatologic diseases

Allergic contact dermatitis

carbonless paper, photoactive copy paper.

Irritant dermatitis

low relative humidity, volatile organic

compounds, fiberglass.

Photodermatitis

monochromatic light

### Lung Cancer

Radon, environmental tobacco

smoke, asbestos.

## Sick Building syndrome

First made popular in the 1970's

WHO defined complaints as neurotoxic, irritating to mucous membranes, asthma like, odor complaints, skin irritation, nose bleeds.

NIOSH by 1984 examined 400 buildings and attributed inadequate HVAC in 48% of them. Microbiological contamination in only 5%, entrainment of outside agents in 17%, office machines and products in 16% and unknown in 12%. As the years past however further studies around the world indicated that the problem with SBS was not so simple.

Multiple factors often were present. Many cases did not have a defined problem. Office

stress and the individual, group and organizational behavior and psychosocial issues were recognized to be correlated though sometimes unfairly implicated in the absence of a defined physical factor. In the US VOC measurements in the range of 0.5 to 5 ppm are considered prime etiologic agents though mucous membrane irritation is more adequately correlated with a dose response curve at levels exceeding 5 ppm. Five separate chamber studies helped confirm the importance of VOCs. Females are more likely to be affected especially those working with computers, duplicating machines and copy machines. The amount of fleecy or fibrous type material in the air is important. As a survey of non-problematic building occupants will reveal that 20% will have problems consistent with those found in SBS patients, one definition of SBS is when more than 20% of the workforce or department is complaining of symptoms. Some materials in the office may act as a reservoir or sink for VOC and Microbiological products. Some areas are adsorbent to provide this quality.

Inadequate ventilation is evaluated in accordance with standards established by the American Society of Heating, Refrigeration and Air Conditioning Engineers. 5 cubic feet per minute (cfm) per occupant in areas where there is no smoking and 20 cfm where smoking is permitted was the original standard in 1981 though now modified to ASHRAE 62-89. 20 cfm per occupant of outside air in office buildings (15 with mechanical ventilation) is required. In addition 80% of occupants should be satisfied with the air quality. There are problems with these standards.

Other issues include heavy metals such as phenylmercuric acetate in paint historically and lead aerosols from sanding, asbestos, tobacco smoke, biomass products, carbon monoxide, occupant byproducts such as aftershave, perfumes hairsprays, pesticides, carpeting and other remodeling byproducts are all relevant.

Many associated problems remain unresolved such as multiple chemical sensitivity, mass psychogenic illness, electromagnetic dangers, long-term carcinogenic or neurotoxic effects of low-level pesticides or VOCs.

Approach to analyze such buildings should be done in several tiers or phases. Standardized approaches and questionnaires are now available. Work team methods allow proper input of concerns and permit proper communication of results or progress to all parties concerned. Initial sampling for Carbon dioxide levels (800 ppm or less), and proper walk through with a trained individual is first step as well as determining attack rate and types of complaints and medical problems. Second step or tier requires a team effort with engineers, occupational physicians, industrial hygienists and microbiologists.

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