

Moisture Problems in Attic or Under-Roof Areas

This information sheet describes some possible causes of excessive moisture accumulation in attics or under-roof areas. Some remedial actions are also discussed that can minimize excessive moisture accumulation.

Some signs of excessive moisture accumulation include: excessive rust, moisture, or frost accumulation on roofing nails; dark stains, moisture, or frost on the roof sheathing; excessive water drip marks on attic flooring or insulation; significantly buckled or delaminated roof sheathing. These signs will vary, depending upon the severity of the condition. These moisture indicators are typically most significant on north facing or shady sides of roofs.

Excessive moisture accumulation occurs because moisture will condense on cold surfaces in an under-roof area, just like moisture will condense on a cold glass of water. Moisture accumulation is most significant when outside temperatures are very cold because air can hold less moisture as the temperature decreases.

The recommended relative humidity inside of a house during the winter months is approximately 30-50 percent. At higher levels of relative humidity condensation may occur inside of the house on windows, window frames, or cold wall or ceiling surfaces. Depending upon how tight a house is constructed (measured by air changes per hour) and outside temperature, even a relative humidity of 30 percent may be too high. Condensation may occur at relatively low levels of humidity if windows are not well sealed or are single pane glass.

There are numerous sources of moisture in a home. Some common sources include bathing, clothes washing, cooking, and breathing. These sources are typically not a major contributor to excessive moisture accumulation in the living space or the under-roof areas, unless the amount of moisture is unusually high, the house is very tight, or proper venting is not used.

There are some other common sources of moisture accumulation that frequently result in excessive moisture accumulation in under-roof areas, and sometimes in the living space. These sources are overuse of a humidifier (or an improperly functioning humidifier), water-moisture penetration through foundation walls or floor slabs, and use of unvented gas or kerosene space heaters. Even when basements, crawl spaces, or floor slabs do not appear to be excessively damp they can be a significant source of moisture accumulation. Because of the relatively moderate temperature in the basement, crawl space, or living space this moisture can go unnoticed and may not cause any problems in these areas. As the moisture migrates into the under-roof area, which is much colder during the winter months, the relative humidity in these areas increases to the point that condensation can occur on cold surfaces. This condensation can cause mold accumulation, deterioration, etc.

A simple test can be conducted to determine whether a significant amount of moisture is passing through a foundation wall or floor slab. Tape an approximately one foot square piece of aluminum foil or plastic sheeting on the wall or floor and leave it in place for at least one day. If moisture is observed when the material is removed, this is the result of water/moisture penetration.

How does the moisture get from the bottom of the house to the top of the house? Something called the stack effect is responsible for most moisture migration. As warm air rises, some of this air enters opening at the top of the house and passes into the under-roof area. Also, the air escaping at the top of the house causes the pressure inside of the house to decrease, causing cold air to enter through openings at the bottom of the house (this is called infiltration). Air infiltration is typically a significant source of heat loss in the average house. This increases heating costs and can effect comfort). Solving moisture problems can also decrease utility costs and make the house more comfortable.

Most of the openings that allow air to enter the under-roof area are not very apparent. Some common examples of openings found in houses include: gaps at pull-down attic stairways or other under-roof access openings; openings around chimneys and plumbing vent stacks; gaps at the top of the exterior and interior walls; poorly sealed joints in ductwork located in under-roof areas or in walls; opening in ceiling at wall cavities above stairways, above closets, etc. A significant amount of air can leak through relatively small gaps and some openings can provide a direct path from the basement or crawl space directly into the under-roof area.

What should you do about excessive moisture in under-roof areas? Some contractors and home Inspectors recommend increasing ventilation in the under-roof area. If ventilation is inadequate this may be advisable, but increasing ventilation often does not solve the problem. Increased under-roof ventilation can increase airflow in the under-roof area and lower the temperature in the under-roof area. This may increase condensation and lower the effectiveness of insulation. Also, because airflow is not uniform in an under-roof area, significant condensation may still occur.

The best solution to solving a moisture problem is to control the moisture at its source. If the problem is caused by a humidifier, moisture can be reduced by adjusting the humidistat control, disabling the humidifier, or repairing the humidifier. If the problem is the result of water-moisture penetration, there are many remedial actions that may help. These can include: cleaning or repairing rain gutters and downspouts; altering downspout drains; regrading the property, especially near the perimeter of the foundation; sealing foundation walls or floor slabs; using a dehumidifier; installing a perimeter drainage system. Because of the many conditions that can cause foundation water-moisture penetration and the many possible solutions, each house must be evaluated to determine the likely causes and recommended solutions.

After water-moisture penetration is controlled as best as is practical, the next approach to controlling moisture migration to under-roof areas and air infiltration is to seal the various paths of air leakage discussed above. A reasonable competent homeowner can seal many of these areas. Others are best addressed by a reasonably competent contractor or a specialized contractor familiar with weatherization techniques and having the special equipment needed for this work.

It is interesting to note that the less air infiltration there is into a house, the higher the relative humidity will be. If air leaks are properly sealed, this moisture will be in the living space, where it is desirable in the winter months. As a home is made tighter, heating and cooling costs decrease, the home is usually more comfortable, the there is less need to introduce humidity by using a humidifier. In extremely tight homes there can be a need use mechanical ventilation to assure that pollutants or moisture do not accumulate to unhealthy levels. This is usually not a concern in the average home, even after sealing typical air leaks.