Humidity and Mildew: Causes and Cures

Mold and mildew is a major problem in warm, humid climates such as the U.S. southeast where as many as 70% of all homes are reputed to eventually suffer from mildew problems. Mildew increases the risk of making the building occupants sick and gives rise to expensive and frequent repairs and redecorating. Mildew is a mold that grows under warm, humid conditions. Optimal growth conditions are from 77° to 86° F (25° to 30° C), and between 62% and 93% relative humidity.

Sources of humidity in homes

Relative humidity (RH) inside buildings can be greatly increased by adding moisture to the air in many different ways. In houses, human activities such as preparing meals, washing dishes and clothes, steam baths, whirlpool tubs, showers, aquariums, plants, and even breathing add a lot of moisture to the air. A 15-minute shower can add 1.7 pounds (0.75 kg) of moisture to the air; a cord of uncured wood drying out can add 600 pounds (272 kg) of water; the infiltration of humid air can add 360 pounds (163 kg) of water a day to a typical home.

Moisture also enters from outside – through open doors and windows and by infiltrating the building envelope. Natural ventilation through cracks, crevices and chimneys will cause some air infiltration, but this is accelerated by makeup air entering the building to replace air that has been "exhaled" by exhaust fans. Infiltration can change the air 24 to 48 times a day, and when moisture laden outside air is brought in it throws a tremendous load on air-conditioning equipment. This moisture can amount to hundreds of pounds a day. With 100% relative humidity, clothing, paper products, wood and some textiles can absorb up to 20% of their weight in water.

Another source: Oversized air conditioners

Improperly sized air conditioning units can also greatly increase the humidity inside buildings as well. The role of air conditioning in humid conditions is twofold; remove moisture from the air, and reduce the temperature. Removing moisture from air requires a far greater amount of energy than simply lowering the temperature. Thus, it is vital that A/C units run constantly in humid conditions to keep the RH below 60% (the level at which mildew mentioned previously begins to grow)

Unfortunately, A/C units are often oversized in humid climates for the load requirement of the building. In these cases, the units only run long enough to reduce the air temperature, and do not actually remove much moisture. The result is a lower indoor temperature, but actually a higher RH (colder air cannot hold as much moisture as warmer air). To the occupants, this environment feels clammy or "cave-like" and less comfortable. This causes the occupants to turn down the thermostat further, which can make the problem worse, and wastes energy keeping the building cooler than it needs to be.

Oversized A/C units are commonplace in humid climates because of building practices of the past. Older buildings had high rates of random air leakage. Ductwork for systems were typically placed in unconditioned spaces (i.e. attics and crawl spaces), and there was a loss of conditioned air into these spaces due to leaks in the ducts (see design note titled: Insulating and sealing Ductwork). These practices led to a great uncertainty for the A/C contractor, who had to design a system to make up for the shortcomings. The result was over-designed, oversized units.

Solving the problem: Control air-leakage and correct A/C sizing

The only way to avoid mildew is to control the interior RH through reduced air leakage and proper sizing of A/C equipment. Building an air-tight structure accomplishes two things; it limits the amount of moisture-laden air that gets inside, and it makes life

easier for the A/C contractor, who can size a system that does not need to account for all that random infiltration. A properly sized A/C unit runs for longer periods, removing more moisture from the air and lowering the RH as a result. Further reduction in A/C sizing can be achieved by sealing ductwork and/or installing ductwork within the conditioned space of the building (see design note titled: Unvented Attic and Cathedral Ceiling Construction). Unfortunately, constructing buildings in humid climates that are free from high RH and mildew has been difficult to achieve in the past.

Vapor barriers are NOT the solution

Most air leaks into buildings occur through sill plates, electrical outlets, duct systems, and penetration through attics, floors, and around windows and doors. One attempt to combat the moisture problem has been to apply a vapor barrier placed against the inside of the interior wall. This is the wrong place for a vapor barrier in a humid climate. The vapor barrier, at this relatively cool location, provides a surface for condensation to occur as outdoor air moves inside. Placing the vapor barrier on the inside of the exterior wall creates another problem in the winter, when interior vapor is trying to move outside.

The solution is a monolithic air barrier with The Icynene Insulation System®

The recommended solution was first proposed by the School of Building Construction at the University of Florida: Eliminate the use of a vapor barrier and instead use an air-retarder in the wall to inhibit the passage of airborne moisture into the building. While an air barrier inhibits the entry of air it must be slightly vapor permeable to allow building materials to dry.

The Icynene Insulation System® is a site-installed cellular foam material that provides an excellent air barrier throughout the entire building envelope. By expanding into cracks and crevices and adhering to other building materials, this soft flexible foam ties all other building assembly materials together into a monolithic continuous envelope.

No other sheet-type air barrier material or method can match Icynene's® performance when applied to an entire building situation. With the air-sealing ability of Icynene® in place, preventing outdoor moisture from entering the building the A/C contractor can select a system that is sized appropriately for the cooling load. Experience has shown that typical A/C size can be reduced by 30 to 50% in humid climates. The smaller unit(s) run for longer periods of time keeping the indoor RH lower while consuming less energy.

Additional tips for occupants

- Set air-conditioner temperature higher when using a ceiling fan.
- Set heating thermostat lower when they are away from the house.
- Keep the interior temperature below 75° F (24° C) and RH below 60%.
- Wipe-dry any thing that gets wet after use – things like shower doors, wet floors and tiles, counter-tops, sinks, and spills in general. And hang wet towels, mops and clothing outside to dry. By doing this, the amount of moisture evaporating inside the home will be drastically reduced.
- Close the fireplace damper when not in use.
- Keep doors and windows closed in the morning or after a rainfall, when the humidity is high.

Tips for builders

- Build a tight building easily using Icynene® insulation.
- Install mechanical ventilation that also dehumidifies incoming air.
- Ensure that shower stalls and baths drain properly and do not puddle.
- Waterproof and seal exterior block walls.
- Do not install a vapor barrier on exterior walls.