

Healthy indoor air

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We spend most of our lives indoors, especially if we are very young, ill or elderly. Evidence is increasingly showing the link between indoor environment and health, and it is not just about cold living conditions, it is about the air we breathe and the fact that we are 1000 times more likely to breathe pollutants indoors.

Achieving a healthy indoor environment is a balance of temperature, moisture and ventilation. Addressing some simple principles will bring healthier living conditions inside your home.

Temperature

For a healthy home, your living areas should be above 18°C between 5pm and 11pm in winter and your bedrooms should be above 16°C between 11pm and 7am. New Zealand's homes are often below this. Recent New Zealand research on insulation and health has shown that internal air temperatures below 12°C can have a significantly detrimental impact on health.

And it's not just a matter of warmth. Cold air holds far less moisture than warm air. In cold temperatures the moisture naturally in the air settles on cold surfaces such as un-insulated walls, ceilings and windows as condensation. Condensation and cold are the perfect conditions for growing mould which thrives in humidity greater than 70% on cold surfaces with condensation potential.

Mould, with its tiny spores, is at the root of many respiratory illnesses and asthma as well as some forms of gastroenteritis. Fungi growth affects about 40% of New Zealand homes and can cause adverse health effects such as respiratory illnesses, asthma and allergies. Dust mites also thrive in humid environments, exacerbating asthma and allergies.

Keeping your home warm is very important. See Fact Sheets on heating your home and keeping heat in to find out more.

Moisture and dampness

Dry your house out and keep it dry

Eliminate unnecessary moisture sources such as unflued gas heating (see Fact sheet on Heating: Unflued gas heaters). Check for drainage problems, badly fitting windows, and plumbing and gutter leaks in and under your house – get them fixed. This may seem basic but it can make a big difference.

Up to 30kg of water can be released by damp soil under a house every day. This phenomenon, known as rising damp, is a major cause of mould growth in homes. Remove any soil in contact with the cladding and remove anything blocking under-floor vents.

You can minimise ground-sourced moisture by laying a sheet of polythene on damp ground beneath the house. This is sometimes called a moisture or vapour barrier. Available from most hardware stores, about \$120 will cover the cost of polythene and tape needed for a medium-sized house or flat. Here's how to do it:

- Fold the polythene out away from you to provide a smooth clean surface.
- Lap and tape joints.
- Tape around piles.
- Run a few centimetres up the edge of the walls.
- Weigh down with bricks or stones



Some people use a dehumidifier to remove moisture from the air, but we suggest that you eliminate moisture sources and improve ventilation in wet areas before considering a dehumidifier. If you do use a dehumidifier, ensure the water collected is emptied frequently and close your windows and doors when running it.

Tips for eliminating moisture sources

- Take care not to obstruct perimeter wall ventilation, which helps to shift moisture otherwise trapped beneath the house.
- Fix any leaks or stormwater drainage problems.
- Make sure your windows and doors are weather-tight.
- Cover pots when they're boiling on the stove.
- Dry clothes outside – not inside.
- Avoid over-watering indoor plants.

Ventilation

Good indoor environment quality requires, among other things, adequate ventilation. See www.smarterhomes.org.nz/design/ventilation/ for a discussion of the relationships between climate, temperature, insulation, thermal mass, moisture, humidity, and condensation. Provided these guidelines are followed, a well-designed house achieves adequate ventilation passively, i.e. without the need for mechanical assistance. Mechanical ventilation requires energy consumption and the maintenance and eventual replacement of filters and moving parts. A well-designed house shouldn't need active measures to reduce condensation -- the temperature and humidity should never reach the point where condensation will occur. Ventilation is important because it:

- lowers humidity and reduces mould.
- makes homes easier to heat.
- makes home healthier.
- reduces over-heating in warmer weather.
- dilutes pollutants (although it is always better to avoid them in the first place).
- provides fresh air.

Ventilate to remove moist air

Passive ventilation will also contribute to addressing condensation and dampness in your home. Window vents or louvres will help bring fresh air into your home. Equally, a solar powered ventilation system can be useful to control airflow through your home to maintain comfortable temperatures and get rid of moisture.

Control moisture at its source with mechanical ventilation. Install and use bathroom extractor fans and kitchen rangehoods when showering or cooking. Vent your clothes dryer outside the house. Make sure all extractor fans and rangehoods are vented to the outside and not vented into the roof space as that will allow moisture to accumulate and damage your internal roof structures.

You can also take action to ventilate your home. All houses need to be aired so open the windows regularly during the winter to remove stale air. Consider security stays so the house can be ventilated when you are not at home.

Tips for ventilation

- The laundry, bathroom and kitchen are all areas where substantial amounts of water are generated. Simple technologies exist to solve these issues: a showerdome or mechanical ventilation system in the bathroom, a rangehood in the kitchen, and adequate extraction for clothes dryers, if vented to the outside, are all effective solutions.
- Regularly air your home - open windows and doors to replace stale air with fresh.
- Installing strip-passive vents or security stays in windows allows air to enter the home without compromising security.
- Louvres are another great way to encourage air movement.
- If renovating or building a new home, include openable, high-level windows in the design to enable rising warm air to escape.

Control indoor pollutants at source

Building and home interior materials may contain solvents and chemicals that can release fumes for years after construction. Some of these chemicals have been linked to asthma and skin conditions. Others - if breathed or ingested - may have more harmful effects.

Indoor pollutants are 1000 times more likely to be inhaled than outdoor ones. Pollutants include volatile organic compounds (VOCs), respirable particulates, gases, fungi, bacteria and dustmites.

VOCs are commonly found in paints and varnishes, carpets and vinyl floors, fabrics, adhesives and cleaning products. They are highest after a home has been built or renovated. While many are in low concentrations, together they can form a potent cocktail of harmful compounds, causing nose and throat irritations, respiratory problems and also cardiovascular disease.

When renovating or building, look for products and materials that:

- Are pre-dried or quick drying.
- Are breathable.
- Use water as the solvent. Water-based products have lower solvent.
- Use natural, plant-based ingredients.
- Are classed as having zero or low VOCs.
- Are Environmental Choice certified. Such products have low levels of VOCs and hydrocarbon solvents; and no heavy metals, formaldehyde or harmful solvents.

Tips for reducing indoor pollutants

- Don't use paint as a sealant.
- Choose Environmental Choice certified products.
- Let new furniture and carpeting air in a well-ventilated and dry area outside the home before installing and using it. This is known as off-gassing
- Ventilate your home following renovations. Ideally you should renovate in summer to enable plenty of ventilation with outdoor air. Especially consider airing babies' rooms before your baby arrives.
- Maintain sure your living areas are always well-ventilated and ventilate kitchens, ensuite, laundry and bathrooms when these rooms are in use. Ventilate most when outdoor air temperature is between 16°C – 25°C.
- Avoid using cleaning products, such as floor polishes, that include VOCs.

Whole house mechanical ventilation systems

Whole house ventilation systems are increasingly being promoted as the solution to house performance problems such as dampness and cold. However, they're also a very expensive item to install and you will want to be certain they will make a difference.

There are two types of system: Positive pressure or roof cavity systems; and Balanced pressure or heat recovery systems

Positive pressure or roof cavity ventilation systems are the most common type available in New Zealand. They bring filtered air from the roof space into the house through a single, or multiple, ceiling vents. This forces the stale air to leak out through gaps, windows and doors. The performance of these systems depends on the sizing of the fans, the distribution of the ceiling vents throughout the house and how airtight your home is.

Most existing New Zealand homes are draughty rather than airtight, making these systems less effective. Research also shows that the air in a roof space can hold more moisture and be colder than the air inside a home. In addition, your roof space may be polluted by dust, mould and vermin so the quality of the air entering the house depends on the filter type and whether you regularly change or clean filters. The Energy Efficiency and Conservation Authority (EECA) recommends that the home ventilation systems source their 'fresh' air from the outside, not from the roof space.

Balanced pressure or heat recovery ventilation systems pre-warm the incoming air from the heat or energy in the outgoing air using an air-to-air heat exchanger (usually in the roof space).

These systems are most effective in very airtight, new, well-heated homes in very cold parts of the country. Most existing homes are not airtight enough, even if they have full wall insulation and window replacement.

In the homes Beacon has looked at, condensation problems were caused by:

- Lack of insulation
- Not enough heating
- Uncontrolled moisture sources (leaks, ground water, unvented wet areas)

If you are thinking of installing a ventilation system:

1. Address your insulation, heating and moisture removal first.

The actions recommended above (getting rid of moisture sources by extractor fans, vapour barriers under the house, drying clothes outside and making sure dryers are vented to the outside, getting rid of unflued gas heaters, insulating, and regularly airing your house) are cost effective and proven methods for reducing moisture in all houses. These actions should be undertaken before considering a whole house mechanical ventilation system.

2. **Get your house tested for draughts** (often called a blower door test) and only consider one of these systems if your house is quite airtight.

Typical features for healthy homes

- Rangehood in kitchen vented outdoors
- Bathroom fan vented outdoors
- Solar powered, roof-mounted ventilation systems
- Opening windows, with top windows able to be left open
- Passive vents such as window inserts
- Underfloor vapour barrier
- Clothesline outside
- Low toxicity materials e.g. Environmental Choice certified paints
- Good drainage and management of runoff so it keeps away from the house

For more information:

- See Fact sheets on
 - Introduction to heating your home
 - Keeping heat in: Overview
 - Keeping heat in: Insulation
 - Improving your cold damp house
- Visit the Environmental Choice website at <http://www.enviro-choice.org.nz>
- Read more about Beacon's research into ventilation systems at http://www.beaconpathway.co.nz/further-research/article/testing_ventilation_systems
- EECA have recently produced a research report on roof space ventilation systems, which you can read at <http://www.eeca.govt.nz/sites/all/files/home-ventilation-systems-09.pdf>