

Winter is a time many of us pull our portable humidifiers out of the basement or closet, and turn them on in bedrooms to help keep the air moist. Or perhaps you have central humidification in your home, and operate that during the heating season.

To discuss humidification, I have to first talk about relative humidity (or RH). Relative humidity is a measure of how much moisture is in the air at a given temperature, as compared to how much moisture that air can maximally hold at that temperature. So if air is at 70% RH, it can hold 30% more moisture before it reaches the saturation point and can hold no more. As air cools, its capacity to hold moisture is reduced, so its relative humidity rises (i.e. air that is cooled may have RH that rises from 70% to 80%, thus reducing its capacity to hold more moisture from 30% to 20%).

Our sweat lingers on our skin on a hot, humid day, because the moisture evaporates more slowly in conditions of high RH. Evaporation of sweat from our bodies has a cooling effect, thus lowering the temperature of our skin. In the winter, heated, dry air can be uncomfortable because the moisture our bodies produce evaporates more quickly, making us feel cold. This is one reason why so many people humidify their homes in winter.

But humidification can sometimes cause indoor air quality (IAQ) problems.

I'll start with portable units. Ultrasonic humidifiers can aerosolize minerals, bacteria and algae in the water and distribute these potential contaminants and allergens along with the mist. Evaporative pad humidifiers (cool mist) are prone to biological contamination because the cellulose evaporative filter pad is biodegradable and thus serves as a nutrient (often for *Stachybotrys chartarum*, the feared "black mold").

Turning to furnace humidifiers (central humidification), in models with standing water in a tray, the water is usually full of biological growth (including bacteria, mold and actinomycetes – soil microorganisms that grow like mold but are the size of bacteria). This growth produces byproducts that are potentially allergenic. When the water film breaks on the humidifier sponge and the water drips from the rotating drum, irritants and contaminants may become airborne within small water droplets. When the droplets evaporate, even smaller particulate allergens remain suspended in air for extended periods of time. These particles may be small enough to be inhaled deep into the lung. When such particles settle on furniture and other surfaces, they can become re-aerolized when the surface dust is disturbed.

So what kind of humidification system or equipment is OK from an indoor air quality point of view? For portable equipment, I recommend only a steam humidifier or a warm mist unit such as the Honeywell "Quick Steam." These units boil the water and emit only water vapor; minerals and other contaminants are left behind. Beware, however: old-fashioned steam humidifiers usually keep making steam until they run out of water. A humidistat should shut off the machine when the RH reaches the set point, and newer warm-mist humidifiers must be so equipped. Clean your portable unit regularly.

For central humidification, use a trickle or steam type unit, which has no water reservoir. Any central humidification equipment should be inspected at least monthly to be sure that there are no leaks and that no water is soaking into fiberglass material that may line the furnace or duct (this can lead to mold growth). And a leaking furnace humidifier can corrode a heat exchanger or furnace vent pipe, allowing combustion products (containing carbon monoxide) to escape.

Unfortunately, some species of mold (mildew) can grow when the RH is over 80%. When you are humidifying the house, therefore, it is important to measure the RH, to be sure that it does not exceed 40%. (Air at 40% RH in the middle of the room may reach an RH of 80% or higher when that air comes in contact with cold surfaces such as in cold closets or unheated entranceways.) Place several thermo-hygrometers (relatively inexpensive, available at many hardware and home supply stores) in different rooms in/on different levels of your house. A RH of 50% or more may feel great on your skin, and your house plants may love it; but you may likely find mold growth joining your "indoor greenhouse" if you keep the RH that high.

#### **Microbial growth in a rotating-drum furnace humidifier**

