

## Mold Detection, Prevention and Mitigation

### What Is Mold?

Molds are fungi. Fungus is the general overall term used for mold, mildew, mushrooms, woodrot, rust and yeasts. The fungi are a distinct group of organisms with over 1,000 different types found in the U.S. The most common are *Alternaria*, *Aspergillus*, *Cladosporium*, *Fusarium*, *Penicillium*, *Rhizopus* and *Stachybotrys*. These fungi produce microscopic cells called spores that burst and spread easily through the air, settle on surfaces and, if the conditions are right, grow into thriving colonies. Fungi contain no chlorophyll and so are unable to make their own food. They survive by releasing enzymes that help them absorb and digest nutrients (cellulose, protein and fats) from their host materials, which is any living or dead organic matter. Mold can range in color from white to green and orange to brown and black. Early development of mold will have a fine web-like appearance of filaments (hyphae) on the surface or in the structure of its substrate. As it matures, it develops a bushy appearance with fruiting bodies that contain the spores.

### The Health Effects of Mold

Exposure to mold is common both inside and outside the home. Some people are more sensitive to mold than others, especially those with allergies and asthma. Some may be strongly affected when exposed to larger quantities of mold.

Mold exposure may cause:

- Cold-like symptoms
- Watery eyes
- Sore throat
- Wheezing
- Dizziness, and
- May trigger asthma attacks

Because mold spores are very small and can be easily inhaled, it is not safe to live in houses with high mold levels. Exposure to prolonged high spore levels may cause the development of an allergy to mold.

Types of people who are most severely affected by indoor mold growth include:

- Infants and children
- Elderly people
- Individuals with respiratory conditions or sensitivities such as allergies and asthma
- Persons having weakened immune systems (people with HIV infection, chemotherapy patients, organ transplant recipients)

### Detection of Mold

Molds can usually be detected by a musty odor, and discoloration of surfaces is common with mold growth. The mold may be found in shades of whites, greens, browns, blacks or oranges.

If you see or smell mold, you have a problem. Reliable sampling for mold can be expensive since it requires special equipment and training. Testing is not generally recommended as a first step. Usually it is not necessary to determine what type of mold you have. All molds should be treated the same and regarded as potential health risks.

### Causes of Mold Growth

Mold can grow in a home for various reasons including:

- Flooding
- Condensation – on windows or walls caused by indoor humidity that is high or surfaces that are cold (such as north-facing walls and moist summer air contacting air-conditioned surfaces)
- Poor ventilation in attics and closets
- Overflow from tubs, sinks or toilets
- Excessive moisture from firewood stored indoors
- Excessive humidifier use – increases relative humidity
- Inadequate venting of kitchen and bath humidity
- Improper venting of combustion appliances (such as kerosene and gas heaters)
- Failure to vent clothes dryer exhaust outdoors (including electric dryers) or using indoor clothes line
- House plants – water from a large number of plants can generate large amounts of moisture
- Excessive moisture from inadequate dehumidification during air conditioning (oversized system)
- Standing water found in condensate drain pans (refrigerator, air conditioner) and in crawl spaces

- Leaky basement
- Dripping pipes
- Roofs in need of repair or faulty gutters

## Conditions for Mold Growth

Molds grow on organic materials such as paper, leather, dirt and soap scum. They grow best at warm temperatures, but they can grow over a large temperature range.

## Ways to Prevent Mold

Cleaning and drying surfaces prevents mold growth. Mold will grow on damp surfaces within a couple days at normal temperatures.

Reduce moisture levels in the bathroom by running an exhaust fan during and after showers.

Fix plumbing leaks and seepage to prevent the buildup of moisture and prevent the growth of molds.

Store clothing dry and clean to prevent the growth of mold on clothes.

Reduce humidity levels by discontinuing use of a humidifier if the relative humidity is more than 40 percent, and use dehumidifiers and air conditioners when levels of humidity are high. Also, ventilate with outside air during the winter when outside temperatures are colder than indoor temperatures. Ventilating with warm summer air typically increases the air's relative humidity in a basement.

Increase the flow of air within your home. Moving furniture away from walls and opening closet doors to permit air circulation limits the growth of molds.

Prevent condensation. Insulating walls and installing storm or thermal pane windows keeps surfaces warm and limits condensation. In areas with high relative humidity, additional precautions may be necessary to ensure that your home stays mold free. For example, the use of vinyl wallpaper on exterior walls can cause vapor to be trapped inside your walls, thus creating excellent conditions for mold growth.

## Cleanup of Mold

### Cleanup and Removal of Mold

People can experience health effects when exposed to mold even if it is dead, so it must be removed. Killing active mold by applying a biocide such as chlorine bleach does not minimize health risks. Anyone spending more than a brief time

cleaning in a moldy environment should use a HEPA filter or N95 rated mask; typically it will have two straps. Also, use gloves.

Porous materials should be thrown out or completely decontaminated if they are moldy. Materials such as hard plastic, glass and metal can be cleaned. Remove the mold from non-porous materials using a soap or detergent. Never mix bleach and ammonia. Disinfect structural members that have been cleaned by applying a solution of 1 cup chlorine bleach per 1 gallon water or follow manufacturer's recommendations. The surface should be thoroughly wetted with the solution. Keep the surface wet with the bleach solution for 10 to 15 minutes to kill the mold. Allow the solution to dry naturally 6 to 8 hours. The area must be well ventilated since bleach fumes may cause lung irritation. Remember that chlorine deactivates termite treatments. After cleanup, termite treatments should be reapplied.

Other products that kill mold are biocides. These biocides have Environmental Protection Agency (EPA) registration numbers on the bottle and instructions for the intended application.

## Methods to Remove Mold from Various Products

Always clean surfaces, removing the mold, before using a chlorine bleach solution. Bleach changes the surface color.

For places where termites pose a problem, remember that chlorine deactivates termite treatments. After cleanup, termite treatments should be reapplied.

**Painted Surfaces Inside the Home** – Scrub moldy surfaces with a detergent. Do not mix bleach with cleaners containing ammonia. After the mold has been removed, discoloration can be removed using a solution of 1 cup chlorine bleach to 1 gallon water. Rinse with clean water and allow to dry thoroughly before painting or papering.

**Painted Exterior Surfaces** – Scrub mold on paint with a solution of 1/3 cup detergent that does not contain ammonia, 1 cup chlorine bleach and 1 gallon of water.

**Bathrooms** – Scrub surfaces with a solution of 1 cup chlorine bleach, 1 tablespoon detergent that does not contain ammonia and 1 gallon water. Keep the surface wet for about 10 minutes, then rinse well with water and dry.

**Roofs with Asphalt Shingles and Fiberglass Panels** – Use a mixture of 1 quart chlorine bleach, 1 ounce of detergent and 1 gallon water at the rate of

1 gallon per about 40 square feet. This solution will damage metal rain gutters and plants, so control runoff and rinse surfaces contacted by the solution.

#### **Wood Shingles, Decks and Other Untreated**

**Wood** – Scrub surfaces with a solution of 1 quart chlorine bleach and 1 ounce detergent in 1 gallon water. Rinse thoroughly. If stains remain, increase the concentration of bleach to water and re-treat. Allow wood to dry thoroughly before painting or enclosing.

**Clothing and Other Textiles** – Brush, shake, sun and air mildewed textiles outdoors. Launder washable items with detergent and chlorine bleach when appropriate.

**Leathers** – Dyes used on leathers are very sensitive to numerous substances. Moisten a cloth with a solution of 1 cup denatured alcohol to 1 cup water, wipe away visible mold and dry in circulating air.

**Carpet and Rugs** – Discard pads containing mold. It is nearly impossible to remove all the mold in a pad. Carpet should also be discarded except for minor mold infestations. It is best to hire a professional carpet cleaner or restorer to clean wall-to-wall carpet. If you try to save the carpet yourself, apply rug shampoo with a carpet shampooer according to manufacturer's directions. Expose mold growing on the back of carpet to the direct rays of the sun. Scrub the back of the carpet using a detergent. Paint the carpet backing with a solution of 1/4 teaspoon chlorine bleach to 1 cup of water or another sanitizing product applied according to the label directions. Rinse several times. After shampooing and sanitizing, dry the carpet or rugs quickly by laying them outdoors in the sun and wind or use fans to speed dry.

**Upholstered Furniture and Mattresses** – If occupants are not sensitized to mold, very minor mold infestations may be tolerated in upholstered furniture and mattresses. Brush surface mold away with a broom outdoors. Vacuum outdoors, or use a vacuum with a HEPA filter bag. Discard the disposable vacuum cleaner bag. Use the services of a professional upholstery cleaner, or sponge the item with detergent suds and wipe with a clean cloth. Avoid getting the stuffing wet. Wipe the furniture with a cloth moistened with a solution of 1 cup denatured or rubbing alcohol to 1 cup water and dry thoroughly. Place the item in the sun for a few hours and air it thoroughly, or use a fan and indirect heat to dry. If mold is growing into the fabric or in the padding of an upholstered piece, nothing will eliminate the mold or odor except renovation or replacement.

**Books** – Stand books on end. Spread out pages to dry. Wipe off mold with a clean, dry cloth. After a few hours, stack and press to avoid wrinkling. Alternate opening and stacking until completely dry. Sprinkle talcum powder or cornstarch on pages to absorb moisture. Books may be frozen until you have time to work with them.

**Wood Furniture** – It is essential to differentiate between a little surface mold on the finish and mold that has grown through the finish and into the wood. If there is extensive mold growth, the wood should be sanded to remove the entire area of mold using appropriate personal respiratory protection or another method used to remove the mold. Caution should always be used when refinishing wood furniture that has been exposed to mold; whenever possible these items should be replaced rather than repaired.

### **Drying Out Before Rebuilding**

The problem: Wood submerged in water will absorb a large amount of water. Rebuilding too quickly after a flood can cause continuing problems such as mold growth, insect infestations and deterioration of the wood and wall coverings.

How long until it's dry? It may take weeks for the wood to be adequately dry to close a wall. The drying time will vary depending on the initial moisture content and the drying conditions.

How can I tell if it's dry enough? Test it with a wood moisture meter. Wood should have a moisture content of less than 15 percent before drywall, paneling or other coverings are placed on the wood. Do-it-yourselfers may be able to purchase, borrow or rent a meter from a hardware store or lumberyard. If a contractor is doing the work, homeowners should have the contractor verify with a meter that the wood is dry.

### **How Can I Dry Things Out?**

It is important to remember that each of these procedures works best in certain situations; these depend very much on your climate. During times with higher humidity, using central air systems and dehumidifiers will most likely be the most effective method to dry out your belongings and home.

- **Ventilation** – Ventilation is usually the best way to dry things out; several gallons of water can be removed per day. Provide an entrance and exhaust opening for air to promote cross-ventilation. Place a fan in a window or door with the fan facing to the outdoors. Seal the rest of the opening with cardboard, plywood or blankets so

the fan can create a vacuum. Use fans to circulate air over wet surfaces. Face fans into corners or other secluded areas.

- **Heat** – Heat increases the moisture-holding ability of the air. Use your furnace or large heaters to heat the air. Small space heaters will have little effect. As wood gets drier it may be helpful to heat the house for a few hours then ventilate to exchange moist air with dry air.
- **Dehumidifiers** – A dehumidifier can be used if outside air is humid. Dehumidifiers function most efficiently at warm temperatures. At 80 degrees and 60 percent relative humidity, most residential dehumidifiers will remove 1 to 2 pints of water per hour from the air.

## Mold Information in Foreign Languages

### What Is Mold?

Available in Laotian/English, Spanish/English, Cambodian/English and Hmong/English.  
<http://www.extension.umn.edu/distribution/housingandclothing/DK6944.html>

### Household Mold

English:  
<http://extension.oregonstate.edu/washington/resources/documents/HouseholdMold.pdf>

Russian:  
[http://extension.oregonstate.edu/washington/resources/documents/Mold\\_%20Russian.pdf](http://extension.oregonstate.edu/washington/resources/documents/Mold_%20Russian.pdf)

Spanish:  
<http://extension.oregonstate.edu/washington/resources/documents/Mohodelacasa.pdf>

Acknowledgment for this information is given to Dr. Kenneth Hellevang, North Dakota State University Extension Service, Fargo, ND.

Vietnamese:  
[http://extension.oregonstate.edu/washington/resources/documents/Mold\\_Vietnamese.pdf](http://extension.oregonstate.edu/washington/resources/documents/Mold_Vietnamese.pdf)

## Mold Resource Web Links

### EPA Mold Resources

[www.epa.gov/iaq/molds/moldresources.html](http://www.epa.gov/iaq/molds/moldresources.html)

### Mold Allergy (National Institute of Health)

<http://www.niaid.nih.gov/publications/allergens/mold.htm>

### Home Moisture

<http://www.homemoisture.org>

## Lessons

### Controlling Home Moisture for Indoor Air Quality Presentation

<http://www.homemoisture.org/presentations.htm>

### Mold in Your Home Presentation

<http://www.homemoisture.org/presentations.htm>

### Keep Your Home Healthy Presentation

<http://www.homemoisture.org/presentations.htm>

### What's the Matter with Mold?

<http://cecp-online.org>