

MAINTAINING
YOUR HOME

Do you think
you have a
mold problem
in your home?

University of Wisconsin-Extension Cooperative Extension

Controlling Molds and Mildew

This publication is intended to help you assess the problem, understand the causes and health risks, and decide what to do about mold in your home.

The terms **mold** and **mildew** describe microscopic fungi that grow on surfaces of various materials. While mildews are generally white, molds come in a variety of colors including white, brown, green, orange, pink, purple and black.

This publication refers to these similar fungi collectively as molds. Distinguishing molds from mildews is not usually important for controlling them in homes.

Molds reproduce by dispersing vast quantities of tiny spores of varied shapes and sizes. Mold growing on a single slice of bread can release billions of spores into the air. Spores are continually coming into the home with air from outside or on clothes and shoes.

Mold spores are very light and float around homes, landing everywhere. Most surfaces have the nutrients these fungi require for growth. The presence of **moisture** determines where molds actually begin growing.

Outdoors, molds play an important role in decomposing dead vegetation and animal matter. They secrete enzymes that break down these materials for food.

Indoors, molds do not actually cause wood to decay. But they often precede other fungi that can cause decay of wood and wood-based products in your home.

Some molds also produce musty odors, unsightly stains on walls and ceilings, and health problems.

Health problems associated with molds

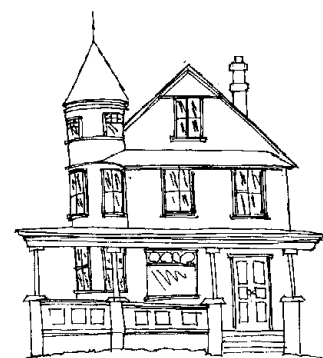
Mold spores are a significant cause of allergic reactions such as hay fever in people sensitized to molds. Because mold spores are so small, they reach sensitive respiratory tissue when inhaled.

The most common reactions are runny nose, eye irritation, cough, nasal congestion, headache, skin rashes and fatigue.

Allergic reactions to molds vary by individual. The degree of sensitivity is based in part on genetics, age, health, and exposure to other **allergens** — substances that induce allergies.

Sensitivity to molds can also trigger **asthma** — labored breathing accompanied by wheezing, coughing, gasping and feeling tight in the chest. Asthma afflicts 15 million people in the United States, according to the Centers for Disease Control.

In most cases, experts recommend against spending the time and money for testing.



Prolonged or intense mold exposure can cause other serious health problems:

- **Organic Dust Toxic Syndrome** is characterized by flu-like symptoms and can occur after a single heavy exposure to mold. Such an exposure might occur while cleaning a severely contaminated basement or crawl space.
- **Hypersensitivity Pneumonitis** occurs after repeated exposures to an allergen, and can cause permanent lung damage. This usually requires repeated high-level exposures. While it primarily affects agricultural workers, homeowners and remodelers who deal with major mold problems may be at risk.
- **Opportunistic infections**, such as lung infections, can affect people with weakened immune systems.

Many molds produce chemicals called **mycotoxins** that help them compete in their environment. These chemicals are poisonous to bacteria and other molds; some are also used as important medicines.

A few of these chemicals, such as **aflatoxins**, can poison humans and livestock. Most of the known human health problems associated with mycotoxins have been from eating stored food such as grain or peanuts contaminated by mold.

In homes, a class of mycotoxin known as the **trichothecenes** — produced by *Stachybotrys*, *Fusarium* and *Trichoderma* molds — has drawn attention for their possible effect on humans who breathe them in. However, knowledge of the importance of inhaled mycotoxins to human health is incomplete. Mycotoxins have not been clearly shown to harm humans breathing mold-contaminated air.

The musty odor associated with mold is unlikely to be from mycotoxins, which are generally odorless. Some molds produce musty odors by generating volatile organic compounds as part of their digestive process. The chemicals that create these odors have been linked to symptoms such as headaches, nasal irritation, dizziness and nausea, depending on individual sensitivity. The musty odors should cease when the mold stops growing.

Should you test for mold?

The first thing many people want to do when they think they have a mold problem is to have their home tested for mold. They want to determine if they actually have a problem and what species of mold they have.

In most cases, experts recommend against spending the time and money for testing. Regardless of the species, mold should be removed as quickly as possible and the underlying moisture problem corrected. Testing only delays cleanup. Testing can be very expensive, and misleading if not done correctly.

No standards exist for determining when airborne mold spore concentrations are considered a health risk. This is in part because individuals vary in sensitivity to mold.

If family members are experiencing problems and there is no visible mold, recent flooding or water leaking, consider other environmental causes such as pet dander and carbon monoxide. Rule these out before assuming you need mold testing.

If a physician determines that molds may be involved but there are no visible mold problems, consider a thorough building inspection to look for past or current moisture problems.

If you discover large mold infestations, testing may be warranted. Identifying the fungus and its potential health effects can determine the extent of cleanup needed. Such cases may call for professional removal by a **mold remediation specialist** (see page 7).

Before and after testing is a good idea if extensive mold remediation is planned. This assures that cleanup has reduced mold levels in the house to acceptable levels.

Approaches to testing

A sample can be sent to a laboratory for culturing and analysis. The sample should be sealed in an airtight bag for shipping.

Surface sampling uses a cotton swab or sticky tape to collect material from a surface where mold is suspected.

An inspector may scrape samples of the mold directly from the surface into a Petri dish containing nutrients that the fungus can use to grow.

A sample of porous material such as wall board or ceiling tiles can be removed.

A vacuum can be used to sample mold. Be aware that samples of material vacuumed from carpeting are likely to include mold spores even if mold is not a problem in the home.

In general, knowing how much mold and what types are on surfaces does not accurately indicate the amount of mold spores people in the home are likely to breathe.

Air sampling can give a more accurate picture of mold spore concentration in the air. Air sampling requires special equipment and is a job for professionals.

Even air sampling does not necessarily give an accurate picture of mold conditions and health risks in the house. Some relatively harmless molds produce large amounts of spores, while other dangerous molds produce fewer spores that are generally not airborne.

Airborne mold levels and test results are affected by:

- Traffic into and throughout the house.
- Whether the heating or central cooling system is operating.
- Whether the windows have been open.
- Which collection media are used for air sampling.

A 1-day assessment only provides a snapshot of air quality that day.

An accurate assessment would use several test methods and collect samples over several days — and cost several hundred dollars.

Still want your home tested?

If you want to have your home assessed and tested for mold, you can get a list of indoor air quality consultants who provide this service in Wisconsin. Call or visit the Web site of the Wisconsin Department of Health and Family Services Bureau of Environmental Health Indoor Air Quality (IAQ) Program:
(608) 266-1120 — Weekdays
www.dhfs.state.wi.us/eh/HLthHaz/pdf/IAQConsList.pdf

Eliminating damp areas is the best long-term treatment of mold problems.

Controlling mold

Drying up moisture sources

Mold needs enough moisture to grow. Mold spores that land on damp surfaces grow and multiply within an hour.

The best way to control mold problems is to eliminate the moisture supply. Surfaces most often become damp when:

- **Water leaks.**
- **Water vapor in the air condenses on cool surfaces.**

The first step is to check for water leaks. Check under sinks and around tubs and showers for damp areas or dark stains. Check the walls and ceilings in adjacent rooms as well. The problem may show up as water stains on the wall or ceiling that backs up to the leak.

Also check for roof and basement water leaks. Basement leaks are often due to poor surface drainage. Check to be sure rainwater does not pool against the house due to poor drainage. Also check to be sure gutters and downspouts are directing rainwater well away from the home.

Look for water stains or dark spots. Water stains may reveal a hidden area of mold growth.

If soils outside the basement are wet, some of this moisture can move through the basement wall and make the basement damp.

You can check for this by taping a piece of clear plastic tightly to a wall. If there is moisture behind the plastic after 24 hours, moisture moving through the wall is part of your problem. If the moisture is on the room side of the plastic, condensation is a problem.

If condensation is a problem, the next step is to dry up water vapor in the air.

Relative humidity is a measure that describes the amount of moisture in the air relative to the maximum moisture the air can hold at a given temperature. Mold growth is inhibited at relative humidities below about 50 percent. However, the relative humidity of the air near cool surfaces in the home can be well above 50 percent even when the overall relative humidity is below 50 percent.

In summer, relative humidity can easily exceed 50 percent in basements. Warm summer air can hold a great deal of moisture.

While basement walls in newer homes are often insulated, floors are not. Cool air can hold less water vapor than warm air. When outside air at 80° F with a relative humidity as low as 60 percent enters a basement and cools to 65° F, the relative humidity rises to 100 percent — meaning the air is saturated and moisture will condense on cool surfaces.

The higher the outside temperature and relative humidity, the more moisture is available to condense. Similarly, the cooler the basement, the more moisture condenses.

Mold can be a problem for items stored on basement floors or against concrete walls. Carpeting laid on uninsulated concrete floors is particularly vulnerable to mold infestation.

Condensation for various relative humidity levels when the outside temperature is 90 degrees Fahrenheit

Outside temperature	Relative humidity	Condensation temperature
90	80%	83
90	70%	78
90	60%	74
90	50%	69

If the moisture problem results primarily from condensation, then the best solution is twofold.

1. **Keep moist air out.** Close the basement off as much as practical to keep warm, humid air out.
2. **Dry up basement air.** Cover crawl space floors with heavy plastic to reduce evaporation. Use a dehumidifier to reduce moisture in basement air.

Dehumidifiers are rated by the number of pints of water they collect per day. Small capacity models should be adequate for most homes. But *Consumer Reports* found that larger models are often more efficient than smaller ones.

Turn off your dehumidifier when the air conditioner is on. Whole house air conditioning usually reduces humidity levels enough that you do not need to run a dehumidifier. Cooling may also drop the basement temperature enough that the dehumidifier will not work effectively.

In fall and winter, moisture can condense on cold surfaces such as window frames, walls in closets next to outside walls, or walls behind furniture where heat does not circulate. Mold can be a problem in these areas.

Some houses are so airtight that humidity is trapped inside during winter. Windows fog and mold forms because water from humid air is condensing on cold surfaces.

In cold weather, reduce the amount of moisture produced in the house.

- **Vent the dryer outdoors.** Be sure the clothes dryer is venting outside. A clothes dryer venting indoors releases a gallon or more of water into the house for every load you dry.
- **Check for plumbing leaks.** Check under sinks, tubs, toilets, around the water softener, furnace and washer for drips, wet places or stains.
- **Keep the basement dry.** Make sure water is draining away from the outside of your home. If not, water could be coming through basement walls and adding to your humidity problem.

Increase ventilation in cold weather. If reducing moisture production is not enough, the next step is to increase ventilation.

- **Use your range hood when cooking, cleaning or washing dishes.** Use bath fans for 15 minutes after showering or bathing. Fans will only help prevent humidity problems if they are vented outside.
- **If humidity is still a problem, leave fans on for several hours per day.** Open a window about 1 inch at the other end of the home to provide replacement air when the vent fan is running. Cold outside air contains little moisture and dramatically drops relative humidity levels as it warms.

Some houses are so airtight that humidity is trapped inside during winter.



Do not use a dehumidifier in winter. Most dehumidifiers are meant to work at temperatures of 65° F or warmer, and with humidity levels above 50 percent. During winter, increasing ventilation is more effective — and costs less.

If your basement floods, it is critical to dry out the flooded areas within 48 hours to avoid extensive mold. If your house floods, see the UW-Extension Disaster Handbook: www.uwex.edu/ces/news/handbook.html

If you do not have a computer, try your local library. Most libraries have a computer connected with the Internet.

For more tips on drying up your home, ask your county UW-Extension office for the publications *Moisture Problems in the Home* NCR 312 and *HomeWorks News* B3731, also available from Cooperative Extension Publications at the address on the back page.

Caution: Individuals who are sensitive to mold spores should be aware that a sudden drop in relative humidity and drying damp surfaces can cause dry fungi to release spores all at once and create a temporary increase of spores in the air. This is how the fungi guarantee their survival when moisture is scarce.



Removing surface mold

To eliminate potential health problems, mold must be removed, not just killed. How to do this safely depends on whether:

- The infested area is small or large.
- The infestation is
 - merely a surface problem such as is often the case with mold on exterior paint, or
 - imbedded in wood or porous material.

Cleaning small areas

To clean up **small areas** — 10 square feet or less — particularly when the mold is clearly a surface problem:

1. Scrub the area with liquid dishwashing detergent and water (see safety precautions on page 7). Use enough detergent to make suds.
2. Rinse with clear water.
3. If mold stains remain, apply a solution of chlorine bleach (sodium hypochlorite) to the surface:
 - 1 cup of bleach in 1 gallon of water

Leave this on for 15 minutes. The bleach will kill any remaining mold.

Caution: Be careful not to mix this bleach solution with the dishwashing detergent, which may contain ammonia. Ammonia can form a poisonous gas when mixed with the chlorine in bleach. Also be sure to open windows and run exhaust fans when using the bleach solution.

4. Rinse carefully. The rinse is not only to remove the remaining cleaning solution, but also to remove the mold residue. Dead mold spores can still cause allergic reactions. Dispose of cleaning cloths in a sealed plastic bag, and flush all cleaning solution and rinse water down the toilet.

Cleaning large areas

For areas larger than 10 square feet — particularly for confined areas such as crawl spaces — health risks are a concern. Most experts recommend calling in professionals with the right safety equipment and knowledge.

1. Remove and replace porous material such as wall board or ceiling tiles. These usually cannot be effectively decontaminated if mold has gone beyond the surface.
2. Clean wood and masonry using the directions and cautions for cleaning small areas.
3. Rinse carefully to remove from the area dead mold material.
4. If any mold stains remain, remove these mechanically.
Caution: Sanding or scraping prior to cleaning with detergent and water is dangerous since it could release massive amounts of molds into the air. When sanding after detergent cleaning, take precautions to avoid breathing mold-contaminated dust or spreading it beyond the area (see safety precautions).
5. Once areas are free of all traces of mold, you can apply paints and sealers containing fungicides to inhibit future mold growth.

Safety precautions when removing mold

When removing large mold infestations, take the following precautions:

1. Use a respirator such as the N-95 Disposable Respirator. These may be available at farm supply stores, but the best source may be safety supply companies. Note that an N-95 Disposable Respirator is different from a common dust mask.*
2. Wear eye protection and rubber gloves.
3. Remove from the work area any furnishings not already contaminated.
4. Isolate the work area from the rest of the house. Tape plastic over doorways, and block heat registers and returns.
5. Place contaminated material in plastic bags and carefully seal.
6. Once work is completed and contaminated materials removed, use a HEPA (high efficiency particulate air filter) vacuum to clean the room thoroughly.

Safe removal of mold contamination can be complicated, and poses health risks to the workers as well as to occupants. Therefore, it is usually wise to call on professionals who have the experience and equipment to do the job safely and completely.

The Wisconsin IAQ Program maintains a list of contractors who do this type of work. To obtain the list of Wisconsin mold remediation and water restoration contractors, call the IAQ Program or visit their Web site: (608) 266-1120 — Weekdays www.dhfs.state.wi.us/eh/HlthHaz/pdf/IAQMoldContrs.pdf

Dead mold spores can still cause allergic reactions.



* Reference to products is not intended to endorse them, nor to exclude others that may be similar. If you use this product, follow the manufacturer's current label directions.

Web sites

Environmental Health and Safety Indoor Fungi Resources — See photos used in microscopic identification of mold species.
www.dehs.umn.edu/iaq/fungus/pictures.html

Hiring a professional — Get lists of professionals who assess, test and clean up mold, and tips on hiring such help, from the Wisconsin Department of Health and Family Services Bureau of Environmental Health Indoor Air Quality (IAQ) Program.
www.dhfs.state.wi.us/eh/HlthHaz/fs/moldindx.htm

Housing: Owning and Renting Resource — On-line tips from John Merrill, extension housing specialist, University of Wisconsin-Madison:
www.uwex.edu/ces/flp/house

Mold/Moisture/Mildew — Resources for more information from the U.S. Environmental Protection Agency (EPA):
www.epa.gov/iaq/molds

If you do not have a computer, try your local library. Most public libraries have a free computer connected with the Internet. A Web page labeled PDF (portable document file) requires Adobe Acrobat™ Reader.

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Produced by Cooperative Extension Publishing, UW-Extension: Rhonda Lee, editor, Susan Anderson, designer.

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