INDOOR MOISTURE – CAUSES AND CURES

We’re all familiar with New Zealand’s cold damp houses, but to understand the causes and fix the problems, it helps to know a bit about how water vapour works.

By Malcom Cunningham, BRANZ Principal Scientist

Cold damp buildings are unhealthy and lead to elevated illness rates, particularly respiratory illnesses such as asthma. It’s not just the lower temperatures that cause these ailments, but the proliferation of biocontaminants like moulds, bacteria and dustmites that occur when indoor relative humidity is high. Condensation on windows is also caused by high indoor humidity and may be the first sign of problems.

Solutions can be straightforward and include first controlling the moisture, then ensuring adequate ventilation, heating and insulation. Scientific studies have shown that retrofitting houses with insulation, making them warmer and drier, significantly improves occupant health.

The science behind condensation

To understand the causes of moisture problems in buildings requires some knowledge of the physics of water vapour. Water has three phases: solid (ice), liquid (water) and gas (water vapour). The relative humidity of air is a measure of the quantity of water vapour in that air compared with the maximum the air can hold.

When a body of air is cooled, its relative humidity automatically rises (see Figure 1). When air at 20°C with 40% relative humidity has its temperature lowered to 15°C, its relative humidity rises to 55%. If its temperature is lowered to 6.2°C, its relative humidity rises to 100%, and moisture condenses out of the air.

This temperature is known as the dewpoint. Moisture or condensation will form on any cold surface, such as windows or the linings of external walls, that is below the dewpoint (100% relative humidity).

For mould to grow, the relative humidity at surfaces only needs to be above 80%. Figure 2 shows mould stains on a ceiling. Here the relative humidity near the ceiling under the joists is below 80%, whereas the relative humidity near the ceiling where there is no insulation is above 80%. Mould grows on this part of the ceiling because the surface is colder.

How to make houses warmer and drier

There are several ways to make houses warmer and drier. These improvements should be implemented in the following order:

- Control moisture at source.
- Ventilate.
- Heat.
- Insulate.

CONTROL MOISTURE AT SOURCE

The most effective way of dealing with a moisture source is to remove it. For example, unflued gas heaters produce large quantities of water and should be replaced by heating that doesn’t produce moisture. The next best action is to use mechanical ventilation such as rangehoods and bathroom fans to remove moisture at source.

VENTILATE

Openable windows, windows with ventilators or even stack ventilators all provide natural ventilation. Low levels of ventilation result in high indoor humidity (see Figure 3). Houses should be provided with the means to achieve at least 0.5 air changes per hour.
ASTHMA AND NZ HOMES

A Finnish study found mould and damp in housing was a cause of childhood asthma. Now, similar research is being carried out here.

By Caroline Shorter, Research Fellow, School of Medicine and Health Sciences, University of Otago, Wellington

Do the conditions of our homes contribute to the onset of asthma in our children? This is the question that researchers at Otago University’s Wellington School of Medicine are trying to answer with a study looking at housing factors and their relationship to onset of wheezing in young children.

The HOME study is a Health Research Council-funded collaboration between Otago University and health researchers from Finland, who recently carried out a similar study, which found that dampness, mould and leaks were associated with the onset of asthma in Finnish children.

Housing and asthma onset

New Zealand has very high rates of asthma, and the team at Otago University is keen to know whether the Finnish findings are true for New Zealand homes. The study team at Otago has previously found that housing conditions can worsen symptoms in a child with asthma. The current study will address whether housing conditions are causing the onset of asthma.

Otago University’s Wellington Asthma Research Group has teamed up with 54 medical practices in the wider Wellington region who are helping to recruit into the study children who have either recently started wheezing and been medicated for this or, as a comparison group, have no history of wheezing.

A total of 450 families will be involved in the study, and by July 2012, researchers hope to have some answers to whether housing conditions contribute to the onset of asthma.

HEAT

Raising the temperature of the indoor air automatically reduces the relative humidity. Heating particularly reduces the humidity on windows and on the surface of exterior walls, thus avoiding mould growth and condensation.

INSULATE

Insulating a house well makes it easy and cheap to heat. It raises the temperature of windows and the surface of exterior walls, thus lowering the humidity and further avoiding mould growth and condensation.

Beware of construction moisture

Construction moisture is another important source of indoor moisture. Concrete, timber and other building products can be enclosed before they have had time to dry properly. This results in high relative humidity, condensation and mould growth.

New houses are often closed up during the day while owners are at work. The low ventilation levels and newly enclosed building elements loaded with construction moisture can cause serious moisture problems in these new houses.

Concrete slabs are the most important potential source of construction moisture. They contain several thousands of litres of water. The rule of thumb is that concrete takes a month per 25 mm of slab thickness to dry out.

Timber can also be a problem and shouldn’t be allowed to get wet before or during construction. As well as warping and shrinking as it dries, a significant amount of construction moisture can be released into the inside of the building.

Figure 3: Relative humidity changes, depending on ventilation levels.