

# Ventilation

## — essential for our health

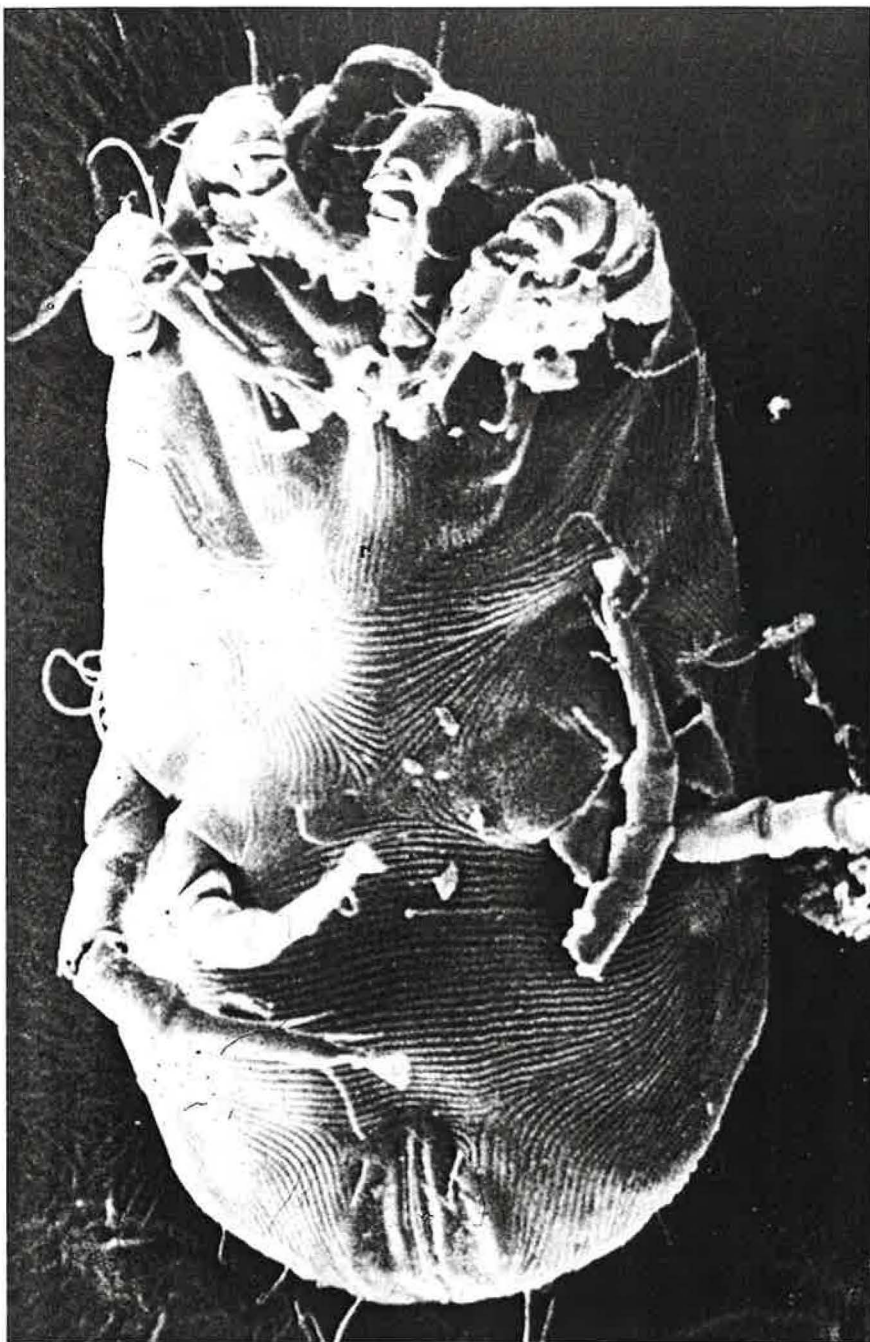
By Jan Sundell

**What is the relationship between ventilation and allergy? What is the significance of the increased incidence of house dust mites? And what part does ventilation play in relation to the Sick Building Syndrome? With the support of the Swedish Council for Building Research, Jan Sundell has presented a doctoral thesis in English on this subject.**

**O**ver the past few decades, we in Sweden have seen an alarming increase in allergic diseases. For instance, asthma among schoolchildren has increased from ca 2% in 1970 to ca 6% in 1990. This rise has been related to changes in the indoor climate. New construction materials, new materials in fittings and furnishings, and a reduction in ventilation air flow (in order to save energy), have been suspected as the causes.

The Sick Building Syndrome, SBS, is characterised by the fact that people who spend time in certain indoor climates such as dwellings, offices and schools more often than usual report discomfort and diffuse symptoms. Symptoms which are frequently reported are general symptoms such as headaches and fatigue, mucous membrane symptoms such as irritation of the nose, throat and eyes, and skin symptoms on the face and the upper body. Several of these symptoms have recently been clinically verified.

With regard to all the above complaints, there is a general lack of studies which demonstrate the importance of ventilation, and especially the rate of flow of fresh air. With regard to SBS, however, there are a large number of reports in which the increased incidence



**The house dust mite** is the most important allergen in relation to asthma and allergy of the airways. Today there is a worrying increase in the number of mites in dwellings in Sweden.

PHOTOGRAPH: SWEDISH VETERINARY MEDICINE SVA.

of symptoms is stated to bear a relationship to modern ventilation systems.

The principal aim of the thesis was to investigate whether, and if so to what extent, ventilation characteristics

and the concentration of airborne pollutants (TVOC and formaldehyde) indoors exhibit a covariation with the following:

— in the home, the occurrence of house dust mites and allergic com-

plaints in children

- in offices, the prevalence of SBS symptoms.

### Allergic children examined

The prevalence of house dust mites is a serious problem for allergic persons all over the world. For its survival and proliferation, HDM needs moist conditions. Cold winters with the associated dry indoor air have not favoured the spread of house dust mites. In Sweden and other regions with similar climatic conditions, sensitisation to HDM was therefore rare previously, but in recent years sensitisation to HDM has increased. This has occurred in e.g. the Stockholm region. There is also an increase in the number of HDM.

The first investigation in my thesis is a case control study of the influence of the housing environment on the development of allergy among children in the Stockholm region. The result from the study shows

- that children who are sensitised to HDM live in dwellings with elevated contents of HDM allergen in the mattress dust,

- that the prevalence of HDM allergen exhibits covariance with the humidity in the bedroom, with condensation on the inside pane of the window, as well as with ventilation in the dwelling as a whole and in the bedroom.

In single storey single family houses with natural ventilation considerably more household dust mites were found than in single family houses on more than one storey. Prevalence was least in blocks of flats. The differences are probably due to differences in ventilation in these different types of dwellings.

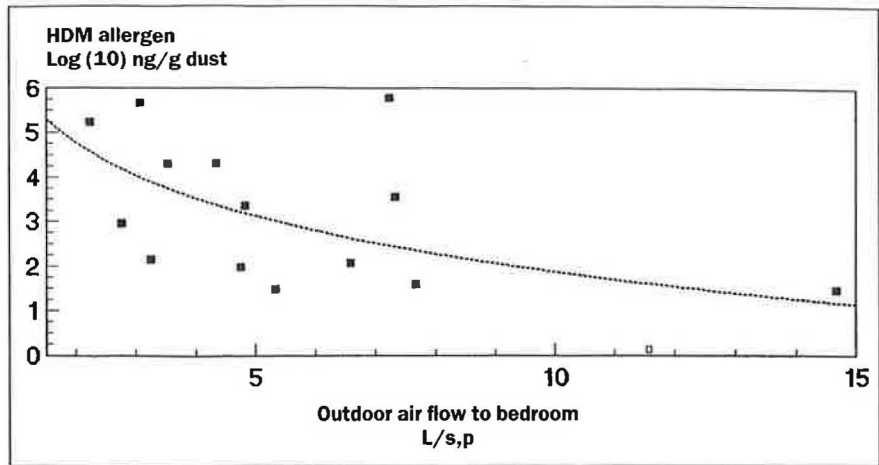
### Office workers in Västerbotten County

The other study is a multistage study of indoor environment and health among office workers in Västerbotten County in the north of Sweden.

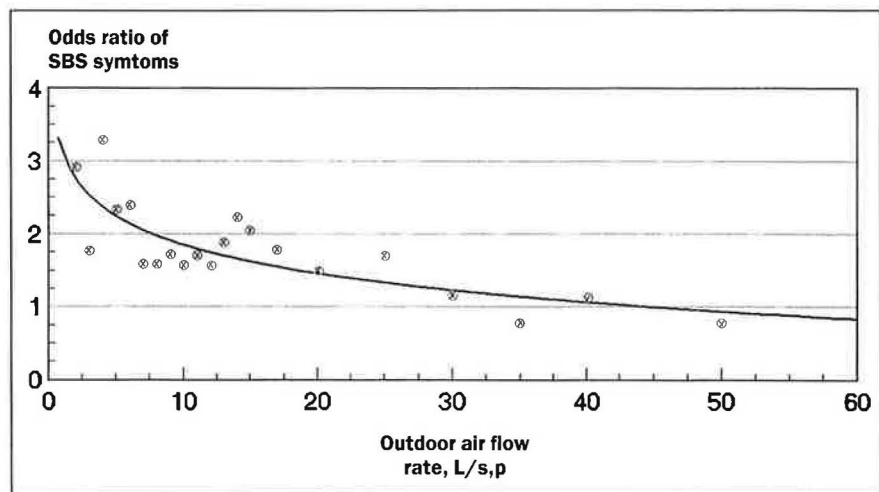
In stage one a questionnaire was sent to 5986 persons distributed over 210 office buildings. The response rate was almost 96%. The questionnaire contained questions concerning symptoms and complaints at work, psycho-social conditions, the characteristics of the work, the characteristics of the office room and the building, and the characteristics of the dwelling.

Stage two consisted of two case control studies, one of which related to SBS (n = 450 persons). The second study was concerned with skin complaints associated with work with VDUs.

For stage three, 14 high prevalence



**House dust mite allergen** in mattress dust as a function of ventilation in the dwelling. The higher the rate of ventilation, the fewer the HDM allergens.



**The relative risk of SBS symptoms** due to low ventilation rates. The lower the rate of ventilation, the higher is the risk of sick building symptoms.

buildings and 15 buildings with a low prevalence of SBS were selected. In these buildings extensive measurements were made of chemical (TVOC and formaldehyde) and microbiological airborne pollutants, as well as measurements of electrical and magnetic conditions. Measurements of chemical compounds were made in the outside air, supply air and room air.

### Low air flows, elevated incidence of SBS

Low air flows exhibit covariation with an elevated incidence of SBS. A dose-response relationship has been demonstrated. A short operating period for ventilation (less than 10 hours), a low cleaning frequency, copiers or humidifiers in the room, also exhibited covariation with an elevated incidence of SBS symptoms.

On the other hand, the type of ventilation system, rotary heat exchangers, use of return air, the type of floor material or other finishes, were not indica-

tors of an increased risk of symptoms.

The total content of volatile organic compounds (TVOC) had a negative correlation with the occurrence of symptoms, which indicates that TVOC is not a relevant chemical measure of air quality in a health perspective.

The sensation of "dry air" is common in office environments, and has a strong covariation with all symptoms. This sensation is not coupled with the physical humidity of the air, but exhibits covariation with technical characteristics and "lost" TVOC. It would seem that widespread complaints of dry air may be an important indicator of a sick building.

### Ventilation important for our health

To sum up, the results of these studies demonstrate that ventilation in buildings is a matter of essential importance from a public health standpoint. Seen in a historical context, this is substanti-



ally a repetition of the conclusions drawn from studies conducted between 1850 and 1885, for instance in Germany (Pettenkofer) and in Sweden (Heyman, Karolinska Institute). One difference is that at that time the great threat was tuberculosis, while today we regard allergies and other hypersensitivity reactions as a growing problem. ■

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**References:** In English: Sundell J. "On the association between building characteristics, some indoor environmental exposures, some allergic manifestations and subjective symptom reports". Indoor Air Supplement No 2/94.

## The Allergy Train shows how healthy buildings can be constructed

During tree busy weeks this autumn – 29 September to 25 October – a different train than the ordinary will be travelling around Sweden. This is the Allergy Train, one of the major efforts during Allergy Year 95, which is an information campaign to disseminate knowledge about asthma and allergy.

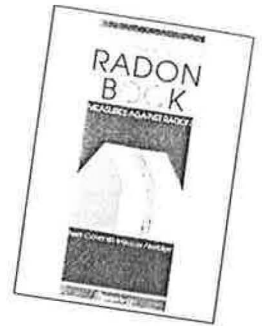
On its journey, the Allergy Train will stop in 23 towns and will invite the public, mass media, companies and authorities to receive information and to take part in activities to do with the subject of allergy.

The Swedish Council for Building Research, which has for a long time accorded priority to research on healthy buildings, will mount an exhibition on the Allergy Train, showing how buildings can be adapted to allergic persons and how moisture problems can be avoided.

In many of the towns through which the train passes the Council will arrange separate conferences addressed to building owners, developers, building managers and tenants in the area. ■

Information concerning the part taken by the Council in the Allergy Train can be obtained from Information Secretary Gabrielle Waldén, tel +46 8 617 73 00, fax +46 8 653 74 62.

# Remedies for radon in buildings



By Bertil Clavensjö and Gustav Åkerblom

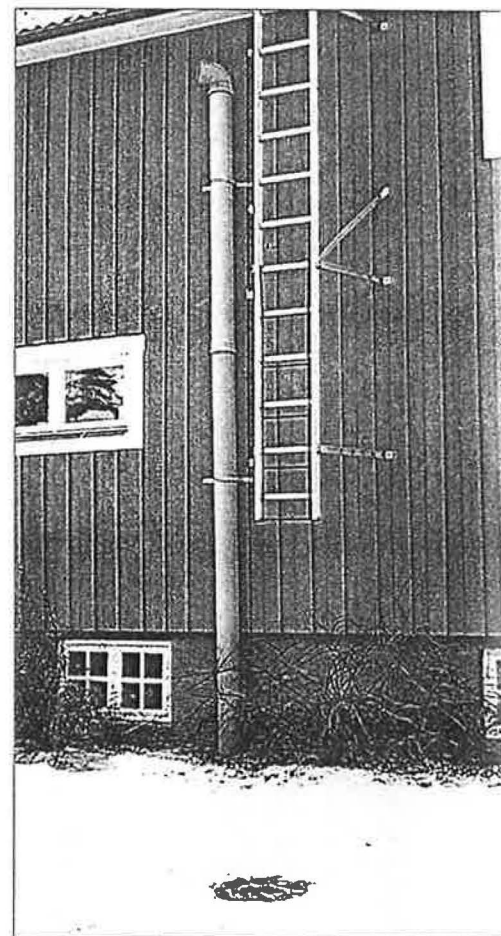
**Radon in indoor air is a serious health problem. Next to smoking, it is the greatest cause of lung cancer. High radon contents are especially dangerous in regions where heating is needed over a large part of the year. A new handbook in English gives you knowledge of remedial methods.**

**A**ll round the world, radon in indoor air is regarded as a serious health problem. In its report "Protection against radon-222 at home and work" (ICRP 65, 1993), the International Commission on Radiation Protection (ICRP) recommends that member countries should lay down threshold limits for radon in homes and workplaces and should encourage action against radon.

Within the EU, several research projects are in progress concerning radon and action against radon. Most of the member countries have recommended or compulsory limits for radon in homes and workplaces. In the US, the Environmental Protection Agency (EPA) has large programmes to reduce radon contents in homes and to prevent radon in new buildings.

### Sweden the first

Sweden was one of the first countries to note the health hazards due to radon in homes, and was the first country in the world to lay down compulsory limits for radon in dwellings in 1981. These are now 400 Becquerel per cubic metre (Bq/m<sup>3</sup>) for existing buildings and 200 Bq/m<sup>3</sup> for new buildings.



**The only visible part** of a radon well is the vent pipe outside.

Dwellings where the contents are over 400 Bq/m<sup>3</sup> are regarded as unsanitary dwellings.

The population of Sweden is 8.5 million. It is estimated that each year between 300 and 1500 Swedes, with 900 as the most probable number, die of lung cancer caused by radon in the home. In 11% of the 4.2 million dwellings in the country, the radon content is higher than 200 Bq/m<sup>3</sup>, and in 4% higher than 400 Bq/m<sup>3</sup>. Several thous-