

Health Aspects of the Office Building

Dr. F. J. C. Roe, Consultant Pathologist/Toxicologist
Wimbledon

Introduction

In addressing the title of this talk, I need first to distinguish "illness" from mere "discomfort". People do not live their lives saying to themselves every five minutes of the day "I feel well", "I feel comfortable". On the contrary both "illness" and "discomfort" constitute situations of awareness that for one reason or another all is not well. But the threshold for such awareness is heavily dependent on circumstances (see Table 1)

If one consults a physician because one is not feeling well, he/she will go through a check list for absence of disease (see Table 2)

The immediate and short-term effects of pollutants in indoor air are listed in Table 3. For comparison, Table 4 lists the sources of discomfort.

Medical examination of a complainant about the air quality in an office might provide evidence of irritation of the conjunctiva and/or of the mucous membranes of the upper respiratory tract, atopic symptoms, mental confusion and death. However, in the case of symptoms such as headache and nausea the examining physician has to rely on what the complainant says. Indeed, none of the effects of the types of discomfort listed in Table 4 would be objectively evident during the physical examination of complainants.

Variability and adaptability of humans

It is important not to assume that humans are all the same in what they consider to be comfortable in relation to ambient temperature, humidity and air flow, etc. Furthermore, people can adapt to ambient air conditions which are quite different to those to which they are accustomed. To some extent this adaptation is brought about by increasing or reducing the thermal insulation, water absorbability and draught resistance provided by the clothes they wear. However, physiological adaptive mechanisms are also important. A reduction in skin blood flow can bring about valuable conservation of body heat. Reduced food intake, especially reduced protein intake during the hottest period of the day, leads to reduced endogenous heat generation, etc. Discomfort from high ambient temperature and/or high ambient humidity can also be reduced by reducing energy expenditure associated with work and leisure activities.

In rich countries, less reliance is placed on man's capacity for adaptation. Instead, air-conditioning systems are widely used in offices and homes. These certainly reduce discomfort where air conditioning is functioning efficiently. However, people who grow used to conditioned air, suffer increased discomfort when they are deprived of it, particularly because they are not dressed suitably for the ambient temperatures and humidity levels with which they are faced.

One other fact merits attention. There is a human need for variability. People do not necessarily want to live continuously at a constant temperature. By contrast they actively enjoy the sensual pleasure of feeling a soft

breeze on their skin. Sensory boredom contributes to the longing that people experience after they have spent some time within an air-conditioned building for "a breath of fresh air". Thus it behoves heating and ventilation experts to recognise both the between-person variability and the temporal variability in the needs of individuals in relation to the temperature and humidity of indoor air.

If we now list the requirements for comfort in the office (Table 5) we see that few of these impinge directly on health though several may do so indirectly. Draughts may give rise to muscular pains, noise may damage hearing and irritants can damage the respiratory tract.

Main causes of illness within in buildings

Illnesses attributable to poor indoor air quality can be classified as shown in Table 6. Heading the list is infections - particularly upper respiratory infections transmitted from person to person. The risk of transmission of such infections is closely related to the overcrowding of indoor spaces although inadequate and/or poorly designed/maintained ventilatory systems clearly enhance the risk. Infections caused by micro-organisms that multiply within the ducting or in blocked filters, although less common, may be serious, e.g. Legionnaires disease. By contrast chemical irritation and allergic diseases (e.g. asthma, rhinitis) are mainly attributable to inadequate ventilation, the inappropriate choice of building materials and fabrics and/or the inappropriate indoor use of chemicals which require the provision of specially designed exhaust ventilation.

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Although occupations involving the use of asbestos under conditions of high airborne dust levels are closely associated with increased risk of asbestosis, lung cancer and cancer of the pleura. There is probably no risk at all to health from working in buildings where asbestos has been used in the construction provided that airborne fibres are not emitted into the atmosphere. The safety of various man-made fibrous building and fabric materials is still very much the subject of ongoing research. The picture that is emerging is that long-thin fibres which are not readily soluble in body fluids pose the greatest risks to health.

Asthma, rhinitis and other allergenic diseases generally appear to be increasing in incidence, especially within big cities. Some of the apparent increase is probably due to greater awareness and fashion. On the other hand, some of the increase appears to be real and there is at present no obvious explanation of this. It is difficult to believe that it is attributable to increasing airborne levels of allergenic pollens and, in my view, unlikely to be due to a change in the common type of outside air pollution from the high sulphur dioxide pollution of the 1960s to the high nitrogen dioxide pollution of the 1990s. The so far unanswered question is whether the higher average indoor temperatures of today are in some way increasing the risk of allergenic disease. In an increasingly litigation-conscious world it is becoming ever more common for people to blame their allergic symptoms on such things as other people who use perfumes, or aftershave lotions, office plants and flowers, building materials and fabrics, and environmental tobacco smoke, etc. Although individual humans can become allergic to almost anything, none of these factors is likely to be a real cause of allergenicity under ordinary circumstances. By contrast, real risks of allergenic

symptoms can be associated with mechanical ventilation symptoms if ducts are not regularly or properly cleaned and/or if filter pads are not properly fitted and regularly renewed.

Environmental Tobacco Smoke

At present, employers are being put under increasing pressure to introduce smoking bans in the work-place. By yielding to such pressure they can cut down on cleaning costs and reduce ventilation rates. If they do the latter, however, they may actually impoverish indoor air quality. A main arguments against the introduction of such bans is that irritation from environmental tobacco smoke is indicative of inadequate ventilation and that they should not be used to deprive smoker of indulgence in the habit. Be that as it may, as a non-smoking medical scientist, who has studied the available evidence, I am of the opinion that exposure to low ambient levels of environmental tobacco smoke poses no serious risk to health. Accordingly, it is wrong to worry people that they are at risk of developing serious chronic lung disease, lung cancer or coronary heart disease if they are exposed to low levels of environmental tobacco smoke. Decisions to ban or not ban smoking in work places should be made democratically and sympathetically and not against a background of unwarranted fear of risk of serious disease.

Conclusion

It is chastening to realise that many of the health problems and many of the discomforts associated with working in offices today arose from attempts (a) to improve the working environment by the use of mechanical ventilation instead of natural ventilation via openable windows and (b)

to save heating costs of recirculating warm air. Although complaints about the quality of the environment in offices are common, most actual health problems can be avoided by good design of buildings and ventilatory systems, and the choice of building materials and furnishings which have only a low emission rate of volatile organic compounds combined with good maintenance and, above all, good general office management.

Table 1 : Factors which influence the perception of suboptimal indoor environment

1. Boredom
2. Lack of job satisfaction
3. Poor relationships with colleagues
4. Sensitivity (e.g. formaldehyde)
5. Conditioned reflexes
 - Olfactory, e.g. E.T.S.
 - Auditory, e.g. A particular voice

Table 2 : A doctor's check list for absence of disease

Questions and physical examination

Appetite

Growth or Maintenance of body weight

Bowel function

Bladder function

Breathing and respiratory function

Cardiac function

Muscular movements and joint movement

Eyesight, hearing, taste, smell and touch

Nervous function - reflexes, speech

Cognitive ability

Skin condition

Libido, menstruation, sexual function

Absence of abnormal swellings

Absence of bleeding or discharge

Table 3 : Immediate effects of polluted indoor air

Headache	-	Reduced O ₂
	-	High CO ₂
	-	High temperature
	-	High humidity
Itchy eyes, irritated throat, blocked nose	-	Aldehydes such as acrolein, acetaldehyde, formaldehyde
	-	Oxides of nitrogen
	-	Sulphur dioxide
	-	Dust particles
Atopic symptoms	-	Allergenic pollens, fungal spores, bird feathers, animal dander, etc.
Nausea	-	Volatile organic chemicals liberated by building materials, fabrics
	-	Pipe, cigar, cigarette smoke (i.e. environmental tobacco smoke)
	-	Garlic
	-	Body odours and perfumes
	-	Food and cooking smells
Mental confusion, death	-	Carbon monoxide

Table 4 : Sources of discomfort

Temperature	-	Too high
	-	Too low
	-	Draught
Humidity	-	Too high
	-	Too low
Air composition	-	Too much CO ₂
Air pollution	-	VOC
	-	Ozone
	-	Fumes - heating
	-	- cooking
	-	Body odour
	-	ETS
	-	Plants/pollens
-	Animal smells	
Light	-	Too much
	-	Too little
	-	Glare
	-	Flashing
	-	Shadow
Noise	-	Mechanical
	-	Human
	-	Radio
View	-	No view into distance
	-	No window
General	-	Dust/dirt
	-	Untidiness

Table 5 : Requirements for comfort in the office

- * Acceptable temperature
- * Acceptable humidity
- * Absence of draught
- * Acceptable noise levels & acceptable types of noise
- * Acceptable lighting
- * Control over one's environment
 - openable windows (N.B. yen for 'fresh air')
 - adjustable heating, lighting
- * View into the distance
- * Absence of adours - particularly on entering a room or area.
- * Absence of airborne irritants
- * Assurance of absence of inapparent hazards
 - CO
 - Radon
 - Asbestos
- * Adequate personal space: i.e. absence of overcrowding
- * Cleanliness
- * Tidiness
- * Agreeable social contacts

Table 6 : Kinds of illness from indoor air

Infections from	:	other people
	:	poorly designed/maintained ventilation
	:	outside air
	:	pets, vermin, etc.
Chemical toxicity	:	Acute toxic, e.g. CO
	:	Irritants, e.g. SO _s , NO _x , Ozone, ETS
	:	Chronic toxicity (e.g. Hg, solvents, insecticides, airborne particles and fibres)
Allergenic	:	Fungal spores (from poorly designed/maintained ventilation; external air)
	:	Building materials (e.g. formaldehyde)
	:	Chemicals used within buildings