

We already know what acceptable, healthy indoor conditions are. Decades of research has shown a defined range of indoor conditions reduce the risk of adverse health impacts. No matter what house you live in you can improve your health if you live within this range of healthy indoor air quality.

This guide explains what a healthy home is, why we're trying to achieve it, and what any New Zealander can do to their own house to improve their health. These measures may improve the health of the occupant and may also cost more to operate, the degree of either depends on the unique circumstances.

Measure

Ventilation



Ventilation is vital for keeping you and your home healthy. Ventilation brings fresh air into the home and expels stale air, preventing a build-up of dangerous pollutants.

There is a difference between natural and mechanical ventilation – natural ventilation relies on infiltration (draughts) or opening windows or doors. This can provide a good source of fresh air if the weather is favourable. In Auckland our weather is suitable for natural ventilation 8% of the year.

Mechanical ventilation allows you to manage the flow of fresh air coming into your home and stale air going out. Unlike natural ventilation, incoming air can be tempered or treated to be comfortable. Mechanical ventilation can combine with airtightness for the best performing homes.

Mechanical ventilation should supply fresh air and not contaminated air from the roof space.

Internal moisture



Warmer air can hold more moisture so heating and ventilation is also an effective way to reduce the relative humidity in a house. Warm air absorbs moisture and ventilation exhausts it, so ventilation with heat recovery will keep the relative humidity in the healthy range (40%–60%).

Too much or too little moisture impacts our body's ability to fight infections. Relative humidity is a measure of moisture in the air.

When relative humidity falls outside the optimum range of 40% – 60% viruses, mould, dust mites, and other allergens thrive.

Temperature



The healthy range for indoor temperature is 18–25°C.

Periods spent outside this range can have measurable effects on the health of occupants. Cold temperatures can reduce the body's immune response making us more susceptible to illness.

Cold temperatures also raise relative humidity, a dangerous combination for those with respiratory disease such as asthma, bronchiectasis and COPD.

Carbon Dioxide



We breathe to get oxygen in and carbon dioxide out. Too much carbon dioxide in our blood can impact our body's ability to function. High levels of CO₂ (>2000ppm) can cause symptoms such as headaches, restlessness and tiredness.

A poorly ventilated room, closed up to keep the heat in, can cause high levels of indoor contaminants such as CO₂ which becomes detrimental to the health of those in it. Your home must have the ability to ventilate with clean, fresh, uncontaminated air while ideally keeping the heat in.

Insulation



Insulation slows the flow of heat, either in or out by trapping small pockets of air inside. A whole-house approach for insulation is needed. A lack of insulation in ceiling and floors results in heat loss, but walls and windows make up most of the heat loss from a home.

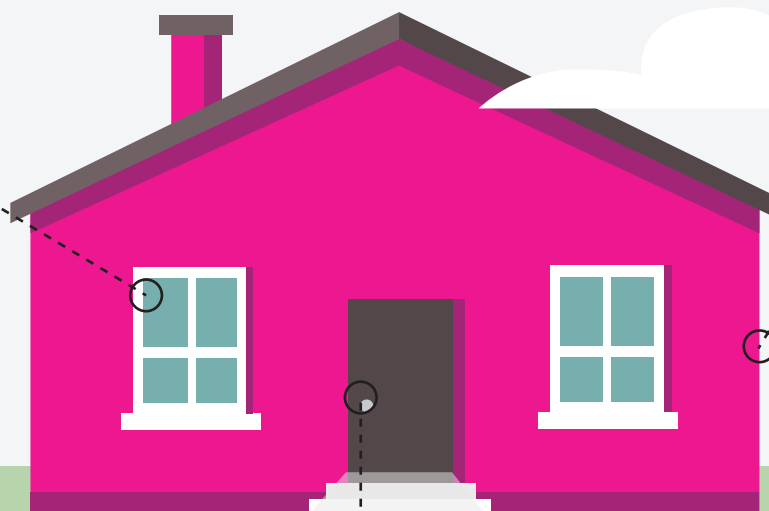
Insulation slows heat loss but doesn't stop it, so heating is still required.

Heating & Cooling



The house should ideally be designed to stay healthy and comfortable with minimal input, but even passive houses need small amounts of heating or cooling. Since insulation only slows the flow of heat, heating or cooling systems are there to kick in at the hottest and coldest time of the year.

Adding heating can also solve moisture issues by raising surface temperatures. While it may be inefficient, if nothing else you can add heat all winter long to keep the building dry.



Airtightness



Air flowing in and out of the home takes heat with it. When the wind blows, it forces cold air into the house, replacing the warm air. These draughts are uncomfortable and make it difficult or impossible to maintain healthy temperatures in the home. Improving airtightness keeps the heat from escaping, which makes ventilation very important to keep the air fresh and dry.

Gaps under or around doors and windows or open chimneys are the most common places for heat to escape.

Airtightness testing allows you to find and stop this heat from escaping.



WHAT ARE THE OUTCOMES OF NOT MEETING THOSE METRICS?



Condensation

Water forming on the insides of windows, walls and ceilings can decay surfaces and support organic growth. Condensation occurs when humid air reaches a cold surface. You can prevent condensation by decreasing the humidity and increasing the surface temperatures. Turning up the heat, or leaving the heat on at least 16°C with a thermostat will reduce the potential for condensation.



Allergens

In their most common form found in housing, airborne allergens are a leading cause of respiratory-related health impacts. These can be by-products of dust mite populations growing in the house, or concentrations of outdoor allergens let in through open windows or draughts. Allergen concentrations inside can be controlled using effective mechanical ventilation and filtration.



Particulate matter

Particulate matter is the leading cause of respiratory illness worldwide. Particulate matter comes in various forms such as pollutants, by-products of cooking, smoking, pollen and similar. These microscopic particles irritate the lungs triggering an inflammatory response.



Volatile organic compounds

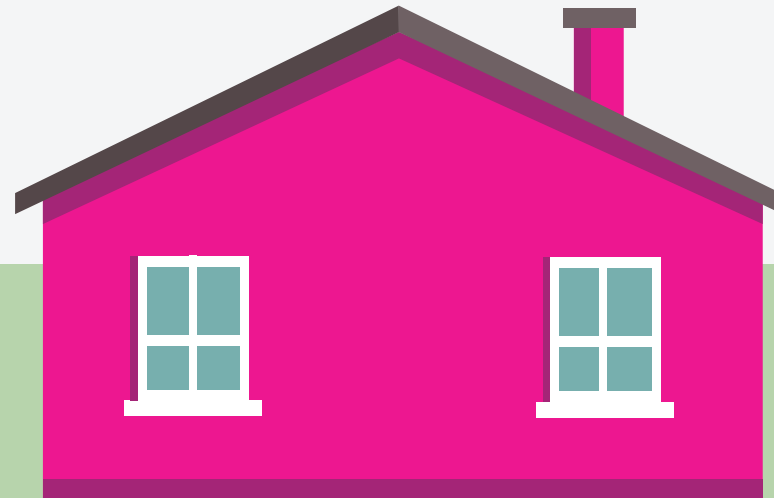
Many materials give off gases across their lives. In low doses, these are harmless, but higher concentrations can be detrimental to health. Because VOC's are mostly unavoidable, removing them is the most effective way to avoid the build-up inside houses. And the best way to remove them is with continuous mechanical ventilation.



Mould Growth

Mould needs three things to grow: Moisture, good temperature and a food source. Moisture in homes is most commonly provided by condensation on cold surfaces. That condensation forms when the surfaces inside are allowed to cool down, and the mould grows when the inside is warmed up while people are there. Food sources for mould are anything organic, ranging from plasterboard to timber, or even surface dust on materials that are otherwise not organic (like window frames).

Mould can also occur inside the walls of your home, so if you see mould, it's likely there is also mould that you can't see. Especially if you have to clean mould from the same place, time and time again. There is no safe level of mould growth; sensitive people or high amounts of mould can cause allergic reactions. Clean mould where it occurs but aim to stop it from its source.



WHAT ARE SOME EASY FIXES TO MY HOUSE?

Things to avoid: (They might address the symptom, but they don't go to the source.)



Dehumidifiers – Heating and ventilation are the first places to look for reducing moisture. Dehumidifiers can help, but heating and ventilation keeps you comfortable and oxygenated while also removing heaps of moisture.

Curtains – Curtains provide some insulating benefit if they create a pocket of still air by keeping heat in, they also make the windows colder. The colder surfaces of the window form condensation more often.

Closing bedroom doors – Bedrooms don't usually have ventilation systems; thus, airflow around the door is the only potential source of air exchange. Blocking the base of the door prevents any airflow at all. Keeping the door open slightly overnight can help keep CO2 and humidity down, but ducted ventilation would be best.

Opening windows for ventilation – This makes it hard to control the temperature and humidity in the space. If opening your windows is the only source of ventilation, do it for a short period and then close them back up or leave them open a crack with a heater directly below.

Turning heating off and on – Turning off the heating seems like it would save energy but this leaves the room colder when you want to heat it back up later. Even when the room is empty, maintain a background temperature above 16°C. Maintaining a constant temperature can be more energy-efficient than manually turning the heater system off and on yourself. It also helps dry out the house when you aren't in the room, evaporating any moisture to be removed by ventilation.

Don't have a huge budget to spend? Try these tips:



Leave the heat on – Consistently heating the house reduces the time when condensation can form. Maintenance heating keeps surfaces dry and prevents the growth of mould and dust mites. This can also be more energy-efficient than trying to turn the heat off and on. Some studies found a heat pump was 13% more efficient when left to self-control the temperatures versus trying to manually control the temperature.

Leave the fan on – Extractor fans in kitchens and bathrooms are effortless ways to remove particulate matter and humidity from indoor spaces. Running the bathroom fan for 8 hours throughout the day can be enough ventilation and is inexpensive.

Stop draughts – Cracks and gaps you can see through are relatively obvious. However, air can flow around other smaller gaps like electrical outlets, attic roof hatches, recessed light fixtures, wall junctions and window openings. Any place one material meets another is a potential air leakage path. Use a sealant to close these gaps or even temporary seals like tape can be useful in some instances.

Cover windows properly – A tight-fitting window film is an inexpensive way to create a pocket of still air that provides extra insulation in the winter. Unlike curtains, using a plastic film prevents humid air from reaching the cold window surfaces.

Move furniture away from exterior walls – Furniture blocks heat from reaching the cold surfaces, so it is common to see mould form behind sofas, tables and beds.

Circulate heat throughout the room – Use a small fan to blow warm air to all parts of the room, this avoids having areas of cold and hot in the same room and evens out the surface temperatures.

