

Most people in Britain spend over three-quarters of their time indoors and personal exposure to many air pollutants is thus determined more by concentrations indoors than outdoors. Whereas air pollution outdoors is routinely monitored from fixed sites, much less is known about the levels of air pollution indoors. This is because indoor air quality may vary a great deal from one building to another, depending upon the rate of emission from the structural components, internal fittings and heating devices, the rate of natural and artificial ventilation and, for many pollutants, the activities of the occupants. Relationships between the indoor environment and respiratory health have recently been reviewed with a view to revising building regulations and setting guidelines for indoor air quality (see footnote). This factsheet summarises the sources and possible health effects of indoor pollutants which are known or suspected causes of respiratory disease.

Figure 1: Indoor pollutants of concern

Known or suspected non-infective causes of respiratory disease which may be present in indoor air of homes, offices or schools

Irritants	Allergens	Carcinogens
Nitrogen dioxide	House dust mites	Radon
Sulphur dioxide	Pet dander	Asbestos
Particulates	Feather bedding	Tobacco smoke
Tobacco smoke	Mould spores	
Formaldehyde	Cockroaches	
Volatile organic compounds (VOCs)	Bird Droppings	



The components of indoor air of primary concern with respect to lung disease may be grouped as irritants, allergens or carcinogens (figure 1). This list excludes microbial pathogens, although some of these, such as *Legionella pneumophila*, may be related to building design. The main sources within the home are illustrated in figure 2. However, the presence of an emission source is not always a good predictor of indoor pollutant levels, which depend also on rate of removal by ventilation or absorption, and the pollutant concentration in outdoor air. For particulate matter such as allergens, the airborne concentration also depends on dispersal by activity patterns within the room.

Figure 2: Sources of indoor pollutants

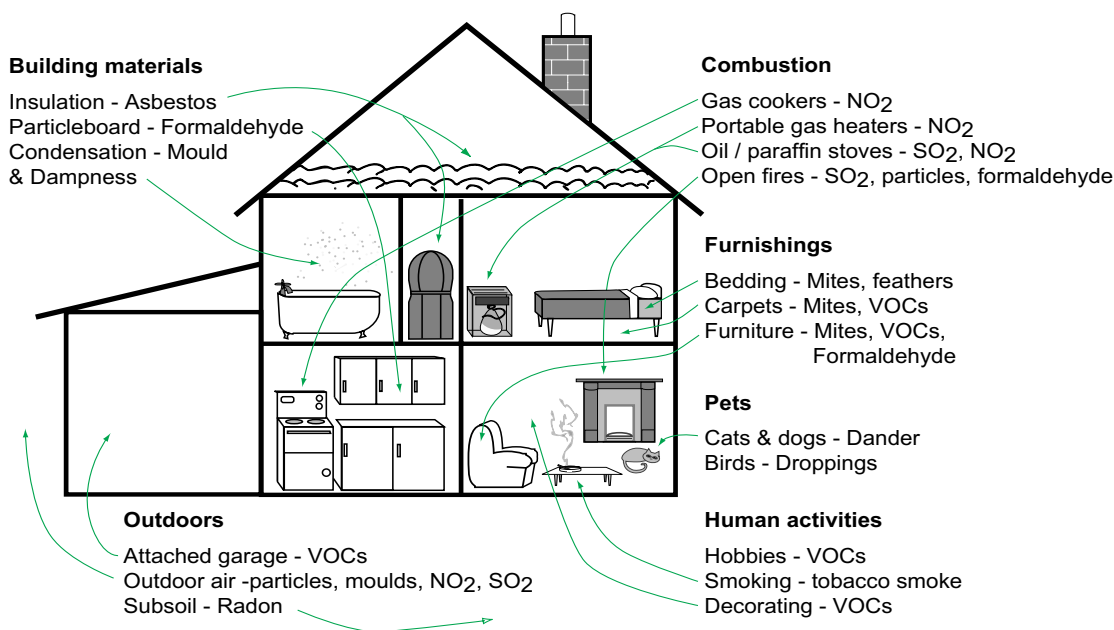


Figure 3 summarises the principal known or suspected respiratory effects of indoor air pollutants. The evidence linking specific pollutants to ill-health is often incomplete, and is rarely sufficient to quantify the effect of different levels of exposure on the occurrence of disease (dose-response relationship). For some contaminants, such as radon and asbestos, occupational exposures at high levels provide strong evidence of cancer risk, although uncertainty arises in extrapolating to the lower levels of exposure typically encountered in homes. For others, such as nitrogen dioxide, domestic exposure provides the clearest evidence of an association with disease, but at levels which are generally lower than those causing adverse effects in experimental exposure studies. A third group are those pollutants for which toxicological experiments or anecdotal case-reports suggest a health hazard but there is insufficient or inconsistent epidemiological evidence to confirm or exclude an effect of importance to public health.

Radon is the only pollutant for which specific indoor air quality standards have been set in the United Kingdom. Above an "action level" of 200 Bq/m³ for existing homes, home owners are urged to take measures to reduce radon concentrations. An estimated 100,000 of the 21 million homes nationwide are above this action level.

Figure 3: Health effects of indoor pollutants

Strength of evidence linking indoor air pollutants to respiratory disease

Pollutant	Health effect	Initiation	Exacerbation
Nitrogen dioxide	Acute chest illnesses	++	
	Asthma	+	+
Sulphur dioxide	Acute chest illnesses	+	
	Chronic bronchitis	+	++
	Asthma	+	++++
Particulates	Acute chest illnesses	+++	
	Chronic bronchitis	+	++
	Asthma	+	++
Tobacco smoke (environmental)	Sneezing & coughing	+++	
	Acute chest illnesses	++++	
	Asthma	++	+++
Formaldehyde/VOCs	Sneezing & coughing	+++	
House dust mite	Asthma & rhinitis	+	+++
Pet dander	Asthma & rhinitis	+	+++
Feather bedding	Asthma & rhinitis		+
Cockroaches	Asthma & rhinitis	+	+
Mould spores	Asthma & rhinitis	++	+
	Allergic alveolitis	+++	
Bird droppings	Allergic alveolitis	+++	
Radon	Lung cancer	++++	
Asbestos	Lung cancer	++++	
	Mesothelioma	++++	
Tobacco smoke (environmental)	Lung cancer	+++	

Key:

- + Inconsistent evidence, occasional reports, anecdotes or case-series
- ++ Consistent evidence of association, uncertainty about causality
- +++ Presumed causal relationship, uncertainty over dose-response
- ++++ Presumed causal relationship, some information on dose-response



Summary

- Many irritants, allergens and carcinogens may be present in indoor air.
- Pollutant concentrations are often higher indoors than outdoors, but the levels of exposure encountered in typical British homes are not routinely monitored.
- Respiratory health effects of many indoor pollutants are known or suspected, but the "dose-response" relationship between level of exposure and risk of disease is poorly understood, and the effects of reducing exposure cannot be predicted with certainty.
- Indoor air quality guidelines do not exist for most domestic pollutants, although action levels have been set for radon.

Footnote

The evidence summarised here is discussed at greater length in two recent publications:

Raw GJ, Hamilton RM. *Building regulation and health*. Watford, Building Research Establishment, 1995

Humfrey C, Shuker L, Harrison P. *Indoor air quality in the home*. Leicester, Institute for Environment & Health, 1996

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