



Commonwealth Department of
Health and
Ageing

HEALTHY HOMES

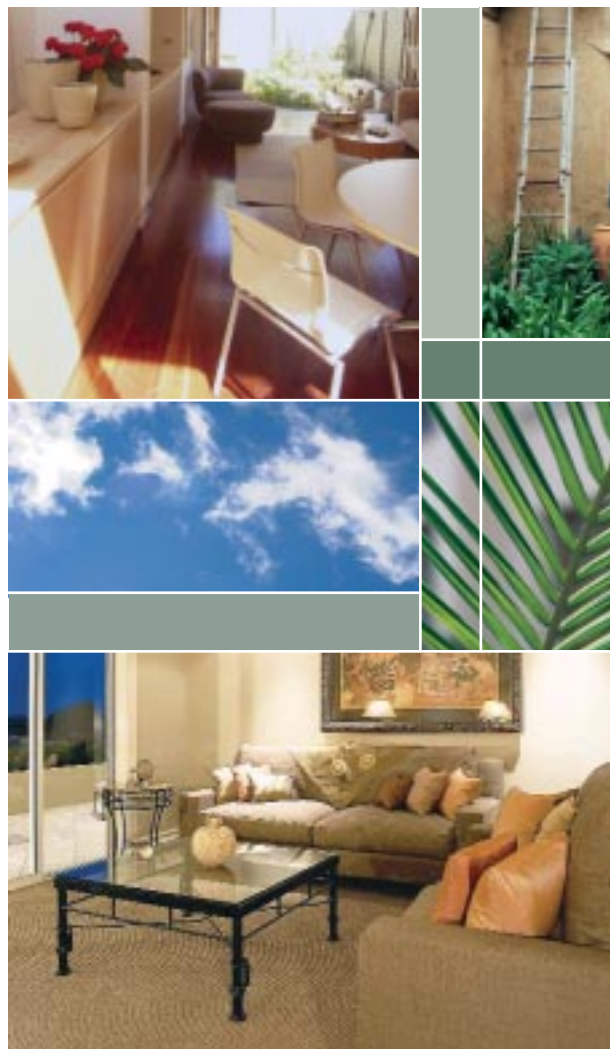
A guide to indoor air quality in the home for buyers, builders and renovators



enHEALTH



A guide to indoor air quality in the home for buyers, builders and renovators



eñHEALTH



Images from *Your Home* Consumer Guide / Technical Manual © Commonwealth of Australia are published by permission of the Australian Greenhouse Office. The *Your Home* Consumer Guide and Technical Manual are available on line at www.yourhome.gov.au. A free copy of the Consumer Guide is available by phone on 1300 130 606.

Images are numbered sequentially and attributed in the order: left to right, top to bottom on any page.

Cover and Title page	1. Yvonne Haber & Joanna Rich Architects 2. Nigel Noyes Photography	Page 19	1. Nigel Noyes Photography 2. Mirvac Lend Lease Village Consortium 3. Colin Bell Photographer
Page 1	1. Nigel Noyes Photography	Page 20	1. Luxury Home Design 2. Elsa Hutton Photographer / Inside Out Magazine 3. Sunpower Design P/L
Page 5	1. Austral 3. Yvonne Haber & Joanna Rich Architects 6. Ricardo Zen 8. Tri-Scan Pty Ltd	Page 23	1. Clare Design 3. Henley Properties 5. Insulation Solutions 6. Mirvac Lend Lease Village Consortium 7. Henley Properties 8. Yvonne Haber & Joanna Rich Architects
Page 7	1. Austral	Page 24	1. Environa Studio / SIMART Photography
Page 8	1. Taylor Oppenheim Architects Pty Ltd	Page 25	1. Paul Kahrau 2. Philip Follent Architects 3. Yvonne Haber & Joanna Rich Architects
Page 9	1. Mirvac Lend Lease Village Consortium 2. Philip Follent Architects 3. Austral 4. Philip Follent Architects	Page 26	1. Insulation Solutions
Page 11	1. Chris Barnett Architects / Paul Kahrau Photography 2. Insulation Solutions 5. Ricardo Zen 6. Alliance Clare Design / Richard Stringer Photography	Page 27	1. Colin Bell Photographer 2. Caroline Pidcock Architects
Page 12	1. Mirvac Lend Lease Village Consortium 2. Caroline Pidcock Architects	Page 30	1. Insulation Solutions 2. Environa Studio 3. Austral
Page 14	1. McKenzie Homes	Page 33	1. Mike Bowman
Page 18	1. Henley Properties	Page 41	1. QMBA / Your New Home

© Commonwealth of Australia 2002

ISBN: 0 642 82121 6

Publications Approval number: 3137

This work is copyright. Apart from any use as permitted under the Copyright Act 1968, no part may be reproduced by any process without prior written permission from the Commonwealth available from the Department of Communications, Information Technology and the Arts. Requests and inquiries concerning reproduction and rights should be addressed to the Manager, Copyright Services, Info Access, GPO Box 1920, Canberra ACT 2601.

Department of Health and Ageing

ACKNOWLEDGMENTS

The Commonwealth Department of Health and Ageing acknowledges the assistance of the Built Environment Research Unit, Building Division, Queensland Department of Public Works in creating this booklet.

The support of the Housing Industry Association and Master Builders Australia is gratefully acknowledged.

Concept/Editor: Chris Greenaway

Contributions: Michael Ball, Anne Bullen, Neil Davidson, Keith Eigeland

Editor: Jenny Cook, PenUltimate

The technical advice provided by the Editorial Committee is gratefully acknowledged. The Editorial Committee members were; Jan Bowman, Sophie Dwyer, Geoff Morgan and Steve Brown. Our thanks also to Anne-Louise Ponsonby for her contribution.

Photos courtesy of the Australian Greenhouse Office and The Carpet Institute of Australia Ltd.

CRITICAL REVIEW GROUP

Dr Keith Adam, a medical practitioner and Director of Health for Industry, a commercial practice which specialises in occupational health.

Ms Mary Baker, a graduate architect and trained nurse, specialising in hospital and health facility design.

Dr Steve Brown, a principal research scientist with CSIRO Manufacturing & Infrastructure, specialising in particulate and gaseous pollutants in indoor air and control of indoor pollutant sources.

Mr Dale Gilbert, Director of the Built Environment Research Unit and specialist in public policy development.

Dr Ray Mullins, immunology and allergy specialist, Canberra, representative of Australasian Society of Clinical Immunology and Allergy.

Dr Anne Neller, a lecturer with University of the Sunshine Coast, specialising in public and environmental health.

Dr Shannon Rutherford, a lecturer with Griffith University, specialising in airborne biological particles and public health.

Dr Melissa Stoneham, a lecturer with Queensland University of Technology, specialising in public health promotion.

Dr Mimi Lai-Kuan Tang, allergist, immunologist, representative of National Asthma Council Australia.

DISCLAIMER

The Commonwealth, the members of the enHealth Council, Master Builders Australia and Housing Industry Association make no representations or warranties, express or implied, in relation to the relevance, accuracy, completeness or fitness for purpose of this document in respect of any particular user's circumstances. Users of this document should satisfy themselves concerning the application of this publication to their situation and, where necessary, seek expert advice. The Commonwealth, the members of enHealth Council, Master Builders Australia and Housing Industry Association shall not be liable to any person or entity with respect to any liability, loss or damage caused or alleged to have been caused directly or indirectly by this publication.



HIA's GreenSmart initiative focuses on educating builders, designers, product manufacturers and consumers about the benefits of environmentally responsible housing.

HIAGreenSmart is an industry-driven response that aims to encourage a mainstream application of its principles to today's housing. As a voluntary initiative, GreenSmart provides appropriate market recognition for environmental endeavours in the residential construction industry. You can find out more about GreenSmart at www.greensmart.com.au

The Healthy Homes Guide provides the consumer with valuable information about indoor air quality and therefore complements GreenSmart's market-driven approach to advancing responsible building practices.



CONTENTS

What's it all about?	3
Clean air, or mean air?	5
How does indoor air quality affect your health?	6
What contributes to poor indoor air quality?.....	6
How can pollutants enter the human body?	8
How does the human body defend itself?	8
Size matters	8
... as does the amount (dose).....	9
Potentially hazardous air substances	11
Passive smoke	12
Lead	12
Asbestos.....	14
Combustion products	15
Volatile organic compounds	16
Pesticides	17
House dust mites	18
Pollen	18
Pets	19
Fungi and moulds.....	20
Cockroaches.....	20
Bacteria	21
Clear the air: questions for a healthy home	23
Planning.....	24
Design	25
In-use/maintenance	28
Renovation	30
Further information	33
Glossary	38
enHealth Council	41
Terms of reference	42
Publications	42





WHAT'S IT ALL ABOUT?

The old saying, 'an ounce of prevention is worth a pound of cure', neatly summarises what this booklet is about.

With ever increasing emphasis being placed on healthy lifestyles, many people are asking: how 'healthy' is the air we breathe? By world standards, Australia has relatively clean outdoor air. Nevertheless, many Australians list air quality as one of their highest environmental concerns.

So, as most of us spend more than 90 per cent of our lives indoors, it is worth thinking more closely about air quality, especially inside the home.

This booklet provides householders, home-buyers, builders and renovators with balanced information and health advice about air pollutants that may be found inside the home.

It discusses the likely sources of indoor air pollutants, and the health conditions that may be associated with these pollutants. It provides advice and actions that you can take to protect your health and the health of other people in your home. This booklet will also help householders make better-informed decisions about health and indoor air quality issues when discussing home maintenance or renovation activities with their architect, builder or building material suppliers.

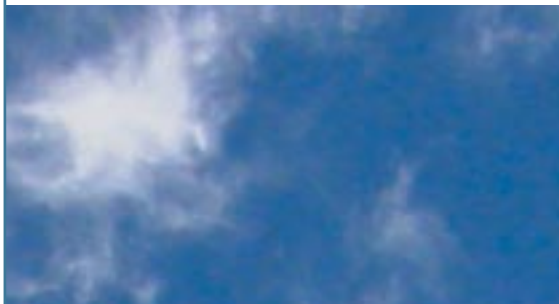
This booklet is divided into four sections:

- 1. Clean air, or mean air? — a description of sources of indoor air pollutants, how the human body may become exposed and how it deals with these pollutants;**
- 2. Potentially hazardous air substances — a description of some of the air pollutants that might be found in your home in a little more detail, and whether or not they have the potential to create health problems for you or your family; and practical advice on how to maintain a healthy indoor air environment;**
- 3. Clear the air: questions for a healthy home — a list of questions you could ask when planning, designing, using and/or renovating a home; and**
- 4. Further information — ideas on where to go for more advice or help on a particular issue.**

CLEAN AIR, OR MEAN AIR?



Is the air in your home affecting the health of you or your family?



Air is a mixture of gases and small particles and the air in your home can contain substances that may affect your health. These substances may be pollutants or allergens. Air pollutants may be gases or particles, and may come from man-made sources or occur naturally.



HOW DOES INDOOR AIR QUALITY AFFECT YOUR HEALTH?

Poor indoor air quality may cause a range of health effects from mild and generally non-specific symptoms such as headaches, tiredness or lethargy to more severe effects such as aggravation of asthma and allergic responses. Most of these conditions can also arise from a number of different causes other than the quality of the air in your home.

(A glossary of health terms is provided at the end of this booklet).

Consult your doctor if you are concerned about any of these health conditions.

WHAT CONTRIBUTES TO POOR INDOOR AIR QUALITY?

Whether a source of air pollutants causes an indoor air quality problem or not depends on:

- the type of air pollutant;
- the amount and rate at which it is released from its source; and
- the degree of ventilation available in the home to remove it from indoors.

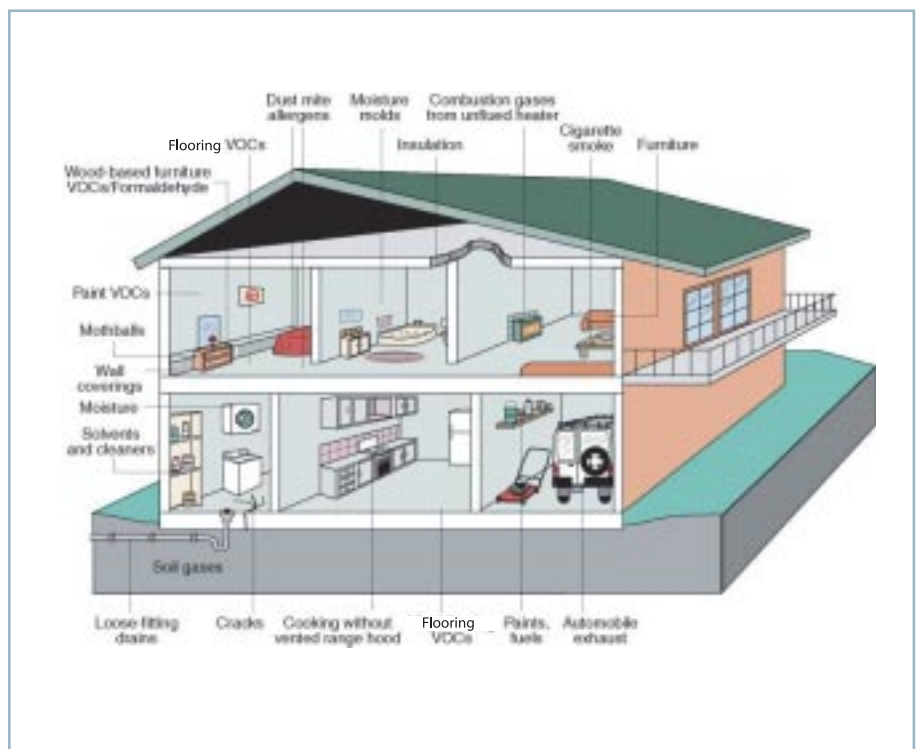
Sources of indoor air pollutants include:

- building operations and construction materials;
- household products;
- various human indoor activities; and
- external factors (from outdoors).

Figure 1 summarises typical indoor air pollutant sources.

Table 1 identifies some indoor air pollutants and their potential health effects.

Figure 1. Indoor air pollutant sources



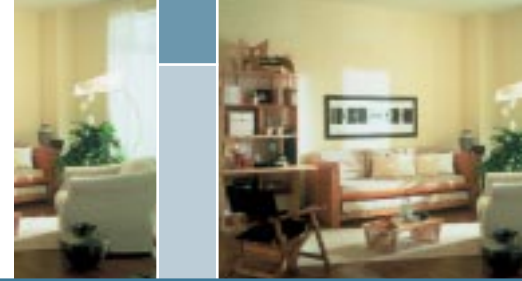
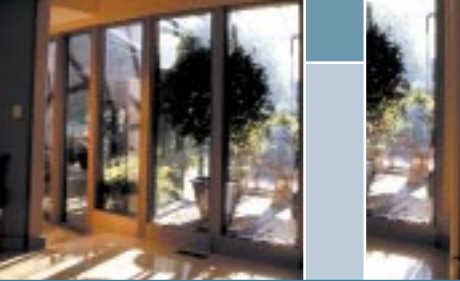


Table 1. Indoor air pollutants

POLLUTANT	MAJOR SOURCE(S)	HEALTH EFFECTS
Nitrogen dioxide	gas combustion	chronic respiratory disease
Carbon monoxide	kerosene, gas and solid fuel combustion, cars idling in enclosed garage, cigarette smoke	aggravation of cardiovascular disease, poor foetal development
Formaldehyde	pressed wood products, laminates consumer products (hobbies, crafts)	eye, nose, and throat irritation, reduced lung function, aggravation of asthma
Volatile Organic Compounds (VOCs)	new building products, cleaning products, office equipment, consumer products	eye, nose and throat irritation, headache, lethargy
Passive smoke	tobacco smoking	eye, nose and throat irritation, aggravation of asthma, chronic respiratory disease, lung cancer
House dust mite allergens	dust mites in bedding, carpets, furniture	aggravation of asthma, nasal inflammation, eczema
Mould spores	bathrooms, damp rooms, window sills, indoor plants, poorly ventilated areas	aggravation of asthma, nasal irritation and inflammation
Lead in indoor dust	Pre-1970s paint, hobbies and renovation	poor childhood intellectual development



HOW CAN POLLUTANTS ENTER THE HUMAN BODY?

In general, pollutants enter the human body through:

- *breathing* in polluted air (inhalation),
- *swallowing* harmful substances (ingestion), and
- absorbing pollutants *through the skin* (absorption).

A person is most commonly exposed to air pollutants when they breathe in an air pollutant or allergen. Exposure to an air pollutant by swallowing or through the skin may occur in some circumstances. For example, infants can get substances on their hands when they spend time on the floor, and may swallow the substances when they put their fingers in their mouths.

HOW DOES THE HUMAN BODY DEFEND ITSELF?

The body has a range of defences against airborne substances. Some defences keep substances out of the body; others overcome substances once they enter the body.

The skin is a very effective barrier. It stops most substances entering the body. However, some substances, such as solvents are capable of moving past this barrier.

The skin's protection is less effective if it is damaged or diseased.

The respiratory tract has built-in defences from the nose to the deepest part of the lungs. Larger particles in the air are likely to be caught in the nose and upper airways, becoming trapped in the mucus that lines them. Mucus in the upper airways is constantly pushed back up the airway to the throat by millions of special hair-like filaments called cilia. These cilia can be damaged by smoking.

Small particles penetrate deeper into the lung, down to the smaller airways and the tiny air sacs (alveoli). The alveoli are normally responsible for moving oxygen from the lungs into the blood stream. The particles are engulfed by specialised defensive cells called macrophages and removed from the lungs.

Some particles are made of proteins, for example, pollen or cat dander. When these particles are inhaled they may initiate an allergic response by the complex network of cells and organs that make up the immune system. The immune system fights 'foreign' proteins that cause disease, like viruses, bacteria and fungi. An allergic reaction is an overreaction by the immune system to foreign substances that, on their own, might not cause disease.

Everybody's immune system reacts differently to different substances. Not everyone is allergic and there are differences between individuals as to the substances they are allergic to. Allergies can also vary

within the same individual over their lifetime. A number of factors influence the effectiveness of the immune system, including: age, gender, genetics, state of health, and other factors in the environment.

Inhaled gases usually penetrate the respiratory tract barriers very quickly. Gases pass through the surface of the upper nasal passages, reaching the nerves responsible for smell, which then send a message to the brain. Gases can also enter the bloodstream through the lungs. Once in the blood-stream, the absorbed gases, along with any other pollutants present, are channelled through the liver where they are processed. Most substances are eventually expelled from the body.

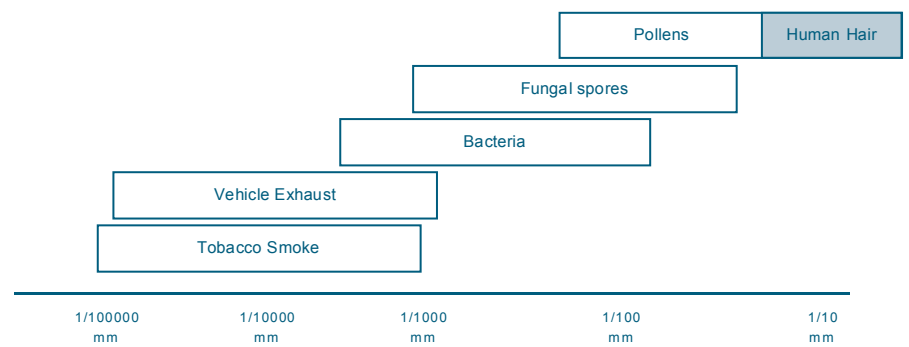
SIZE MATTERS ...

The body's respiratory tract and supporting systems operate in a way that either automatically screens out larger particles or actively engulfs and disposes of smaller particles. As a general rule, particles larger than one-hundredth (1/100th) of a millimetre rarely get past the nose. Particles between 1/100th and one-thousandth (1/1000th) of a millimetre become trapped in the mucus of the airways. Only the very smallest of particles are likely to reach the most important part of the lung – the alveoli. Figure 2 gives you an idea of how small these particles are.



In general, pollutants enter the human body through: breathing, swallowing and absorbing

Figure 2. Relative particle sizes in comparison to thickness of human hair



... AS DOES THE AMOUNT (DOSE)

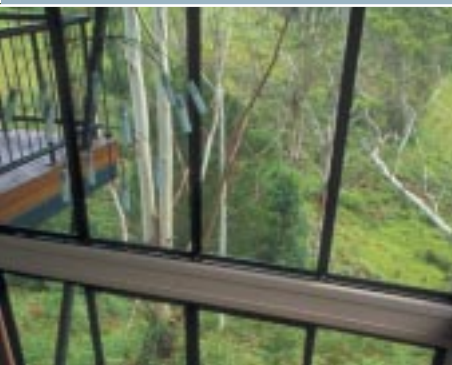
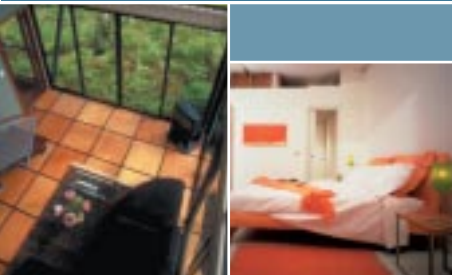
Generally, the greater the amount of pollutant (exposure), the greater the health response.

The duration of exposure is also important. If low-level exposure occurs over a long period of time (perhaps many years), the total dose may be large.

Some groups of people in the community are more vulnerable to pollutants than others. These include:

- the very young;
- the very old;
- those with pre-existing respiratory or cardiovascular disease; and
- those who are sensitised to a substance.

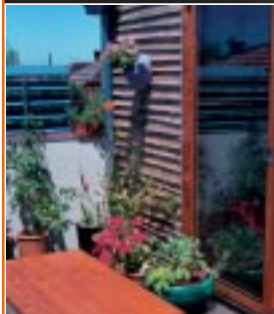
Some of these groups are also more likely to spend more time indoors than the general population.



POTENTIALLY HAZARDOUS AIR SUBSTANCES



There are many different types of airborne substances.



Exposure to most substances indoors is generally low and of little or no health consequence. This section summarises the more important types of pollutants and allergens that might be found in Australian homes.

For more detailed information on these, and other air pollutants and allergens, try some of the books and web sites listed at the end of this booklet.





PASSIVE SMOKE

Passive smoke is the mixture of gases and fine particles that comes from the ends of burning cigarettes and the smoke that smokers breathe out into the environment around them which may be inhaled by other people. Passive smoke is also called environmental tobacco smoke (ETS), second-hand smoke and tobacco smoke pollution.

Tobacco smoke is known to cause many serious adverse health effects. The health risks of smoking are not discussed here as they are well described in many other publications and generally widely known.

Those who are most affected by passive smoking include babies, young children and people with asthma. People with heart conditions may also have a higher risk of being affected than other people.

The exposure of children to passive smoking is of particular concern, as about 40 per cent of Australian children, aged four and under, live in households with smokers. Young children have under-developed and more fragile lungs than adults and are more affected by breathing tobacco smoke. When children breathe in passive smoke they are likely to have decreased lung function (weaker lungs), sore throat or eyes, coughing, wheezing and excess phlegm.

Exposure to passive smoke is a very strong risk factor for the development of asthma. It is also a potential risk factor for Sudden Infant Death Syndrome (SIDS) commonly known as cot death. Children exposed to environmental tobacco smoke in the home are also more likely to become smokers.

Research also suggests that tobacco smoke can multiply the harmful effects of other pollutants on the human body, for smokers and for non-smokers.

The only sure way to remove the risk completely is to stop smoking inside the home. There is no evidence that improving ventilation reduces the health risks.

LEAD

Lead is a naturally-occurring metal that is found in the environment, and has been widely used in, for example, batteries, flashing, fishing sinkers, and as an additive in paints and petrol. Many older building and household products contain lead but newer products no longer do. Items such as old paint, flashing, and old PVC (plastic pipes, fittings and wire) and glazed pottery can contain variable amounts of lead.

The use of lead in new domestic products in Australia is, for the most part, tightly regulated. Leaded petrol, for example, was removed from sale in 2002, and the use of lead in most current household paints is restricted.

Some work and hobbies use lead or lead-based products, including lead-lighting, making fishing sinkers or pottery glazing. People can unknowingly take lead residues into their homes on clothes, skin, hair and equipment.

Lead is a concern when small particles or fumes are swallowed or inhaled. People may come into contact with lead from home renovation activities, particularly when stripping old paint, through some hobbies or coming into contact with contaminated soil.

Young children are especially at risk because their developing bodies absorb lead much more readily than adults do. Crawling on the ground, and putting toys or fingers in their mouths increases the chance of swallowing contaminated dust, soil or paint chips. Lead may slow a child's mental and/or physical progress, and can cause behavioural problems when absorbed.

Household pets have also been poisoned by eating paint chips. Therefore, it is important to prevent exposure of all members of the family.

People renovating old homes should be especially careful when cleaning or removing paints (see also the section on 'Renovation'). Care needs to be taken to avoid sanding, abrasive blasting or burning paint containing lead to protect yourself and your family. Do not burn old painted wood in fireplaces or in barbecues.

Sources of lead poisoning can usually be traced, with the majority of recent cases being linked to either home renovation (removing old paint) or drinking water that has been contaminated by, for example, lead solder or old brass fittings.

You can ask your doctor to order a blood test to determine the amount of lead in your body. If you are concerned about your health or that of your family, in relation to lead, consult your doctor.

For general advice about managing lead risks in the home, contact your local or state health department.

Lead is a concern when small particles or fumes are swallowed or inhaled





ASBESTOS

Asbestos is a naturally occurring fibrous silicate mineral. It was used widely in the construction, car and textile industries because of its strength and ability to resist heat and acid.

The three main types of asbestos which may be commonly found in old products are:

- ‘white’ — used in asbestos blankets and asbestos-cement (AC) sheets,
- ‘brown’ — used for heat insulation (also AC sheets), and
- ‘blue’ — used for car battery cases, cement pipes and AC sheets prior to the mid-1960s.

Now that the health hazard of asbestos is well understood, it is no longer allowed to be used in building products for the home. The importation and use of all forms of asbestos will be prohibited from 31 December 2003.

Asbestos-containing products were rarely labelled. Products like cement sheet, roofing sheet, some textured paints, vinyl floor tiles, pipe lagging and fire-resistant boards and blankets bought for the home before the mid 1980s may contain some asbestos. Asbestos was phased out in many of these products after the mid 1980s.

Nearly all of the disease or deaths attributed to asbestos are linked to people who mined the mineral, made and/or installed products containing the mineral, or closely

worked with asbestos-containing products (like demolition workers, maintenance workers, and brake/clutch mechanics).

Generally, home building products which contain asbestos do not pose a risk to health. However, if the asbestos is disturbed during activity which produce fibres or dust from the asbestos product, (for example, home maintenance or renovation) asbestos fibres may be released into the air and inhaled.

Microscopic fibres become airborne when asbestos-containing products are sawn, drilled, sanded or ground. Some ageing asbestos-containing products can deteriorate to a state where they are likely to crumble when disturbed (friable), releasing asbestos fibres into the air when handled.

Living with asbestos-containing products does not automatically lead to ill-health. The risk to your health depends on:

- whether asbestos-containing products are damaged or breaking down and releasing fibres into the air;
- the size and type of the fibres;
- the length of the exposure;
- the concentration of the inhaled fibres; and
- an individual's susceptibility or if they have any pre-existing disease.

The potential for ill-effects from asbestos fibre exposure is greater in smokers than in non-smokers.

As the level of exposure which may cause health effects is not known, exposure to asbestos fibres or dust containing asbestos fibre exposure should always be kept to a minimum.

Always seek professional advice about managing asbestos in your home. Accurate identification can be difficult, and immediate removal is not necessarily the best option. Work practices for removal and/or disposal of asbestos-containing products are covered by regulations — check with your relevant state or territory authorities for specific guidelines.

Generally, home building products which contain asbestos do not pose a risk to health if left undisturbed.

COMBUSTION PRODUCTS

Combustion products include smoke (that is, small soot particles), ash and a variety of gases. Combustion products can get inside your home from fireplaces and heaters burning wood, coal, gas or kerosene, gas cooking appliances, tobacco smoking, outdoor air, exhaust from cars in garages, and hobbies, such as welding and soldering.

Particles produced by combustion are so small they behave almost like a gas — they can enter or leave a home very easily. When you breathe them in they travel into the deepest part of the lungs. Under certain circumstances these particles and gases may cause ill-health or, in extreme cases, even death.

The type, complexity and amount of gases given off by combustion varies greatly; much depends on fuel type, the efficiency of the burning process and the condition and age of the appliance. Commonly produced harmful gases include carbon monoxide (CO), nitrogen dioxide (NO₂) and sulfur dioxide (SO₂).

Carbon monoxide is a gas that, at high concentrations, is very poisonous to people. It is hard to detect because it has no colour, smell or taste. When carbon monoxide enters the bloodstream it reduces the blood's ability to carry oxygen, which reduces the amount of oxygen going to the brain, heart and other parts of the body.

Depending on how much you are exposed to, and for how long, symptoms may range from headaches to confusion, collapse or even death. At high levels of carbon monoxide exposure, death can occur within minutes.

Nitrogen dioxide and sulfur dioxide can irritate the eyes, nose, throat and lungs. Of the two, sulfur dioxide is more noticeable — even minor exposure can lead to irritation.

More complex combustion products known as polycyclic aromatic hydrocarbons (PAHs) may also be produced and can adhere to the surface of airborne particles. While a number of PAHs are either suspected or recognised as possible cancer-causing substances, more research is needed to understand their impact on health.

In many cities around Australia, wood heaters are a major source of outdoor air pollution during the wintertime. Wood heaters can also increase indoor air pollutants if not operated properly. Unflued or faulty gas heating and cooking appliances can also increase nitrogen dioxide and carbon monoxide exposure.

Charcoal heat beads are safe to use in outdoor barbeques, but not indoors. Never use treated or painted woods in any barbeque or indoor fireplace; painted wood can contain lead; treated woods, such as fence palings, can contain arsenic. When burnt, these substances may be released into the air or be present in the ash and pose a risk to health and/or to the environment.

Combustion products from different sources can add together and build up in poorly ventilated rooms to levels that could affect your health.

To maintain good air quality when you have combustion sources:

- vent products to the outdoors (via a flue, chimney, exhaust fan or rangehood) where possible;
- keep flues and chimneys clean, and make sure any permanent ventilation openings are not blocked;
- have heating or cooking appliances serviced regularly to ensure they are working properly and are not leaking gases into your home;
- make sure plenty of fresh outdoor air is coming into the room(s);
- make sure insulation has not obstructed a heater flue or ventilators in the wall or roof space.
- always follow the appliance manufacturer's instructions — seek advice from the manufacturer, supplier or your gasfitter/plumber if you have any concerns;
- make sure doors connecting garages to the house are tightly sealed;
- minimise running time for vehicle engines in garages;
- never use an appliance if it is damaged or not working properly;
- do not use a gas oven or gas cooker to heat a room; and
- do not use barbeques or camp stoves indoors.

VOLATILE ORGANIC COMPOUNDS

Volatile organic compounds (VOCs) are chemicals (containing carbon) that evaporate into the atmosphere at room temperature. They often have an odour and are present in a wide range of household products, construction materials and new furnishings. Some household products that contain VOCs include paints, varnishes, adhesives, synthetic fabrics, cleaning agents, scents and sprays. VOCs can also occur as a result of personal activities, such as smoking.

When used in building products or other indoor items, VOCs slowly make their way to the surface and escape, 'offgas', into the surrounding indoor air (a process similar to evaporation). Most offgassing tends to occur when the products are new and/or freshly installed. After this initial release, offgassing lessens dramatically over time.

Only a few specific VOCs have been studied in any detail and little is known about the health hazards when VOCs mix with each other and other pollutants. The level of VOCs in the home can vary greatly, not only over time but also from room to room, especially if new VOC-containing products are frequently introduced. In some cases VOC concentrations can build up to levels that are higher indoors than outdoors. Levels in poorly ventilated rooms increase with increasing temperature.

The health problems that may be attributed to VOC exposure are many and varied. Symptoms include nasal or airway irritation, headache, and in some cases, vomiting, and feelings of drowsiness. Not only do the symptoms vary from individual to individual, but a person's response can also change over time. Asthmatics and those with sensitive airways, for example, can experience effects from VOCs at lower concentrations than other people do.

Strategies to reduce VOC exposure in the home take two forms:

- consider not using, or reducing the use of, products that contain VOCs; and
- if the product is necessary, ensure adequate ventilation when using it — you should open doors and windows, whenever possible and practicable.

Air fresheners, cleaning sprays, polishes and spray deodorants and other spray toiletries are major sources of VOCs and should not be used excessively in non-ventilated areas. Building products are another source of VOCs. When selecting such products you should:

- look for building products that are pre-dried in the factory or are 'quick-drying';
- use surface coating products that are water based or classed as containing zero or low levels of VOCs;

- seek advice from the supplier or manufacturer, particularly if the information displayed on the container is not clear — you can ask for the product's Material Safety Data Sheet (MSDS).
- make sure the room is fully ventilated, when adding new furnishings or resurfacing walls and floors, until the odour reduces considerably or disappears.

Only use pesticides when absolutely necessary.

PESTICIDES

Pesticides are chemicals used to control plant and animal pests and may be used in and around the home. There are many types of pesticides including insecticides, herbicides, termiticides and fungicides. Some pesticides are very specific, targeting only one type of animal or plant species. Others are effective on a broad range of species.

Pesticides are safe to use indoors when the product is used according to the directions on the label. You are more likely to be exposed to harmful levels of pesticides and to experience health effects if you do not carefully follow the instructions on the label.

Only use pesticides when absolutely necessary. There are a number of effective ways to control pests in your home that do not require chemicals. For example, good hygiene will reduce the opportunity for pests to establish themselves in your home.

In Australia, most professional pest controllers are licensed by state authorities and are required to have training in safe pesticide use. When selecting a pest controller check to see if they are licensed and perhaps even speak with some of their other customers.



HOUSE DUST MITES

House dust mites are microscopic creatures closely related to ticks and spiders. Mites feed mainly on minute flakes of dead skin that people shed. They thrive in warm, moderately humid conditions found in your home.

Mite droppings and body parts crumble into tiny particles which can be easily inhaled. The proteins in these particles can induce an immune response in some people who are allergic to house dust mites and make asthma, hay fever, and eczema worse. Recent research suggests that exposure to mite allergens as a baby or young child may play a role in the initial onset of asthma.

Mite activity is highest in regularly used soft furnishings, such as mattresses, doonas, pillows, couches, chairs, cushions, carpets, curtains and drapes and in soft toys. These items, particularly bedding, potentially place people in close contact with the allergens for long periods of time.

To minimise house dust mite exposure, it is important to reduce exposure to the allergen by lowering the levels of mite allergens and discouraging mite growth.

Things you can do include:

- Wash sheets and pillowcases in hot water. Hot water washing (greater than 55°C) of bedding kills mites and removes droppings. Cooler water washes mite droppings away but is less

effective at killing mites. If you have a house dust mite allergic disease (such as asthma), you should wash bedding every week.

- Encase mattresses, pillows, doonas and blankets in covers that mites cannot pass through. Covers stop mite allergens scattering from bedding to the air, and reduce the amount of moisture getting into bedding, making them less likely to harbour dust mites. You should hot wash covers regularly.
- Dry cleaning kills mites but does not necessarily remove allergens. The dry cleaning chemicals can also leave VOC smells.
- Vacuum your carpets regularly. Ensure the vacuum cleaner is in good working order and has a fine filter system to minimise allergens escaping from the machine. eg HEPA cleaners (see page 28 *Is the floor properly cleaned?*)
- In new homes, consider installing a wall-mounted vacuum system which expels exhaust air outdoors.
- Wet-mop smooth floors rather than dry sweep, and dust furniture with a damp rather than dry cloth to reduce airborne dust levels.
- If you have an allergy to house dust mite allergens, consult your local allergy self-help group on how to set up a low-mite-allergen home.

POLLEN

At certain times of the year (typically Spring) most grasses and many trees and shrubs produce large numbers of light-weight pollen grains that can travel in the wind for many kilometres.

Such windborne pollens are so small (typically between 1/100th and 6/100th of a millimetre) that they can be inhaled and lodge in either the nose or upper parts of the lungs. When pollen comes into contact with moisture, such as that in mucous membranes in our airways, many pollen proteins pour out of the grain and into the mucus.

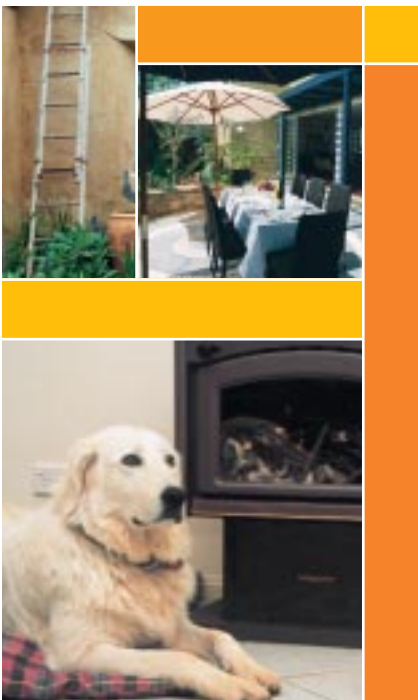
The range of health responses varies, from mild nasal inflammation, through to hay fever, asthma and dermatitis. It is also known that a person can be more affected by pollen allergens if other airborne pollutants are present.

As with many allergens, it is possible that exposure to pollen allergens during the first months of life can mean you are more likely to be affected and to suffer allergies as an adult. Also, some individuals may have a genetic predisposition toward pollen allergy.

For pollen-sensitive people, the best protection remains personal awareness of the seasons and conditions that trigger a reaction. If possible, identify the plants that cause a reaction and discuss this with your doctor, who may refer you to qualified medical staff for skin-prick tests. Remove the offending plants from indoors and stay away from those outdoors during the pollen season.

Keep a record of your health responses and see if a pattern emerges. For example, it has been shown that many severe asthma attacks are triggered by a combination of rainstorms and high pollen counts (the rain seems to 'burst' the pollens, the fragments of which can be inhaled deeply into the lungs).

Medication to alleviate the symptoms may be appropriate, but discuss this with your doctor.



PETS

The presence (or even former presence) of a pet can lead to ill-health for some people. A number of diseases can be passed from pets to humans; talk to your doctor or veterinarian if you would like to know more. What is more common, but still poorly understood, is that pets may cause allergic reactions in people.

Cat and dog saliva, oil from cats' skin, dander and 'droppings' are all known to carry allergens. The daily grooming habits of dogs and cats cause allergens to remain, even for a short time, on the surface of the fur. Over time, the dried oil or saliva either falls off or sticks to other surfaces, such as clothes, furnishings or bed covers.

Cat dander is especially sticky. It is often found in places where there is no cat, having been carried there on people's clothes. The fine particles to which the allergens are attached become part of the microscopic dusts around the home. If the dusts are disturbed they become airborne and may be inhaled.

For people who are allergic to animal proteins, such as cat dander, exposure to animal dander allergen will worsen allergic diseases, such as hayfever and asthma. However, studies have provided conflicting results on the possible link between family pets in early life and subsequent asthma.

For those with animal allergies, it is important to reduce exposure by:

- stopping pets from coming indoors (check local government by-laws about leaving cats and dogs outside);
- excluding pets from bedrooms and reducing opportunities for them to sleep on beds, sofas or carpets;
- washing pets regularly (even cats) to reduce the allergen load (it will not remove it completely); and
- washing hands after stroking or playing with pets to lower the risk of swallowing or inhaling allergens; or
- removing the pet altogether, by finding it a new home.

Removing pets from the family home can be a difficult decision, but one that takes into account both medical and social considerations.



FUNGI AND MOULDS

Fungi and moulds are an important part of the natural world, often forming complex relationships with other plants or animals. Most fungi are invisible to the human eye, being nothing more than just a collection of fine transparent filaments. Under favourable conditions however, many can grow rapidly producing sizeable and sometimes colourful growths. These growths contain spores — the next generation of fungi — that can become airborne and be inhaled.

Mould spores are present all year round, but levels are highest in Spring and Autumn. Indoors they like damp areas such as bathrooms, cellars, pot plants and poorly ventilated rooms and under stairs. Outdoors they will be in the garden, lawn, bark-chips, compost heaps and piles of leaves.

The presence of moulds in or around the home may cause health problems. Whilst we still don't have a full understanding of why some people are more affected than others we do know of three ways in which moulds make people ill:

- allergic reactions of varying strengths can be triggered when airborne mould spores are inhaled;
- toxic poisoning may occur if various mycotoxins (including VOCs), produced by a mould, become absorbed through the skin, the lungs or the intestine — reactions vary, but sometimes they affect the human nervous system; and
- some fungi can infect various parts of the human body, particularly the lungs and the skin — often such infections relate directly to an occupation, although anyone whose immune system is weak can be at risk.

Having a warm dry house with effective extraction fans is a good way to discourage mould growth. To reduce mould or other fungi growth in your home:

- reduce indoor relative humidity to below 50 per cent, if possible, by increasing ventilation and air circulation, extracting moist kitchen, bathroom and laundry air to the outdoors with exhaust fans, and venting clothes driers to the outdoors;
- make sure there are enough door- or window-openings in each room to allow moisture-rich air from evaporative coolers to flow through the house and not

condense in any one room — many modern coolers automatically drain after use which allows them to dry out and reduces mould and fungal growth inside the cooler;

- clean and disinfect the internal surfaces of evaporative coolers every year — for more information, ask the manufacturer, supplier or local health department; and
- do not use unflued gas and kerosene heaters as they release water vapour and other combustion products.

COCKROACHES

Cockroaches can be found in most homes, at least for short periods. The two types of cockroaches most commonly found in the home are the large 'American' and small 'German' species. Australia has its own native 'roaches, but they are most commonly found outside.

Cockroaches in your home can cause two health problems:

- cockroaches themselves can transfer bacteria onto food or food preparation surfaces; and
- cockroach particles can induce an allergic reaction in some people.

Controlling cockroaches is best achieved by good housekeeping and maintenance. You should:

- clean all food preparation surfaces regularly — don't leave any food lying around, including pet food and kitchen scraps; and keep all foods in sealed containers;

- make sure cupboards, fixtures and fittings are snug, leaving no gaps into external walls — this is especially important in kitchens and bathrooms;
- install fly screens on windows and doors to reduce the number of cockroaches that come in; and
- reduce access to water — cockroaches, like humans, don't stay long in places where they can't drink.

Many chemicals are registered for controlling cockroaches — they come as sprays, dusts and baits:

- sprays can be applied as spot or crack and crevice treatments;
- dusts can be applied with a puff duster into cracks and hiding places that are hard to reach with a spray; and
- baits (pastes, gels and particle) are generally of lower toxicity to humans than many dusts and sprays but often require precise placement, are usually more expensive, and are often not as effective in controlling heavy infestations.

When selecting and using chemicals, make sure they are registered for use on cockroaches and are mixed and applied according to the directions on the label. If you are unsure, ask your local health department for advice or ask a professional pest control company to treat your house.

BACTERIA

Bacteria are found almost everywhere. Many bacteria occur normally in the human body — some are even beneficial to our health.

In the home, bacteria are always present, but only rarely lead to health problems. Where problems do occur, they are likely to arise from one of the following sources (only one of which relates directly to indoor air quality):

- *food* — food poisoning usually occurs through a combination of poor hygiene, incorrect food preparation and inappropriate storage practices;
- *people* — physical contact with people who have, or are carrying, a bacteria-caused health condition;
- *pets* — physical contact with pets carrying a bacterium which can cause disease in humans;
- *water aerosols* — legionnaire disease is a rare form of pneumonia caused by Legionella bacteria which occur naturally in the environment in soil and water. If this environmental bacterium is allowed to multiply to high numbers in warm water with the right conditions, it can cause illness if breathed in small droplets (aerosols) by vulnerable people, such as the elderly, diabetics, people with weakened immune systems and smokers; and

- potting mixes — a different form of legionnaire disease may be caught from potting mixes. Always use potting mix outdoors; read the manufacturer's instructions; and use gloves and wear a dust mask to avoid breathing the fine potting mix dust — you can reduce the amount of dust by wetting the mix. Always clean up the surrounding surfaces and wash your hands after use.

Spa pools or hot tubs may be contaminated with Legionella bacteria, particularly if they are located outdoors or close to doors or windows. You need to properly disinfect and maintain spa pools or hot tubs that recirculate warm water to reduce the risk of legionnaire disease and skin infection. Spa baths that are drained after each use are less risky and need only be maintained in a clean condition after use. Your hot water system needs to have adequate temperature control for storage and should be used regularly.

CLEAR THE AIR: QUESTIONS FOR A HEALTHY HOME



**Seek the advice of an
appropriate professional.**



Asking health-oriented questions is a positive way to add to your store of knowledge about what air pollutants might be in your home. It also helps you to make a more informed decision about what to do next.





No one person will have all the answers. The advice of friends might be given with the best of intentions, but can you be sure it is correct? Where possible, especially on health and technical matters, seek the advice of an appropriate professional. They may charge a fee, but you should look on this as an investment in the future health of you and your family.

Before asking questions of other people, it will help if you first ask questions about your own health and that of your family. Before jumping to conclusions about whether or not your home is making you ill, look for clues and patterns, such as:

- Do you notice any change in your health before and after a particular change in the home environment?
- Is there any change in your health after particular activities, like dusting or cleaning?
- Do your health problems occur at the same time each year?
- Do your health problems get better if you and your family are away from home for any extended periods, such as holidays?

PLANNING

What was the home site previously used for?

The land on which you intend to build (or have built) may have been used for something very different to residential. Talk to long-standing residents in the area — they may recall something about the land's former use. Visit the planning section of your local government. Ask your solicitor about the various legal searches that can be done which might show how the land was used.

Is there contamination of the site?

Your inquiries may show that chemical residues from previous industrial or agricultural processes (such as petrol stations or cattle dips) may be present in the soil. In extreme cases, some residues can cause toxic gases to leak from the soil. Having the soil tested by an analytical laboratory will give some indication as to whether a hazard exists or not.

What about current and future industrial or agricultural development?

Think about how emissions from existing or future industries might affect you and your family. The closeness of, for example, a main road, bus depot, airport, orchard or industrial plant will probably influence the amount of airborne pollutants entering your home. Talk with your local government's Planning Department about likely future land use in your area.

Is the home site located on 'igneous' rock?

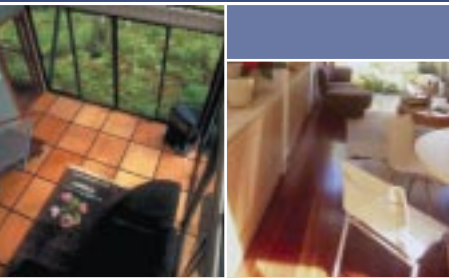
Radon is a radioactive gas which seeps out of some types of igneous rock, particularly granite, when radium, a naturally occurring radioactive element decays. It causes problems in some American and European homes because the gas may accumulate in poorly ventilated basements. In Australia, however, very few homes have been found to contain this hazard. Those of greatest potential risk may be some earth-sheltered houses (such as mudbrick, dugouts) depending on the radioactivity levels in the earth materials. Check with your local radiation health authority and your local government's chief building engineer. Also, Geoscience Australia may be able to provide details on local radioactivity levels www.ga.gov.au/minerals/radio.html

Does the home's location make best use of the local climate?

Local topography, proximity of trees, and nearness to water all have an influence on the air temperature and wind patterns around your home. A home located on top of an exposed hill will be affected very differently to the same home located in a deep valley, or on an urban block with houses nearby. The designer must consider the unique circumstances of your home's location and design it in a way that enhances natural ventilation and/or shelter.



Topography, trees, and nearness to water all influence the air temperature and wind patterns around your home.



If buying or moving to an established home, will major renovations be needed?

Upgrading and revitalising an established home is, in many ways, a positive and satisfying thing to do. Yet, the materials used within some old homes, as well as the activities associated with renovation, can increase the health risks for renovators and anyone else in the home during the work. Friable asbestos products, lead-based paint, pesticides, cockroach faeces and mould spores are all potential hazards. If the renovations must be done, consider the risks and how they might be managed through safe work practices and clean-up.

Will the main types of plants in the area to which you intend moving make your hay fever worse?

Ask a local plant specialist to explain what the main local vegetation types are within 1 kilometre of your new home. If your hay fever is brought on by, for example, flowering pasture grasses, or a particular species of eucalypt, then moving to the new home without investigating its surroundings might lead to future health problems.

DESIGN

How effectively does the home's design use natural ventilation?

Careful design and orientation of your home can create conditions that encourage external breezes and convection currents to draw stale air out and fresher air in. If you need windows to remain closed for security or noise reasons, consider installing fixed wall vents to ensure adequate ventilation. However, it is important to strike a balance between the need to introduce fresh air into your home and the need to maintain comfortable room temperatures and acceptable energy conservation. Ask the designer to explain how this will work in your home.

Does the home's design keep moisture to a minimum?

In brick homes, if a damp-proof course has not been fitted (or has since been broken) moisture may migrate from the ground into the building wall. In all homes, high and prolonged periods of humidity can lead to an increase in moisture within the building. Both situations may encourage mould growth. Talk to an architect or building designer about ways of lessening levels of moisture in your home.



Will building security compromise health outcomes?

Concern for personal and property safety leads many home occupants to close doors and windows. While reducing the chance of burglary, it also reduces air exchange. Consider what security products can be installed that allow you to feel secure, but also allow you to regulate the amount of air exchanged between indoors and out.

Is mechanical ventilation a good idea?

Few Australian homes use mechanical means to move air into and around the home. We mostly rely on windows and doors that can be opened (and in older homes fixed wall vents) to provide ventilation into homes. The ducted air systems we typically use may heat or cool recirculated indoor air, but don't introduce fresh air from outdoors or attempt to remove pollutants. Mechanical ventilation systems for homes are starting to appear on the Australian market — seek advice from a specialist mechanical engineer about what system meets your needs. Evaporative cooling systems increase indoor humidity and may increase levels of mould or dust mites within your home. Once installed, make sure the unit is regularly maintained according to the manufacturers' instructions.

Is your home adequately insulated?

The installation of adequate and appropriate insulation in your home will result in greater energy efficiency with significant savings in

fuel costs, will improve thermal comfort (cooler in summer, warmer in winter), and will help reduce noise between areas inside your home. Home insulation is now mandatory in most Australian states for all new homes and major renovations. The choice of insulation will depend on the level of noise control, energy efficiency and comfort required, and the cost. You should discuss the options available with a qualified builder. You should also insist on being provided with an MSDS (material safety data sheet) and other product specifications from the supplier of your preferred insulation material.

Does your home 'design out' termites?

Termites (or white ants) are a very important part of Australia's ecology. Unfortunately, our homes are often built close to theirs, and in ways that provide them with both food and shelter. In the past, environmentally persistent chemicals (organochlorines) were used to kill termites, but these have now been banned due to health and environmental concerns. They have been replaced with other chemicals (organophosphates) that pose less of an ecological hazard and have less potential for long-term health risks. Ask your designer or building inspector whether your home is designed to prevent termite entry — specially designed physical barriers, like mesh or crushed rock to reduce the need for extensive and repeated application of termite-killing chemicals.

Can the dust be easily removed from the rooms?

The visible and invisible dusts in your home are made up of many substances. While most of the dust will probably be benign, there may be a small proportion that, if inhaled or swallowed, could trigger a health response. As most dusts are best removed with a damp cloth, it makes sense to design and furnish your room(s) with easy to clean and washable surfaces and/or fabrics.

Carpeted floors?

Nearly all residential carpets are laid using gripper strip but underlay and any adhesives can be sources of VOCs.

Carpets come in a variety of weaves, pile heights and fibre types. Ask for assistance from a salesperson in relation to any individual sensitivities and family needs. eg. long pile can hold more dust. It is a good idea to ventilate the home well when carpets or other materials are introduced.

The process of removing old carpets can release trapped dust into the air.

What about tiled, vinyl (plastic) or polished floors?

Smooth floor surfaces, like ceramic tiles, vinyl or polished wood, can make it easier for you to clean. However, before specifying such products, think about whether there are likely to be any VOCs present, either in the product itself or in other products used to lay (like adhesives) and seal the floor covering (like varnishes and paints) and for maintenance products, such as cleaning fluids and polishes.

Is a wood-burning heater your best option?

Wood-burning heaters and stoves are a popular way of providing warmth. But, if poorly installed and/or badly maintained, they can be a major source of fine combustion particles and gases from leaks and from opening of the door for refuelling. If you really want to install a wood-burning heater or stove, first check that your local government allows you to do so. Compare the safety and efficiency claims of competing manufacturers. There are minimum Australian Standards that heaters and stoves must achieve. Make sure the flue or vent is properly designed and installed, and is regularly maintained and that only well-seasoned wood is burnt.

Are gas appliances vented to the outside?

Gas is a popular way of cooking, and space and water heating, with appliances coming in many shapes and sizes. Where you have a choice, *always* buy appliances that vent their combustion products to the outside (gas cookers should be vented to the outside by an exhaust fan or a range hood).

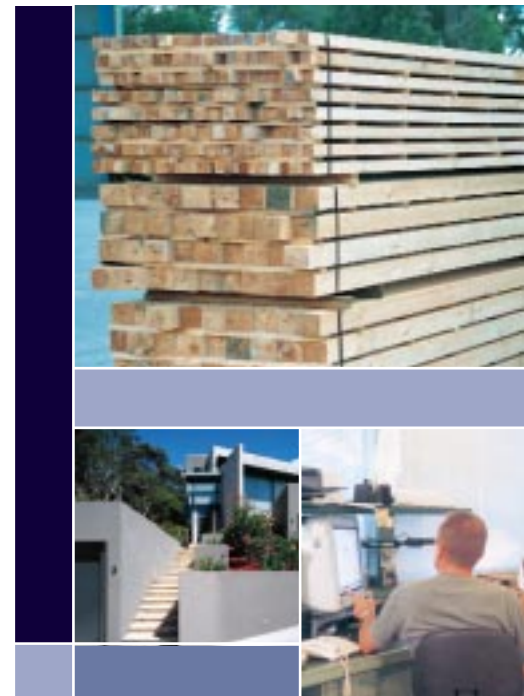
Unvented mobile gas heaters, although cheap and convenient to use, are considered by some researchers to pose a health risk and have been associated with more frequent respiratory symptoms. If use of unvented heaters is unavoidable, buy only low-NOx appliances, and don't

operate them in confined spaces for long periods of time. Also, make sure the heated area is permanently ventilated by installing fixed wall vents (compulsory in some States). Make sure the heaters are well maintained by regular servicing by a licensed gasfitter.

Older heaters (pre-1990) are more likely to produce higher NOx values than new heaters. Consider replacing your old model with a new, flued (vented) model. There are many rules and regulations covering the different appliances — your local gas supplier, gas appliance fitter or appliance vendor should be able to explain which rules apply to which appliances.

Is there a sealable door between the garage and the rest of your home?

The exhaust from conventional petrol and diesel engines contains many pollutants, including millions of very fine particles and a variety of toxic gases. Such engines should not be run in confined spaces (like a garage) for more than a few seconds, unless there is good ventilation. It is not wise to allow contaminated air from the garage to circulate through your home. If you have a choice, choose a garage that stands apart from your home. If the garage is attached to your home, make sure the linking door is well fitted and able to be securely sealed against leaks.



Doormats can reduce the amount of materials brought into your home

IN-USE/MAINTENANCE

Do the kitchen, laundry or bathroom windows remain damp for more than fifteen minutes after cooking or washing?

If your home's original design did not have good ventilation, or recent renovations have changed your home's configuration, there may not be enough 'air changes' to quickly remove cooking odours or moisture. Ideally, the kitchen, laundry and bathrooms should have exhaust fans to vent moist air to the outside. Ask your fan supplier about energy efficient models. In the absence of exhaust fans, and where it is safe to do so, open kitchen and/or bathroom windows to 'flush' the air after cooking, washing clothes and bathing.

When was the kitchen exhaust fan or range hood last cleaned?

While a well-sited kitchen exhaust fan and/or range hood that vents to the outside may remove many of the particles and gases that arise when cooking on gas stoves, fat droplets settle within the vent. These deposits build up over time and can become both a fire hazard and a home for fungi and bacteria. Kitchen exhaust fans and range hoods should be washed regularly.

Is the floor properly cleaned?

All floors have the capacity to accumulate fluff, dust and other matter such as grass seeds brought into the house on shoes. Dust carries microbiological materials such as bacteria and spores. Cleaning frequency will depend on the traffic and the type of use. Avoid cleaners that use fragranced products as they include VOCs.

Smooth flooring should be cleared of dust before wet mopping so that the water does not simply spread the dust. To avoid build up of dust trapped in the pile, clean carpets regularly. Invest in a modern vacuum cleaner with high filter efficiency (HEPA filters) and mechanical pile agitation ('turbo' or motorised vacuum heads). In most homes, carpets should be professionally cleaned every 18 months. Always seek professional advice about the best way to clean your carpet — cleaning methods will vary depending on the type of carpet, its 'backing' and any underlay present.

How well does your vacuum cleaner capture fine particles?

Most modern mobile vacuum cleaners are good at picking up and retaining visible dusts. However, many struggle to remove all the particles trapped in carpets, and nearly all machines let very fine particles pass through the filter/bag, back into the room's air.

If your health or that of your family seems to suffer after floors have been vacuumed, you may need to consider a central vacuum system which expels exhaust air outdoors. Alternatively, you should consider purchasing a specialised high filter efficiency (HEPA) vacuum cleaner, preferably with mechanical pile agitation (they cost more than conventional vacuums). If you are particularly sensitive to allergens, you should consider wearing a face mask during vacuuming and for a short period afterwards.

Are doormats located at all entrance points?

Doormats can reduce the amount of material brought into your home on the soles of footwear. This is relevant to indoor air quality as lead particles, from either vehicle exhausts or contaminated soil, can enter your home and become part of the dust load.

How good a fit is the 'fitted kitchen'?

Cockroaches actively seek tight spaces into which they can squeeze. So, if you provide food, water and a snug place to stay — like the little cracks and crevices common in poorly fitted kitchens — cockroaches couldn't be happier.

Think about better food hygiene (deny them anything to eat) and plugging all those tiny gaps between the kitchen unit, the wall and the floor. Ask your local hardware supplier about the types of non-toxic 'gap sealants' available.

The wood you intend to burn: has it been chemically treated?

When burning wood, either indoors or out, make sure it has not been chemically treated. Do not burn wood with varnish, paint or any other visible chemical treatment, like creosote. Avoid burning 'CCA-treated' wood (CCA refers to chromated copper arsenate preservative). CCA timber — it often has a green tinge, but there is no simple way to be sure. If in doubt, don't burn it. The best type of wood to burn in heaters and stoves is well-seasoned, clean wood.

Thinking of installing an electronic 'fly zapper'?

Be careful when deciding where to place an electronic 'fly zapper'. When flies strike some models their bodies explode, creating small particles of fly — along with any bacteria or viruses they may be carrying — which then float in the surrounding area. If you must have a 'fly zapper', place it some distance from food preparation and eating areas. Zappers are also indiscriminate — they attract and kill beneficial insects too. Consider installing flyscreens on doors and windows instead.

Thinking of buying an Ozone generator?

Ozone is a lung irritant and can increase the health risk from other airborne pollutants.

Thinking of buying new fixtures made of pressed wood products?

Before you buy, check to see if the new lounge suite, table, chair or cupboard is made, wholly or partly, from plywood, particleboard or medium-density fibreboard (MDF). Such products often use formaldehyde resins which can release (off-gas) formaldehyde gas for many years. While some Australian manufacturers try to produce 'low-emission' products, there is no guarantee that the amount of formaldehyde released will be low (some imported products may be more likely to have high emission levels).

Do the new soft furnishings have low gas emissions?

Many soft furnishings contain foams or other synthetic materials. These materials can release various unhealthy gases over time. Some manufacturers are working to reduce off-gassing from their products. Ask the supplier for details about the chemicals used in the product and for their advice on possible health effects. Especially ask about VOCs. Try to find products that meet low-emission labels if they're available (see also <www.aela.org.au> for relevant information).

Is that fragrant product such a good idea?

Most liquid cleaning agents, many personal hygiene products, air fresheners and perfumed toiletries contain VOCs of one sort or another. While some people show no ill-effects from inhaling the fragrances, there are those whose health rapidly deteriorates after smelling or coming into contact with one or more of these types of product, even for just a few seconds.

Are you looking after your compost heap properly?

Although compost heaps are an excellent way of recycling vegetable scraps and organic matter from the garden, they need regular maintenance, and should be located well away from living areas. Unless the heap is managed correctly, not only will it attract unwanted vermin, such as rats, mice and cockroaches, but it may also increase the numbers of fungal spores in the air close to your home. Most gardening books will provide good information on how to look after your compost heap or you can ask your local nursery.

Has the potting mix been stored in a cool place?

Sealed bags of soil potting mix have, on occasions, been known to contain high levels of the bacteria responsible for legionnaire disease (*see also Bacteria*). It is a good idea to store unopened bags in a cool, dark place. When opening a bag for the first time, do so in a well-ventilated area and avoid breathing the dust. Wearing a face mask may also help.



RENOVATION

Does the paint you intend to remove contain lead?

Lead paint is most likely to be found in homes built before 1970. Paints containing up to 50 per cent lead were commonly used on the inside and outside of houses built before 1950. Even up to the late 1960s paint with more than 1 per cent lead was still being used. Recent regulations have reduced the levels of lead in paint to 0.1 per cent.

Commercial home test kits are available from some hardware stores. For more reliable results, use the services of an analytical laboratory. If you do find lead in or around your home, phone your state or territory public health unit for advice (*see also Further information — Lead*).

What precautions are you or your painting contractor taking when sanding back existing paint?

Rubbing existing paint with an abrasive, such as sandpaper, creates a lot of fine particles. This is a potential health risk, both when the particles are in the air (where they can be inhaled) and when they settle on a surface (where children or pets may swallow them). The risk increases if the paint contains more than very small amounts of lead or other metals. Contractors know how to capture the dust before it travels any distance through or into your home and should take care in cleaning up residues. Without appropriate equipment, vacuuming of lead paint dust is not recommended.

What precautions are needed when removing or replacing existing insulation?

The ceiling spaces, walls and some floors of many Australian homes are insulated at the time of building or as part of home improvements. The materials used have mostly been glass wool and rock wool, but more recent insulation materials include cellulose fibre, sheep wool, polyester, reflective foil membranes and rigid foams. Whilst most of these materials have been shown to be stable and remain intact for the life of the home, some materials may be prone to deteriorate or break down over time. Before removing or replacing the existing insulation, where available, check the insulation packaging material for handling instructions as some insulation materials are more unstable than others and more prone to be dusty when disturbed.



Do you think your home is making you or your family ill? If, after reading this booklet and related web sites, you believe something in your home may be making either you or your family ill, your next step should be to discuss the matter with your doctor.

If you can identify the product, you could also ask for an MSDS (material safety data sheet) and other product specifications from the supplier of the material.

Regardless of the type of insulation originally installed in your home, all insulation products will gather dust from inside the house and be blown in by the wind. Using a reflective foil sarking under roof tiles should significantly reduce dust from entering the attic space and also provide incremental insulation benefits. Always take care when removing any insulation, and prevent skin, eye and respiratory discomfort by wearing loose comfortable clothing, gloves, and a disposable dust mask. If dusty, and whenever working overhead, also wear eye goggles. When removing insulation from the ceiling space, it is best to remove it from the roof rather than through the house. You should discuss the options available for removal and disposal of damaged or unwanted insulation with a qualified builder, or qualified professional insulation installer.

Does the second-hand oven or heater you are buying contain asbestos?

Until the 1980s asbestos was widely used for its heat-resisting properties. Ovens, heaters and other heat-related appliances often had parts made of asbestos. Some asbestos products become more dangerous if damaged with age because the material gets dislodged and particles float off into the air. Check aging appliances thoroughly — if in doubt seek professional advice or simply don't buy.



FURTHER INFORMATION

MULTI-TOPIC TEXTS

- Book *Indoor Air Quality: A Report on Health Impacts and Management Options* by the Commonwealth Department of Health and Aged Care, 2000. ISBN 0 6424 4667 9.
- Web above text available at http://www.health.gov.au/pubhlth/publicat/document/metadata/env_indoorair.htm
- Book *Indoor Air Quality* by S. Brown. A State of the Environment Technical Paper for Environment Australia, 1997. ISBN 0 6422 5279 3.
- Web above text available at <http://www.ea.gov.au/soe/techpapers/12indora.html>
- Info Indoor Air Quality Information Clearing House (IAQ INFO), Address: PO Box 37133, Washington, DC 20013-7133, Phone: (800) 438-4318 or (709) 356-4020, Fax: (703) 356-5386, Email: iaqinfo@aol.com
- Book *State of Knowledge Report: Air Toxics and Indoor Air Quality in Australia* by Environment Australia, 2001.
- Web above text available at <http://www.ea.gov.au/atmosphere/airtoxics/>
- Booklet *Indoor Air Pollution: An Introduction for Health Professionals* by the United States Environmental Protection Agency, 1994. US Gov# 1994-523-217/81322.
- Web above text available at <http://www.epa.gov/iaq/pubs/hpguide.html>
- Book *Indoor Air: A Health Perspective* by J. Samet and J. Spengler (Eds), John Hopkins University Press, Baltimore, 1991. ISBN 0 8018 4125 9.
- Book *Indoor Air Quality Handbook*, J. Spengler, J. McCarthy and J. Samet (Eds), McGraw-Hill, NY 2000, ISBN 0 0744 5549 4
- Book *Toxics A to Z: A Guide to Everyday Pollution Hazards* by J. Harte, C. Holdren, R. Schneider and C. Shirley. Elsevier Science Ltd., 1991. ISBN 0 5200 7224 3.
- Book *The Low Allergy Garden* by M Ragg, Hodder Headline Australia Pty Limited, NSW, 1996.
- Info Pamphlet on types of plants — The NSW Asthma Foundation, Unit 1, Garden Mews, 82-86 Pacific Highway, St Leonards NSW 2065 <http://www.asthmansw.org.au/>

ALLERGIES

- Web The Australasian Society of Clinical Immunology and Allergy (ASCIA) <http://www.allergy.org.au>
- Web Allergy Research Foundation (WA) <http://www.wn.com.au/arf/>
- Web The Allergy Report, Vols 1, 2 & 3 by The American Academy of Allergy, Asthma and Immunology, 2000. <http://www.theallergyreport.org/reportindex.html>

ANALYTICAL LABORATORIES

- Book For locally-based testers, check your *Yellow Pages* under LABORATORIES.
- Web Main page for National Association of Testing Authorities. <http://www.nata.asn.au/>

ASBESTOS

- Book *A Review of Occupational and Environmental Exposure to Asbestos Dust* by S. Brown. CSIRO DBR Report, 1981. ISBN 0643027890.

ASTHMA

- Web National Asthma Campaign, 2000. <http://www.nationalasthma.org.au/index.htm>
- Web Asthma Australia, 2000. <http://www.asthmaaustralia.org.au/>

CARPETS

- Booklet *Textile Floor Coverings – Cleaning maintenance of residential and commercial carpeting* (AS/NZS 3733:1995) by Standards Australia.

CHEMICAL DATABASES

- Web <http://dino.wiz.uni-kassel.de/dain/index.html>
- Web <http://chemfinder.cambridgesoft.com/>

ENVIRONMENTAL TOBACCO SMOKE

- Web <http://www.health.usyd.edu.au/tobacco/>
- Web <http://www.health.gov.au/nhmrc/advice/nhmrc/execsum.htm>
- Web <http://www.quit.org.au>

FUNGI

- Web *Guidelines on assessment and remediation of fungi in indoor environments* by the New York City Department of Health, 2000.
www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html

GASES OF COMBUSTION

- Web <http://www.lungusa.org/air/envcombusti.html>
Web <http://www.epa.gov/iaq/pubs/combust.html>
Web <http://www.epa.gov/iedweb00/asthma/triggers/combust.html>
Web <http://www.jlconline.com/jlc/archive/energy/vent/>

HEALTH IN CONTEXT

- Booklet *Australia's Health 2000* by the Australian Institute of Health and Welfare.
ISBN 1 7402 4054 5.
Web above text available at <http://www.aihw.gov.au/publications/health>

HEALTH — PSYCHOLOGY

- Book *Learned Optimism* by M. Seligman. Random House, Australia, 1992.
ISBN 0 0918 2568 7.

HEALTH — RISK ASSESSMENT

- Web *Environmental Health Risk Assessment* by Department of Health and Aged Care and enHealth, 2000. <http://enhealth.nphg.gov.au/council/pubs/pdf/envhazards.pdf>

HOME DESIGN

- Book *Australian Model Code of Residential Development (AMCORD)* by Commonwealth Government. AGPS, 1995. ISBN 0 6444 5276 5.
- Folder *BDP Environment Design Guide* by the Australian Council of Building Design Professions Ltd, regularly updated 1995 to 2000.
- Book *Building Materials, Energy and the Environment* by B. Lawson. Royal Australian Institute of Architects, 1996. ISBN 1 8631 8023 0.
- CD *Breath-Easy Home Design* CD \$15 from Asthma Foundation Victoria
<http://www.asthma.org.au/>
- Web *CSIRO Manufacturing & Infrastructure Technology* <http://www.cmit.csiro.au>
- Web *EA Your Home*
<http://www.greenhouse.gov.au/yourhome/home.htm>

LEAD

- Booklet *Lead Alert: the six step guide to painting your home* by Environment Australia, 1999. ISBN 0 6425 4627 4.
- Web above text available at <http://www.ea.gov.au/atmosphere/airquality/lead/pubs/leadpaint.pdf>

MATERIAL SAFETY DATA SHEETS

- Web <http://www.msds.com.au/>
- Web <http://physchem.ox.ac.uk/MSDS/>

OZONE

- Web *Ozone generators that are sold as air cleaners* by the United States Environmental Protection Agency, 1998. <http://www.epa.gov/iaq/pubs/ozonegen.html>

PARTICLES

Book *Particles in our air: concentrations and health effects* by R. Wilson and J. Spengler (Eds). Harvard University Press, 1996. ISBN 0 6742 4077 4.

PETS

Web Animals and Public Health, 2000.
<http://www.health.usyd.edu.au/achp/pets/index.html>

RADON

Web *Radon in Homes*. An information sheet from the Australian Radiation Protection and Nuclear Safety Agency. http://www.health.gov.au/arpansa/is_radon.htm

SAFETY

Book *Designing Out Crime: Crime Prevention Through Environmental Design* by S. Geason and P. Wilson. Australian Institute of Criminology, Canberra. 1989. ISBN 0 6421 4307 2.

STANDARDS

Web Main page for Standards Australia. <http://www.standards.com.au/>

WOOD HEATERS

Web *Breathe the benefits* by Environment Australia.
<http://www.ea.gov.au/atmosphere/airquality/woodsmoke/breath-the-benefits.htm>



GLOSSARY OF TERMS

Allergen: Almost any substance (for example, pollen, house dust mites and some food) which stimulates the immune system into producing antibodies.

Allergy(ies): A general term describing an immune system's excessive (hypersensitive) reaction to specific substances called 'allergens'.

Alveoli: Millions of microscopic thin-walled cells located at the end of the airways within the lungs where gases from the atmosphere are exchanged with gases carried by the blood stream.

Antibodies: Proteins produced by specialist cells in the body which are designed to bind to substances recognised as foreign agents (allergens).

Analytical laboratory: A laboratory, which contains specialist staff and equipment, devoted to analysing chemicals. Laboratories vary greatly in the scope of the work they undertake. Commercial labs work to special rules to ensure the quality of their work — they are accredited by the National Association of Testing Authorities (NATA).

Asthma: Asthma is a chronic inflammatory disorder of the airways in which many cells play a role. In susceptible individuals this inflammation causes symptoms which are usually associated with widespread but variable airflow obstruction that is often reversible either spontaneously or with treatment, and also causes an associated increase in airway responsiveness to a variety of stimuli.

Australian Standards: A large number of published documents which set out specifications and procedures designed to ensure that a material, product, method or service is fit for its purpose and consistently performs in the way it was intended (see Further information — Standards).

CCA: Chromated copper arsenate preservative used to treat some timber products – particularly those to be used outdoors. Treated timber often has a green hue.

Damp-proof course: (or dampcourse) A horizontal layer of impervious material laid in a wall to stop moisture rising into the wall.

Dander: Minute scales that fall from the hair, feather and skin of all warm blooded animals.

Eczema: An itchy inflammation of the upper layers of the skin, occurring on the face or body especially where the skin creases.

ETS: Environmental tobacco smoke

Faeces: Waste matter discharged from the intestines, excrement, droppings.

Flashing: A protective sheet of metal (often lead or copper) covering a joint or surface on a roof or wall that may be exposed to rain.

Formaldehyde: A component of many glues and resins, produced and used in the chemical and plastics industries and used in manufacture of pressed wood products such as particleboard or chipboard.

Fungi: A group of related organisms that are neither plant nor animal, for example mushrooms are a type of fungi, as are yeasts, moulds and mildews.

Genetic predisposition: The inherited information that determines physical characteristics of each individual that is encoded in the genes at conception (heredity).

Hazard: When doctors, building designers, engineers, chemists and researchers talk about 'hazard' they are referring to something that has a potential to cause harm. Fire, for example, is a hazard — everyone knows fire has the potential to cause harm.

HEPA: High efficiency particulate arresting is a term used in association with filters, being a reference to a specific type of filter capable of preventing 99.97 per cent of particles from passing through it.

Igneous: One of three broad terms (sedimentary, igneous and metamorphic) used to categorise rock types.

Lethargy: A perceived/subjective symptom — a feeling of fatigue, drowsiness or laziness.

Low-NOx: A shorthand technical term used to describe the output of a combustion process containing comparatively low levels of the gases nitric oxide (NO) and nitrogen dioxide (NO₂).

Lung cancer: A non-specific term for various conditions characterised by abnormal growth of cells in or around the lungs, leading to the formation of tumours.

Macrophages: Large, white blood cells, capable of ingesting and or destroying substances foreign to the human body. There are many different types of macrophage, each performing specific tasks, often in close association with particular tissues or organs.

MSDS: Material Safety Data Sheet. Australian manufacturers are required to provide specific details about the composition and use of their products. You are entitled to ask the product's retailer for a copy of the any product's MSDS.

Mycotoxins: A range of chemical compounds, variously produced by different fungi, which are toxic to humans.

Organochlorine: A large group of organic compounds containing chlorine which in the past were widely used as insecticides, such as DDT, lindane and chlordane.

Passive smoke: The mixture of gases and fine particles that comes from the ends of burning cigarettes and the smoke that smokers breathe out.

PVC: Polyvinyl chloride, a light, durable and widely used form of plastic.

Pollutant: That which pollutes, a polluting agent.

Radium: A naturally-occurring radioactive metallic element.

Radon: A naturally occurring radioactive gas produced from radioactive decay of radium.

Relative humidity: A ratio, usually expressed as a percentage, of the amount of water present in the air relative to the amount that would be present if the air were saturated. Since the latter depends on temperature, relative humidity is a function of both moisture content and temperature.

Risk: When doctors, building designers, engineers, chemists and researchers talk about 'risk' they mean the likelihood of harm occurring from exposure to a hazardous agent.

Solvent: A liquid capable of dissolving a substance and holding it in solution.

VOCs: Volatile organic compounds are chemicals (containing carbon) that evaporate into the atmosphere at room temperature.

enHealth Council

The enHealth Council, a subcommittee of the National Public Health Partnership, brings together top Environmental Health officials at the Federal and State/Territory level along with representation from the Australian Institute of Environmental Health, the environment and public health sectors, the Indigenous community and the wider community. The Council has responsibility for providing national leadership, implementation of the National Environmental Health Strategy, forging partnerships with key players, and the development and coordination of advice on environmental health matters at a national level. The advice development process is strongly based on collaboration and consultation.



MEMBERSHIP

Chair

Members

State and Territory Health Department representatives:

New South Wales	Director Environmental Health
Victoria	Manager Environmental Health
Queensland	Manager Environmental Health Unit
Western Australia	Acting Director Environmental Health Service
South Australia	Director Environmental Health
Tasmania	Senior Medical Officer Occupational Health
Northern Territory	Program Director Environmental Health
Australian Capital Territory	Manager Health Protection Service
New Zealand	New Zealand Health Ministry

Commonwealth Department of Health and Ageing Director, Environmental Health

Australian Institute of Environmental Health National President

Environment Australia

Public Health Association of Australia

Aboriginal and Torres Strait Islander Commission

Australian Consumers' Association

National Indigenous Environmental Health Forum Chair

Secretariat services are provided by the Environmental Health Section, Commonwealth Department of Health and Ageing.

TERMS OF REFERENCE

1. Provide national leadership on environmental health issues by:
 - i) coordinating and facilitating environmental health policies and programs
 - ii) establishing strategic partnerships between environmental health stakeholders
 - iii) setting priorities for national environmental health policies and programs
 - iv) providing an open consultative system for policy development
 - v) facilitating cost effective use of environmental health resources.
2. Drive the implementation of National Environmental Health Strategy.
3. Advise the Commonwealth, States and Territories, Local government and other stakeholders on national environmental health issues.
4. Coordinate the development of environmental health action plans at local, state and national levels.
5. Promote and develop model environmental health legislation, standards, codes of practice, guidelines and publications.
6. Strengthen the national capacity to meet current and emerging environmental health challenges.

7. Provide a pivotal link between international fora and environmental health stakeholders in Australia and strengthening Australia's collaboration with countries in the Asia-Pacific region.

PUBLICATIONS

(This list includes monographs produced by the National Environmental Health Forum which the enHealth Council has replaced).

Foundation documents

The National Environmental Health Strategy

The National Environmental Health Strategy Implementation Plan 2000

Human environment interface

Water series

1. Guidance for the control of Legionella (1996)
2. Guidance on water quality for heated spas (1996)
3. Guidance on the use of rainwater tanks (1998)

Soil series

1. Health-based soil investigation levels, 3rd edition (2001)
2. Exposure scenarios and exposure settings, 3rd edition (2001)
3. Composite sampling (1996)

Metal series

1. Aluminium, 2nd edition (1998)
2. Zinc (1997)
3. Copper (1997)

Air series

1. Ozone (1997)
2. Benzene (1997)
3. Nitrogen Dioxide (1997)
4. Sulfur dioxide (1999)

General series

1. Pesticide use in schools and school grounds (1997)
2. Paint film components (1998)
3. Guidelines for the control of public health pests – Lice, fleas, scabies, bird mites, bedbugs and ticks (1999)

Exposure series

1. Child activity patterns for environmental exposure assessment in the home (1999)

Counter disaster series

1. Floods: An environmental health practitioner's emergency management guide (1999)

Environmental health justice

Indigenous environmental health series

1. Indigenous Environmental Health No. 1 (1999)
2. Indigenous Environmental Health No. 2 (2000)
3. Indigenous Environmental Health No. 3 (2001)

Environmental health systems

1. National standard for licensing pest management technicians (1999)
2. Environmental Health Risk Perception in Australia (2000)
3. Health Impact Assessment Guidelines (2001)
4. Environmental Health Risk Assessment Guidelines For Assessing Human Health Risks From Environmental Hazards