

Breaking the Mold

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MAIN POINTS

- Mold spores are everywhere.
- If you have a mold problem, you have an environment problem.
- In order to eradicate the mold problem, you must address the environmental problem. The localized outbreak will continue to be problematic until the environment is corrected and stabilized.
- Assume all mold is toxic in order to ensure the safety and health of your patrons and yourself; only a mycologist can accurately identify the many types of mold.
- If items from a rare or special collections have significant mold problems, consult a conservator for advice about potential cleaning, time and cost.

WHAT IS MOLD?

Mold is ubiquitous

- Mold and mildew are part of the kingdom *fungi* and are studied in the field of mycology.
- There are over 100,000 known fungi and it is estimated there are over 200,000 unidentified fungi.
- Mold grows on surfaces in masses of branching threads which resemble dense cobwebs. These fertile threads stand up from the surface and release spores into the air. The spores are carried by air currents, insects or animals.

Some molds, like aspergillus niger, may be lethal.

- Any outbreak, regardless of size, should be assessed by a mycologist to determine the species present. A local hospital can provide a referral to a mycologist.
- Because some molds are toxic, assume that *all* molds are toxic and take precautions. This will ensure the safety of your staff, your patrons and yourself.
- Both active and dormant molds have an adverse effect on people. People with allergies or asthma should stay away from mold, as it will seriously irritate and inflame lungs, and can cause skin and eye irritations and infections. Prolonged exposure to germinating molds in closed areas (like libraries) can permanently damage lungs, mucous membranes, cornea, the respiratory tract, stomach, intestines and skin.

Always wear a fitted respirator, not a dust mask, when working with mold.

- Refer to the list of sources at the end for respirator information.
- Be sure to wear protective clothing that can be immediately removed and washed or thrown away; throw away cartridges from the respirator daily; wear gloves that can be thrown away or washed.

WHY IS MOLD HARMFUL IN LIBRARIES?

- Mold is one of most serious, damaging and underappreciated sources of damage in libraries and archives because molds eat library materials.
- Mold stains paper, cloth, leather; it destroys images; it degrades materials and causes them to be difficult to handle.
- Mold grows on any organic host offering nutrients, including paper, adhesives, leather, dust, and sooty dirt.
- Most molds grow when the relative humidity (RH) meets or exceeds 70-75%. Some molds grow at lower relative humidities.
- High temperatures, poor air circulation, and accumulated grime assist and accelerate the growth of mold once it has germinated.
- **IMPORTANT:** *Most molds found in libraries will become active when RH rises above 70%. Only high RH can initiate and sustain mold growth. Once RH drops below 70%, molds stop growing and becomes inactive or dormant, **but the desiccated mold growth and spores will remain viable on the host material. They will become active when RH rises above 70%.***

HOW TO IDENTIFY MOLD

- Accumulation of dirt, dust, stains, and cobwebs are often misidentified as mold. Examine the growth and eliminate these possibilities.
- Determine whether the mold growth is active or dormant.
 - Check under magnification.

Does it look like a fine web of filaments on the surface?
Science departments or teachers may have a microscope available. Or, small, hand-held illuminated magnifiers are inexpensive and available commercially.
 - Is it damp? Does it smell musty?
 - Test with a swab.

If it is dry and powdery it is dormant.
If it smears it is active. This can be difficult to identify. If there is doubt, assume the mold is active.
- Have your building engineer check temperature and RH levels. If the RH level is above 70% this must be lowered in order to ensure that growth is inhibited.

HOW TO MAINTAIN A LOW MOLD-RISK ENVIRONMENT

It is not possible to maintain a mold-free environment since mold is truly ubiquitous. Consider these recommendations as measures to help control mold growth.

1. Humidity

- The amount of moisture in the air is the most important environmental factor to control. RH levels should be below 70%.

2. Temperature

- Most molds thrive in warm environments. When combined with high relative humidities, temperatures of 70-75°F can cause mold to develop. Some molds are capable of growing in cooler climates, but the common types found in libraries will grow less quickly in cooler temperatures.

3. Adequate air circulation will help to control mold growth because it helps to control moisture through evaporation.

- A well designed and maintained heating, ventilation, air-conditioning system (HVAC) with humidity control will offer the best protection. Also useful are the following:

- *Fans*: best placed near outside walls and close to floor level. Make sure the fans are not blowing active mold into the environment.
- *Portable dehumidifiers* : particularly useful for localized problems but will not combat a poorly functioning HVAC system.
- *Fans and vents in attics*: increase air circulation by pulling air through the building.

4. *Miscellaneous environmental conditions*:

- Don't shelve books directly against an outside wall. Because of differences in outside and inside temperature, moisture may develop in or along the wall. Allow air to circulate along the wall to enable evaporation.
- Keep the quantity of indoor plants to a minimum and don't allow indoor planted areas.
- Regularly inspect your collections for mold and mildew. This allows you to catch any infestations before they become large. Continue to monitor infestations as a barometer of the environmental conditions in your library.
- If books are donated to the library that may have been stored in a garage or attic, check them for mold before adding them to the rest of the collection.
- If there is uncertainty about environmental conditions or questions regarding a mold outbreak, consult a conservator or another outside consultant.

WHAT CAN YOU DO IF YOU HAVE A MOLD OUTBREAK?

1. *Determine if active or inactive mold*; inactive molds still pose a health risk because they are still in the air and may begin growing as soon as the environment permits it.
2. *Isolate affected materials*:
 - If a small quantity, put in sealed plastic bags.
 - If a large quantity, quarantine affected area with plastic sheeting or by closing doors. Cut off air circulation to affected area and contact outside help immediately. Do not allow access into affected area by anyone. When dealing with the material, wear protective clothing, gloves, and a respirator.
 - If the mold outbreak is very extensive consider replacing materials and/or contact a conservator to estimate cost of mold removal from items.
3. *Determine source of outbreak*

- Look for a source of water such as leaking roof or pipes, damp basement, blocked gutters, broken window, or moisture along outside walls. Have an engineer or facilities maintenance staff member check HVAC system, as this can be the prime area for fungal growth and spore distribution.

You must pinpoint the source of the outbreak in order to effectively manage and eradicate the mold. Mold will continue to grow no matter how often you treat the materials if the source of the problem is not addressed.

Remember: if you have a mold problem, you have an environmental problem.

4. *Increase air circulation and decrease RH.*

- Options: open windows, set-up fans and dehumidifiers, readjust HVAC system.

PROTECTIVE GEAR

Dust masks are ineffective as protective gear because they are not properly fitted to the face. With each breath you take it is possible to get a concentrated stream of dust and mold where the mask is not tight against the face, especially at the nostrils and the cheeks.

- Dust masks have the potential to be more harmful than good.
- Filtered respirators are a much better and safer option. Considering all of the health and safety issues surrounding mold, respirators become the only reasonable option.
- Filtered respirators should be fitted by a professional. Contact your respirator vendor or the Texas OSHA office for information.
- There are different kinds of filters (i.e. particulate or solvent) and it is important to make sure that you have the right kind for the right job. A filter designed for organic solvents will not protect against mold.

To check the fit on a respirator:

- The intake valves are at the filters on the sides.
- Cover the intake valves and inhale - there should be no air coming in.
- To check the out-take valve, hold your hand at the valve on your chin and exhale. No air should escape easily.
- In addition to a fitted respirator, always wear disposable gloves. Cover hair, shoes, etc. if the outbreak is severe.
- Throw gloves, filter cartridges, and disposable clothing away daily.

HALTING MOLD GROWTH

The current recommended practice is to freeze or air-dry the materials first before you clean them. Freezing and air-drying offer options for halting the spread of the mold while you prepare for cleaning.

1. *Freezing* will halt the growth, but will not kill the spores. Freezing is only a temporary measure until the books are returned to a normal environment.

- Have a disaster manual on-hand and make-sure that staff are familiar with it and know how to implement the established disaster procedures.
- In the disaster manual you should have a list with the names, addresses, and phone numbers of vendors with industrial-sized freezing facilities.

2. *Air-drying*

- It is preferable to work on moldy materials outdoors where mold spores will not contaminate other collection materials or recirculate into the HVAC system.
- If this is not possible, air-drying should be done in an area that is vented to the outside in order to prevent the spread of spores to uncontaminated materials.
- Interleave effected books with blank newsprint and/or blotters.
- Books can be stood on end and fanned out.

3. *Ultra-violet radiation.* Because UV radiation can kill many types of mold, books can be fanned open and left in the sun for no longer than a few hours.

- Use this method sparingly. Ultra-violet light darkens paper and accelerates aging. Only materials in which light fading is acceptable should be considered.
 - Books should not be placed outdoors if the RH is above 70%, because this could encourage and accelerate mold growth.
 - This process needs careful and continued monitoring and is best used only in a small, localized outbreak.

CLEANING THE AREA

1. *Chemical methods*

To remove mold growth from walls, shelves, and storage areas, you can use chemical solutions. Chemicals used for cleaning mold are separated into bleaches and fungicides. Only fungicides will eradicate some of the mold. Chemicals will kill most of the mold

and mildew, but unless the macro-environmental problems are corrected the mold could possibly return.

- Make sure the area is properly ventilated while cleaning.
- Do not return books to the area before it has been cleaned.
- Depending on how serious the outbreak is, it may be necessary to clean carpets and draperies.
- Shelves, storage areas, floors, and walls should be cleaned with diluted chlorine bleach (check the bottle for the correct diluted strength).
- Rinse the areas that have been cleaned with chemicals with water and dry thoroughly before returning any collection materials.
- Ducts, filters, and other parts of HVAC systems should be checked, replaced, or cleaned by engineers or members of the facilities maintenance staff.

*** When cleaning with chemicals, you have to consider the toxicity and instability of the fungicide as well as the mold. Anything that harms a living thing like mold can also potentially harm other living things, like humans.*

2. *Non-chemical methods:*

Cleaning with non-chemical methods is preferred over chemical techniques because it does not harm the books, leave chemical residue, and it is non-toxic to humans.

5. Vacuuming with the proper equipment is a very effective method of removing mold because it doesn't spread the spores into circulating air.
 - Do not use a house-hold vacuum. The filtering system is completely inadequate and recirculates mold spores into the air.
 - Use a commercial strength, high efficiency particulate-arresting (HEPA) filtered vacuum. Vacuums that utilize HEPA filtration remove particles and irritants that other conventional vacuums can't remove. Non-HEPA vacuums allow potentially hazardous contaminants and allergens to pass through the vacuum cleaner system and be redistributed into your environment.

CLEANING THE COLLECTION MATERIALS

Realistically, only heavy accretions will be removed by cleaning. Both active and inactive mold spores can remain trapped in the fibers and surfaces of the book or paper.

1. You can use soft brushes or cloth rags to wipe mold from book bindings and covers.
 - Be careful not to brush mold into the air or onto other objects.

- Discard brushes and rags frequently. Store them inside sealed plastic bags until discarded.
2. Removing inactive mold from paper can be done with smoke sponges, which are available from preservation supply catalogs, and white vinyl erasers like “MagicRub” or “Statler-Mars,” which are available at art-supply stores.
- Be sure to be gentle and do not grind the mold into the paper.
 - Construct a paper tray from newsprint paper with three low walls, so that eraser crumbs and moldy debris do not spread. For small books this can also be done by cutting off one of the large sides of a grocery bag, turning it to rest on the remaining side, and using it to catch the eraser crumbs.
 - Throw *everything* away, including: brushes, sponges, erasers, paper trays.
- *Stains or smell may be permanent.*
To remove unwanted mildew or moldy odors:
 - Place natural charcoal or baking soda in bowls or inside isolation chambers (such as a sealed box) to absorb unwanted smells.
 - Do not wipe books with these materials.

GENERAL RESOURCES

- Much of the content of this presentation was adapted from Sandra Nyberg’s SOLINET leaflet from November 1987. It is available via:
<http://palimpsest.stanford.edu/solinet/moldnew.htm>
- SOLINET (Southeastern Library Network, Inc.) is a not-for-profit library cooperative based in Atlanta which offers preservation information. <http://www.solinet.net>
- Conservation On-Line (CoOL) is a project of the Preservation Department of Stanford University Libraries and a full text library of conservation information, covering a wide spectrum of topics of interest to those involved with the conservation of library, archives and museum materials. Conservation and preservation information for the general public can be found at
<http://palimpsest.stanford.edu/bytopic/genpub/>
- Amigos Library Services, Inc. is a non-profit organization that serves the southwestern states and provides training, disaster preparedness/recovery, site surveys and consultations. <http://www.amigos.org>

- Occupational Safety and Health Administration, U.S. Department of Labor (OSHA).
<http://www.osha.gov>
(800) 688-9889 for federal information
(512) 916-5783 for Texas information
- Respirators available at Cuevas Distribution, Inc. a laboratory medical safety equipment and supply company based in Fort Worth. (800) 328-3827