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# AGENDA

- 8:45            Mold Basics  
                  What is mold?  
                  Exposure to mold  
                  Visual Assessment  
                  Clean-Up  
                  Mold in the Media
- 9:30            Break
- 9:45            Health Effects  
                  Symptoms  
                  Stachybotrys Chartarum
- 10:15           Legal issues and Regulations  
                  Mold Regulations  
                  Workers' Compensation  
                  Standards?
- 10:30           Moisture and Mold Inspections  
                  Perimeter Visual Inspection  
                  Hidden Mold
- 11:45           Lunch
- 12:45           Moisture and Mold Inspections (Cont'd)  
                  Humidity and Mold  
                  Water Intrusion  
                  Filtration
- 2:15            Break
- 2:30            Moisture and Mold Remediation  
                  Guidelines for Remediation of Mold  
                  Sampling?
- 3:30            Interpretation of Results  
                  Proposed Guidelines  
                  Containment  
                  Clean up

# **COURSE OBJECTIVES**

Students will understand more about mold and the health effects of exposure to mold. Information on assessing mold contamination, clean up and remediation will help students to know what steps must be done to limit health effects.



## Got Mold?

Ohio Bureau of Workers'  
Compensation  
Division of Safety and Hygiene

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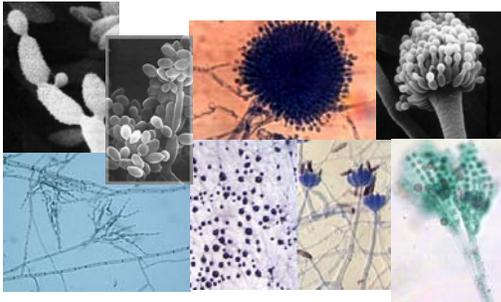
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### What is mold and where is it found?



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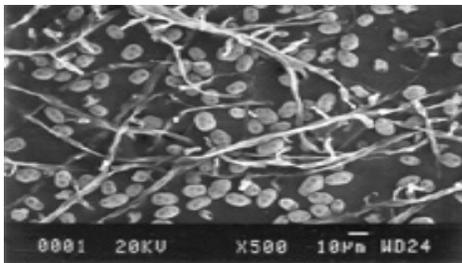
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### The State of the Science

- Mold has always been present  
– Leviticus 14:33-45



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### How can you be exposed to mold?

- Damaged or disturbed moldy material
- Inhaling spores

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### Is mold all the same?

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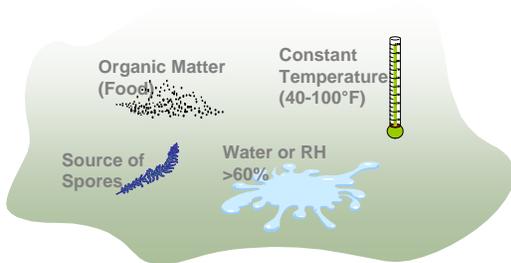
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### How does mold grow?



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**You can only control one thing**

**WATER!**



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**Should I be concerned about mold in indoor environments?**

Mold should not be permitted to grow and multiply indoors.

- When this happens, health problems can occur and building materials, goods and furnishings may be damaged.

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How do I tell if I have a mold problem?

- Investigate, don't sample. Use your eyes to look for mold growth and by using your nose to locate the source of a suspicious odor, signs of excess moisture or the worsening of allergy-like symptoms

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## How can mold affect your health?

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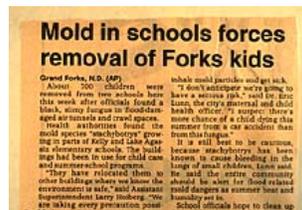
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## Will my health or my child's health be affected, and should we see a physician?



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## What should you do if mold is present in your home or apartment?

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## Houston Flood 2001



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### **NIOSH has determined**

- Significant relationship exists between work-related respiratory disease and:
  - An assessment of water and mold damage
  - An increase in endotoxin and ultra-fine particles
  - Indicators of mold in chair or floor dusts

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**NIOSH has not determined**

- A link between indoor air molds and other health effects such as:
  - Bleeding from the lung
  - Memory loss

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Q 1. I heard about "toxic molds" that grow in homes and other buildings. Should I be concerned about a serious health risk to me and my family?

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Q 2. How common is mold, including *Stachybotrys chartarum* (also known by its synonym *Stachybotrys atra*) in buildings?

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Q 3. How do molds get in the indoor environment and how do they grow?

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Q 4. What is *Stachybotrys chartarum* (*Stachybotrys atra*)?

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Q 5. Are there any circumstances where people should vacate a home or other building because of mold?

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Q 6. Who are the people who are most at risk for health problems associated with exposure to mold?

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Q 7. How do you know if you have a mold problem?

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Q 8. Does *Stachybotrys chartarum* (*Stachybotrys atra*) cause acute idiopathic pulmonary hemorrhage among infants?

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Q 9. What if my child has acute idiopathic pulmonary hemorrhage?

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Q 10. What are the potential health effects of mold in buildings and homes?

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Q 11. How do you get the molds out of buildings, including homes, schools, and places of employment?

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Q 12. What should people do if they determine they have *Stachybotrys chartarum* (*Stachybotrys atra*) in their buildings or homes?

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Q 13. How do you keep mold out of buildings and homes?

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Q 14. I found mold growing in my home; how do I test the mold?

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Q 15. A qualified environmental lab took samples of the mold in my home and gave me the results. Can CDC interpret these results?

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- **Summary:** In summary, *Stachybotrys chartarum* (*Stachybotrys atra*) and other molds may cause health symptoms that are nonspecific. At present there is no test that proves an association between *Stachybotrys chartarum* (*Stachybotrys atra*) and particular health symptoms. Individuals with persistent symptoms should see their physician. However, if *Stachybotrys chartarum* (*Stachybotrys atra*) or other molds are found in a building, prudent practice recommends that they be removed. Use the simplest and most expedient method that properly and safely removes mold.

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## Health Effects

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## How can mold affect your health?

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## Symptoms

excessive reporting by building occupants of one or more of the following symptoms:

- headache
- lethargy
- tight chest
- fatigue
- wheezing
- congestion
- dizziness
- burning eyes
- watery eyes
- sinus difficulty
- flu-like symptoms

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**What is Stachybotrys chartarum?**

- Black mold?
- Toxic mold?
- Killer mold?
- Death mold?
- Fatal fungus?
- \$ Mold is Gold? \$
- Cleveland 1994

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**How can you tell if Stachybotrys chartarum is present in your home?**

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**How can Stachybotrys chartarum affect your health?**

- There is inadequate evidence to support the conclusion that exposure to mycotoxins in the indoor environment is causally related to symptoms or illness among building occupants.
- There is inadequate evidence to support recommendations for greater urgency in cases where mycotoxin-producing fungi have been isolated.

AIHJ Sept/Oct 2001

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**Stachybotrys chartarum**

- Does this take stachybotrys off the hook?
  - It does make mycotoxins
  - It can cause disease in animals
  - A transfer mechanism needs to be identified
  - It is less than 1% of indoor fungus
- Conclusion
  - Mycotoxins are real
  - Fungi should all be treated with respect

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**Stachybotrys chartarum**

- Problems in Cleveland study
  - Bias in data collection
  - Infants illness very unlike animal disease
  - How would toxin get to babies?
  - Cluster of stachybotrys exposed babies in Chicago were not sick
  - Statistical problems with the analysis
  - CDC recanted entire study

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**Will my health or my child's health be affected, and should we see a physician?**

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**How can I be exposed to mold?**

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**Legal Issues and Regulations**

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**Texas Mold Rules**

- Must have an address in Texas to conduct business

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**Current state of mold regulation**

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## Fed & state Regs

- NIOSH says there are:
  - No accepted standards for mold sampling in indoor environments or for analyzing and interpreting the data in terms of human health
  - Molds are everywhere – if you test you will find mold
  - It is not known what quantity is acceptable in indoor environments with respect to human health

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## No Standards Yet

- Why are there no standards?
  - Most studies have tended to be based on baseline environmental data, rather than human dose-response data
  - Individuals have different sensitivities to molds, so setting standards and guidelines for indoor mold exposure is difficult and impractical

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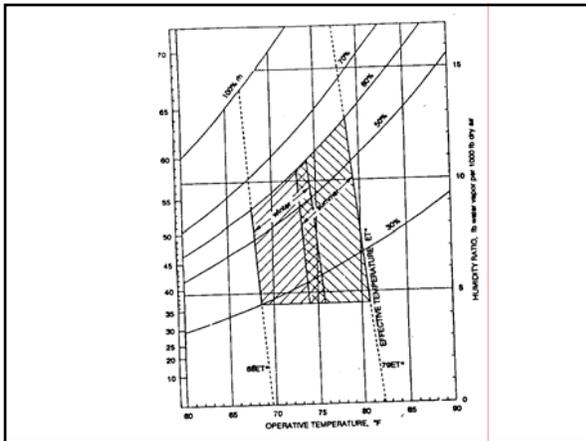
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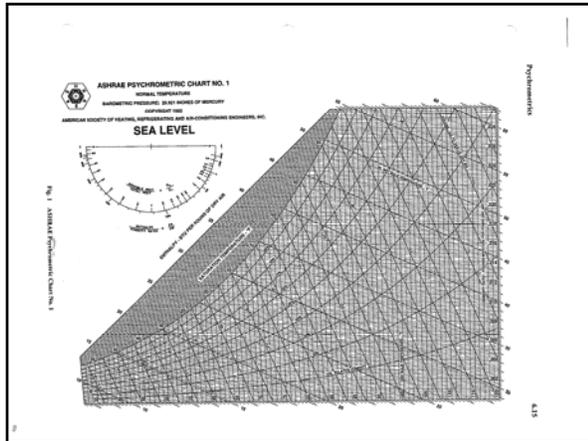
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### Terminology

- Psychrometrics
- Temperature
- Grains of moisture
- Relative humidity
- Dew point

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### The Fundamental Law of Mold

- Mold problems = Water problems




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## Mold Prevention Strategies

- Infiltration control
- Humidity control
- Surface temperature control
- Proper grading

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## Moisture and Mold Inspections

Ohio Bureau of Workers'  
Compensation  
Division of Safety and Hygiene

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## Mold Dynamics

- Hidden Mold
- Mold Distribution
- Mold Needs



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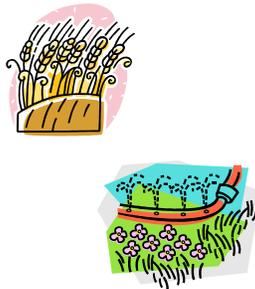
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## Needs

- Temperature
- Light
- Food
- Moisture



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### IAQ Milestones

- 1976 Legionnaires Outbreak
- 1987 NIOSH Guideline for IAQ Investigations
- 1989 ACGIH Bioaerosol Assessment & Control (2<sup>nd</sup> Ed. 1999)
- 1991 EPA Building Air Quality
- 1993 NYC Guidelines to Assessment & Rem. Stachy
- 1993 American IAQ Council Founded
- 1994 Pulmonary Hemosiderosis in Cleveland
- 1994 IAQ Association Founded
- 1995 EPA Tools for Schools (2<sup>nd</sup> Ed. 2000)
- 2000 NYC Guidelines/ Assessment & Rem. Fungi in IAQ
- 2001 EPA Mold Rem. In Schools & Commercial Bldgs.
- 2003 IICRC S520 Stds. & Ref. Guide for Professional Mold Remediation

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### Potential Hidden Mold



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### Potential Hidden Mold



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### Potential Hidden Mold



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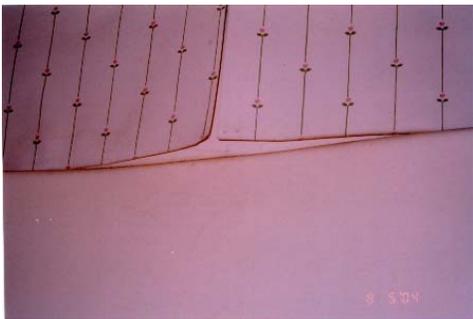
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### Potential Hidden Mold



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### Wood Decay

- Brown rot caused by cellulose digestion (basidiomycetes)
- White rot caused by lignin digestion (basidiomycetes)
- Soft rot caused by wet wood (bleached with black zone lines) (microfungi and ascomycetes)

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## Finding Hidden Mold



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## Humidity and Mold



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## Humidity and Spore Release

- Dry Spores
  - High periods between 10:00 am – 3:00 pm
  - Release by desiccation
- Slimy Spores
  - High periods between midnight – 3:00 am
  - Release by bursting

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## Humidity and Spore Release

Bldg Engineers look for water pathways

- If more water and dust is present usually equates to more mold growth
- Settled dust testing may be a good indicator
- Exposure pathway, may be settled dust
- Univents that are turned on and off can be good distributors of mold
- Drywall can act like sponge

(Morey, Yang, Miller, Tiffany; AIHCE-2000)

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## Fungal Categories

Leaf Surface  
(*phyllplane*)

*Alternaria*  
*Cladosporium*  
*Epicoccum*

Outdoor growth on leaf surfaces. Presence in building through infiltration.

Soil Fungi

*Aspergillus*  
*Penicillium*

Outdoor growth in soil. Outdoor infiltration and indoor sources.

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## Fungal Categories

Water requiring  
(*hydrophilic*)

*Aspergillus Fumigatus*  
*Botrytis*  
*Fusarium*  
*Stachybotrys*  
*Sporobolomyces*  
*Ulocladium*  
*Zygomycetes*  
*Yeast*

Outdoor growth on moist organic matter.  
Outdoor infiltration and indoor sources.  
Higher indoors = presence of excess water.

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## Fungal Categories

### Toxogenic

*Aspergillus Flavus*  
*Aspergillus Fumigatus*  
*Aspergillus Versicolor*  
*Fusarium*  
*Stachybotrys*

Outdoor and indoor.  
Outdoor infiltration and indoor sources.  
Presence indoors may indicate concern for occupant health

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## Measuring Humidity



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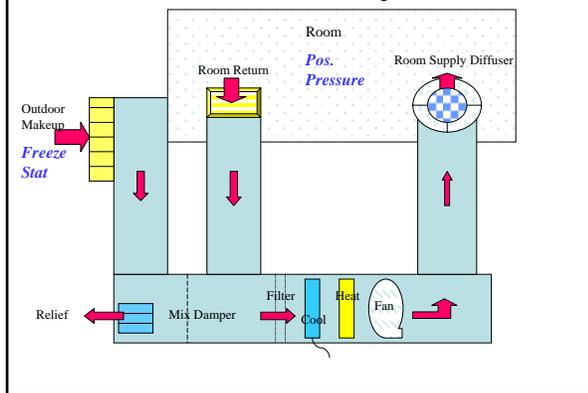
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## Basic Ventilation Design



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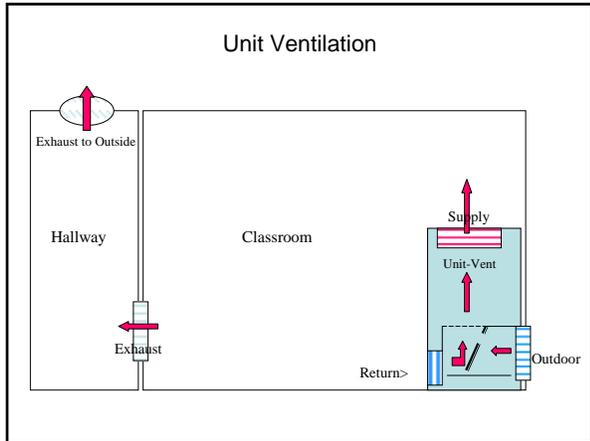
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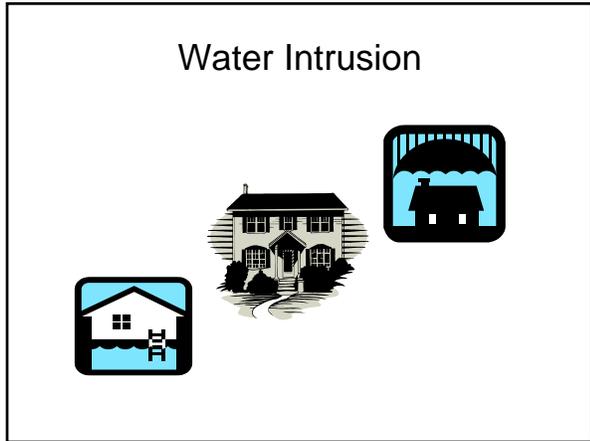
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## Water Intrusion

Water Activity

Drywall like a sponge

Moisture Meters

Condensation

Damp/Dirty filters/ coils

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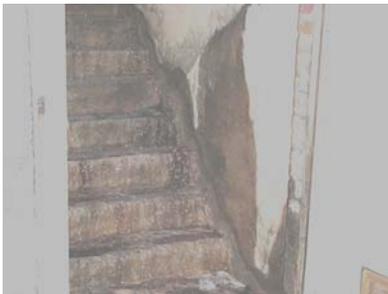
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## Water Intrusion



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## Free Water in/on bldg. Material

[Aw = Water Activity]

- Aw **Low** < .8 =Primary colonizers (first to grow in dust/dirt on wall/ceiling cavities, carpet, furniture) **Aspergillus V., Penicillium & Wallemia** fungi
- Aw **Moderate** .8-.9 =Secondary colonizers (common outdoors and infiltrate through air inlets & cloths) **Cladosporium, Paecilomyces, Scopulariopsis & Aspergillus** fungi
- Aw **High** >.9 =Tertiary colonizers (hydrophilic; grow on wet or recently wet bldg. materials; in cooling towers, humidifiers, cooling coils, and condensate pans) **Fusarium/Stachybotrys/ Acromonium/Ulocladium/Trichoderma/Chaetomium** fungi;  
**Pseudomonas/Bacillus/Streptomyces/ Actinomyces** G- bacteria

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## Water Intrusion



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## Water Intrusion



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## Moisture Meters

Carpet, Wood, Brick, Wallboard, Concrete



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## Filtration




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## ASHRAE 52.2 MERV

- | MERV  | %Eff. | Final Resist | Controls       | Type                      |
|-------|-------|--------------|----------------|---------------------------|
| 1-4   | <20   | 0.3 in. w.g. | Disp./Wash./ES | Pollen/mites/fiber        |
| 5-8   | 20-70 | 0.6 in. w.g. | ES/Pleated     | Dust/mist/spores          |
| 9-12  | 70-90 | 1.0 in. w.g. |                | Fume/Legionella Box/Bag   |
| 13-16 | 90-99 | 1.4 in. w.g. | ES             | Tob.Sm./Bacteria Box/Ind. |
- Minimum Efficiency Reporting Value (MERV)
  - Highly controlled laboratory testing, instead of dust spot
  - Minimum efficiency instead of average
  - Filter ability to remove particles of specific size

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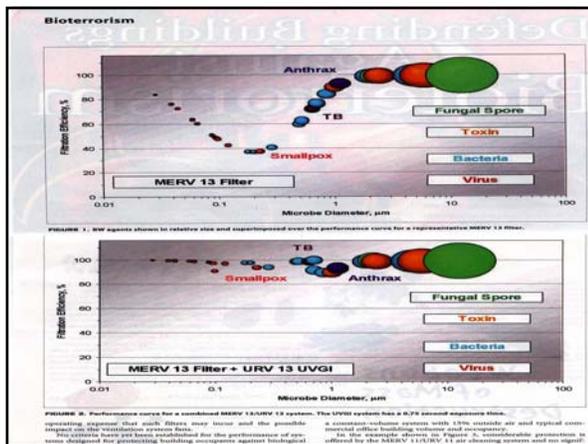
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GERMS OF TERROR:

Disease	Origin	Prevention	Treatment
Anthrax	Bacillus anthracis bacterium	Vaccine available	antibiotic treatment before symptoms occur
Botulism	Clostridium botulinum bacterium	Vaccine currently not available	Antitoxins can halt progress
Plague	Yersinia pestis bacterium	Vaccine given until 1998	Antibiotics
Smallpox	Poxvirus	Mass inoculation stopped in 1972	Supportive therapy and Quarantine

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### Filtration/ Infiltration



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# Moisture and Mold Remediation

Ohio Bureau of Workers' Compensation  
Division of Safety and Hygiene

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## Checklist for Mold Remediation

EPA 402-K-01-001 (p.27)

### Investigate



- Assess size of moldy area (square feet)
- Consider hidden mold (wall cavity, air ducts, etc.)
- Clean up small mold problems
- Select remediation manager for medium to large mold problems
- Identify sources & type of water/ moisture sources
- Consult qualified professionals when necessary
- Consult with occupants throughout process

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## Checklist for Mold Remediation

(Continued)

### Plan Remediation

- Use professional judgment to customize guidelines
- Plan to dry non-moldy materials
- Determine cleanup method for moldy items
- Determine proper personal protection equipment
- Protect building occupants

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## Checklist for Mold Remediation

(Continued)

### Remediate

- Fix moisture problems (implement repair and maintenance)
- Dry non-moldy materials within 48 hours
- Clean and dry moldy materials
- Discard moldy porous items that can't be cleaned

Also (IICRC pp. 46-47) (AREC)

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## Occupant Health Investigation

- Clinical Investigation
  - No commercially available reliable diagnostic tests at this time
  - Assessment of symptomatic and asymptomatic occupants
  - Especially if occupant health problem remains unclear
- Epidemiologic Investigation
  - Recommended to clarify a building related problem
  - Baseline for comparison to remediation/ intervention
- Treatment
  - Almost always requires removal from environment
  - Treatments have not demonstrated long term relief

(IICRC S520 pp. 46-47)

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### EPA Guidelines for Remediating Materials with Mold Growth (from Clean Water)

Material Affected *	Cleanup Method
< 10 sq. ft.	Paper/Books/ Wallboard (3) Concrete/ Carpet/ Furniture/ Drapes (1,3) Wood, Plastic, Metal (1,2,3)
10 – 100 sq. ft.	Paper/Books (3) Wallboard (3,4) Concrete (1,3) Carpet/ Furniture/ Drapes (1,3,4) Wood, Plastic, Metal (1,2,3)
> 100 sq. ft.	Paper/Books (3) Wallboard (3,4) Concrete (1,3) Carpet/ Furniture/ Drapes (1,3,4) Wood, Plastic, Metal (1,2,3) Wood (1,2,3,4)

- 1 – Wet Vacuum / Steam Clean / Complete Extraction
- 2 – Damp wipe with water or detergent solution
- 3 – HEPA Vacuum / after material is thoroughly dried
- 4 – Discard (sealed with normal waste) / HEPA Vacuum area after removal

EPA "Mold Remediation in Schools and Commercial Buildings," EPA 402-K-01-001, March 2001

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**EPA Guidelines for Remediating Materials with Mold Growth**  
(from Clean Water)

Material Affected *	<b>Personal Protection Equipment</b>
< 10 sq. ft.	Minimum (Gloves, Goggles, N-95 Respirator)
10 – 100 sq. ft.	Limited (add ½ mask & coveralls Full (add head gear, foot coverings, full face with HEPA)
> 100 sq. ft.	Full (Gloves, goggles, coveralls, head gear, foot coverings, full face with HEPA)

1 – Wet Vacuum / Steam Clean / Complete Extraction  
 2 – Damp wipe with water or detergent solution  
 3 – HEPA Vacuum / after material is thoroughly dried  
 4 – Discard (sealed with normal waste) / HEPA Vacuum area after removal

EPA "Mold Remediation in Schools and Commercial Buildings," EPA 402-K-01-001, March 2001

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**EPA Guidelines for Remediating Materials with Mold Growth**  
(from Clean Water)

Material Affected *	<b>Containment</b>
< 10 sq. ft.	None Required
10 – 100 sq. ft.	Limited (Seal area with fire-retardant polyethylene sheeting, maintain negative pressure with HEPA, block supply & return air vents)
> 100 sq. ft.	Full (two layers of fire-retardant poly with airlock chamber, maintain negative pressure with HEPA to outside, block supply & return air vents)

1 – Wet Vacuum / Steam Clean / Complete Extraction  
 2 – Damp wipe with water or detergent solution  
 3 – HEPA Vacuum / after material is thoroughly dried  
 4 – Discard (sealed with normal waste) / HEPA Vacuum area after removal

EPA "Mold Remediation in Schools and Commercial Buildings," EPA 402-K-01-001, March 2001

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## Should Sampling Be Done

- Is there a clinical link?
- Are the symptoms directly associated with mold?
- Is bacterial growth involved?
- Are there significant chronic symptoms without visible mold?
- Is there a persistently musty odor without visible mold?

(Any one of these may trigger sampling)

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## Sampling Mediums



**Biosampler** 12.5 lpm 8-hours, preserves viability  
Viable and total Endotoxin Bacteria  
Less efficient collection of hydrophobic bacteria and fungal spores



**Button Sampler** 4 lpm on filter, limited viability  
Viable and total Endotoxin Bacteria  
Good collection uniformity low sensitivity to ambient conditions



**Bio Stage Impactor** 14.15/28.3 lpm on culture medium  
Viable and Bacteria  
Easy to use, organisms remain viable, cost effective, time proven  
Particle bounce, short sample times



**Spore traps** 15 lpm impaction on tacky glass  
Total pollen fibers  
Low particle bounce allow direct quantitative analysis  
Slide overload short sample times  
(Air-o-cell, Burkard, Allergenco, Cyclex-D, Laro)

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## Sampling Mediums



**Bio Cassette** 28.3 Lpm Impaction onto culture media  
Viable Bacteria  
No preparation, sterilization, disassembly, organisms remain intact and viable, low stress on particles  
Particle blow off/ bounce, short sample times



**Surface Swab** Wipe sample  
Viable and total / bacteria  
Easy to use, fast, non-destructive  
Sampling must be handled aseptically



**Bio-Tape** Lift Surface sample  
Fungal pollen fibers  
Non-destructive, predetermined sample area  
Possible secondary contamination of sample



**Carpet Filtration** using filter 10 lpm  
Fungi and fibers  
Easy to use Cost effective

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## Interpretation of Results (Air)

- Pathogenic fungi - Aspergillus, Cryptococcus, Histoplasma
- Toxogenic fungi - Stachybotrys atra, Aspergillus, Fusarium
- Presence of 1 or more species greater than outdoor
- > 50 cfu/m<sup>3</sup> of 1 or > species except Cladosporium, Alternaria
- Different profile of species indoor than outdoor
- Mixture up to 150 cfu/m<sup>3</sup> OK if similar to outdoor
- Higher levels OK in summer if tree fungi like Cladosporium
- Elevated levels may reflect building problem but not disease
- Even low levels of **Stachybotrys**, Aspergillus Versicolor and various Penicillium beyond background a concern

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## Mold Indicators

Aspergillus vers., Wallemia can show damp (condensate problem)

Cladosporium, Alternaria are normal in buildings

Stacybotrys, Trichoderma, Chactomium indicate wet problems

Ceiling tile formerly wet will have low water

Aspergillus versicolor, Wallemia

Penicillium indicates an inside moisture source

Common in outdoor air to find 20,000+ spores m3

(Such as Cladosporium)

(Common soil Penicillium, Aspergillus are < 1% in air)

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## National Allergy Bureau Data

< 6500 Grains/m3 - Only individuals extremely sensitive to mold spores will suffer

< 13,000 - Many individuals sensitive to mold spores will suffer

< 50,000 - Most individuals with any sensitivity to mold spores will suffer

> 50,000 - Almost all individuals with any sensitivity to mold spores will suffer. (can be severe)

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## Proposed Guidelines

(AIHA Synergist Nov. 2001 pp.20-21)

Type	Normal	Possible Contamination	Probable Contamination
Air / Residential	<5000 <500	5000-10,000 500-1000	>10,000 spores/m3 >1000 cfu/m3
Air / Commercial	<2500 <250	2500-10,000 250-1000	>10,000 spores/m3 >1000 cfu/m3
Dust/Bulk Samples	<100,000 <10,000 <50,000	100,000-1,000,000 10,000-100,000 50,000-100,000	>1,000,000 sp/gram >100,000 cfu/gram >100,000 mycelial frags/g
Swab Samples	<10,000 <1500		>10,000 cfu/in2 >1500 cfu/cm2
Tape Samples	No significant fungal material or biomass	5-25%	25-100%

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### Some Consultants Use the Following

Type	Air CFU/m <sup>3</sup>	Swab CFU/in <sup>2</sup>	Bulk CFU/gram
No growth/ Background	--	< 100	< 100
Low/ Normal	< 250	100 - 10,000	100 - 25,000
Moderate/ Borderline	250 – 1000	10,000 – 100,000	25,000 – 200,000
Active Growth/ Sporulation	1000 - 5000	100,000 – 1,000,000	200,000 – 1,000,000
Very Active Growth	> 5000	> 1,000,000	> 1,000,000

(EMSL Analytical Inc., 2004)

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### Background in Non-complaint Bldgs.

- Of 150 Commercial Buildings = 233 cfu/m<sup>3</sup> when outdoor 1000
- Of 800 residential Buildings = 1200 cfu/m<sup>3</sup> when outdoor 1500
- Large % of Buildings have air fungal levels > 500 cfu/m<sup>3</sup>  
(a level often advocated for remediation)




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### Containment

To prevent contamination of other areas of the building  
Prevent occupant and remediator exposure to mold




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## Limited Containment

- Between 10 and 100 square feet
- Single 6-mil layer
- Overlap flap entrance
- Taped to wall, floor, ceiling or on a stud frame
- All vent, door, chase, riser pathways must be sealed
- Remember common air plenums above drop ceilings
- Keep under negative pressure

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## Full Containment

- Greater than 100 square feet
- Double sheeting layer
- Decontamination layer or airlock
  - Large enough for changing in and out of work clothing

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## Move Occupants?

- Size of job
- Health of occupants
- Hazard of substrate
- Type of remediation
- Type of mold

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## Containment

- Maintain negative pressure
- Exhaust to the outside
- Proper containment will mean the sheeting will billow inward (as viewed from outside containment)
- Fluttering or billowing outward (as viewed from outside containment) indicates a compromised containment with leakage



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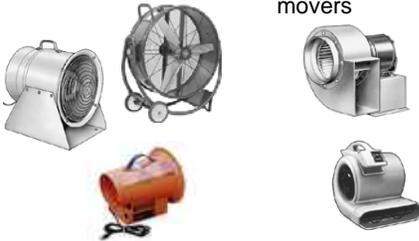
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## Air movers and Dryers

- Axial Air movers
- Centrifugal Air movers



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## Remediation Key Steps EPA 402 K 01 001

Assess Size, Source and damaged material  
(Leaks, HVAC, Maintenance, Condensation, Humidity)

### Select Remediation Manager

Communicate with occupants

Consult with health professionals as necessary

### Plan remediation

In-house people (Containment and PPE)

Outside expertise

### Remediate

Fix source of problem

Dry non-moldy materials within 48 hours

Clean & dry moldy materials (do not just kill or encapsulate)

Discard moldy materials that are not cleanable

Post remediation assessment

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## Selecting A Contractor

- **Proposal** - have them explain the nature of the diagnosis and/or mitigation they will perform
- **Experience** - Ask how much and what type of clean up work the firm has done. Find out if the contractor belongs to trade groups and follows industry standards/guidelines in conducting mold evaluation and remediation. Ask for a list of recent customers.
- **Contract** - protects both parties

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## Selecting a Contractor, continued

- **Conflict of interest** - If you hire a consultant to investigate and identify a problem in a building, that should be all the consultant does. Do not hire a consultant who also provides remediation services. Although most consultants and contractors are honest, some may interpret environmental results (which are often somewhat uncertain) to steer you toward their services.
- **Shop around** - get more than one estimate.
- **Check with the Better Business Bureau** -

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## PPE

- **Avoid Inhaling**
  - Minimum N-95 Respirator
- **Avoid Skin Contact**
  - Minimum Gloves
- **Avoid Eye Contact**
  - Minimum Goggles



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### Average Spores/m3 During Remediation

- Bathroom
  - 1 sq. ft. => 1,000,000
  - 10 sq. ft. => 10,000,000
  - 100 sq. ft. => 100,000,000
- Bedroom
  - 1 sq. ft. => 300,000
  - 10 sq. ft. => 3,000,000
  - 100 sq. ft. => 30,000,000

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### Suggested Minimum Respirators

Spores/m3	Protection Factor	Respirator
50,000	5	Filtering Facepiece
100,000	10	Half-face APR
200,000	50	Full-face APR
600,000	1,000	Full-face PAPR
>10,000,000	10,000	SCBA or Quant. Fit test

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### Clean-up by type

Discard and Replace –	Ceiling Tile, Insulation
Extract water (vacuum) – Dehumidify Accelerate drying (fans)	Carpet (24-48 hrs.), Concrete, Hard surface flooring
Dry in place (if not swelled) – Ventilate wall cavity	Wallboard
Damp wipe –	Hard surfaces

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## Porous Textiles, Uphostery, Paper

- Laundering – with detergents, sanitizers, Chlorine/Oxygen (sodium perborate) bleaches, Increase water temperature
- Dry Cleaning – Standard methods to physically remove contaminant, rather than microbial kill
- Upholstery/Area rugs – Per IICRC S300 “Standard And Reference Guide for Professional Upholstery Cleaning”  
HEPA vacuum, rapid drying
- Paper documents – HEPA (downdraft) brushing, Air washing, rapid drying

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## IICRC Reference of Antimicrobial Agents

- |                      |                         |   |
|----------------------|-------------------------|---|
| • Alcohols (eth/IPA) | 60-90% solution         | B,V,F<br><u>non-irritating or staining IOM, flammable</u>                 |
| • Quaternary Ammonia | .4-1.6% solution        | B*,V*,F<br><u>Inexpensive IOM, limited efficacy</u>                       |
| • Phenolics          | .4-5% solution          | B,V,F,(T)<br><u>Inexpensive, residual Toxic,irritant, corrosive</u>       |
| • Iodophors          | 75 ppm                  | B, V, F, S**, T**<br><u>Stable, residual IOM, expensive</u>               |
| • Glutaraldehydes    | 2% solution             | B, V, F, S**, T<br><u>Resists OM, noncorrosive, irritating, expensive</u> |
| • Hypochlorites      | ≥5000ppm free Cl (1:10) | B, V, F, S**, T<br><u>Inexpensive IOM, toxic, corrosive</u>               |
| • Hydrogen Peroxide  | >3% solution            | B, V, F, S**, T<br><u>Relatively Stable Corrosive, expensive</u>          |
- B=Bactericidal V=Virucidal F=Fungicidal S=Sporicidal  
T=Tuberculocidal
- IOM=Inactivated by organic matter \* = Limited \*\*=Long contact time

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## Know When Finished?

- The water problem is completely fixed
- Mold removed and no odor present
- Sample results similar to outdoors
- Follow-up evaluation (sustainability)
- Health complaints subside

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# Communicate

- Essential for successful remediation
  - Regular memos
  - Meetings
- Tell about
  - Size of project
  - Planned activities
  - Timetable

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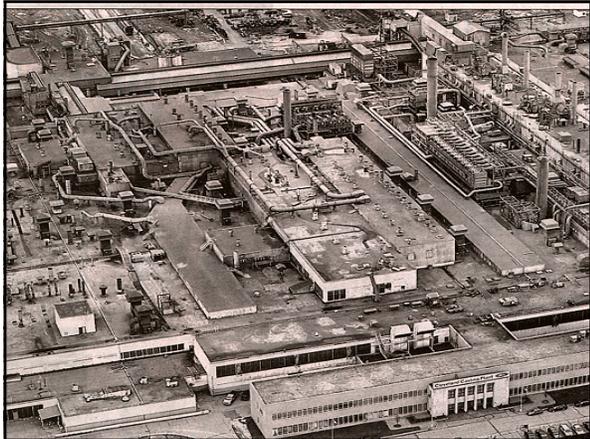
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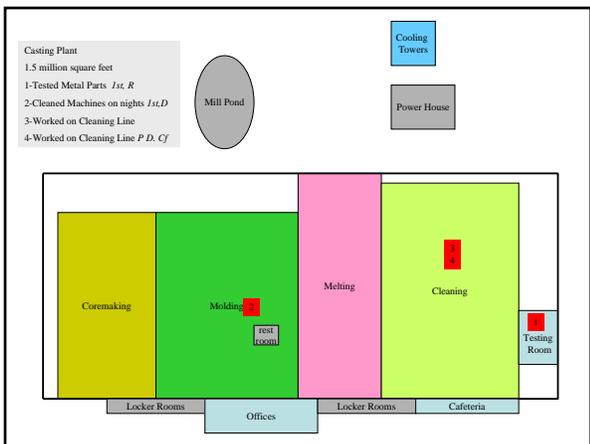
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## Tuberculosis

### Anticipation

- Hospitals
- Nursing Homes
- Public Health

### Recognition

- Occupants are sources, not building structure

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## Tuberculosis

### Evaluation

- Physician diagnosis of patient

### Control

- OSHA / CDC has guidelines for prevention of spread of TB bacillus in affected industries

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## Structural Characteristics



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## Substitute Materials

- Green board
- Low VOC Paints
- Pesticide not containing (allergic/ sensitizer/ carcinogen)
- Non-pesticide if has good adhesion, elasticity and vapor barrier, over a primer, will likely do the job.
- Wall board thermal break
- Vapor barriers

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## Green Building Coalition

- ([www.clevelandgbc.org](http://www.clevelandgbc.org))

### Leadership in Energy & Environmental Design

- Rating system
- For New Construction, Commercial Interiors, Homes, Existing Buildings, Core & Shell, Neighborhood Development
- Awards points for things such as minimum IAQ performance, Carbon dioxide monitoring, Ventilation effectiveness, Construction materials (Low-emitting), Indoor chemical and pollutant sources, Thermal Comfort per ASHRAE 55-1992 (Humidity)

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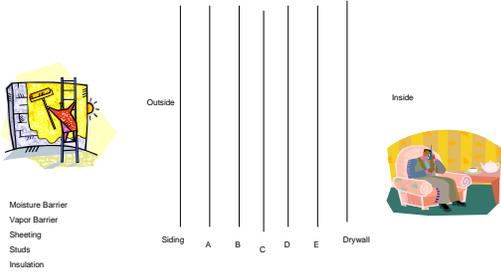
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## Typical Wall Construction




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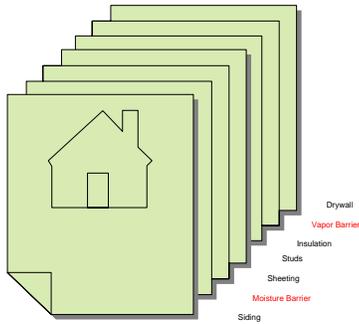
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## Correct Wall Construction




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## Masonry

- Air Space between brick and inside wall
- Weep holes
- Flashing at cap
- Waterproofing




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## Moisture Barrier



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## The Wall Should Not Let Moisture Pass From the Inside



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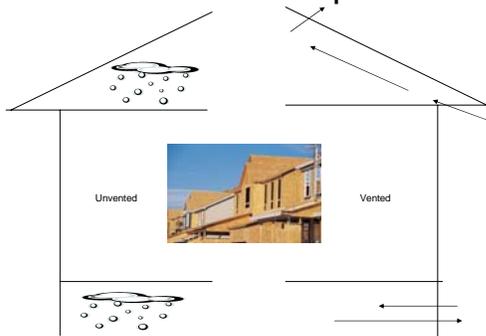
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## Attic & Crawl Spaces



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### ??? Is There a Mold Issue ???

- In addition to other issues, is mold also a concern?
- Signs of current, past or future growth?
- What is the source?
- What will prevent it in the future?

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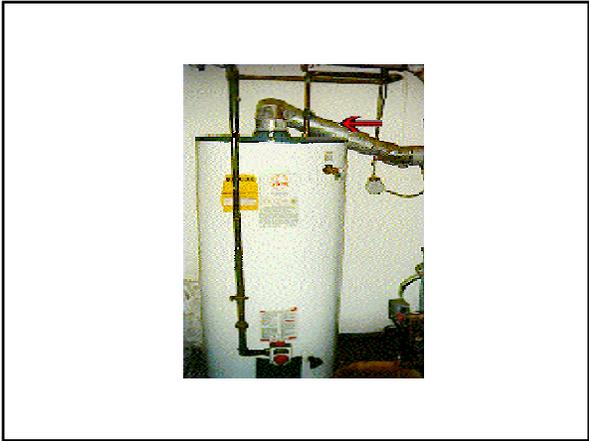
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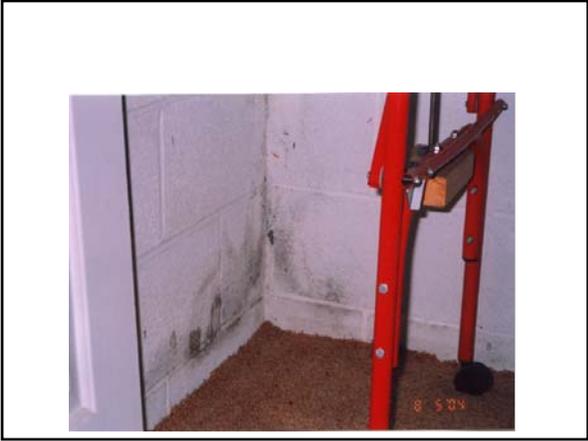
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## Certification Authorities

Institute of Inspection, Cleaning & Restoration (IICRC)

[www.iicrc.org](http://www.iicrc.org)

*Applied Microbial Remediation Tech*

*Water Restoration Tech*

*Applied Microbial Remediation Specialist*

Indoor Air Quality Association (IAQA)

[www.iaqa.org](http://www.iaqa.org)

*Certified Mold Remediator (CMR)*

American Indoor Air Quality Council (AmIAQ)

[www.iaqcouncil.org](http://www.iaqcouncil.org)

*Certified Mold Remediation Supervisor (CMRS)*

National Air Duct Cleaner Association (NADCA)

[www.nadca.com](http://www.nadca.com)

*Ventilation System Mold Restorer (VSMR)*

*Air System Cleaning Specialist (ASCS)*

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## EPA - Resources

**U.S. Environmental Protection Agency (EPA), Indoor Environments Division (IED) An Office Building Occupant's Guide to IAQ**

[www.epa.gov/iaq/pubs/occupgd.html](http://www.epa.gov/iaq/pubs/occupgd.html)

**Biological Contaminants**

[www.epa.gov/iaq/pubs/bio\\_1.html](http://www.epa.gov/iaq/pubs/bio_1.html)

**Building Air Quality Action Plan (for Commercial Buildings)**

[www.epa.gov/iaq/base/actionpl.html](http://www.epa.gov/iaq/base/actionpl.html)

**Floods / Flooding**

[www.epa.gov/iaq/pubs/flood.html](http://www.epa.gov/iaq/pubs/flood.html)

**Indoor Air Quality (IAQ) Home Page**

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

**IAQ in Large Buildings / Commercial Buildings**

[www.epa.gov/iaq/base/index.html](http://www.epa.gov/iaq/base/index.html)

**IAQ in Schools**

[www.epa.gov/iaq/schools/index.html](http://www.epa.gov/iaq/schools/index.html)

**Mold Remediation in Schools and Commercial Buildings**

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

**Mold Resources**

[www.epa.gov/iaq/pubs/moldresources.htm](http://www.epa.gov/iaq/pubs/moldresources.htm)

**U.S. EPA IAQ Information Clearinghouse**

Phone: (800) 438-4318 or (703) 356-4020

Fax: (703) 821-8236

Email: [iaqinfo@aol.com](mailto:iaqinfo@aol.com)

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## Asthma & Allergy - Resources

Asthma and Allergic Diseases:—

**American Academy of Allergy, Asthma & Immunology (AAAAI)**  
(800) 822-2762 [www.aaaai.org](http://www.aaaai.org)  
Physician referral directory, information on allergies and asthma

**Asthma and Allergy Foundation of America (AAFA)**  
(800) 7-ASTHMA (800-727-8462) [www.aafa.org](http://www.aafa.org)  
Information on allergies and asthma

**American Lung Association (ALA)**  
(800) LUNG-USA (800-586-4872) [www.lungusa.org](http://www.lungusa.org)  
Information on allergies and asthma

**Asthma and Allergy Network/Mothers of Asthmatics, Inc. (AANMA)**  
(800) 878-4403 or (703) 641-9595 [www.aanma.org](http://www.aanma.org)  
Information on allergies and asthma

**National Institute of Allergy and Infectious Diseases (NIAID)**  
(301) 496-5717 [www.niaid.nih.gov](http://www.niaid.nih.gov)  
Information on allergies and asthma

**National Jewish Medical and Research Center**  
(800) 222-LUNG (800-222-5864) [www.njc.org](http://www.njc.org)  
Information on allergies and asthma

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## Flooding - Resources

Floods/Flooding:

### Federal Emergency Management Agency (FEMA)

(800) 480-2520 [www.fema.gov/mit](http://www.fema.gov/mit)

Publications on floods, flood proofing, etc.

### University of Minnesota, Department of Environmental Health & Safety

(612) 626-5804 [www.dehs.umn.edu/remanagi.html](http://www.dehs.umn.edu/remanagi.html)

Managing water infiltration into buildings

### University of Wisconsin-Extension, The Disaster Handbook

(608) 262-3980 [www.uwex.edu/ces/news/handbook.html](http://www.uwex.edu/ces/news/handbook.html)

Information on floods and other natural disasters

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## (A-B) Resources

### American College of Occupational and Environmental Medicine (ACOEM)

(847) 818-1800 [www.sioxland.com/acoem/](http://www.sioxland.com/acoem/) Referrals to physicians who have experience with environmental exposures

### American Conference of Governmental Industrial Hygienists, Inc. (ACGIH)

(513) 742-2020 [www.acgih.org](http://www.acgih.org) Occupational and environmental health and safety information

### American Industrial Hygiene Association (AIHA)

(703) 849-8888 [www.aiha.org](http://www.aiha.org) Information on industrial hygiene and indoor air quality issues including mold hazards and legal issues

### American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE)

(800) 527-4723 [www.ashrae.org](http://www.ashrae.org) Information on engineering issues and indoor air quality

### Association of Occupational and Environmental Clinics (AOEC)

(202) 347-4976 [www.aoec.org](http://www.aoec.org) Referrals to clinics with physicians who have experience with environmental exposures, including exposures to mold; maintains a database of occupational and environmental cases

### Association of Specialists in Cleaning and Restoration (ASCR)

(800) 272-7012 [www.ascr.org](http://www.ascr.org) Disaster recovery, water and fire damage, emergency tips, referrals to professionals

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## (C-F) Resources

### Canada Mortgage and Housing Corporation (CMHC)

(613) 748-2003 [International] [www.cmhc-schl.gc.ca/cmhc.html](http://www.cmhc-schl.gc.ca/cmhc.html) Several documents on mold-related topics available

### Carpet and Rug Institute (CRI)

(800) 882-8846 [www.carpet-rug.com](http://www.carpet-rug.com) Carpet maintenance, restoration guidelines for water-damaged carpet, other carpet-related issues.

### Centers for Disease Control and Prevention (CDC)

(800) 311-3435 [www.cdc.gov](http://www.cdc.gov) Information on health-related topics including asthma, molds in the environment, and occupational health

### CDC's National Center for Environmental Health (NCEH)

(888) 232-6789 [www.cdc.gov/nceh/asthma/factsheets/molds/default.htm](http://www.cdc.gov/nceh/asthma/factsheets/molds/default.htm) "Questions and answers on *Stachybotrys chartarum* and other molds"

### Energy and Environmental Building Association (EEBA)

(952) 881-1098 [www.eeba.org](http://www.eeba.org) Information on energy-efficient and environmentally responsible buildings, humidity/moisture control/vapor barriers

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## (G-M) Resources

**Institute of Inspection, Cleaning and Restoration Certification (IICRC)**  
(360) 693-5675 [www.iicrc.org](http://www.iicrc.org) Information on and standards for the inspection, cleaning, and restoration

**International Sanitary Supply Association (ISSA)** (800) 225-4772 [www.issa.com](http://www.issa.com)  
Education and training on cleaning and maintenance

**International Society of Cleaning Technicians (ISCT)** (800) WHY-ISCT (800-949-4728) [www.isct.com](http://www.isct.com)  
Information on cleaning such as stain removal guide for carpets

**Material Safety Data Sheets (MSDSs) - Cornell University**  
<http://msds.pdc.cornell.edu/msdssrch.asp> MSDSs contain information on chemicals or compounds including topics such as health effects, first aid, and protective equipment for people who work with or handle these chemicals

**MidAtlantic Environmental Hygiene Resource Center (MEHRC)**  
(215) 387-4096 [www.mehrc.org](http://www.mehrc.org) Indoor environmental quality training on including topics such as mold remediation

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## (N) Resources

**National Air Duct Cleaners Association (NADCA)**  
(202) 737-2926 [www.nadca.com](http://www.nadca.com) Duct cleaning information

**National Antimicrobial Information Network (NAIN)**  
(800) 447-6349 <http://ace.orst.edu/info/nain/> Regulatory information, safety information, and product information on antimicrobials

**National Association of the Remodeling Industry (NARI)**  
(847) 238-9200 [www.nari.org](http://www.nari.org) Consumer information on remodeling, including help finding a professional remodeling contractor

**National Institute of Building Sciences (NIBS)**  
(202) 289-7800 <http://nibs.org> Information on building regulations, science, and technology

**National Institute for Occupational Safety and Health (NIOSH)**  
(800) 35-NIOSH (800-356-4674) [www.cdc.gov/niosh](http://www.cdc.gov/niosh) Health and safety information with a workplace orientation

**National Pesticide Telecommunications Network (NPTN)**  
(800) 858-7378 <http://ace.orst.edu/info/nptn/> Information on pesticides/antimicrobial chemicals, including safety and disposal information

**New York City Department of Health,  
Bureau of Environmental & Occupational Disease Epidemiology**

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## (O-Z) Resources

**Occupational Safety & Health Administration (OSHA)**  
(800) 321-OSHA (800-321-6742) [www.osha.gov](http://www.osha.gov) Information on worker safety, includes topics such as respirator use and safety in the workplace

**Sheet Metal & Air Conditioning Contractors' National Association (SMACNA)**  
(703) 803-2980 [www.smacna.org](http://www.smacna.org) Technical information on topics such as air conditioning and air ducts

**Smithsonian Center for Materials Research and Education (SCMRE)**  
(301) 238-3700 [www.si.edu/scmre](http://www.si.edu/scmre) Guidelines for caring for and preserving furniture and wooden objects, paper-based materials; preservation studies

**University of Michigan Herbarium**  
(734) 764-2407 [www.herb.lsa.umich.edu](http://www.herb.lsa.umich.edu) Specimen-based information on fungi; information on fungal ecology

**University of Tulsa Indoor Air Program**  
(918) 631-5246 [www.utulsa.edu/iaqprogram](http://www.utulsa.edu/iaqprogram) Courses, classes, and continuing education on indoor air quality

**Water Loss Institute, Association of Specialists in Cleaning and Restoration**  
(800) 272-7012 or (410) 729-9900 [www.ascr.org/wli.asp](http://www.ascr.org/wli.asp)  
Information on water and sewage damage restoration

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# DRAFT Residential Mold Clean Up Guidelines

This document provides information and guidance for property owners and tenants on how to clean up residential mold problems and prevent mold growth. A resource section is also provided for more information.

There is a significant difference in the approach use for small (less than 10 square feet) and large (100 square feet or more) areas of contamination. Small areas may be handled by the homeowner or maintenance staff using personal protective equipment (see Precautions). However, for cases of much larger areas, only experienced contractors or specially trained maintenance staff should be used. *Sensitive individuals should not clean mold or be near areas being cleaned.* If you have asthma, mold allergies, lung disease or illness, or conditions or diseases that impair the immune system, then you should have a friend or professional clean up for you.

*Keep in mind these key steps when dealing with mold:*

## **Prevent Exposure**

If you are experiencing adverse health symptoms that may be caused by mold, avoid use of the room that is contaminated with mold until clean up can be finished.

## **Control Moisture and Mold Growth**

1. Dry all materials and surfaces within 24 to 48 hours of leaks or flooding to prevent mold growth - professional assistance may be necessary.
2. Fix all moisture sources before clean up is begun—Mold will only grow if there is moisture.
3. Remove or dry all wet materials (do not take moldy items to a clean area of the home).

## **Common indoor moisture sources include:**

1. Flooding
2. Failing or clogged rain gutters
3. Poor drainage around the house
4. Roof leaks
5. Movement through basement walls and slab
6. Failure to vent clothes dryer exhaust outdoors (including electric dryers)
7. Condensation (caused by indoor humidity that is too high or surfaces that are too cold)
8. Plumbing leaks
9. Overflow from tubs, sinks, or toilets
10. Firewood stored indoors
11. Humidifier use
12. Inadequate venting of kitchen and bath humidity
13. Improper venting of combustion appliances
14. Line drying laundry indoors

## Mold Clean Up

### **Mold Clean Up Safety Precautions:**

The known hazards from lead and asbestos are much greater than mold. If your residence was built before 1978 you must follow additional lead paint and dust control the steps in the publication, *Reducing Lead Hazards When Remodeling Your Home*.

- Wear eye protection, rubber gloves, washable or disposable clothing, including: long pants, high collared shirt, or disposable painter's jump suit; socks and closed-toe shoes.

- ☑ N-95 mask/respirator available at hardware stores for about \$7 (exhalation valve may make it easier to use); make sure it is tight and form fitting
  - A HEPA respirator may also be used.
  - those with beards or deformations will not be able to wear a face mask and should contract with a professional.
- ☑ Ventilate space if using a disinfectant such as bleach
- ☑ Limit air travel to other areas of the house by closing doors or sealing open areas with plastic sheeting.
- ☑ Take breaks in fresh air often.
- ☑ Change your clothes and shoes before leaving the work area, take off your mask after removing your outer clothing, and place all work clothes in a bag and wash separately from other laundry.
- ☑ Shower and wash your hair right after finishing work.
- ☑ Stop cleaning if you have dizziness, nausea, difficulty breathing, or develop a rash. Consider asking a family member or friend to finish for you or contract with a professional.

**Protect yourself and others while cleaning**

### How to Clean Up Mold:

1. The moisture source that has caused the mold growth must be corrected to prevent future mold growth.
2. Turn off ventilation system.
3. Close all windows and doors in the contaminated room except for the nearest window and place a box or window fan in it to blow inside air to the outdoors.
4. All porous, non-structural materials contaminated with mold should be removed and discarded (such as wall board/dry wall, insulation, wood firing strips, wood molding, ceiling tiles, etc.). House hold items such as bedding, furniture, and carpeting and padding may be salvable, but heavy contamination cannot be cleaned, especially for sensitive individuals.

Exception to removing porous materials: small, above-ground areas of contamination measuring less than 10 square feet may be cleaned, dried, and sealed. Specifically:

- This does not apply to insulating materials or wall areas below ground level.
- The square footage estimate must include all mold growth in a room and include mold that has spread to another adjoining surface or surface in an adjoining room.
- Surfaces must be intact and sound.
- The contaminated area must be cleaned, dried, and painted with a paint or sealant that includes a fungicide.
- If mold contamination grows back on cleaned surfaces, then porous materials must be removed and moisture control must be re-evaluated.
- The work area should be unoccupied. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons recovering from recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies). These individuals may also be sensitive to chemical odors; the work area may need additional ventilation for 2-to-3 days following chemical applications such as painting.

5. Place all moldy materials in extra-strength garbage bags or wrap and seal in plastic sheeting. Large amounts of materials must be taken to a landfill.

6. With a scrub brush and household non-ammonia based soap or detergent, remove all visible mold on non-porous surfaces and undamaged structural surfaces (cement, stone, metal, plastic, wood studs, load bearing wood).
7. Visible mold on semi-porous surfaces such as structurally sound, load bearing, wood-framing members must be scrubbed off and surfaces sealed.
8. Wipe clean all scrubbed surfaces.
9. Spot check for any missed mold and clean.
10. Optional Disinfection Step:
  - Ventilate area with fresh air.
  - Wipe all moldy surfaces with a mixed solution of 1-cup bleach to 1 gallon of water (enough to enter pores of surface).
  - Do not mix bleach with any other product, especially those that contain ammonia.
  - Let bleach solution sit on surface for 20 minutes.
11. Wipe down any wet surfaces to remove excess moisture.
12. Let air circulate until space is dry—do not enclose a space until completely dry (fans and/or dehumidifier will help speed the drying process).
  - Drying can take several days or longer
  - If mold returns while surfaces are damp and drying, make sure all leaks have been fixed and clean surfaces again as necessary starting at Step 1.

Bleaching, painting over mold growth, or not correcting moisture sources does not correct unsanitary conditions or potential health hazard from mold growth. Bleaching and painting may occur following removal of mold growth listed here.

**How to choose a mold remediation professional:**

Get estimates from three companies. You may find companies under Disaster, Environmental, or Restoration Services, or Mold Remediation in the Yellow Pages. When choosing a company, ask:

- what qualifications they have
- what courses they have taken
- what mold remediation certification(s) the manager has
- if a manager who is certified will be on the job site at all times when work is being done.

Choose someone that has taken a mold remediation course that provides certification recognized by a professional association and has relevant work experience. A written agreement should be provided by anyone you hire. It should state in detail the work to be done, the materials to be used, and the price breakdown for both labor and materials. Review it carefully before signing. Never pay for all repairs in advance, and don't pay cash.

**Mold Resources:**

- **Local Mold and Lead Paint Information**, contact your local health department or board of health.
- **Mold in Homes**. Minnesota Department of Health's very informative web site on mold, health effects, and options for homeowners and tenants. Available online at [www.health.state.mn.us/divs/eh/indoorair/mold/index.html](http://www.health.state.mn.us/divs/eh/indoorair/mold/index.html).
- **Mold Remediation in Schools and Commercial Buildings**. Provides technical guidance on how to clean up mold in school commercial, and residential buildings. EPA# 402-K-01-001. March 2001. Available online at [www.epa.gov/iaq](http://www.epa.gov/iaq) or by calling the IAQ Clearinghouse at (800) 438-4318.
- New York City **Guidelines on Assessment and Remediation of Fungi in Indoor Environments**. Available online at [www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html](http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html)
- **Ohio Department of Health Indoor Environments Section**, Ph. (800) 200-2526, provides advice and information on preventable indoor air hazards, including mold and other asthma triggers.

**Lead Paint Resources**

- **Reducing Lead Hazards When Remodeling Your Home** (Document number EPA 747-K-97-001). September 1997. Available online at [www.epa.gov/lead/leadpbed.htm](http://www.epa.gov/lead/leadpbed.htm). Call 800-424-LEAD (5323) to receive a free copy of this or other lead documents, or to speak with an information specialist. Bilingual (English/Spanish) staff members are available Monday through Friday, 8:30am to 6pm.
- **Alliance to End Childhood Lead Poisoning**. Lead information clearinghouse for landlords, tenants, and homeowners. Available online at [www.aecplp.org](http://www.aecplp.org)
- **Ohio Department of Health**. Listing of lead certified lead risk assessors and contractors at Ph. (877) 668-5323 or (614) 466-1450, and on the Internet at [www.odh.state.oh.us/ODHPrograms/LP\\_PREV/lp\\_list1.htm](http://www.odh.state.oh.us/ODHPrograms/LP_PREV/lp_list1.htm).

NOTE: Compiled by the Ohio Indoor Air Quality Coalition. While the information and recommendations contained in these guidelines have been compiled from sources that are known to be reliable, the Coalition makes no guarantees; *each clean up situation is unique and additional safety measures may be required.* When in doubt, use caution and consult an experienced mold remediator. Complete remediation guidelines are provided in New York City *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*, and additional safety information is available in the manual *Mold Remediation in Schools and Commercial Buildings* listed under Resources above. Last Updated: 11/16/2003



## Preventative Measures

Ohio Bureau of Workers'  
Compensation  
Division of Safety and Hygiene

**How can I control mold growth in  
my home?**



## **Applicability of Mold Sampling Results in Workers' Compensation Claims**

**Don Bentley, PE, CIH  
Industrial Hygiene Technical Advisor  
Bureau of Workers' Compensation  
Division of Safety and Hygiene**

Mold is present everywhere and during every season. Sampling for mold/fungi will usually always produce positive results because mold is present in the air and on objects of your home or office, indoors or outdoors. With regard to problems resulting from mold in the workplace, it is not the **presence** of mold that indicates a problem; it is the **exposure** to a large quantity of mold. When mold is identified as a problem in the workplace, mold will usually be visible and will be accompanied by a musty odor. Mold contamination can always be traced to certain events such as a flooded area or an ongoing wet or damp area.

### **Workers' Compensation Claims**

I was asked to attend a hearing during the first week of December. In this claim, the claimant alleged that elevated exposure to mold in his workplace was producing allergic responses. The claim was denied because he did not have a medical diagnosis of a condition and a statement that the condition was the result of exposure from the workplace. However, the claimant, if he would have had a proper medical diagnosis, was ready to argue that exposure to mold in the workplace was the contributing factor to his disease. The claimant had bulk samples of dust in his work area collected and analyzed for mold. The results of the sampling were reported as total colony forming units (CFU). I have further explained my thoughts on this claim in Attachment A.

In another claim, involving a teacher in the Circleville Schools (claim 01-410533), the claim was allowed for fungal allergy. In this case, the District Hearing Officer writes, "The District Hearing Officer also relies on EMSL Analytic, Inc. report which revealed 24 CFU's per gram of Cladosporium." Cladosporium is one of over 100,000 species of fungi and molds. "This report was based on moldy tiles taken from the claimant's classroom. The claimant testified that she took a sample of the ceiling tiles that had been removed from her classroom and sent it to the above lab for testing."

I contend that the flooding over Christmas break provides more helpful information in allowing this claim than does the results of the bulk sampling. Additionally, the fact that health effects to the individual in this area started shortly after the event is helpful once again in a doctor's diagnosis that the condition is the result of the event. However, if only the results of the bulk sampling were to be used to validate the claim, I would have to say the results are very conclusive that the dust from the ceiling tile was not "moldy". These results would compare very favorably with levels of mold in every home and office setting. I have expanded on this claim in Attachment B.

### **BWC's Division of Safety and Hygiene Position on Mold**

The Bureau of Workers' Compensation, Division of Safety and Hygiene (DSH) does not sample for mold in the workplace. The reason DSH does not sample for mold is no exposure limits exist to help interpret the results and it is quite expensive to perform proper sampling. Information from the New York City Department of Health, EPA, and peer-reviewed Journal Articles, all agree that sampling should not normally be performed, is unnecessary, and is expensive to perform properly. The American Conference of Governmental Industrial Hygienists (ACGIH), book "Bioaerosols, Assessment and Control" also does not recommend sampling, but does provide the steps that must be taken to properly sample a work environment. We have a copy of the book in our Resource Center.

In most cases mold contamination is obvious. If mold is present in the workplace, it needs to be removed as quickly as possible. Additionally, steps must be taken to stop the source of water that produced the environment for mold growth. The presence of a large amount of water, i.e. the room was flooded, the carpet was wet, etc. or an ongoing source of wetness such as improper maintenance of the cooling coils in a heating, ventilating and air-conditioning (HVAC) unit, is usually necessary to produce an event.

### **Published Articles on Mold**

I have included information from two sources to provide backup documentation. The first attachment is from the Technical Exchange, in The Synergist, November 2001. The article "Assessment and Sampling Approaches for Indoor Microbiological Assessments" includes a table that must be read with care (check the units for all numbers). In the table, information is given on normal background levels of fungal spores (mold). This information shows that for bulk samples, normal background levels are as high as 10,000 CFU/gram. This number is many, many times greater than the individual sampling that was performed in either of these claims. There are basically two types of sampling identified in this table. The first two rows deal with air sampling of residential and commercial buildings. The reporting of air sample results will typically be spores per cubic meter of air or colony forming units per cubic meter. The last 4 rows describe different sampling means to obtain a sample material in the building. The rows cover dust sampling, bulk sampling, swab sampling and tape samples. Analysis of bulk material (dust or bulk) is typically reported as spores per gram or CFU per gram. Analysis of swab samples is reported as CFU per square centimeter and tape samples in percent concentration of fungal material. All six sampling types have very specific procedures on how sampling should be performed. The ACGIH book "Bioaerosols, Assessment and Control" outlines the procedures that should be used. The procedures, when done properly are expensive and require a large number of samples to be taken. Additionally, indoor and outdoor samples are needed for air samples to identify if there is "amplification" or a source of contamination indoors. The article also states that the level in non-problem buildings showed fungal spore concentrations in dust to be much lower (103 to 105 CFU/gram), and that dust is never "spore-free".

A peer-reviewed article, "Resolution of Sick Building Syndrome in a High-Security Facility", in Applied Occupational and Environmental Hygiene identifies the levels of airborne fungal concentrations in a building that had visible microbial contamination in the HVAC system. In this case, the airborne concentrations ranged from 85 to 6,157 CFU/cubic meter in the building. The 3 sites that were identified as problem areas were found to have 6,175; 4,778; and 221 CFU per cubic meter. After remediation had taken place and the condition was much improved, the airborne concentrations were found to range from 14 to 500 CFU/ cubic meter. Please note these are air samples and cannot be compared to the claimants bulk samples. Bulk sampling is done because it is very inexpensive, but is also very unreliable.

Additionally, Dave Johnson, Editor & Publisher of Industrial Safety and Hygiene News (ISHN) in November 2001, said: "Experts agree that some people with acute sensitivities are at high risk from certain molds. But they also point out that we've lived with mold since the stone age and actual cases of related health problems are unique or rare, according to the Centers for Disease Control." [www.ishn.com](http://www.ishn.com)

Finally, the New York City Department of Health has issued "Guidelines on Assessment and Remediation of Fungi in Indoor Environments." This document has become accepted by the health and safety community as one of the best documents available on the issue of fungi and mold. In this document it once again states that sampling is usually not necessary. Additionally, no health standards currently exist, so interpretation of results is difficult.

In summary, mold is ubiquitous and so finding the presence of mold in any workplace would be expected. Air or bulk sampling of mold contamination needs to be performed with extreme care and following procedures as outlined in the ACGIH book, "Bioaerosols, Assessment and Control." Not following the procedures can lead to contamination of collected samples or insufficient data to interpret the results. No health standards currently exist which makes interpretation of the results very difficult. The American Industrial Hygiene Association (AIHA) guideline provides the only information I could find. These numbers come from many mold remediation circumstances similar to the remediation sampling described in the Resolution of Sick Building Syndrome in High-Security Facility article.

I hope you find the above information and the attached articles helpful. If you would like to discuss this further, please let me know. Thank you for your time.

Attachments:

- A) Discussion of claim: 00-609357 Staff Hearing on December 5, 2001
- B) Discussion of claim: 01-410533 District Hearing on October 17, 2001
- 1) Clark, Geoffrey A.; "Assessment and Sampling Approaches for Indoor Microbiological Assessments", The Synergist, American Industrial Hygiene Association, November 2001, pg 20-21.

- 2) BWC Division of Safety and Hygiene Information Sheet – Mold, June 2001.
- 3) Hiipakka, David W.; “Resolution of Sick Building Syndrome in a High-Security Facility”, Applied Occupational and Environmental Hygiene, Vol. 15:(8), 2000, pp 635-643.
- 4) D’Andrea, Christopher, Editor “Guidelines on Assessment and Remediation of Fungi in Indoor Environments” New York City Department of Health, November 2000.

### **Attachment A:**

Workers’ Compensation Claim: 00-609357 Staff Hearing on December 5, 2001.

I conducted a visual survey of the basement levels (B2 and B1) of the William Green Building on October 5, 2001. I submitted a report on October 15, 2001, identifying no visible mold in the claimants work area and only isolated situations where the potential existed for mold growth in other sections of the basement level. Building management accompanied me on the survey and addressed problems very quickly. At the time of the hearing, all recommendations made in my report had been implemented. I was not informed of any events that could lead to gross contamination of mold in the basement level. The only flooding that was mentioned on the survey date, was in the print shop area where limited material is present to enhance the growth of mold. The print shop has a tile floor. If standing water were cleaned up quickly, the tile floor would not enhance the growth of mold as carpeting can. The drywall in the area of the leak was removed, which also removed the cellulose material on the drywall that would be a potential for mold growth. The area was visually inspected and was in good condition.

When mold is not visually observed, or an odor does not exist, mold sampling will not produce results that indicate gross contamination. In this case, a bulk sample of dust was taken and submitted to an analytical laboratory. This sample showed very little mold present. Additionally all results of bulk material should be in the form of CFU/gram or spores per gram. The claimant’s lab results were in the form of Total CFU. This number is meaningless for comparative purposes. The Division of Safety and Hygiene did not take samples. When sampling is performed, bulk sampling of material is typically done because it is inexpensive. However, a bulk sample is not a good indicator of the mold contamination in an area.

The best indicator of exposure to mold in this workplace would be the presence of gross contamination of mold or a musty odor. These were not present in this situation. If samples were taken, air samples in the department of concern, air samples in adjacent hallways and rooms, air samples in the HVAC unit and outside air samples would help determine if an extensive amount of mold exists. The results of the air sampling would identify if the mold found in the building were similar to the mold found outdoors or if the number of colony forming units (CFU) were higher inside than outside. If the number of CFU inside the building were much higher than outdoors then **amplification**

would be occurring. Amplification involves mold from outdoors finding a source of wetness indoors where the mold reproduces and creates a problem indoors.

When bulk samples are taken to find mold, those samples are typically taken by removing a section of an obviously moldy area and sending that sample to a lab for analysis. The results of the bulk sample sent to the lab by the claimant are conclusive that they did not take a sample of a “moldy” area.

As a result of my walk-through survey, I can say that in this case, there was no visible mold present in the claimants work area. Additionally, there was minimal mold found in the bulk sampling that was performed, and there have been no documented events, i.e. flooding, or continuous wet areas, which can produce a mold event. Thus, in my opinion, supported by the documentation that is attached to this information sheet, there is no occupational exposure occurring that would be the contributing factor to the individuals medical condition.

#### **Attachment B:**

Workers’ Compensation Claim: 01-410533 District Hearing on October 17, 2001.

I am not familiar with this case beyond what I read in the Record of Proceedings by Jaimee Touris, District Hearing Officer, mailed on 10/23/2001. In this claim, the claimant was diagnosed with fungal allergy with the events occurring in the workplace contributing to the disease.

The District Hearing Officer found in this case that “the claimant’s classroom flooded over Christmas break. In February, after being back at school for approximately one month the claimant began experiencing rash-like symptoms on her arms which eventually spread.” The flooding of the classroom is exactly the type of event that produces a mold event that may produces an affect on personnel. I propose that if an event occurs and both parties agree that an event such as this has occurred, then the environment is ripe for producing affects to the claimant as claimed.

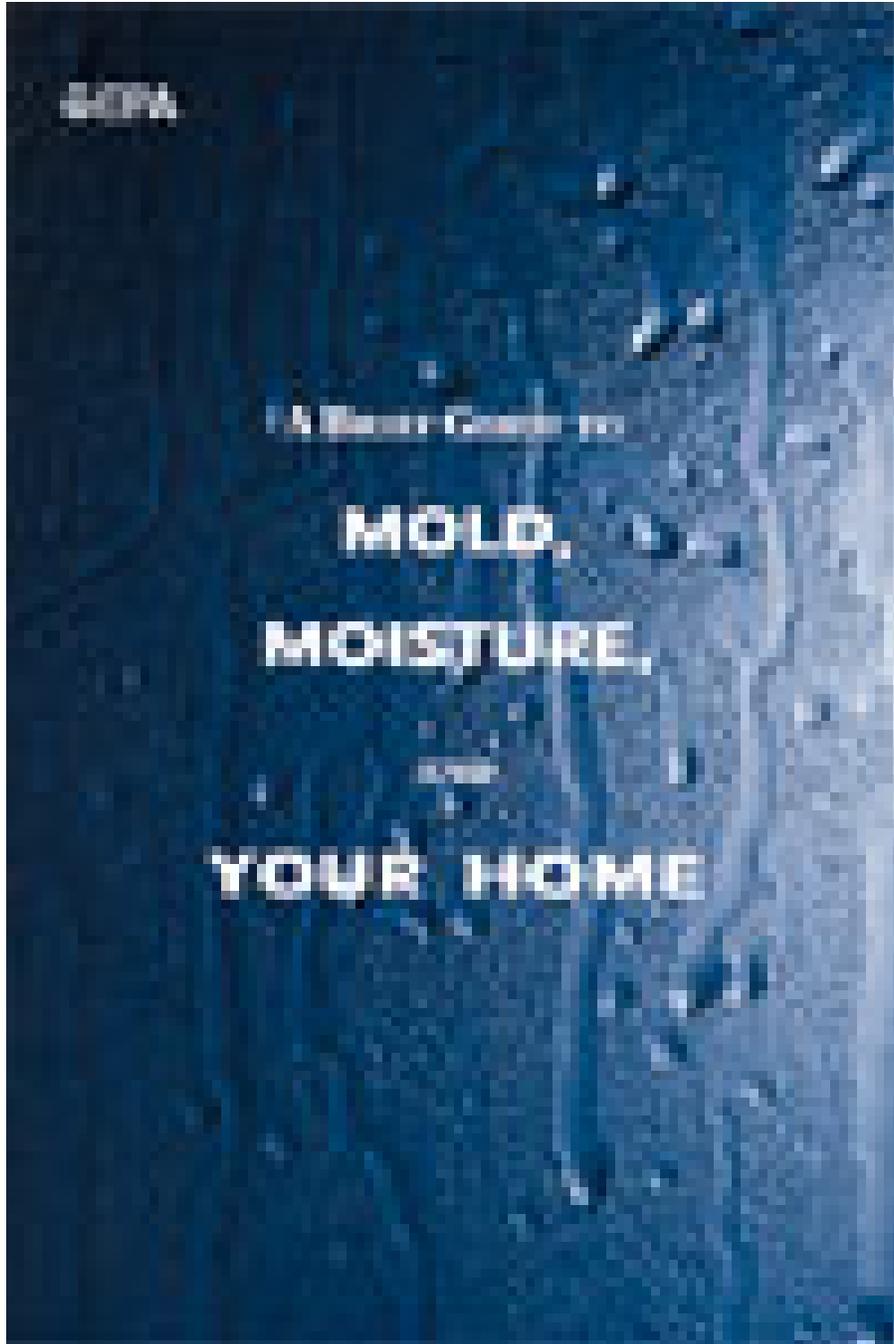
However, the next paragraph in the order says that the “District Hearing Officer also relies on EMSL Analytic, Inc. report which revealed 24 CFU’s per gram of Cladosporium.” This was once again the inexpensive bulk sampling that does not follow protocols for this type of sampling as discussed in the book by the American Conference of Governmental Industrial Hygienists (ACGIH), “Bioaerosols, Assessment and Control.” Comparing the results of the bulk sampling with the Table from Attachment 1, it is obvious that the sample that was submitted was not producing the effects that the claimant was experiencing.

In this case, based on the limited amount of information presented in the Record of Proceedings, I believe that the claimant has a claim and should be compensated. However, the bulk sample should not have been taken and the results should not be relied

upon to make a decision. Comparing the 24 CFU/g of Cladosporium with the table that states that anything less than 10,000 CFU/g of fungal spores would be considered background levels, does not help her case.

Additionally, one sample should not be used to disprove a claim when an event such as flooding has occurred. If sampling is to be performed and used in evaluation of claims, the sampling must follow procedures as outlined by the ACGIH and include both air sampling and bulk sampling.





U.S. EPA, Office of Air and Radiation  
Indoor Environments Division (6609J)  
1200 Pennsylvania Ave., NW, Washington, DC 20460  
**EPA Publication #402-K-02-003**

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## **Acknowledgements**

We would like to thank Paul Ellringer, PE, CIH, for providing the photo of mold on the back of wallpaper in the Hidden Mold section.

**Please Note:** Some of the photos used in this guide are available in higher quality print versions (as 300dpi JPG format images). These files are larger in size, so download may be affected.

## Mold Basics

- **The key to mold control is moisture control.**
- **If mold is a problem in your home, you should clean up the mold promptly *and* fix the water problem.**
- **It is important to dry water-damaged areas and items within 24-48 hours to prevent mold growth.**

### Why is mold growing in my home?

Molds are part of the natural environment. Outdoors, molds play a part in nature by breaking down dead organic matter such as fallen leaves and dead trees, but indoors, mold growth should be avoided. Molds reproduce by means of tiny spores; the spores are invisible to the naked eye and float through outdoor and indoor air. Mold may begin growing indoors when mold spores land on surfaces that are wet. There are many types of mold, and none of them will grow without water or moisture.



[At Left - Mold growing outdoors on firewood. Molds come in many colors; both white and black molds are shown here.

### Can mold cause health problems?

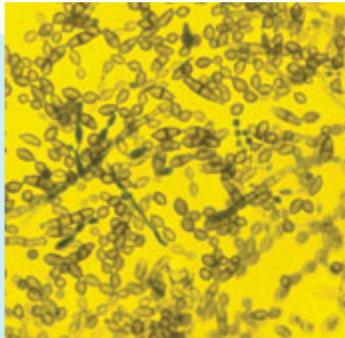
Molds are usually not a problem indoors, unless mold spores land on a wet or damp spot and begin growing. Molds have the potential to cause health problems. Molds produce allergens (substances that can cause allergic reactions), irritants, and in some cases, potentially toxic substances (mycotoxins). Inhaling or touching mold or mold spores may cause allergic reactions in sensitive individuals. Allergic responses include hay fever-type symptoms, such as sneezing, runny nose, red eyes, and skin rash (dermatitis). Allergic reactions to mold

are common. They can be immediate or delayed. Molds can also cause asthma attacks in people with asthma who are allergic to mold. In addition, mold exposure can irritate the eyes, skin, nose, throat, and lungs of both mold-allergic and non-allergic people. Symptoms other than the allergic and irritant types are not commonly reported as a result of inhaling mold. Research on mold and health effects is ongoing. This brochure provides a brief overview; it does not describe all potential health effects related to mold exposure. For more detailed information consult a health professional. You may also wish to consult your state or local health department.

## How do I get rid of mold?

It is impossible to get rid of all mold and mold spores indoors; some mold spores will be found floating through the air and in house dust. The mold spores

will not grow if moisture is not present. Indoor mold growth can and should be prevented or controlled by controlling moisture indoors. If there is mold growth in your home, you must clean up the mold **and** fix the water problem. If you clean up the mold, but don't fix the water problem, then, most likely, the mold problem will come back.



*Magnified mold spores.*

Molds can gradually destroy the things they grow on. You can prevent damage to your home and furnishings, save money, and avoid potential health problems by controlling moisture and eliminating mold growth.

## Who Should Do the Cleanup?

If you already have a mold problem – ACT QUICKLY. Mold damages what it grows on. The longer it grows, the more damage it can cause.

Leaky window – mold is beginning to rot the wooden frame and windowsill.



### Who should do the cleanup?

Who should do the cleanup depends on a number of factors. One consideration is the size of the mold problem. If the moldy area is less than about 10 square feet (less than roughly a 3 ft. by 3 ft. patch), in most cases, you can handle the job yourself, following the guidelines below. However:

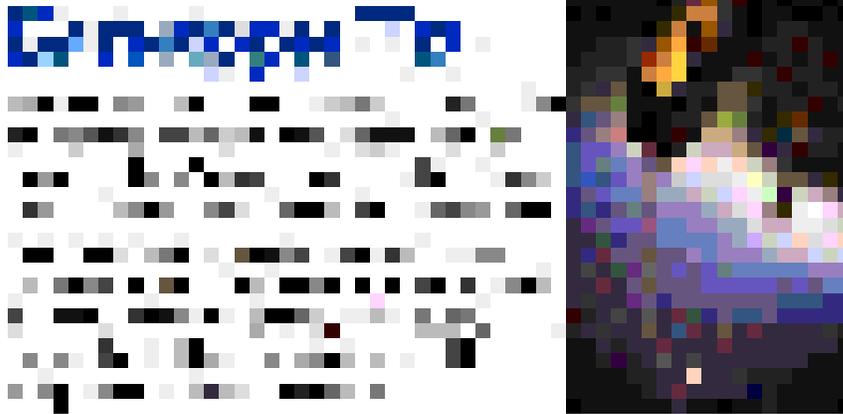
- If there has been a lot of water damage, and/or mold growth covers more than 10 square feet, consult the U.S. Environmental Protection Agency (EPA) guide: *Mold Remediation in Schools and Commercial Buildings*. Although focused on schools and commercial buildings, this document is applicable to other building types. It is available free by calling the EPA Indoor Air Quality Information Clearinghouse at (800) 438-4318, or here at [epa.gov/mold/mold\\_remediation.html](http://epa.gov/mold/mold_remediation.html).
- If you choose to hire a contractor (or other professional service provider) to do the cleanup, make sure the contractor has

experience cleaning up mold. Check references and ask the contractor to follow the recommendations in EPA's [Mold Remediation in Schools and Commercial Buildings](#), the guidelines of the American Conference of Governmental Industrial Hygienists (ACGIH), or other guidelines from professional or government organizations.

- If you suspect that the heating/ventilation/air conditioning (HVAC) system may be contaminated with mold (it is part of an identified moisture problem, for instance, or there is mold near the intake to the system), consult EPA's guide *Should You Have the Air Ducts in Your Home Cleaned?* before taking further action. Do not run the HVAC system if you know or suspect that it is contaminated with mold - it could spread mold throughout the building. Visit [epa.gov/iaq/pubs/airduct.html](http://epa.gov/iaq/pubs/airduct.html), or call (800) 438-4318 for a free copy.
- If the water and/or mold damage was caused by sewage or other contaminated water, then call in a professional who has experience cleaning and fixing buildings damaged by contaminated water.
- If you have health concerns, consult a health professional before starting cleanup.

# Mold Cleanup Guidelines

(Bathroomtips.jpg located in my pictures)



## Tips and techniques

The tips and techniques presented in this section will help you clean up your mold problem. Professional cleaners or remediators may use methods not covered in this publication. Please note that mold may cause staining and cosmetic damage. It may not be possible to clean an item so that its original appearance is restored.



Mold growing on the underside of a plastic lawn chair in an area where rainwater drips through and deposits organic material.

- **Fix plumbing leaks and other water problems as soon as possible. Dry all items completely.**
- **Scrub mold off hard surfaces with detergent and water, and dry completely.**
- Absorbent or porous materials, such as ceiling tiles and carpet, may have to be thrown away if they become moldy. Mold can grow on or fill in the empty spaces and crevices of porous materials, so the mold may be difficult or impossible to remove completely.
- Avoid exposing yourself or others to mold (see discussions: [What to Wear When Cleaning Moldy Areas](#) and [Hidden Mold](#)).
- Do not paint or caulk moldy surfaces. Clean up the mold and dry the surfaces before painting. Paint applied over moldy surfaces is likely to peel.
- If you are unsure about how to clean an item, or if the item is expensive or of sentimental value, you may wish to consult a specialist. Specialists in furniture repair, restoration, painting, art restoration and conservation, carpet and rug cleaning, water damage, and fire or water restoration are commonly listed in phone books. Be sure to ask for and check references. Look for specialists who are affiliated with professional organizations.



Mold growing on a piece of ceiling tile.

## What to Wear When Cleaning Moldy Areas



It is important to take precautions to limit your exposure to mold and mold spores. Mold growing on a suitcase stored in a humid basement.

- **Avoid breathing in mold or mold spores.** In order to limit your exposure to airborne mold, you may want to wear an N-95 respirator, available at many hardware stores and from

- Cleaning while wearing N-95 respirator, gloves and goggles.



companies that advertise on the Internet. (They cost about \$12 to \$25.) Some N-95 respirators resemble a paper dust mask with a nozzle on the front, others are made primarily of plastic or rubber and have removable cartridges that trap most of the mold spores from entering. In order to be effective, the respirator or mask must fit properly, so carefully follow the instructions supplied with the respirator. Please note that the Occupational Safety and Health Administration (OSHA) requires that respirators fit properly (fit testing) when used in an

occupational setting; consult OSHA for more information (800-321-OSHA or [osha.gov/](https://www.osha.gov/)).

- **Wear gloves.** Long gloves that extend to the middle of the forearm are recommended. When working with water and a mild detergent, ordinary household rubber gloves may be used. If you are using a disinfectant, a biocide such as chlorine bleach, or a strong cleaning solution, you should select gloves made from natural rubber, neoprene, nitrile, polyurethane, or PVC (see [Cleanup and Biocides](#)). Avoid touching mold or moldy items with your bare hands.
- **Wear goggles.** Goggles that do not have ventilation holes are recommended. Avoid getting mold or mold spores in your eyes.

## **How Do I Know When the Remediation or Cleanup is Finished?**

You must have completely fixed the water or moisture problem before the cleanup or remediation can be considered finished.

- You should have completed mold removal. Visible mold and moldy odors should not be present. Please note that mold may cause staining and cosmetic damage.
- You should have revisited the site(s) shortly after cleanup and it should show no signs of water damage or mold growth.
- People should have been able to occupy or re-occupy the area without health complaints or physical symptoms.
- Ultimately, this is a judgment call; there is no easy answer. If you have concerns or questions call the EPA Indoor Air Quality Information Clearinghouse IAQ INFO at (800) 438-4318.

## Moisture and Mold Prevention and Control Tips



Moisture control is the Key to MOLD Control. Mold growing on the surface of a unit ventilator.

- Moisture control is the key to mold control, so when water leaks or spills occur indoors - **ACT QUICKLY**. If wet or damp materials or areas are dried 24-48 hours after a leak or spill happens, in most cases mold will not grow.
- Clean and repair roof gutters regularly.
- Make sure the ground slopes away from the building foundation, so that water does not enter or collect around the foundation.
- Keep air conditioning drip pans clean and the drain lines unobstructed and flowing properly.
- Keep indoor humidity low. If possible, keep indoor humidity below 60 percent (ideally between 30 and



Condensation on the inside of a windowpane.

50 percent) relative humidity. Relative humidity can be measured with a moisture or humidity meter, a small, inexpensive (\$10-\$50) instrument available at many hardware stores.

- If you see condensation or moisture collecting on windows, walls or pipes ACT QUICKLY to dry the wet surface and reduce the moisture/water source. Condensation can be a sign of high humidity.

### **Actions that will help to reduce humidity:**

- Vent appliances that produce moisture, such as clothes dryers, stoves, and kerosene heaters to the outside where possible. (Combustion appliances such as stoves and kerosene heaters produce water vapor and will increase the humidity unless vented to the outside.)
- Use air conditioners and/or de-humidifiers when needed.
- Run the bathroom fan or open the window when showering. Use exhaust fans or open windows whenever cooking, running the dishwasher or dishwashing, etc.

### **Actions that will help prevent condensation:**

- Reduce the humidity (see above).
- Increase ventilation or air movement by opening doors and/or windows, when practical. Use fans as needed.
- Cover cold surfaces, such as cold water pipes, with insulation.
- Increase air temperature.

Mold growing on a wooden headboard in a room with high humidity.



[Click on the image above for a larger 300dpi JPG file.]

**Renters:** Report all plumbing leaks and moisture problems immediately to your building owner, manager or superintendent.

In cases where persistent water problems are not addressed, you may want to contact local, state, or federal health housing authorities.



Rust is an indicator that condensation occurs on this drainpipe. The pipe should be insulated to prevent condensation.

[Click on the image above for a larger 300dpi JPG file.]

## Testing or Sampling for Mold

Is sampling for mold needed? **In most cases, if visible mold growth is present, sampling is unnecessary.** Since no EPA or other federal limits have been set for mold or mold spores, sampling cannot be used to check a building's compliance with federal mold standards. Surface sampling may be useful to determine if an area has been adequately cleaned or remediated. Sampling for mold should be conducted by professionals who have specific experience in designing mold sampling protocols, sampling methods, and interpreting results. Sample analysis should follow analytical

methods recommended by the American Industrial Hygiene Association (AIHA), the American Conference of Governmental Industrial Hygienists (ACGIH), or other professional organizations.

## Hidden Mold

### Suspicion of hidden mold

You may suspect hidden mold if a building smells moldy, but you cannot see the source, or if you know there has been water damage and residents are reporting health problems. Mold may be hidden in places such as the back side of dry wall, wallpaper, or paneling, the top side of ceiling tiles, the underside of carpets and pads, etc. Other possible locations of hidden mold include areas inside walls around pipes (with leaking or condensing pipes), the surface of walls behind furniture (where condensation forms), inside ductwork, and in roof materials above ceiling tiles (due to roof leaks or insufficient insulation).

Mold growing on the back side of wallpaper.



### Investigating hidden mold problems

Investigating hidden mold problems may be difficult and will require caution when the investigation involves disturbing potential sites of mold growth. For example, removal of wallpaper can lead to a massive release of spores if there is mold growing on the underside of the paper. If you believe that you may have a hidden mold problem, consider hiring an experienced professional.

### Cleanup and Biocides

Biocides are substances that can destroy living organisms. The use of a chemical or biocide that kills organisms such as mold (chlorine bleach, for example) is not recommended as a routine practice during

mold cleanup. There may be instances, however, when professional judgment may indicate its use (for example, when immune-compromised individuals are present). In most cases, it is not possible or desirable to sterilize an area; a background level of mold spores will remain - these spores will not grow if the moisture problem has been resolved. If you choose to use disinfectants or biocides, always ventilate the area and exhaust the air to the outdoors. Never mix chlorine bleach solution with other cleaning solutions or detergents that contain ammonia because toxic fumes could be produced. Click on the image below for a larger 300dpi JPG file.

**Please note:** Dead mold may still cause allergic reactions in some people, so it is not enough to simply kill the mold, it must also be removed.

Water stain  
on a basement  
wall - locate  
and fix the  
source of the  
water promptly.



**Additional Resources** For more information on mold related issues including mold cleanup and moisture control/condensation/humidity issues, you can call the EPA Indoor Air Quality Information Clearinghouse IAQ INFO at **(800) 438-4318**, or:

- [Mold Resources page](#)



Mold growing on fallen leaves.



## TECHNICAL EXCHANGE

and differences in the sensitivity of individuals.

To date, worker exposure to fungal spores has been measured in a variety of industrial environments including grain terminals, refuse incinerators and whole glass recycling facilities, in concentrations exceeding 500,000 spores/m<sup>3</sup>. Water damaged residences have also shown ele-

vated spore counts, ranging from less than 1,000 spores/m<sup>3</sup> to more than 200,000 spores/m<sup>3</sup>, require any remediation. Abatement workers are exposed to even higher concentrations—in the millions of spores/m<sup>3</sup>.

Over the past few years, hygienists have collectively gathered a significant amount of exposure information from air, dust and

surface samples during both investigative studies and abatement projects. Using numbers adapted from a variety of sources, including peer reviewed publications, courses and seminars presented by other consultants and industrial hygienists, Clark presented the set of proposed numerical guidelines for fungal spores as shown in Table 1.

**Table 1 – Proposed Guidelines for Fungal Spores**

Type	Normal Background *	Possible Contamination Source	Probable Contamination Source
Air Samples from Residential Buildings	< 5,000 spores/m <sup>3</sup> < 500 cfu/m <sup>3</sup>	5,000–10,000 spores/m <sup>3</sup> 500–1,000 cfu/m <sup>3</sup>	> 10,000 spores/m <sup>3</sup> > 1,000 cfu/m <sup>3</sup>
Air Samples from Commercial Buildings	< 2,500 spores/m <sup>3</sup> < 250 cfu/m <sup>3</sup>	2,500–10,000 spores/m <sup>3</sup> 250–1,000 cfu/m <sup>3</sup>	> 10,000 spores/m <sup>3</sup> > 1,000 cfu/m <sup>3</sup>
Dust Samples	< 100,000 spores/g < 10,000 cfu/g < 50,000 mycelial frags/g	100,000–1,000,000 spores/g > 10,000–100,000 cfu/g 50,000–100,000 mycelial frags/g	1,000,000 spores/g > 100,000 cfu/g > 100,000 mycelial frags/g
Bulk Samples	< 100,000 spores/g < 10,000 cfu/g < 50,000 mycelial frags/g	100,000–1,000,000 spores/g 10,000–100,000 cfu/g 50,000–100,000 mycelial frags/g	> 1,000,000 spores/g > 100,000 cfu/g > 100,000 mycelial frags/g
Swab Samples	< 10,000 cfu/m <sup>2</sup> < 1,500 cfu/cm <sup>2</sup>		> 10,000 cfu/m <sup>2</sup> > 1,500 cfu/cm <sup>2</sup>
Tape Samples	NSFM or NSFB ** 1–5%	5–95%	95–100%

\* Types and relative proportions of fungal spores should be similar to outdoors

\*\* NSFM = no significant fungal material, NSFB = no significant fungal biomass

These guidelines were developed for the purpose of addressing concerns regarding fungal assessments and abatement and would not necessarily apply to health effects. In addition, they should not be used as the only means of decision-making in the remediation of fungal contamination.

Clark is with The Sporeless House, LLC.

**Technical Exchange** is a forum where readers discuss and benefit from each other's technical ideas. This approach is an alternative to and not a replacement for peer-reviewed submissions in journals or technical journals. They are invited to help this forum contribute to the benefit of our profession.

Articles are reviewed for subject competence of the authors and for technical quality, accuracy and relevance to the magazine. The guidelines for authors and their submissions are found in *How to Write for The Synergist*, 2000 (available at [www.cesg.com](http://www.cesg.com)) and 2004 (available at [www.cesg.com](http://www.cesg.com)). Submissions will be treated for space and content



## Additional Resources for Mold

### Web Sites

#### General Information

Aerias: <http://www.aerias.org>

Aerotech Labs – InfoBase: <http://www.aerotechlabs.com/Aero>

American Industrial Hygiene Association (AIHA)—Mold Resources:  
<http://www.aiha.org/GovernmentAffairs-PR/html/prmoldsources.htm>

Building Science Corporation: <http://www.buildingscience.com/>

California Indoor Air Quality Program: <http://www.cal-iaq.org/iaqsheet.htm#Mold>

Canadian Center for Occupational Health and Safety:  
[http://www.ccohs.ca/oshanswers/biol\\_hazards/iaq\\_mold.html](http://www.ccohs.ca/oshanswers/biol_hazards/iaq_mold.html)

Centers for Disease Control and Prevention, Mold: <http://www.cdc.gov/nceh/airpollution/mold/>

Education Safety Association of Ontario – IAQ: <http://www.esao.on.ca/scriptcontent/index.cfm>

Environmental Microbiology Laboratory, Inc.: <http://www.emlab.com>

Environmental Protection Agency (EPA), U.S.:  
Sources of Indoor Air Pollution - Biological Pollutants <http://www.epa.gov/iaq/biologic.html>  
Indoor Air Quality Building Education and Assessment Model (I-BEAM) Software  
[http://www.epa.gov/iaq/largebldgs/ibeam\\_page.htm](http://www.epa.gov/iaq/largebldgs/ibeam_page.htm)

Federal Emergency Management Agency (FEMA): <http://www.fema.gov/>

Fungi.ca: <http://www.fungi.ca/moulds.htm>

Georgetown University:  
Mold Medicine & Mold Science: Its Practical Applications for Patient Care, Remediation & Claims May  
13-14, 2002, Georgetown University Convention Center, Washington, D.C.  
<http://phys4.harvard.edu/~wilson/soundscience/mold/mold.html>

Health Departments, State and Local: [http://www.apha.org/public\\_health/state.htm](http://www.apha.org/public_health/state.htm)

National Association of Realtors "Field Guide to Mold and Health Issues:"  
<http://www.realtors.org/libweb.nsf/pages/fg711>

New York Committee for Occupational Safety and Health: <http://www.nycosh.org/moldfacts.html>  
<http://www.nycosh.org/linktopics/indoorair.html>

Occupational Health and Safety Administration (OSHA):  
<http://www.osha-slc.gov/SLTC/indoorairquality/>  
<http://www.osha.gov/dts/shib/shib101003.html>

Texas Dept. of Health, Links to Web Sites about Mold Growth in Buildings:  
<http://www.tdh.state.tx.us/beh/IAQ/MoldLinks.htm>

University of Minnesota: <http://www.dehs.umn.edu/iaq/>

### **Antimicrobials**

Antimicrobial Pesticides, U.S. EPA: <http://www.epa.gov/oppad001/>

### **Construction and Renovation**

American Society of Heating, Refrigerating and Air-Conditioning Engineers: <http://www.ashrae.org>

National Air Duct Cleaners Association: <http://www.nadca.com>

"General Specifications for the Cleaning of Commercial Heating, Ventilating and Air Conditioning Systems:" <http://www.nadca.com/standards/standards.asp>

### **Fungal Biology**

Airborne Pathogen Database, Penn State University:  
<http://www.bio.psu.edu/groups/apdbase/fungus.html>

Introduction to Fungal Biology, University of Sydney, School of Biological Sciences:  
<http://bugs.bio.usyd.edu.au/Mycology/contents.shtml>

Moulds: Isolation, Cultivation, Identification, University of Toronto, Dept. of Botany:  
<http://www.botany.utoronto.ca/ResearchLabs/MallochLab/Malloch/Moulds/Moulds.html>

### **Guidelines**

American College of Occupational and Environmental Medicine (ACOEM):  
<http://www.acoem.org/guidelines/article.asp?ID=52>

Health Canada:  
"Fungal Contamination in Public Buildings: A Guide to Recognition and Management" [http://www.hc-sc.gc.ca/hecs-sesc/air\\_quality/pdf/fungal.pdf](http://www.hc-sc.gc.ca/hecs-sesc/air_quality/pdf/fungal.pdf)

New York City Department of Health: <http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html>

### **Insurance**

Environmental Risk Resources Association: <http://www.erraonline.org/default.htm>

"Mold and Minnesota homeowner insurance": Statement of Minnesota Commerce Commissioner Jim Bernstein: <http://www.commerce.state.mn.us/pages/NewsReleases/Releases2002/News020719.htm>

### **Laboratories**

AIHA Accredited Labs: <http://www.aiha.org/LaboratoryServices/html/lists.htm>

Aerotech Labs: <http://www.aerotechlabs.com/Aero/>

Environmental Microbiology Laboratory, Inc.: <http://www.emlab.com>

Forensic Analytical: <http://www.forensica.com>

## **Legal**

See Georgetown University on first page of resource list.

Poole & Shaffery, LLP: <http://www.pooleshaffery.com>

## **Legislation**

United States, Toxic Mold Safety and Protection Act: [http://www.house.gov/conyers/Mold\\_Bill.pdf](http://www.house.gov/conyers/Mold_Bill.pdf)

California's Toxic Mold Protection Act of 2001:

[http://www.leginfo.ca.gov/cgi-bin/postquery?bill\\_number=sb\\_732&sess=PREV&house=B&author=ortiz](http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=sb_732&sess=PREV&house=B&author=ortiz)

<http://www.cal-iaq.org/SB732update.htm>

## **Medical**

American Academy of Allergy Asthma and Immunology: <http://www.aaaai.org>

American Lung Association: <http://www.lungusa.org/air/envindoorap.html>

DoctorFungus: <http://www.doctorfungus.com>

Mayo Clinic: <http://www.mayoclinic.com>

MedlinePlus: <http://www.nlm.nih.gov/medlineplus/molds.html>

Institute of Medicine, National Academy of Sciences (<http://www.iom.edu/>):

"Clearing the Air: Asthma and Indoor Air Exposures"

<http://books.nap.edu/books/0309064961/html/index.html>

Damp Indoor Spaces and Health

<http://www.nap.edu/catalog/11011.html>

National Institute of Allergy and Infectious Diseases, National Institutes of Health

<http://www.niaid.nih.gov/default.htm>

## **Miscellaneous**

California Department of Health Services:

"Bioaerosols and Green-Waste Composting in California"

<http://www.dhs.cahwnet.gov/org/ps/deodc/ehib/EHIB2/topics/compostbioaerosols.doc>

"Stachybotrys chartarum: The Toxic Indoor Mold." See also links at this page:

<http://www.apsnet.org/online/feature/stachybotrys/>

## **Remediation**

"Fact Sheet: Flood Cleanup - Avoiding Indoor Air Quality Problems:"

<http://www.epa.gov/iaq/pubs/flood.html>

"Mold Remediation in Schools and Commercial Buildings:"

[http://www.epa.gov/iaq/molds/mold\\_remediation.html](http://www.epa.gov/iaq/molds/mold_remediation.html)

## **Residential**

"A Brief Guide to Mold, Moisture, and Your Home:" <http://www.epa.gov/iaq/molds/images/moldguide.pdf>

Duct Cleaning:

"Should You Have the Air Ducts in Your Home Cleaned?" <http://www.epa.gov/iaq/pubs/airduct.html>

Environmental Health Watch Home Moisture Audit:

[http://www.ewh.org/Healthy\\_House/HH\\_Moist\\_Audit.htm](http://www.ewh.org/Healthy_House/HH_Moist_Audit.htm)

Fighting Mold? The Homeowners' Guide:

[http://www.cmhc-schl.gc.ca/en/burema/gesein/abhose/abhose\\_ce08.cfm](http://www.cmhc-schl.gc.ca/en/burema/gesein/abhose/abhose_ce08.cfm)

### **Sampling Equipment**

Aerotech Laboratories, Inc.: <http://www.aerotechlabs.com>

SKC, Inc. Bioaerosol and Biological Samplers: <http://www.skcinc.com/bioaerosol.asp>

### **Wood Products**

Forest Products Laboratory, U.S. Department of Agriculture:

<http://www.fpl.fs.fed.us/documnts/FPLGTR/fplgtr113/fplgtr113.htm>

Western Wood Products Association: [http://www.wwpa.org/index\\_lumberandmold.htm](http://www.wwpa.org/index_lumberandmold.htm)

### **Books, Reports, and Pamphlets**

*Bioaerosols: Assessment and Control*, Janet Macher, editor, ACGIH, 1999.

AIHA Biosafety Committee, *Environmental Mold: State of the Science, State of the Art*, AIHA Press, 2003.

*IICRC Standard and Reference Guide for Professional Mold Remediation S520*, 1<sup>st</sup> ed., Institute of Inspection, Cleaning and Restoration Certification, 2003.

*IICRC Standard and Reference Guide for Professional Water Damage Restoration*, 2<sup>nd</sup> ed., Institute of Inspection, Cleaning and Restoration Certification, 1999.

Indoor Environmental Standards Organization, *Standards of Practice for the Assessment of Indoor Environmental Quality, vol. 1: Mold Sampling; Assessment of Mold Contamination*, IESO, 2002.

American Industrial Hygiene Association, *Report of the Microbial Growth Task Force*, AIHA Press, 2001.

American Industrial Hygiene Association, *The Facts About Mold*, AIHA, 2003.

### **Articles**

Armstrong, Sarah and Jane Liaw, "The Fundamentals of Fungi," *ASHRAE Journal*, November 2002, 18-22.

"Controversy Surrounding Environmental Mold Exposure—Current Scientific Knowledge and Future Directions for Investigational Studies," *OEM Report*, December 2002, 89-96.

Copley, Michael F., "Can the Inspection Leg of the Construction Industry Help Prevent Mold in the Future?," *Code News*, May/June 2003, 29-31.

Fung, Frederick, "Health Effects of Indoor Fungal Bioaerosol Exposure," *Applied Occupational and Environmental Hygiene*, 18:535-544, July 2003.

Fung, Frederick, "Health Effects of Indoor Fungal Exposure," *IAQ Applications*, Winter 2004, 13-14.

Glaser, G., "Doctors Rethinking Treatments for Sick Sinuses," *New York Times*, December 17, 2002.

Lstiburek, Joseph, "Investigating & Diagnosing Moisture Problems," *ASHRAE Journal*, December 2002, 36-41.

Mahoney, Daniel P. and Jerome E. Spear, "Mold Risk Assessment & Remediation," *Professional Safety*, August 2003, 20-26.

Miller, Vincent, "Understanding Mycotoxin Testing and Interpretation," *Occupational Hazards*, May 2003, 49-52.

Norred, William P., "Agriculturally Important Fungal Toxins," *Chemical Health & Safety*, July/August 2000, 22-25.

Page, Elena H. and Douglas B. Trout, "The Role of *Stachybotrys* Mycotoxins in Building-Related Illness," *AIHA Journal*, 62:644-648, 2001.

Pinto, Michael A., "A Reasoned Approach to Mold Contamination," *Professional Safety*, March 2004, 46-48.

Van Loo, Jason M., et al., "Growth of Mold on Fiberglass Insulation Building Materials—A Review of the Literature," *Journal of Occupational and Environmental Hygiene*, 1:349-354, June 2004.

Wilson, S.C., et al., "An Investigation into Techniques for Cleaning Mold-Contaminated Home Contents," *Journal of Occupational and Environmental Hygiene*, 1:442-447, July 2004.

### **Magazines**

*ASHRAE IAQ Applications*, ASHRAE ([www.ashrae.org](http://www.ashrae.org)).

**Many of the above materials are available through the BWC Division of Safety & Hygiene Libraries. Call 800-644-6292 or e-mail [library@bwc.state.oh.us](mailto:library@bwc.state.oh.us).**

## Additional Resources for Mold

### Web Sites

#### General Information

Aerias: <http://www.aerias.org>

Aerotech Labs – InfoBase: <http://www.aerotechlabs.com/Aero>

American Industrial Hygiene Association (AIHA)—Mold Resources:  
<http://www.aiha.org/GovernmentAffairs-PR/html/prmoldsources.htm>

Building Science Corporation: <http://www.buildingscience.com/>

California Indoor Air Quality Program: <http://www.cal-iaq.org/iaqsheet.htm#Mold>

Canadian Center for Occupational Health and Safety:  
[http://www.ccohs.ca/oshanswers/biol\\_hazards/iaq\\_mold.html](http://www.ccohs.ca/oshanswers/biol_hazards/iaq_mold.html)

Centers for Disease Control and Prevention, Mold: <http://www.cdc.gov/nceh/airpollution/mold/>

Education Safety Association of Ontario – IAQ: <http://www.esao.on.ca/scriptcontent/index.cfm>

Environmental Microbiology Laboratory, Inc.: <http://www.emlab.com>

Environmental Protection Agency (EPA), U.S.:  
Sources of Indoor Air Pollution - Biological Pollutants <http://www.epa.gov/iaq/biologic.html>  
Indoor Air Quality Building Education and Assessment Model (I-BEAM) Software  
[http://www.epa.gov/iaq/largebldgs/ibeam\\_page.htm](http://www.epa.gov/iaq/largebldgs/ibeam_page.htm)

Federal Emergency Management Agency (FEMA): <http://www.fema.gov/>

Fungi.ca: <http://www.fungi.ca/moulds.htm>

Georgetown University:  
Mold Medicine & Mold Science: Its Practical Applications for Patient Care, Remediation & Claims May  
13-14, 2002, Georgetown University Convention Center, Washington, D.C.  
<http://phys4.harvard.edu/~wilson/soundscience/mold/mold.html>

Health Departments, State and Local: [http://www.apha.org/public\\_health/state.htm](http://www.apha.org/public_health/state.htm)

National Association of Realtors "Field Guide to Mold and Health Issues:"  
<http://www.realtors.org/libweb.nsf/pages/fg711>

New York Committee for Occupational Safety and Health: <http://www.nycosh.org/moldfacts.html>  
<http://www.nycosh.org/linktopics/indoorair.html>

Occupational Health and Safety Administration (OSHA):  
<http://www.osha-slc.gov/SLTC/indoorairquality/>  
<http://www.osha.gov/dts/shib/shib101003.html>

Texas Dept. of Health, Links to Web Sites about Mold Growth in Buildings:  
<http://www.tdh.state.tx.us/beh/IAQ/MoldLinks.htm>

University of Minnesota: <http://www.dehs.umn.edu/iaq/>

### **Antimicrobials**

Antimicrobial Pesticides, U.S. EPA: <http://www.epa.gov/oppad001/>

### **Construction and Renovation**

American Society of Heating, Refrigerating and Air-Conditioning Engineers: <http://www.ashrae.org>

National Air Duct Cleaners Association: <http://www.nadca.com>

"General Specifications for the Cleaning of Commercial Heating, Ventilating and Air Conditioning Systems:" <http://www.nadca.com/standards/standards.asp>

### **Fungal Biology**

Airborne Pathogen Database, Penn State University:  
<http://www.bio.psu.edu/groups/apdbase/fungus.html>

Introduction to Fungal Biology, University of Sydney, School of Biological Sciences:  
<http://bugs.bio.usyd.edu.au/Mycology/contents.shtml>

Moulds: Isolation, Cultivation, Identification, University of Toronto, Dept. of Botany:  
<http://www.botany.utoronto.ca/ResearchLabs/MallochLab/Malloch/Moulds/Moulds.html>

### **Guidelines**

American College of Occupational and Environmental Medicine (ACOEM):  
<http://www.acoem.org/guidelines/article.asp?ID=52>

Health Canada:  
"Fungal Contamination in Public Buildings: A Guide to Recognition and Management" [http://www.hc-sc.gc.ca/hecs-sesc/air\\_quality/pdf/fungal.pdf](http://www.hc-sc.gc.ca/hecs-sesc/air_quality/pdf/fungal.pdf)

New York City Department of Health: <http://www.ci.nyc.ny.us/html/doh/html/epi/moldrpt1.html>

### **Insurance**

Environmental Risk Resources Association: <http://www.erraonline.org/default.htm>

"Mold and Minnesota homeowner insurance": Statement of Minnesota Commerce Commissioner Jim Bernstein: <http://www.commerce.state.mn.us/pages/NewsReleases/Releases2002/News020719.htm>

### **Laboratories**

AIHA Accredited Labs: <http://www.aiha.org/LaboratoryServices/html/lists.htm>

Aerotech Labs: <http://www.aerotechlabs.com/Aero/>

Environmental Microbiology Laboratory, Inc.: <http://www.emlab.com>

Forensic Analytical: <http://www.forensica.com>

## **Legal**

See Georgetown University on first page of resource list.

Poole & Shaffery, LLP: <http://www.pooleshaffery.com>

## **Legislation**

United States, Toxic Mold Safety and Protection Act: [http://www.house.gov/conyers/Mold\\_Bill.pdf](http://www.house.gov/conyers/Mold_Bill.pdf)

California's Toxic Mold Protection Act of 2001:

[http://www.leginfo.ca.gov/cgi-bin/postquery?bill\\_number=sb\\_732&sess=PREV&house=B&author=ortiz](http://www.leginfo.ca.gov/cgi-bin/postquery?bill_number=sb_732&sess=PREV&house=B&author=ortiz)

<http://www.cal-iaq.org/SB732update.htm>

## **Medical**

American Academy of Allergy Asthma and Immunology: <http://www.aaaai.org>

American Lung Association: <http://www.lungusa.org/air/envindoorap.html>

DoctorFungus: <http://www.doctorfungus.com>

Mayo Clinic: <http://www.mayoclinic.com>

MedlinePlus: <http://www.nlm.nih.gov/medlineplus/molds.html>

Institute of Medicine, National Academy of Sciences (<http://www.iom.edu/>):

"Clearing the Air: Asthma and Indoor Air Exposures"

<http://books.nap.edu/books/0309064961/html/index.html>

Damp Indoor Spaces and Health

<http://www.nap.edu/catalog/11011.html>

National Institute of Allergy and Infectious Diseases, National Institutes of Health

<http://www.niaid.nih.gov/default.htm>

## **Miscellaneous**

California Department of Health Services:

"Bioaerosols and Green-Waste Composting in California"

<http://www.dhs.cahwnet.gov/org/ps/deodc/ehib/EHIB2/topics/compostbioaerosols.doc>

"Stachybotrys chartarum: The Toxic Indoor Mold." See also links at this page:

<http://www.apsnet.org/online/feature/stachybotrys/>

## **Remediation**

"Fact Sheet: Flood Cleanup - Avoiding Indoor Air Quality Problems:"

<http://www.epa.gov/iaq/pubs/flood.html>

"Mold Remediation in Schools and Commercial Buildings:"

[http://www.epa.gov/iaq/molds/mold\\_remediation.html](http://www.epa.gov/iaq/molds/mold_remediation.html)

## **Residential**

"A Brief Guide to Mold, Moisture, and Your Home:" <http://www.epa.gov/iaq/molds/images/moldguide.pdf>

Duct Cleaning:

"Should You Have the Air Ducts in Your Home Cleaned?" <http://www.epa.gov/iaq/pubs/airduct.html>

Environmental Health Watch Home Moisture Audit:

[http://www.ewh.org/Healthy\\_House/HH\\_Moist\\_Audit.htm](http://www.ewh.org/Healthy_House/HH_Moist_Audit.htm)

Fighting Mold? The Homeowners' Guide:

[http://www.cmhc-schl.gc.ca/en/burema/gesein/abhose/abhose\\_ce08.cfm](http://www.cmhc-schl.gc.ca/en/burema/gesein/abhose/abhose_ce08.cfm)

### **Sampling Equipment**

Aerotech Laboratories, Inc.: <http://www.aerotechlabs.com>

SKC, Inc. Bioaerosol and Biological Samplers: <http://www.skcinc.com/bioaerosol.asp>

### **Wood Products**

Forest Products Laboratory, U.S. Department of Agriculture:

<http://www.fpl.fs.fed.us/documnts/FPLGTR/fplgtr113/fplgtr113.htm>

Western Wood Products Association: [http://www.wwpa.org/index\\_lumberandmold.htm](http://www.wwpa.org/index_lumberandmold.htm)

### **Books, Reports, and Pamphlets**

*Bioaerosols: Assessment and Control*, Janet Macher, editor, ACGIH, 1999.

AIHA Biosafety Committee, *Environmental Mold: State of the Science, State of the Art*, AIHA Press, 2003.

*IICRC Standard and Reference Guide for Professional Mold Remediation S520*, 1<sup>st</sup> ed., Institute of Inspection, Cleaning and Restoration Certification, 2003.

*IICRC Standard and Reference Guide for Professional Water Damage Restoration*, 2<sup>nd</sup> ed., Institute of Inspection, Cleaning and Restoration Certification, 1999.

Indoor Environmental Standards Organization, *Standards of Practice for the Assessment of Indoor Environmental Quality, vol. 1: Mold Sampling; Assessment of Mold Contamination*, IESO, 2002.

American Industrial Hygiene Association, *Report of the Microbial Growth Task Force*, AIHA Press, 2001.

American Industrial Hygiene Association, *The Facts About Mold*, AIHA, 2003.

### **Articles**

Armstrong, Sarah and Jane Liaw, "The Fundamentals of Fungi," *ASHRAE Journal*, November 2002, 18-22.

"Controversy Surrounding Environmental Mold Exposure—Current Scientific Knowledge and Future Directions for Investigational Studies," *OEM Report*, December 2002, 89-96.

Copley, Michael F., "Can the Inspection Leg of the Construction Industry Help Prevent Mold in the Future?," *Code News*, May/June 2003, 29-31.

Fung, Frederick, "Health Effects of Indoor Fungal Bioaerosol Exposure," *Applied Occupational and Environmental Hygiene*, 18:535-544, July 2003.

Fung, Frederick, "Health Effects of Indoor Fungal Exposure," *IAQ Applications*, Winter 2004, 13-14.

Glaser, G., "Doctors Rethinking Treatments for Sick Sinuses," *New York Times*, December 17, 2002.

Lstiburek, Joseph, "Investigating & Diagnosing Moisture Problems," *ASHRAE Journal*, December 2002, 36-41.

Mahoney, Daniel P. and Jerome E. Spear, "Mold Risk Assessment & Remediation," *Professional Safety*, August 2003, 20-26.

Miller, Vincent, "Understanding Mycotoxin Testing and Interpretation," *Occupational Hazards*, May 2003, 49-52.

Norred, William P., "Agriculturally Important Fungal Toxins," *Chemical Health & Safety*, July/August 2000, 22-25.

Page, Elena H. and Douglas B. Trout, "The Role of *Stachybotrys* Mycotoxins in Building-Related Illness," *AIHA Journal*, 62:644-648, 2001.

Pinto, Michael A., "A Reasoned Approach to Mold Contamination," *Professional Safety*, March 2004, 46-48.

Van Loo, Jason M., et al., "Growth of Mold on Fiberglass Insulation Building Materials—A Review of the Literature," *Journal of Occupational and Environmental Hygiene*, 1:349-354, June 2004.

Wilson, S.C., et al., "An Investigation into Techniques for Cleaning Mold-Contaminated Home Contents," *Journal of Occupational and Environmental Hygiene*, 1:442-447, July 2004.

### **Magazines**

*ASHRAE IAQ Applications*, ASHRAE ([www.ashrae.org](http://www.ashrae.org)).

**Many of the above materials are available through the BWC Division of Safety & Hygiene Libraries. Call 800-644-6292 or e-mail [library@bwc.state.oh.us](mailto:library@bwc.state.oh.us).**

## Resources Available from the Division of Safety & Hygiene (DSH) Libraries

(800) 644-6292 (614) 466-7388

[library@bwc.state.oh.us](mailto:library@bwc.state.oh.us)

[www.ohiobwc.com](http://www.ohiobwc.com)

### Safety training:

- Safety talks, outlines and scripts - DSH Safety leader's discussion guide, Training Center's One-hour safety presentations, reference books, web resources
- Videos – hundreds of safety and health topics
- Books and articles on training techniques

### Machine and equipment safety:

- Safety standards (ANSI, NFPA, CGA)
- Books and articles on power presses, material handling equipment, lockout/tagout, etc.

### Sample written programs:

- DSH program profiles and sample written programs
- Reference books
- Internet resources

### Illness and injury statistics:

- Statistics from the U.S. Bureau of Labor Statistics
- National Safety Council's *Injury Facts*
- National Institute of Occupational Safety & Health (NIOSH) studies

### Hazard communication and chemical safety:

- Chemical safety information
- Material safety data sheets (MSDSs)
- Sample written programs
- Videos
- Internet resources

### Safety standards

- American National Standards Institute (ANSI) standards (including standards for construction, machinery and equipment, personal protective equipment)
- National Fire Protection Association (NFPA) fire codes (including the Life Safety Code and the National Electrical Code)
- Compressed Gas Association (CGA) standards

### Other topics of interest (books, articles, magazines, videos and standards):

- Confined spaces
- Electrical safety
- Job safety analysis
- New employee orientation
- Powered industrial trucks
- Respiratory protection
- Safety culture
- Scaffolds

Directories and lists of vendors of safety equipment

Occupational Safety & Health Administration (OSHA) regulations

*Manual of Uniform Traffic Control Devices (MUTCD)*

Recommendations of useful Internet sites

BWC publications

**INTERNET WEB SITES  
FOR  
OCCUPATIONAL SAFETY & HEALTH INFORMATION  
April 2005**

**GENERAL**

**NATIONAL SAFETY COUNCIL (NSC)**

<http://www.nsc.org/>

The NSC has a user friendly web site for innovative and current information on home, farm and community, on the road and workplace safety and as well statistical data and charts.

**NORTH DAKOTA WORKFORCE SAFETY & INSURANCE**

<http://www.workforcesafety.com/>

For workplace safety, North Dakota's WSI site puts forth their "safe operating procedures" page where they give information on accident and near miss reports, substance abuse, material handling and storage, walking and working surfaces, and safety program development and orientation.

**OCCUPATIONAL & INDUSTRIAL SAFETY RESOURCES**

<http://www.khake.com/page59.html>

Maintained by a Vocational Information Center, this web site provides links to occupational and industrial safety with lists of directories, national centers, hotlines and help lines as well as specific area coverage such as emergency, disaster and natural hazards, and tool, machine and equipment safety options.

**OKLAHOMA STATE UNIVERSITY**

<http://www.pp.okstate.edu/ehs/>

The Department of Environmental Health & Safety at OSU offers an online safety resource library that is constantly being updated with topics from A-Z including specific areas of safety such as fire, construction, HAZCOM and training. Go to the "Links Library" option.

**SAFETY DIRECTORY**

<http://www.safetydirectory.com/>

Safety Directory.com is an Internet gateway to occupational health & safety sites. This web site is indexed with information on industry specific topics, training, illness and injury, as well as safety publications and resources.

**FEDERAL GOVERNMENT**

**CENTERS FOR DISEASE CONTROL & PREVENTION (CDC)**

<http://www.cdc.gov/>

The CDC is always a good resource for current medical issues throughout the United States. Health topics from A-Z give an in-depth look at most communicable diseases as well as topics such as safe driving, violence, and air pollution, and workplace safety and health topics.

### **FEDERAL EMERGENCY MANAGEMENT ASSOCIATION (FEMA)**

<http://www.fema.gov/>

For up-to-date information on active disasters and emergencies nationwide access this web site first. Publications include options for emergency preparedness and prevention, response and recovery, disaster fact sheets, and public awareness information.

### **NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY & HEALTH (NIOSH)**

<http://www.cdc.gov/niosh/homepage.html>

NIOSH's web site provides current information on many services as well as safety research, including ergonomics programs, respirators, and mining safety. At the chemical page you will find databases and other helpful resources, information on personal protective equipment, as well as government agency web sites of interest.

### **OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION (OSHA)**

<http://www.osha.gov>

OSHA'S official web site includes media releases, online publications, statistics, standards & directives, "Technical Links," training center courses, "hot topics," and "what's new" as well a very useful A-Z index page.

### **INTERNATIONAL RESOURCES**

#### **HEALTH & SAFETY EXECUTIVE (HSE)**

<http://www.hse.gov.uk/>

The United Kingdom has an international safety web site with a good deal to offer on occupational safety & health. Drop down boxes offer A-Z industry information, health and safety topics, tools, research, as well as publications and statistics.

#### **ERGNET**

<http://www.sunderland.ac.uk/~ts0qli/ergnet.htm>

The University of Sunderland in the UK is an international web site directory of "places for ergonomics and human factors". Featuring lists of sources such as societies, organizations, government bodies, institutes, centers and laboratories, this site also gives links to journals, a research database and other general ergonomic sites.

### **OHIO**

<http://www.epa.state.oh.us>

At the official web site for Ohio's Environmental Protection Agency; use the "Topic Index" to find regulations and information on permits, hazardous waste, pollution prevention, wastewater, wetlands, and much more.

### **OHIO STATE LIBRARY/OHIOLINK**

<http://winslo.state.oh.us>

At **OhioLink**, a statewide library and information network, you can search the State Library of Ohio's collection for the BWC's Division of Safety & Hygiene library books as well as other Ohio College and university library collections. Also available at this web site are searchable versions of Ohio Administrative laws and rules, electronic databases, and other Ohio library directories.

## ***SPECIFIC (BY SUBJECT)***

### **CONSTRUCTION**

<http://www.cdc.gov/elcosh/index.html>

CDC's **eLCOSH** is a comprehensive library of construction-related safety information presented in both English and Spanish with items listed under trade, hazard, job site, and others. Also see: The Construction Industry Safety Council, a Center to Protect Workers' Rights resource center at <http://www.buildsafe.org/RSC.htm> for OSHA publications in PDF and hazard alerts.

### **ERGONOMICS**

<http://www.ergoweb.com>

**ERGOWEB** provides current information on ergonomics and human factor science. Offered are: research, case studies, reference material and a forum for questions, answers and discussion.

### **LABORATORY SAFETY**

<http://safety.science.tamu.edu/>

Texas A&M University College of Science is an optional choice for safety in the laboratory information. From hazard identification to waste disposal this web site offers thorough coverage of laboratory safe practices.

### **MATERIAL SAFETY SHEETS**

<http://www.ilpi.com/msds/index.html>

This web site offers many solutions for finding MSDS (100 free sites) as well as chemical manufacturers and suppliers, pesticides including fertilizers, government sites, and other miscellaneous locations for chemical data. Also check any toxicological effects at <http://www.atsdr.cdc.gov/toxprofiles/> and health and safety information on household chemical ingredients at <http://householdproducts.nlm.nih.gov/>.

### **MOTOR CARRIER SAFETY PROGRAMS**

<http://www.fmcsa.dot.gov/safetyprogs/saftprogs.htm>

The Federal Motor Carrier Safety Administration (FMCSA), an administration within the U.S. Department of Transportation, regulates and supports the Nation's interstate commercial carrier industry. The FMCSA web page offers several safety programs in PDF format such as brake safety, fatigue, HAZMAT safety, speed management, sharing the road safely, and other insurance and licensing information.

## **RADIATION**

<http://www.physics.isu.edu/radinf/>

The Radiation Information Network offers a web site that is in-depth with information on radiation topics and issues. In addition to what's new in the field and general information there are regulatory, organizational and society links as well as research and educational resources available to access.

## **SAFETY STATISTICS**

<http://stats.bls.gov/>

Occupational health and safety statistics by industry and occupation can be researched for injuries, illnesses, and fatality data at this web site starting with the "Overview of BLS Statistics on Worker Safety and Health" page.

## ***SAFETY BRIEFINGS, MANUALS, PRODUCTS & PROGRAMS***

### **OSHA POWERPOINT SAFETY PRESENTATIONS**

<http://esf.uvm.edu/sirippt/powerpt.html>

An extensive safety PowerPoint presentation library is available at this web site featuring A-Z topics such as accident investigations, bomb threats, chemical spills, construction, electrical, hand tools, emergency response, fire safety, forklifts, JSA, laser, OSHA compliance, PPE, razor knife safety, safe lifting, and many more.

### **SAFETY PUBLICATIONS & VIDEO RESOURCES**

<http://www.cbs.state.or.us/external/osha/standards/pub.htm>

A valuable resource for safety resources, the Oregon State's Department of Consumer and Business Publications web site is packed with downloadable information. Areas covered are agriculture, asbestos abatement, occupational exposures, HAZCOM, HAZMAT, HAZWOPER, safety practices, writing manuals and programs, tools of the trade, workers' compensation and ergonomics.

Ohio Bureau of Workers' Compensation, Div. of Safety & Hygiene Library  
30 W. Spring St., L-3, Columbus, OH 43215-2256  
(800) 644-6292, press option 2 - 2  
(614) 466-7388/ (614) 644-9634 (fax)  
E-Mail: [library@bwc.state.oh.us](mailto:library@bwc.state.oh.us)

## **Saving You Time and Research**

Requests for copies of OSHA standards, information on starting a safety committee, a video on accident investigation techniques -- these are some of the thousands of inquiries BWC's Division of Safety & Hygiene (DSH) libraries receive each year.

### **DSH has two libraries to serve you:**

- The central library in the William Green Building in downtown Columbus;
- The resource center and video library located at the Ohio Center for Occupational Safety and Health (OCOSH) in Pickerington.

Both libraries are open 8 a.m. to 4:45 p.m., Monday through Friday. Your need for information does not require a visit to the library. You can phone, fax, or e-mail your requests and receive a quick response.

**The central library** provides free information services on the topics of occupational safety and health, workers' compensation and rehabilitation.

**The OCOSH resource center** provides similar services for those who visit OCOSH for meetings and training center classes.

**The video library** offers an extensive collection of videotapes to supplement your organization's safety and health training program. It is a convenient and popular source for Ohio employers to borrow quality occupational safety- and health-related training aids.

Visit our Web site at **[www.ohiobwc.com](http://www.ohiobwc.com)**.

Central library  
30 W. Spring St., Third Floor  
Columbus OH 43215-2256  
**1-800-OHIOBWC**  
(614) 466-7388  
(614) 644-9634 (fax)  
[library@bwc.state.oh.us](mailto:library@bwc.state.oh.us)

OCOSH resource center  
13430 Yarmouth Drive  
Pickerington OH 43147  
**1-800-OHIOBWC**  
Resource center (614) 728-6464  
Video library (614) 644-0018