

SICK BUILDINGS

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Maintenance and design cure sick buildings

Difficult to diagnose and cure, sick building syndrome plagues offices throughout the world. Jim Simpson examines the latest thinking on the problem

Tiredness, stuffy noses and headaches are the three most common complaints to come under the catch-all phrase sick building syndrome (SBS). And yet none is specific enough to be directly attributable to an office building as such. Indeed, one building services manager dismissed sick building syndrome and lethargy as "nothing new — people have always been lazy".

But ever since the term was first coined in a 1983 World Health Organization report, SBS has been a cause of concern.

'25 to 35 per cent of US office stock are sick buildings'

In the USA research shows that 20 to 30 per cent of the office stock are sick buildings and the US Environmental Protection Agency calculates that up to 35 per cent of office workers are in buildings where air quality problems cause illness, absenteeism and low productivity. Nor is the agency immune — its chief toxicologist now has to work from home because he is allergic to one of his office's components — the carpet, it is thought.

In studying SBS there are two main difficulties: the symptoms are hard to measure and they can be caused by a variety of factors. Dr Peter Sherwood-Burge is the medical adviser to the Building Research Establishment's study group on workplace illnesses and he points out that it is difficult to validate many of the complaints held to be SBS: lethargy, blocked or runny noses, dry skin, dry throat. Asthma is one of the few illnesses that can be detected, measured and related to the building.

There are further complications too, as the number of symptoms experienced differ according to how long staff have worked in a particular building and what they do in it. Clerical staff suffer more than professionals, who suffer more than the managerial grades, for instance, and the number of symptoms reported by staff reaches a peak when they have occupied a sick building for two or three years and then subsides slightly. Another factor is age and sex: female workers report more symptoms than males and fewer symptoms are reported by people over 30 years old than are by their juniors.

Despite these difficulties in research SBS is

now accepted as being a true problem, not just one invented to excuse the Monday morning malaise. In America research into the problem is fuelled by the liability of the employers for their employees' health. In Florida and California employees have sued and won after claiming that indoor air pollution caused them illness.

Dr Alan Hedge is an associate professor of design and environment analysis at Cornell University, USA, and he lists the common factors in a sick building as:

- the building being sealed, with no opening windows or natural ventilation;
- heating, ventilating and air conditioning systems;
- ceiling diffusers;
- basement garage;
- synthetic building materials;
- high occupant density;
- no occupant control over air temperature and ventilation;
- high usage of video display units;
- fluorescent primary lighting;
- open plan layout.

The bulk of sick building syndrome sicknesses are respiratory and are accordingly blamed on the air conditioning. But in the modern office some form of heat rejection is essential as office equipment emits an average of 70 kW/m² — a personal computer alone generates 500 W. Also natural ventilation is plainly inappropriate in some situations — where the building is deep plan, so open windows do not help those further inside the building, for instance. On high rise buildings open windows could be too noisy because of wind noise at the upper levels and security can be compromised on low rise developments.

Nonetheless Sheena Wilson, co-founder of the consultancy Building Use Studies and consultant with Jones Lang Wootton Facilities Management, says: "We must question the need for air conditioning. One-third of all air-conditioned offices in Britain are in the public sector and under constant budgetary constraints, so they probably can't afford to maintain the system properly. The lower end of the market should go for simpler buildings and bear in mind the difficulty of getting properly trained maintenance staff."

Hoare Lee and Partners, consulting engineer, is heavily involved in designing HVAC systems and senior partner Stephen Ed-

wards has drawn up a set of guidelines for avoiding SBS in new buildings. He believes that occupant control is the key factor. "Staff must be able to adjust the ventilation and the temperature for their own needs individually with switches that actually work and do something," he says.

Where ceiling heights permit he recommends propellor fans as a simple and cheap means of introducing individual control of air movement. Mr Edwards also questions the use of anti-sun glazing to reduce solar gain: not only does it stop the occupants of a building getting an accurate view of the world outside — it looks more dull and grey — but the heat-absorbing glass can actually act as a radiator. He recommends treating the perimeter and deep plan areas of the building differently for both heating and air conditioning because the perimeter is so much more subject to solar gain and variations in ambient temperature.

Mr Edwards also notes that light fittings produce 50 per cent of the radiant heat in offices and so need to be positioned carefully, to avoid heat building up uncomfortably in areas such as above desks.

'The bar to more complex buildings is the building services manager'

Dr Hedge agrees with Mr Edwards' main points and sums up his approach thus:

- improve the performance of heating, ventilation and air conditioning;
- remove indoor pollutants;
- improve personal control.

He believes that the proposed US legislation points the way forward. Called Ashrae 62-1981R, it embodies many of these factors.

According to the draft regulations, HVAC systems must have a design that is documented and the designer will be responsible if it fails. The proposed regulations also insist on a maintenance record being kept. The outdoor air that is the fresh supply must also meet Federal regulations — and if it does not it must be filtered until it does. And when the fresh air is delivered it has to reach the occupants' 'breathing zone', around 42 in. above floor level.

The proposed regulations are a quantum leap forward on what was permissible

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before. Dr Hedge reckons most US buildings will simply be unable to meet them. However, new products are on the way to meet the need.

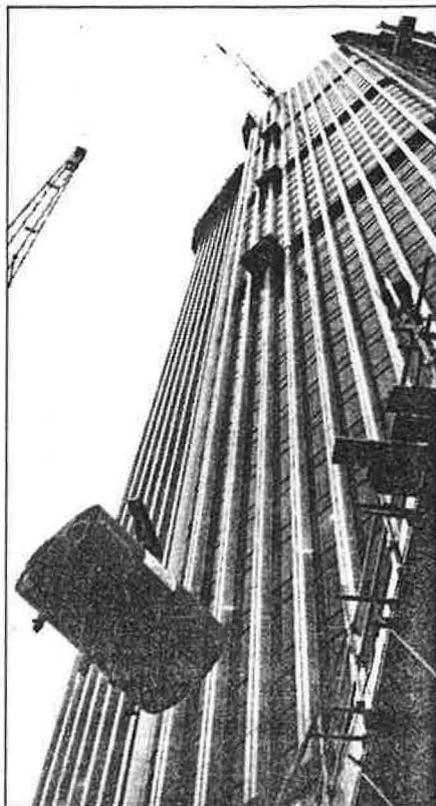
Fourteen buildings in the US now have task air systems whereby the cool, air-conditioned supply comes through circular vents in the floor that get round the problem sometimes encountered with ceiling vents. When cool air is introduced from above it can form a trap for the polluted hot air below, so the occupants never get the benefit of the fresh air because it circulates above their heads. These floor vents are mounted in a standard access floor panel and so can be fitted by maintenance staff according to the member of staff's wishes.

But Johnson Controls of Milwaukee has gone a step further by developing a 'personal environment system', a desktop machine measuring 17 in. by 13 in. by 15 in. that gives the user individual control over air temperature, air flow, lighting, sound conditioning and radiant heat.

Two fans deliver the air and the unit is linked in to a building management system that remembers what that worker wants. It has a sensor so that when the worker leaves, the area is returned to a base level for temperature, air freshness and background sound.

Although not commercially available yet early studies have shown that in one office two workers sitting only across the desk from one another set their working temperatures 10 deg. F apart, illustrating the impossibility of satisfying everybody with a uniformly air-conditioned environment.

However some of the symptoms of SBS, such as headaches and lethargy, are not caused by the building components themselves, even if it has to be handled by the air conditioning. For instance, formaldehyde causes such symptoms and is found mainly in the carpeting and furnishings. Some US corporations, such as the computer company Apple, have taken to baking out new buildings, running them at temperatures far hotter than normal while unoccupied, with many more air changes per hour, in order to



'A sick building is defined by its occupants: they don't feel comfortable working there'

get rid of volatile gases before the building is filled.

But, for existing buildings, the answer lies in maintenance. Simon Turner works in the USA for ACVA Atlantic Incorporated, a specialist firm of 'indoor air quality consultants' that has so far identified no less than 27 species of fungi living in air conditioning systems. "We find poor ventilation and maintenance the main problem where a building is causing problems," says Mr Turner, "In 63 per cent of cases the condensate tray is filthy and needs cleaning."

The building services engineer can also cause problems because the effort to save energy can waste money in sick staff,

explains Mr Turner. Money can be saved on heating the building by recycling the return air but this also recycles the pollutants, so they become more concentrated. But then, that is not the engineer's problem.

ACVA's approach is to survey the design and operation of the air handling system, inspect the inside of supply and return ductwork as well as the filters, ventilation rates, distribution and volume controls. The air itself is then sampled and analysed for carbon dioxide and carbon monoxide, airborne particles, organic and inorganic gases, fungi and bacteria. After this it should be possible to isolate the possible causes of ill health amongst staff — chemical fumes or allergenic fungi, for instance.

The American approach could be adopted here — a cross-disciplinary method drawing from architecture, engineering, chemistry and microbiology.

Certainly Dr Sherwood-Burge believes that the problem requires a team approach that would typically involve the building services manager co-operating with the office manager and a specialist in occupational health.

"The bar to more complicated buildings," says Dr Sherwood-Burge, "is the building services manager, who is typically low paid, of low status and with little training."

Ironically, many of the problems seem to stem from the energy-conscious designs in the 70s that sealed the building envelope.

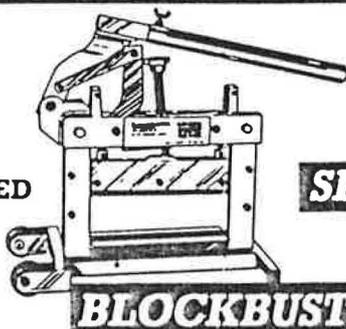
But — as Dr Sherwood-Burge and every other practitioner will argue — savings of energy in running a building, or indeed in training of staff to maintain the plant, are false economies when compared with the cost of staff illness. ○

Dr Peter Sherwood-Burge will be demonstrating his approach to sick building syndrome on Monday April 24 in Horizon on BBC2 which examines Rotherham Council's Norfolk House offices. Dr Sherwood-Burge and other authorities quoted in this article spoke earlier this month at a conference on the subject organised by Hoare Lee & Partners. Edited papers should be available later this year.

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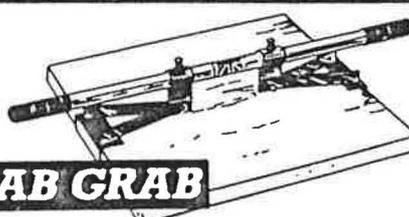
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