Health and Safety Executive OC 311/2

Field Operations Division

To

FCG Specialist Inspectors (Occupational Hygiene)

SICK BUILDING SYNDROME

GUIDANCE FOR SPECIALIST INSPECTORS

The purpose of this OC, which is based on THSD Minute THSD C5/T/4/92, is to provide practical information for Specialist Inspectors dealing with requests for advice on Sick Building Syndrome (SBS). This information is not intended to be used directly for enforcement or pro-active inspection activities.

BACKGROUND

1 Sick Building Syndrome (SBS) is an imprecise term used to describe those buildings in which there is a prevalence of a range of symptoms causing discomfort and a sense of being unwell rather than a distinct illness. There is a particularly high incidence in certain types of buildings, especially offices which are sealed and mechanically ventilated or air-conditioned. SBS is a complex phenomenon, and although a number of potential contributory factors have been suggested, much of the evidence is circumstantial, and no single underlying cause has been found. It is probable the cause is multi-factorial. Clinically-diagnosed illnesses which can readily be attributed to a particular cause, such as humidifier fever, Legionnaires' Disease, or exposure to a toxic agent in the workplace environment are not usually regarded as SBS.

2 The range of symptoms which can be experienced include:

(1) eye, nose and throat irritation;

(2) sensation of dry mucous membranes and skin;

(3) hoarseness, wheezing, coughs and frequent respiratory infections;

(4) skin rash and itching;

(5) headaches and mental fatigue; and

(6) nausea and dizziness.

These symptoms may occur singly or in combination with each other. The symptoms generally increase in severity over the working shift and diminish on leaving the building at the end of the working day. There is also a tendency for an increase in severity of symptoms through the working week.

3 There are a number of common features often found in sick buildings. These include:

(1) forced ventilation or air-conditioning;

(2) lightweight construction;

(3) indoor surfaces covered in fabrics, eg carpets;

(4) a homogeneous thermal environment, being relatively warm and energy-efficient; and

(5) air tight rooms, eg where there are no openable windows or other openings to the outside.

However, the presence of some, or all, of the above features does not necessarily mean that SBS does, or will, occur within that particular building.

POSSIBLE CAUSES

4 No single cause has been identified for SBS, although many contributory factors have been suggested, and a large number of causes are inter-related. SBS may result from the simultaneous combination of a number of factors. Suggested contributory factors include:

(1) physical aspects, such as inadequate ventilation;

(2) thermal discomfort;

(3) low humidity,

(4) air pollution including airborne organic matter; and

(5) other factors, such as low morale and general dissatisfaction with working conditions, may also play a part.

5 It has been suggested that certain features of the work place environment might contribute to SBS including high temperatures, low relative humidities, inadequate ventilation, insufficient fresh air supply, poor lighting and a lack of negatively charged ions.

6 Airborne pollutants such as chemicals, dusts, fibres and microbiological contaminants may have a directly toxic, pathogenic or irritant effect on occupants; they may also have allergenic effects. The pattern of occurrence effectively eliminates infection as a mechanism.

7 Chemical pollutants could originate from the building occupants, eg respiratory carbon dioxide or tobacco smoke. The building, fabric and furnishings may produce airborne contaminants by "offgassing", the gradual releasing of gases and vapours from building materials and furniture, eg formaldehyde from certain types of board. Office machinery and equipment may also be a possible source.

8 Although the potential range of pollutants in offices and similar environments is enormous, levels have generally been found to be minute, in parts per billion compared with currently-established occupational-exposure standards quoted in parts per million. Techniques considerably more sensitive and expensive than normal occupational hygiene practice would be required to measure such pollutants. There is no firm evidence to link SBS with specific airborne pollutants.

9 The presence of particularly strong odours may be an indication of other factors which may be more relevant, such as inadequate ventilation.

10 There is a lack of evidence correlating the incidence of SBS to a cause, or group of causes. Some researchers have suggested that SBS symptoms are an expression of dissatisfaction with the

workplace environment, that SBS is not a physical reaction, but a stress response to unsatisfactory workplace conditions. Any investigation of a "sick building" should include identification, if possible, of any aspect of the workplace environment which produces dissatisfaction. Most buildings will be associated with some staff dissatisfaction, most commonly with respect to thermal comfort. One set of workplace conditions will not completely satisfy all the individual wishes of the workforce.

REMEDIAL MEASURES

11 The complexity and range of factors which may cause SBS in a given case makes the positive identification of cause and any remedial measures very difficult. The action should be aimed towards providing a suitable workplace environment within the reasonably practicable constraints.

12 Air-conditioning/ventilation arrangements are often fixed systems, with limited adjustment for$T_o = T_A + T_r$

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2 temperature and fresh air supply. Any action to achieve variations in the workplace environment outside these limits may involve substantial changes in the ventilation system and also the fabric of the building, with inherent high costs and effort, with no certainty of achieving relief from the symptoms of SBS.

RECOMMENDED WORKPLACE ENVIRONMENT CRITERIA

(ISO 7730 AND CIBSE GUIDES)

13 Most forced ventilation systems work with a large proportion of extracted air being recycled after conditioning; ie filtered, heated or cooled or humidified as necessary. A proportion of fresh/make-up air is always required. The quantity of fresh air required is a function of building occupancy and the level of tobacco-smoking. Fresh air supply rates of 8 litres per second per person would be sufficient for respiratory and odour-dilution needs. Supply rates ranging from 12 litres per second per person for some smoking, to 32 litres per second per person for areas of heavy smoking, are necessary to maintain acceptable atmospheres. Where high fresh air supply rates are required but the existing ventilation system is incapable, without excessive modification, of supplying the higher rates, then provision of a separate dedicated smoking area/rest-room with an integral extract ventilation system may be a reasonable solution.

14 The source of fresh air supply should be sited such that it is not contaminated by external sources such as road traffic, industrial processes and other ventilation system discharges.

15 Lack of perceptible air movement within the workplace can promote a feeling of stuffiness, whereas excessive air movement will produce complaints of draughts. Air velocities should normally be approximately 0.1 to 0.15 metres per second and up to 0.25 metres per second during the summer.

16 The layout of office furniture and partitionings in large open-plan offices should also not interfere as far as practicable with airflow patterns throughout the room, eg office furniture should not obstruct ventilation inlets or outlets.

17 Very low relative humidity, less than 20%, may sometimes cause skin or eye problems in some individuals. It is unlikely that low relative humidity itself is a cause of SBS, but indirect effects may have a bearing on factors such as static electricity build-up, offgassing, and the presence of airborne dusts and fibres. High relative humidity, in excess of 70%, is uncomfortable, and health may be

threatened through the development of surface condensation and mould growth. Levels of relative humidity in the range of 40 to 70% are recommended for the workplace environment. At higher temperatures, the relative humidity should be at the lower end of this range.

18 Simple air-temperature measurements are unsuitable for the assessment of thermal comfort. Personal thermal comfort depends on air-temperature, radiant heat, humidity, air velocity, clothing, activity rates and personal preferences. To identify a reasonable temperature, it is recommended that use of the following equation is made to obtain the operative temperature:

T_o is the operative temperature in °C, T_A is the air temperature in °C, T_r is the mean radiant temperature in °C measured by a thermometer at the centre of a blackened globe. The operative temperature is the index often used in the design of building services systems.

Where there is no radiant heat gain or loss from features such as windows or radiators, T_o can be considered to be equivalent to T_A.

19 The thermal environment of a workplace where the activity is light and mainly sedentary, should conform to the following criteria, tending towards the lower limits:

(1) an operative temperature of 20 to 24°C during winter and 23°C to 26°C during summer.

(2) the vertical air temperature difference between head and ankle levels should be less than 3°C. The mean air velocity should be less than 0.15 m/s in winter and 0.25 m/s in summer.

20 The Fuel and Electricity (Heating) (Control) (Amendment) Order 1980 (file 309) prohibits the use of fuel and electricity for the heating of premises above 19^{o}C. This does not necessarily conflict with the recommended operative temperature. There will be other heat inputs to the building environment such as occupants, office lighting and machinery and also solar gain.

21 Most people prefer to work in natural daylight, and should be able to do so whenever possible. Other aspects of lighting which can have a bearing on SBS are inadequate lighting levels, glare, very uniform artificial lighting, dull decor and tinted glass windows. These features should be avoided where practicable. Further guidance can be found in Guidance Note HS(G)38 Lighting at Work, (file 225).

ADVICE TO EMPLOYERS

22 The following are the first steps which should be undertaken by occupiers in an investigation of a possible case of SBS:

(1) Carry out a work place employee survey to determine if the prevalence of symptoms is higher than expected or are the symptoms caused by a common virus etc. The survey can also identify other obvious causes which can easily be remedied such as changing the workplace temperature;

(2) check general building cleanliness, including checking that vacuum cleaners are effective, regularly emptied, and that filters are clean;

(3) check proprietary cleaning materials are being correctly used;

(4) check general operation of heating, ventilation and air-conditioning systems, including correct setting of dampers, particularly in the fresh air supply system;

(5) check condition and cleanliness of air filters, humidifiers, de-humidifiers and cooling towers; and

(6) check heating, ventilation and air-conditioning system maintenance schedules and compliance with these schedules,

23 On completion of these steps and after any remedial action has been taken, if symptoms persist, it will be necessary to carry out a more detailed investigation of the workplace environment, possibly requiring the services of a building services engineer or competent consultants. However, if it is felt the expertise for such a task exists in-house, then the investigation should include a comparison of the workplace environment with the recommendations made in ISO 7730 and the CIBSE guides.

24 SOURCES OF FURTHER GUIDANCE

(1) Guidance Note EH 22 - *Ventilation of the workplace*. (file 311)

(2) Specialist Inspector Report No 10 - *Sick building syndrome: A review* by J M Sykes. (file 311)

(3) Guidance Note HS(G)38 - *Lighting at work*. (file 225)

(4) Report for Sick Building Syndrome, a Practical Guide, published by the Commission of the European Community.

(5) ISO 7730 - Moderate Thermal Environments, Determination of the PMV and PPD Indicies, Specification for the Conditions of Thermal Comfort.

(HSE Bootle and Sheffield libraries)

(6) Guidance for Indoor Air Quality Investigations, published by the National Institute for Occupational Safety and Health, USA.

(7) CIBSE Guides Volumes A and B published by the Chartered Institute of Building Services Engineers, London. (HSE Bootle library)

(8) HSE Contract Research Report No 42/1992 - *Sick building syndrome: a review of the evidence on causes and solutions*, by G J Raw, Building Research Establishment. (file 311 and FCGs)

(9) OC 311/3 - *Sick Building Syndrome* - which is addressed to FAQ Inspectors, EMAs and ENAs, and provides an inspection policy.

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ASI headings

Air conditioning: health: humidity: offices: sick building syndrome: thermal environment: ventilation.