Post-Flooding Considerations And Mold

June 2005
Version 1.0

Florida Building Commission
2555 Shumard Oak Boulevard
Tallahassee, Florida 32399-2100
(850) 487-1824

Preface

The appropriate response to an unplanned "water event"—such as a broken pipe, sewage back-up, or severe weather such as a hurricane—can mean the difference between a minor inconvenience and long-lasting damage to a home and its contents. In addition to the time and cost associated with restoring the home, you should also be aware that serious indoor air quality problems might occur as the result of mold.

Considerations for handling post-flooding problems are included along with information on mold and the importance of handling any post-flooding situation as if it were a fire. You wouldn't wait to extinguish a fire—nor should you wait to deal with water damage—regardless of what caused it. You must act quickly to resolve the problem.

Special thanks are extended to the following individuals/organizations who so kindly allowed us to use images and information to make this presentation possible: Dr. Sandy Wiggins, North Carolina State University; North Dakota State Cooperative Extension; Dr. Wendell Porter, University of Florida, IFAS; United States Environmental Protection Agency; Amber Wysocki and Dr. Kathleen Parrott, Virginia Cooperative Extension Service.

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For more information regarding the Florida Building Code contact:

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To obtain a complete copy of the 2004 Florida Building Code contact The Florida Department of Community Affairs Building Code Information System Web site:

http://www.floridabuilding.org

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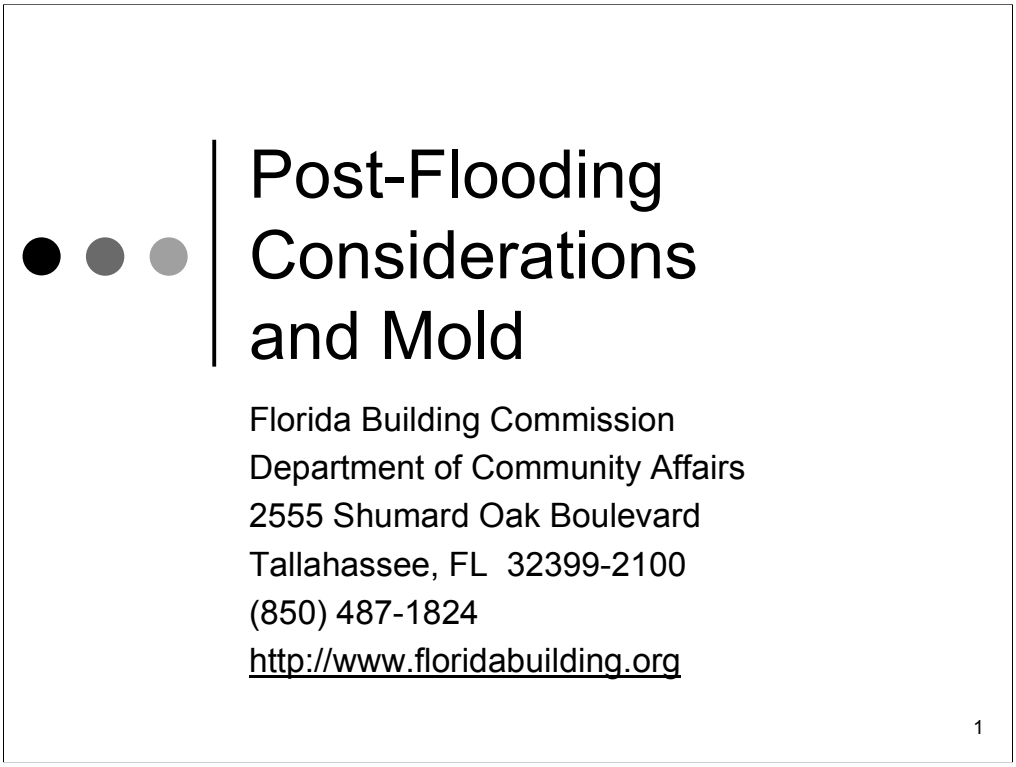
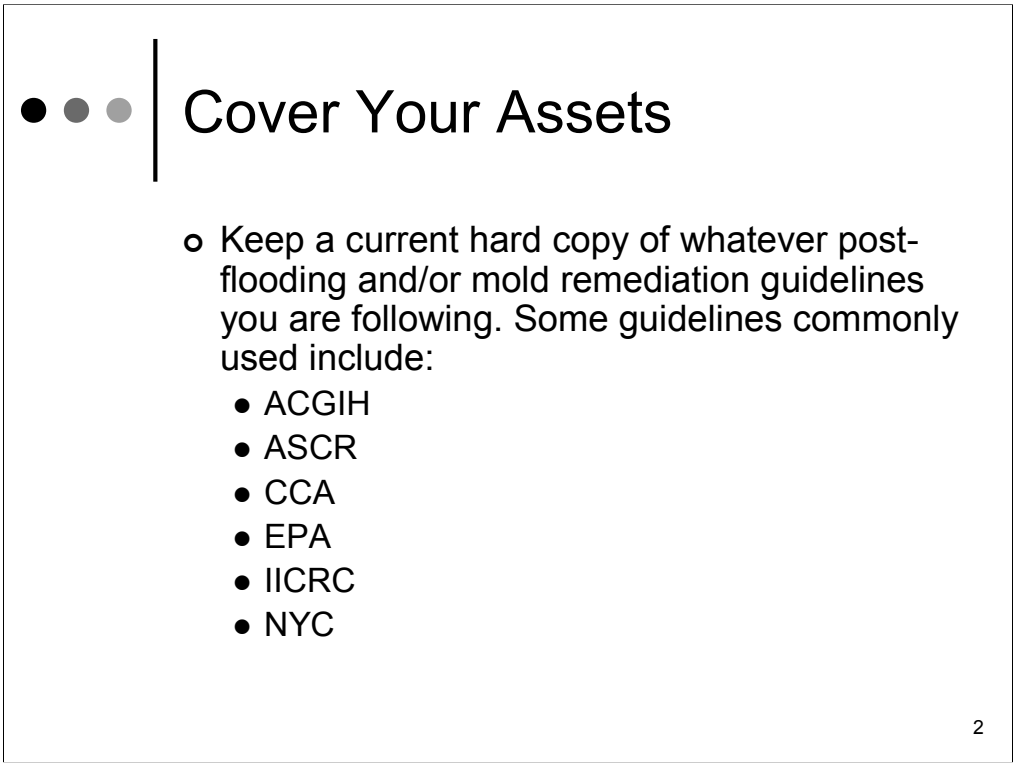


This presentation focuses on post-flooding considerations and mold in residential properties.

The information is intended to give you ideas for areas of what to consider when dealing with post-flooding situations, but is not all inclusive.

Links to additional information are incorporated throughout to give you places to conduct further study. In addition, a separate resource list for websites dealing with mold is at the end of this book.

This is a complex issue that not only requires due diligence, but also common sense. Be sure that you and your employees understand that a "water event"—such as a broken pipe, sewage back-up, or severe weather storm—should be treated in much the same fashion as if it were a fire. If the problem were a fire, you would act right away…the same is true for a post-flooding situation. The faster you act to remove excess water, clean and dry the building, the lesser the potential for you to have a large mold outbreak.



Whether you choose to do the work yourself or hire a contractor (or other professional service provider) to do the cleanup, make sure the contractor has training and experience doing the type of work you are requesting. Check references and ask the contractor what recommendations they are following. Several of the better-known and recognized guidelines/associations include:

- Guidelines of the American Conference of Governmental Industrial Hygienists (ACGIH). Bioaerosols: Assessment and Control www.acgih.org/
- Water Loss Institute, an Institute of the Association of Specialists in Cleaning and Restoration (ASCR) - www.ascr.org (800) 272-7012 or (410) 729-9900; www.ascr.org/institutes/wli/index.cfm (information on water and sewage damage restoration)
- Canadian Construction Association, CCA-82-2004 *Mould Guidelines for the Canadian Construction Industry*. www.cca-acc.com
- U.S. Environmental Protection Agency, Office of Air and Radiation, Indoor Environments Division. *Mold Remediation in Schools and Commercial Buildings*. EPA 402-K-01-001 March 2001. www.epa.gov/iaq/molds/index.html (can apply to residential structures as well)
- Institute of Inspection, Cleaning and Restoration Certification (IICRC), *IICRC Standard and Reference Guide for Professional Carpet Cleaning (IICRC S100).* 2002. www.iicrc.org
- Institute of Inspection, Cleaning and Restoration Certification (IICRC), *IICRC Reference Guide for Professional Mold Remediation (IICRC S520).* 2003, 2004. www.iicrc.org
- Institute of Inspection, Cleaning and Restoration Certification (IICRC), *IICRC Standard and Reference Guide for Professional Water Damage Restoration (IICRC S500).* 1999. www.iicrc.org
- New York City Department of Health & Mental Hygiene Bureau of Environmental & Occupational Disease Epidemiology. 2002. *Guidelines on assessment and Remediation of Fungi in Indoor Environments.* www.nyc.gov/html/doh/html/epi/moldrpt1.shtml

Always keep a record of what guidelines and procedures are followed for each job.

Safety: Injury and Illness Prevention

- Take necessary precautions when entering, cleaning, drying, and leaving the home
- Make certain tetanus shots are up to date
- Wear protective clothing

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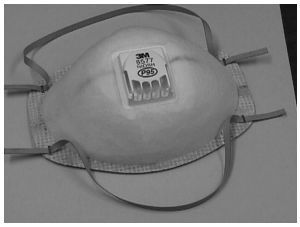
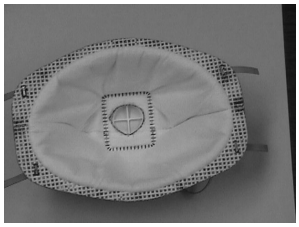
Keep in mind that your safety, and the safety of the occupants of the dwelling you enter, are of paramount importance.

Post-flooding clean up is a difficult task that must take place quickly. Acting quickly to clean and dry is extremely important; however, rushing through a job places you in a position prone to accident and illness. Think before you act and make a plan before commencing any work.

Safety: Injury and Illness Prevention





- Wear one of these (N-95 or P-95) if you think mold spores are present

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In order to limit your exposure to airborne mold, you may want to wear one of these if you suspect mold is present. They are available at many hardware stores and from 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 www.osha.gov/) Note that the OSHA website has a respirator selection program that can help you choose the right respirator for the situation (www.osha.gov/SLTC/etools/respiratory/respirator_selection.html)

Note:

A N-95 respirator covers the nose and mouth and will filter out 95% of the particles in the air. This is the minimum respiratory protection to wear when cleaning small areas of visible or possible mold. *Do not* accept a dust mask…make certain you see N-95 or P-95 (P stands for particulate).

- N95 Particulate Filter (95% filter efficiency level) effective against particulate aerosols free of oil; time use restrictions may apply.
- P95 Particulate Filter (95% filter efficiency level) effective against all particulate aerosols.

Safety: What to wear

- Use N-95 respirator
- Wear gloves
- Wear goggles
- Wear protective clothing

EPA, *A Brief Guide to Mold, Moisture and Your Home*

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Do not breathe in mold or mold spores. Wear at least a N-95 respirator, as discussed in the previous slide if you suspect mold is present.

Do not touch mold or moldy items with bare hands. 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.

Do not get mold or mold spores in your eyes. Wear goggles. Goggles that do not have ventilation holes are recommended.

Wear protective clothing, including rubber boots.

Use the appropriate Personal Protective Equipment (PPE) and containment guidelines for the job.

Don't wear contaminated clothing home. Have another set of clothes that you can change in to at the job site.

Choose a set of guidelines, document what you're using, and follow them.

Safety:
Injury and Illness Prevention

- Always use good hand washing practices during this time.
- It's especially important to wash your hands before smoking, eating or drinking.

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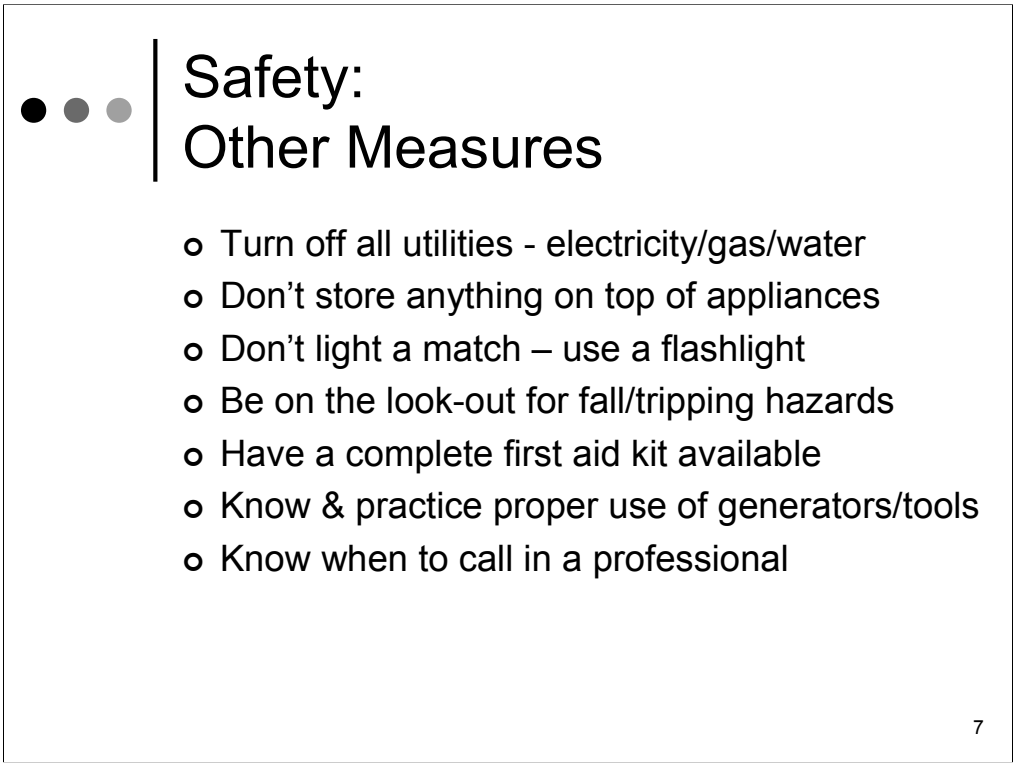

Depending on the severity of the water event, these additional measures should be considered.

Known Water Leak

- Following all safety procedures, turn water off if a leak is the source of the flooding

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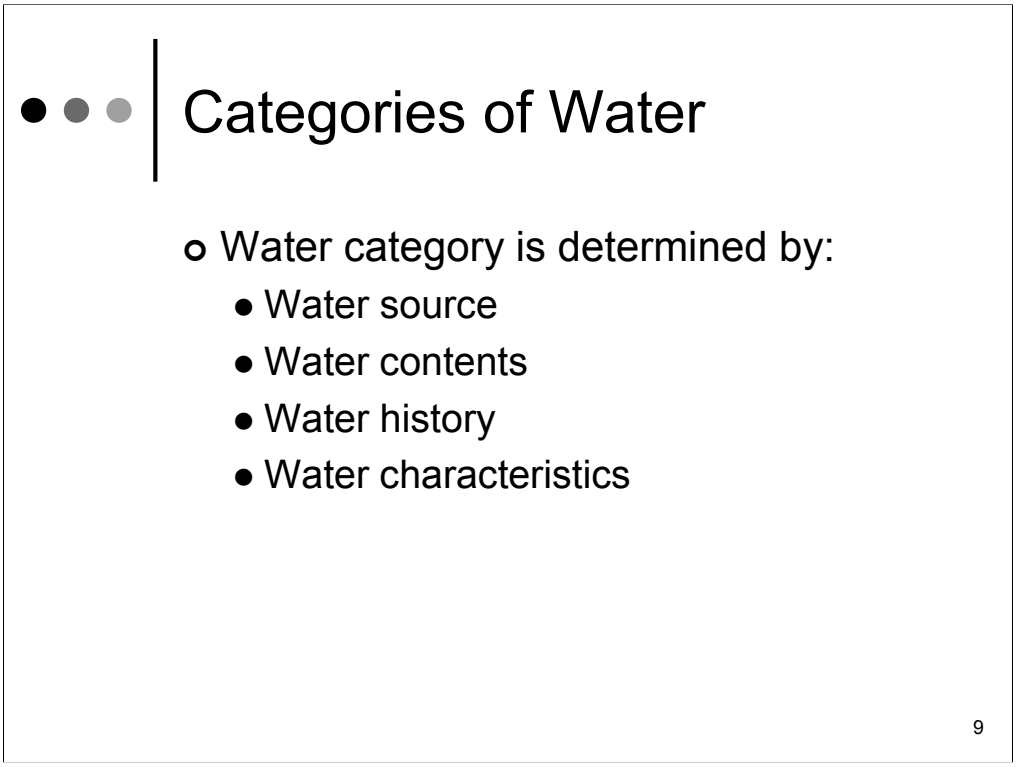
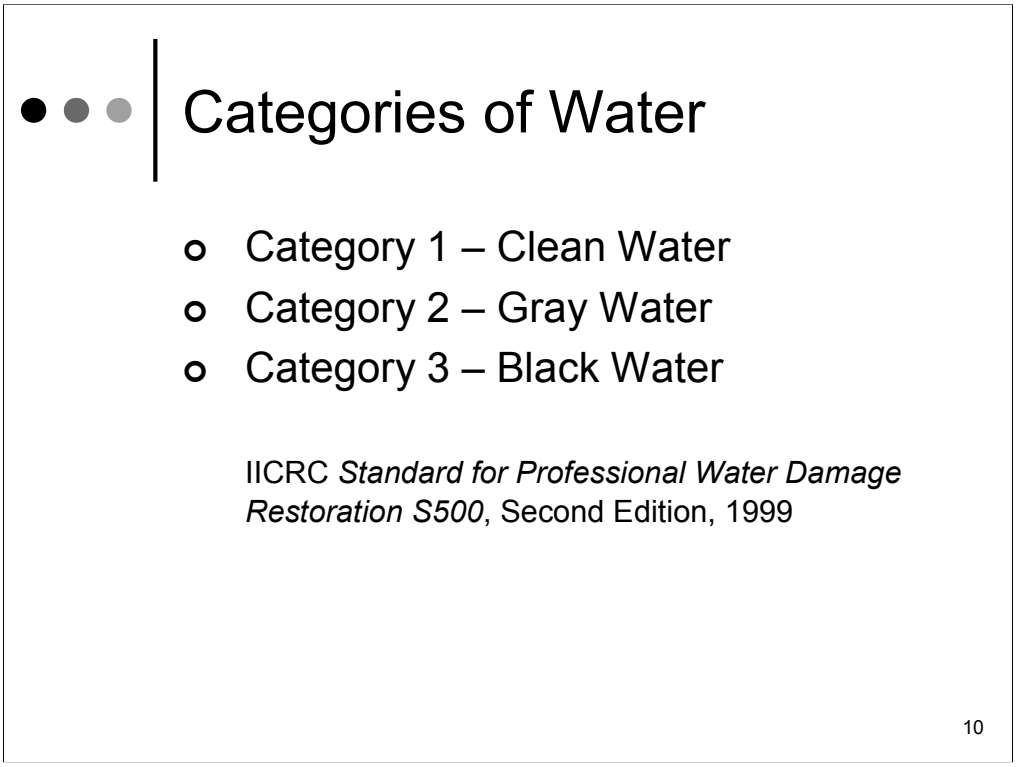
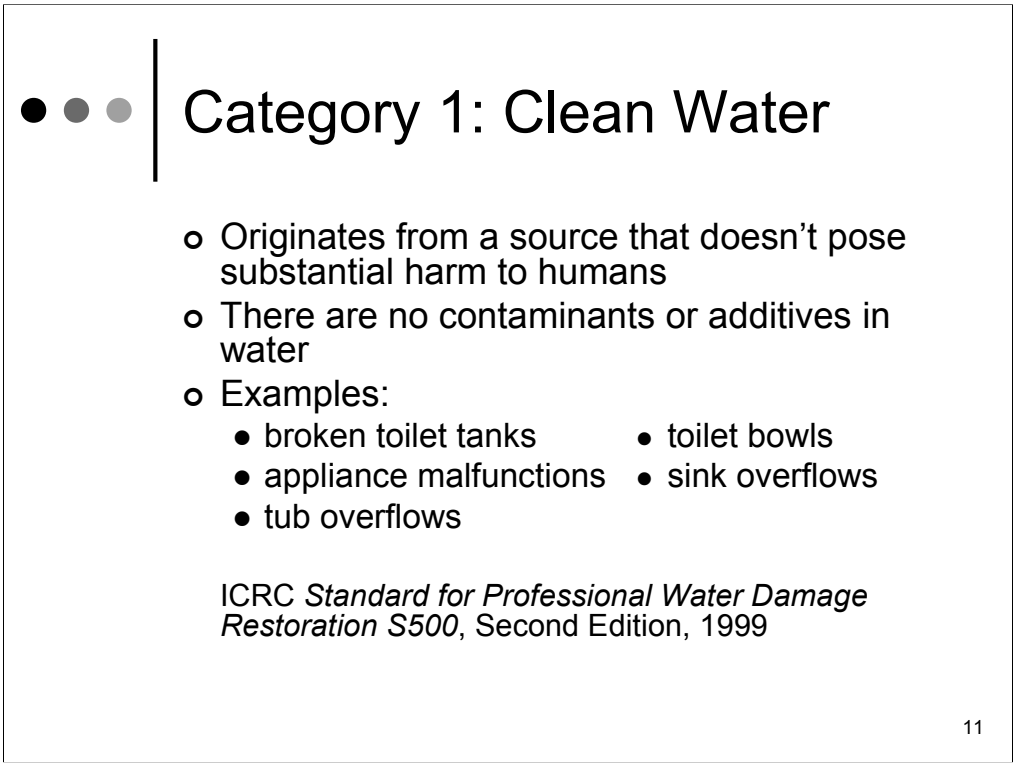


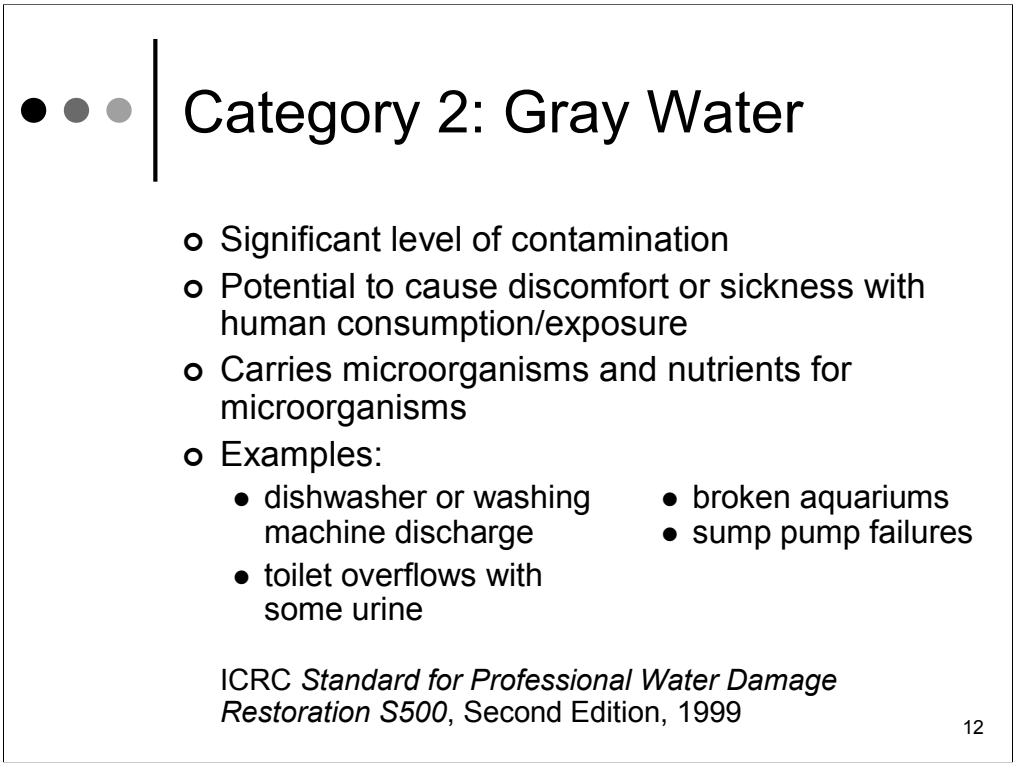
The category of water, as related to a flooding problem, is an important consideration in determining the appropriate clean-up mode. It's important to realize that even potable water can turn into contaminated water in a short period of time.



Generally, floodwater is classified into one of three different categories.



Category 1 water is sometimes referred to as "clean water".



Category 2 water is sometimes referred to as "gray water".

Category 2: Gray Water

- Degree of contamination greatly affected by time and temperature
- If left untreated for longer than 48 hours, it can change to Category 3 water

ICRC *Standard for Professional Water Damage Restoration S500*, Second Edition, 1999

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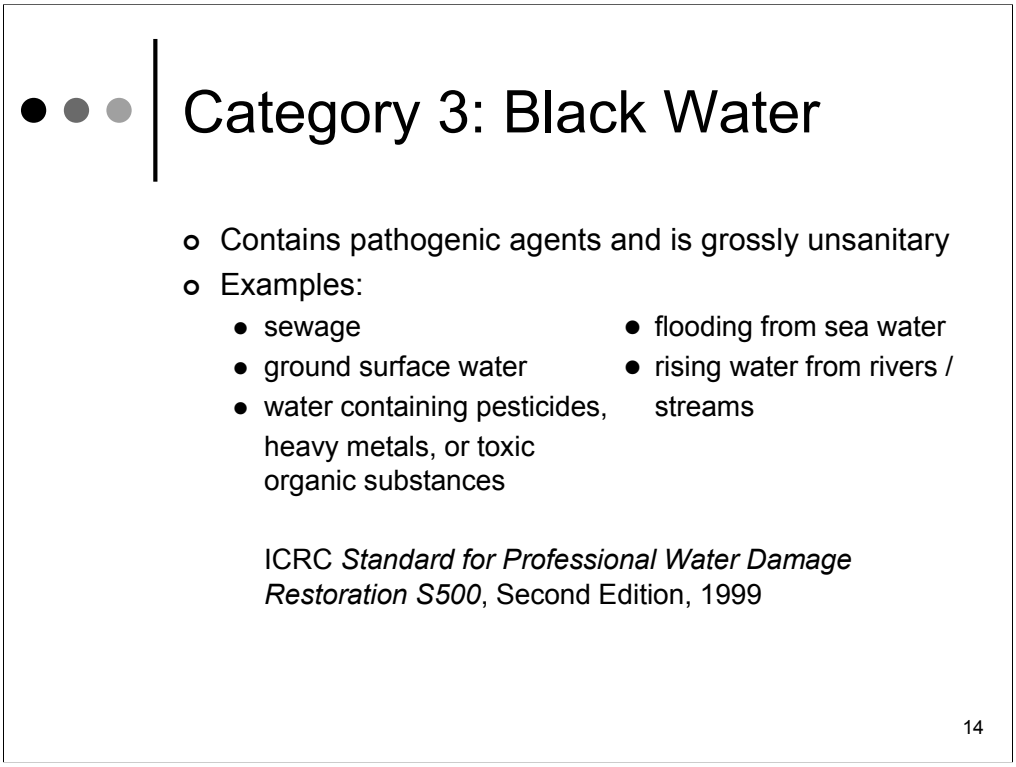
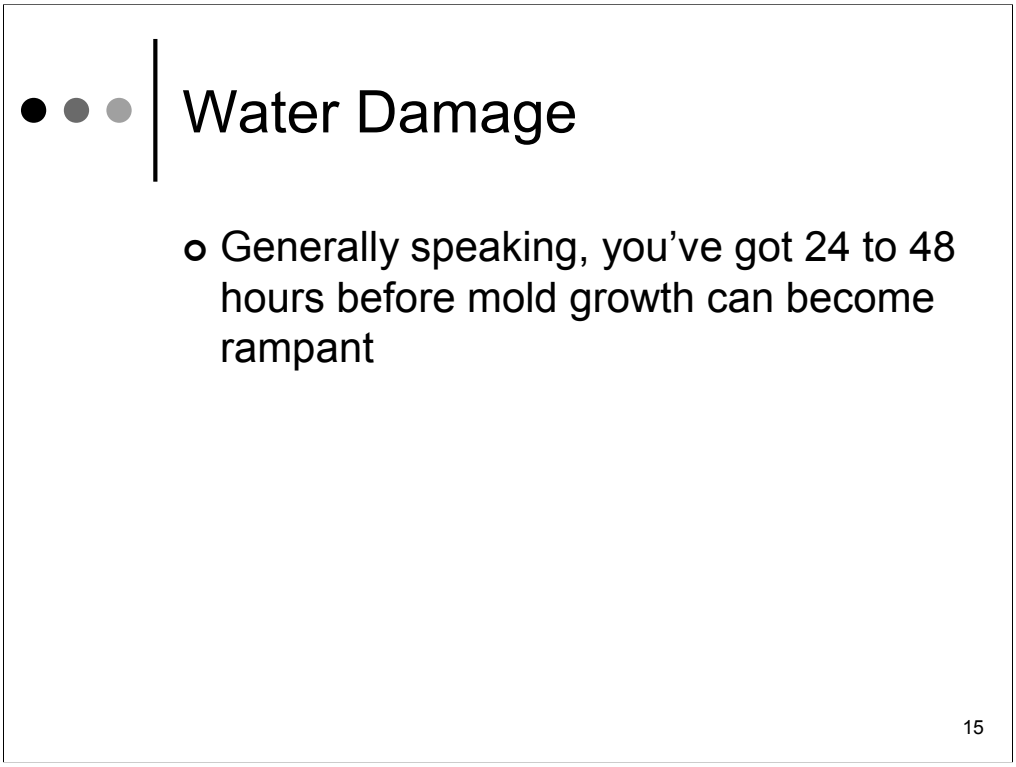


Category 3 water is sometimes referred to as “black water”.



Moisture control is the key to mold control, so when water leaks or spills occur indoors—act quickly. If wet/damp materials or areas are dried 24–48 hours after a leak or spill happens, in most cases mold growth will not be amplified.

Water Damage

- Four steps in cleaning up and drying out:
  1. Remove contaminated mud/debris
  2. Clean
  3. Disinfect
  4. Dry

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Clean Up

- Remove all sediment, debris and organic material deposited by floodwater

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Clean Up

- Remove excess water by mopping or soaking up excess water from hard surfaces or furnishings
- Use wet vacuuming equipment

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Clean Up

- Throw out?
  - Carpet
  - Padding
  - Mattress
  - Box springs
  - Upholstered furniture
  - Pillows
  - Some wood furniture

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Depending on many factors (including time and water category) anything cleanable may be kept—*if* you can clean and dry it within a short period of time. However, if it is wet, it needs to be stored away from unaffected (dry) furnishings and building materials, and most likely kept until an insurance company representative has seen the damaged goods.

Clean Up

- Clean / repair:
  - Some wood furniture

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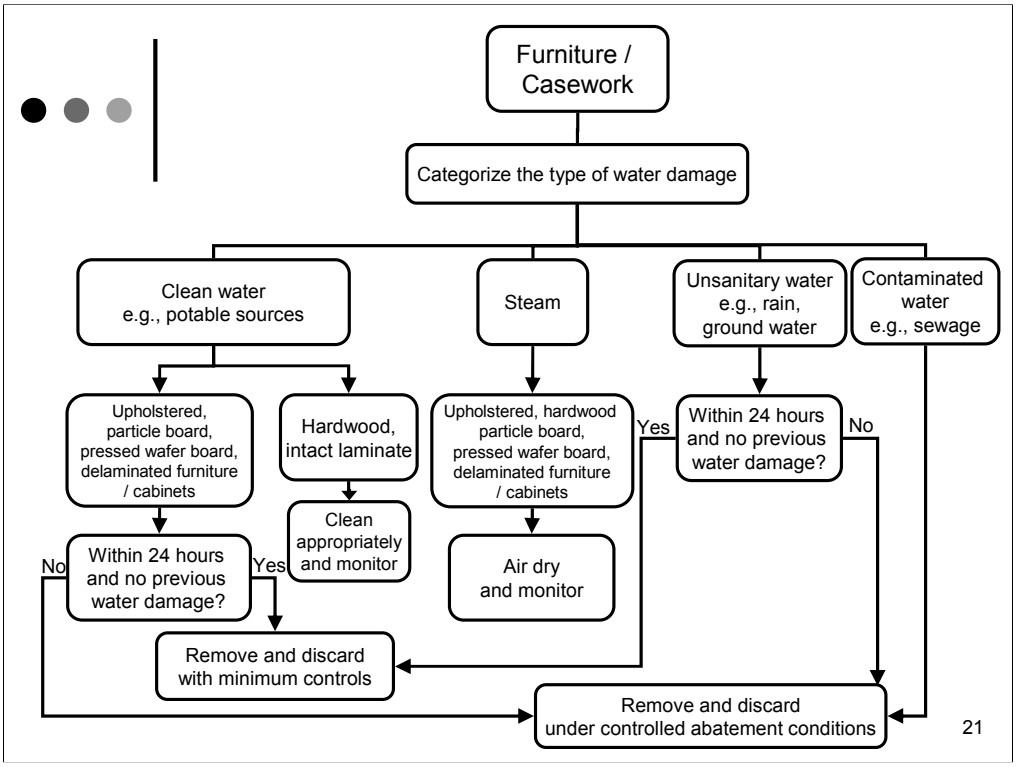
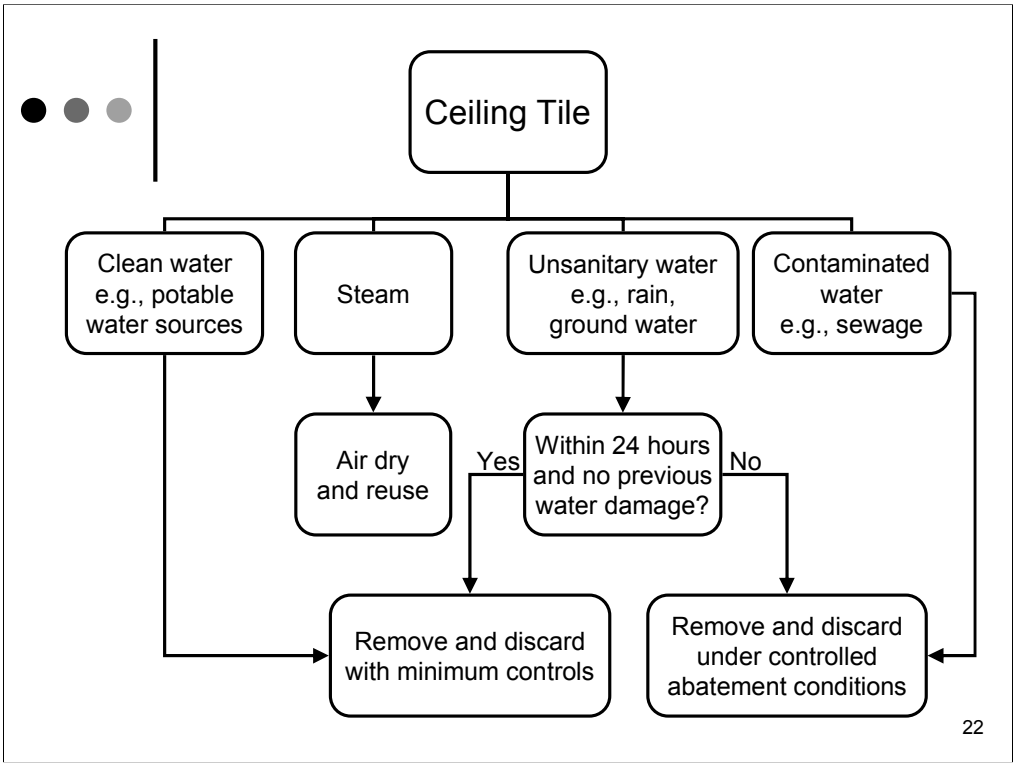
You may not want to be involved in cleaning up anything but the structure itself. However, if you do…



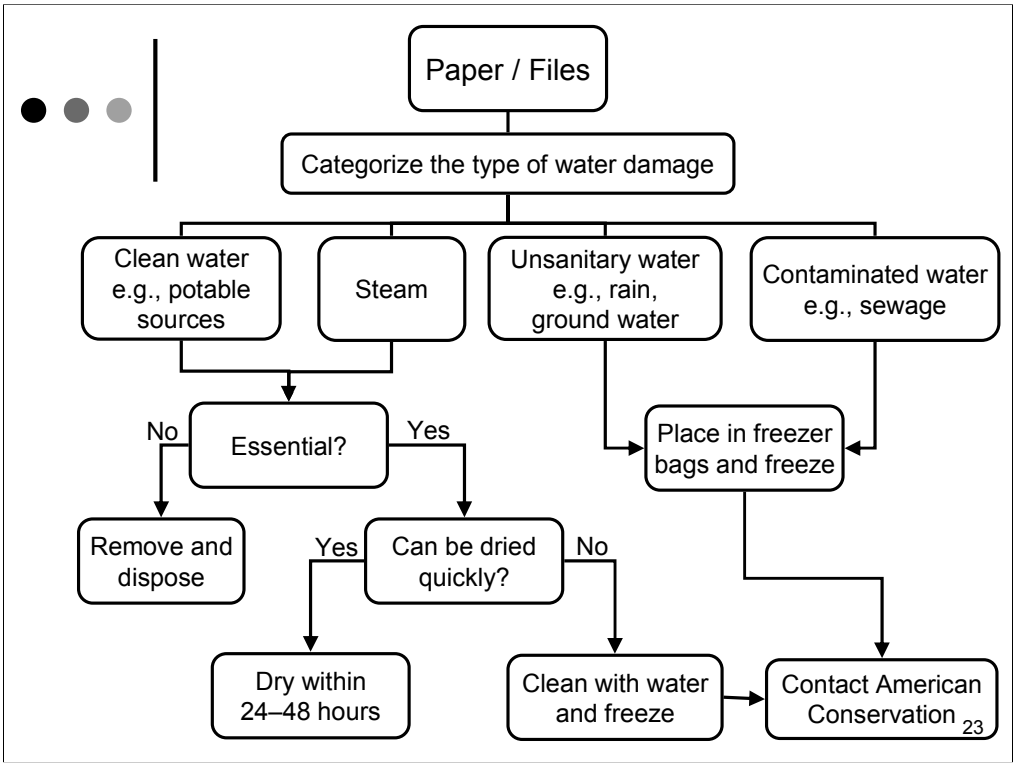
...the University of Minnesota's Environmental Health & Safety Division's publication *Managing Water Infiltration into Buildings* (www.dehs.umn.edu/iaq/flood.html) contains a number of decision algorithms. An algorithm is a special method of solving a certain kind of problem. This is their decision algorithm for furniture/casework. Refer to their entire document for specific details. Note how their categories of water differ from previously mentioned categories.

What is your company's policy?



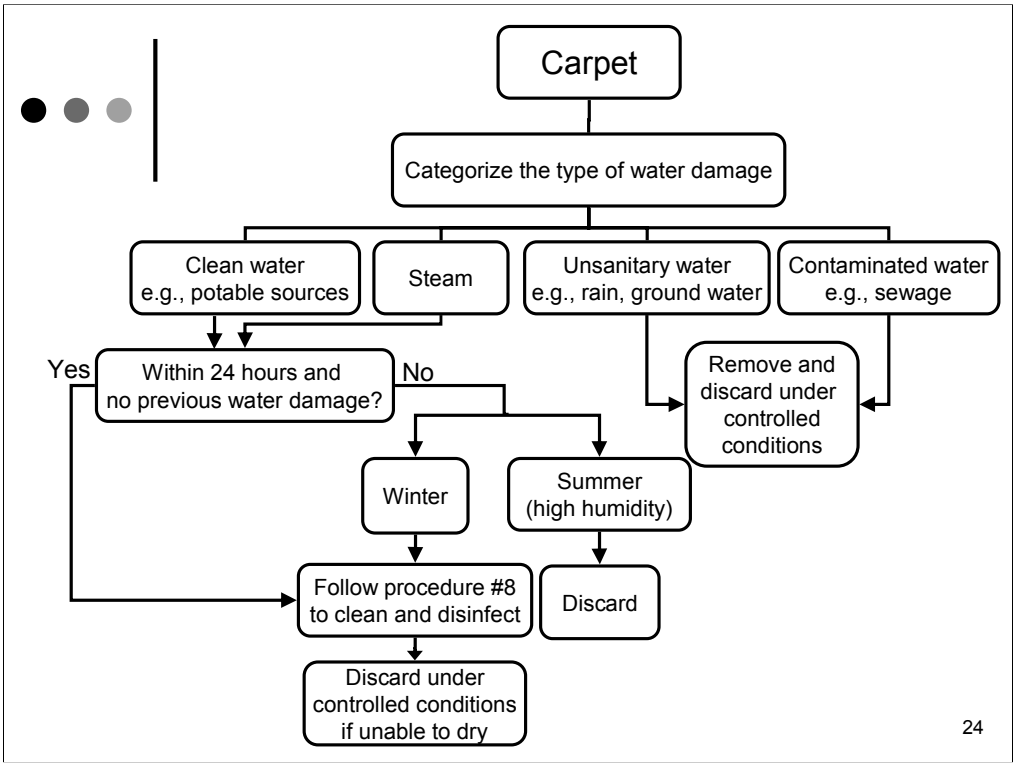
Here is a decision algorithm for water-damaged ceiling tile (www.dehs.umn.edu/iaq/flood.html). Refer to their entire document for specific detail. Note how their categories of water differ from previously mentioned categories.

What is your company's procedure?



A decision algorithm for water-damaged paper/files (adapted from www.dehs.umn.edu/iaq/flood.html). Refer to their entire document for specific detail. Note how their categories of water differ from previously mentioned categories.

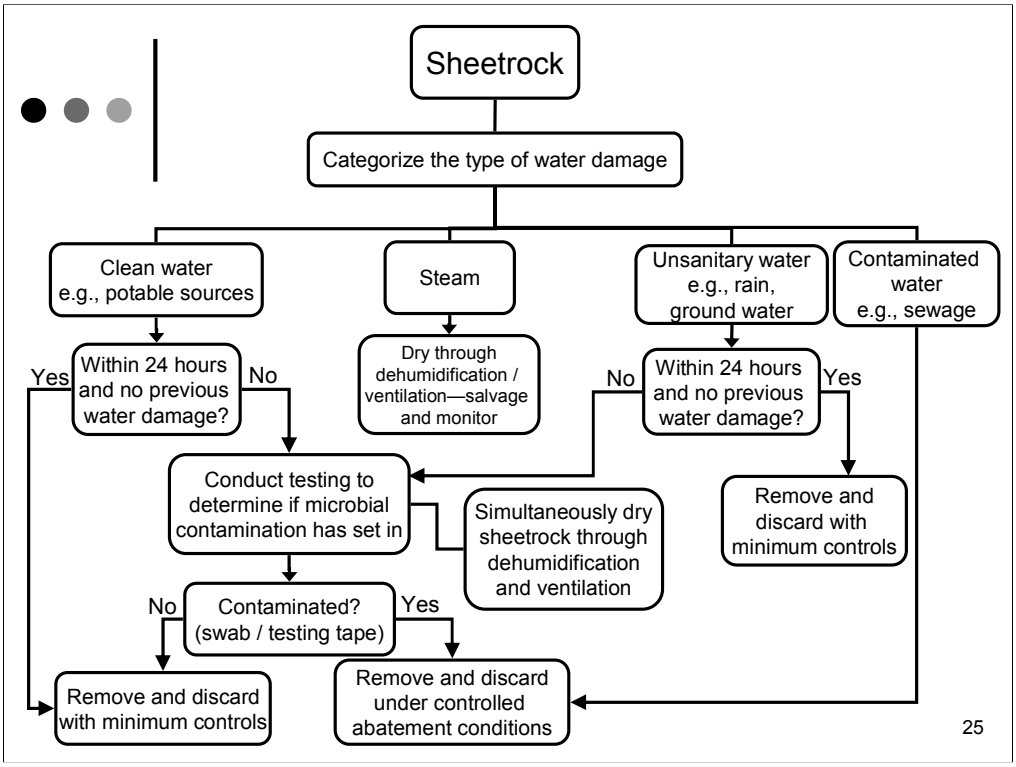
What is your company's policy regarding personal possessions such as papers/photographs/etc.?



A decision algorithm for water-damaged carpet (www.dehs.umn.edu/iaq/flood.html). Refer to their entire document for specific detail. Note how their categories of water differ from previously mentioned categories.

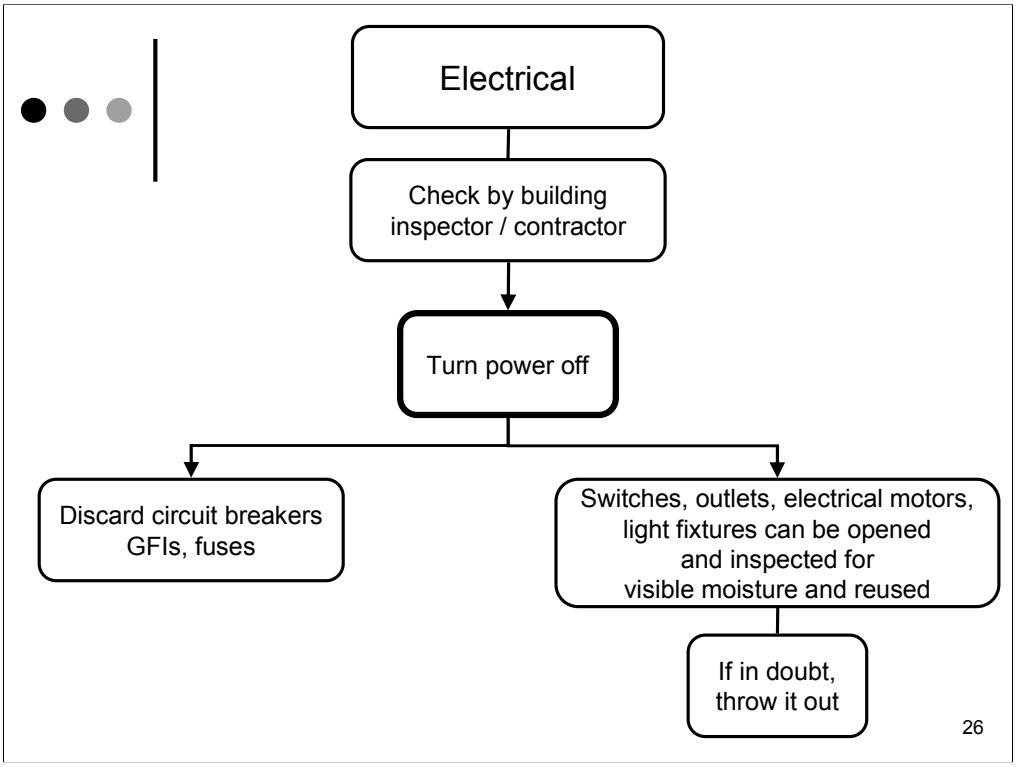
Check out the Carpet and Rug Institute (CRI), (800) 882-8846, www.carpet-rug.com for information on carpet maintenance, restoration guidelines for water-damaged carpet, and other carpet-related issues.

What is your company's procedure?



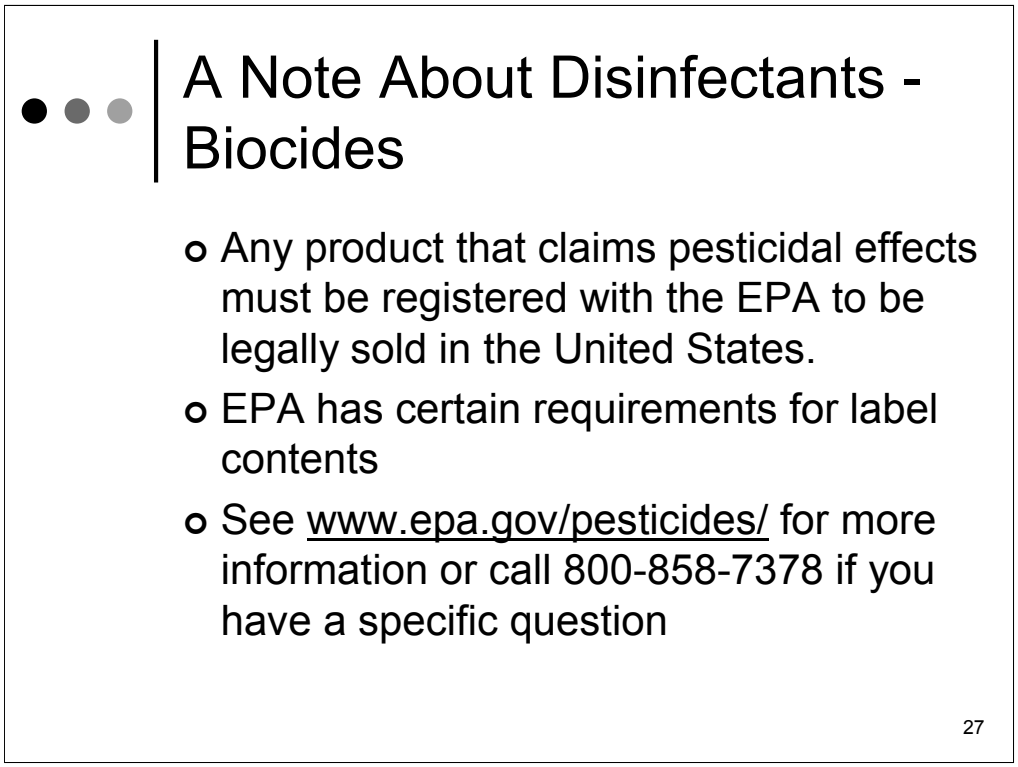
A decision algorithm for water-damaged sheetrock (www.dehs.umn.edu/iaq/flood.html). Refer to their entire document for specific detail. Note how their categories of water differ from previously mentioned categories.

What is your company's procedure?



A decision algorithm for water-damaged electrical equipment/fixtures (www.dehs.umn.edu/iaq/flood.html). Refer to their entire document for specific detail.

What is your company's procedure?



Under the terms of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) any product that claims a pesticidal effect (such as "kills mold dead!") must register with EPA to be legally sold in the United States. The EPA controls what the label says, including statements of safety, and makes sure that there is no unreasonable risk, when used as directed. Every bottle of Weed Killer, every can of Roach-B-Gone, etc. has an EPA product registration number and a label which directs you how to use it safely.

Some common multi-use products (i.e., bleach) may be sold by house brand. If the label says "Bleach for laundry" and make no pesticidal claims, it doesn't have to be registered. Even if some consumers use it as an antimicrobial, instead of bleaching their sheets, the product still doesn't have to be registered. Most commercial sanitizers and sterilizers will be registered, even if they are just bleach, because the pesticidal claim helps sales.

If you know of a product that makes a pesticidal claim and does not have an EPA registration number, let EPA know. There's a lot more information at www.epa.gov/pesticides/ and you may also ask specific questions at the National Pesticide Information Center: (800)-858-PEST or (800)-858-7378, or email npic@ace.orst.edu or check their website npic.orst.edu

Also, check out the Antimicrobial Information Hotline at (703) 308-0127/(703) 308-6467(FAX), Monday-Friday 8:00 AM - 5:00 PM EST; website www.epa.gov/oppad001/; email: Info_Antimicrobial@epa.gov The Antimicrobials Information Hotline provides answers to questions concerning current antimicrobial issues —such as disinfectants, fungicides, others—regulated by the pesticide law, rules and regulations. These cover interpretation laws, rules, and regulations; and registration and re-registration of antimicrobial chemicals and products. The Hotline also provide information on health and safety issues regarding registered antimicrobial products, product labels, and the proper and safe use of these antimicrobial products.

Material Safety Data Sheets (MSDSs): 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. Check the Cornell University Department of Environmental Health and Safety website: msds.ehs.cornell.edu/msdssrch.asp for more information.

Note that agencies differ on their recommendations for cleaning up mold. Many people recommend a solution of automatic dishwasher detergent and hot water. The use of a biocide—such as chlorine bleach—is generally not recommended as a routine practice during mold remediation, although there may be instances where professional judgment may indicate its use (for example, when immune-compromised individuals will be residing in the home or when the water in the home was classified as "gray" or "black"). Note that some people may have a negative reaction to biocides. Also, some biocides may be effective against bacteria, yet not fungal spores. If used, read and follow label directions carefully.

Drying Out: Removal of Building Components

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Once you've cleaned and— if necessary—disinfected, then you need to dry out the area. (When cleaning, use as little liquid as possible to get the job done without adding to the problem. The more liquid added, the more time it will take to dry.)

Keep in mind that sometimes these steps don't always follow in the same order. For instance, why clean a wall if you are going to remove it?

Drying Out: Appliances

- Water seeps into the electric motor, windings, electrical contacts
- Switches may corrode
- Flood waters soak insulation
- Consider cost of replacement vs. cost of new

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If you include appliances in your work, there are several things to consider.

Drying Out: Removal of Building Components

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What guidelines are you following to determine when to remove the paneling or flooring materials??

Drying Out: Removal of Building Components

- Drywall and plaster
- Insulation
- Wall coverings

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Generally, remove 12" to 24" above obvious “wet” areas, due to wicking.

What guidelines are you following to determine when to remove these components?

Drying Out

- Open the house
- Open closet and cabinet doors
- Use fans
- Run dehumidifiers
- Use desiccants

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Drying Out: Removal of Building Components

- Remove and replace duct work? – depending on degree of exposure to moisture and severity of damage

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The U.S. Environmental Protection Agency's publication *Should You Have the Air Ducts in Your Home Cleaned* (www.epa.gov/iaq/pubs/airduct.html) is a good resource on this topic.

Drying Out: Crawl Space

- Allow air to circulate freely
- Remove standing water

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Drying Out

- Dry all building materials, furnishings and HVAC system components so they don't support fungal growth.
- Failing to properly clean and dry a home after flooding does have health risks.

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Possible Disease Agents in Floodwaters

- Food-borne and water-borne diarrhea
- Hepatitis A
- Parasites
- Leptospirosis

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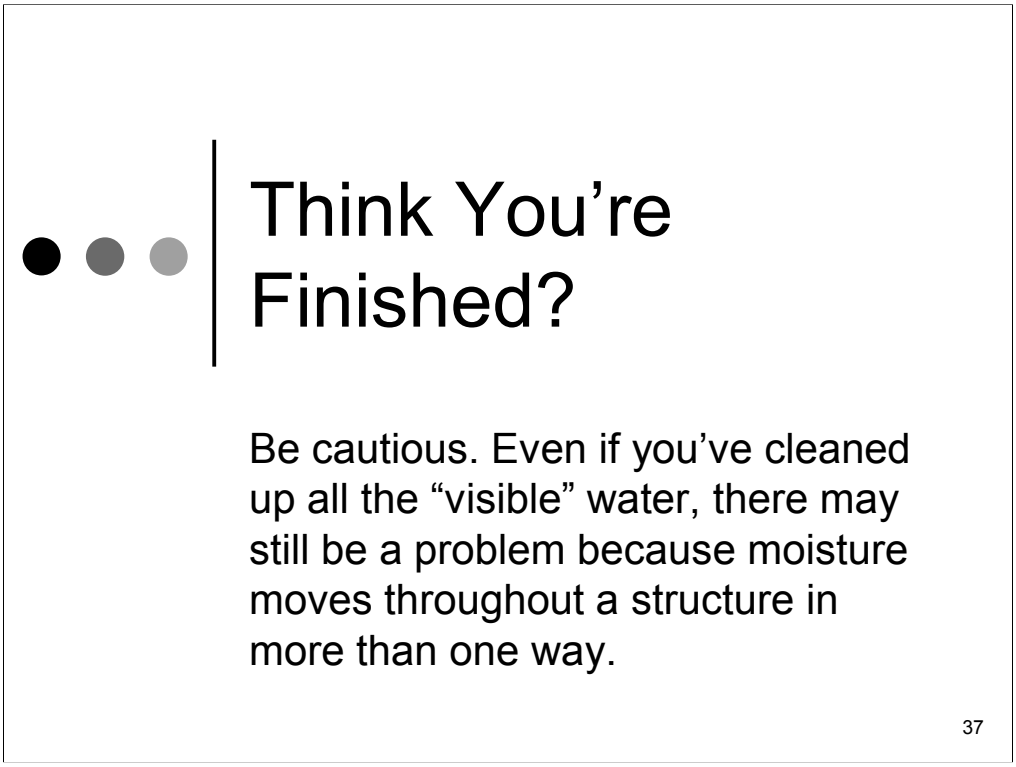
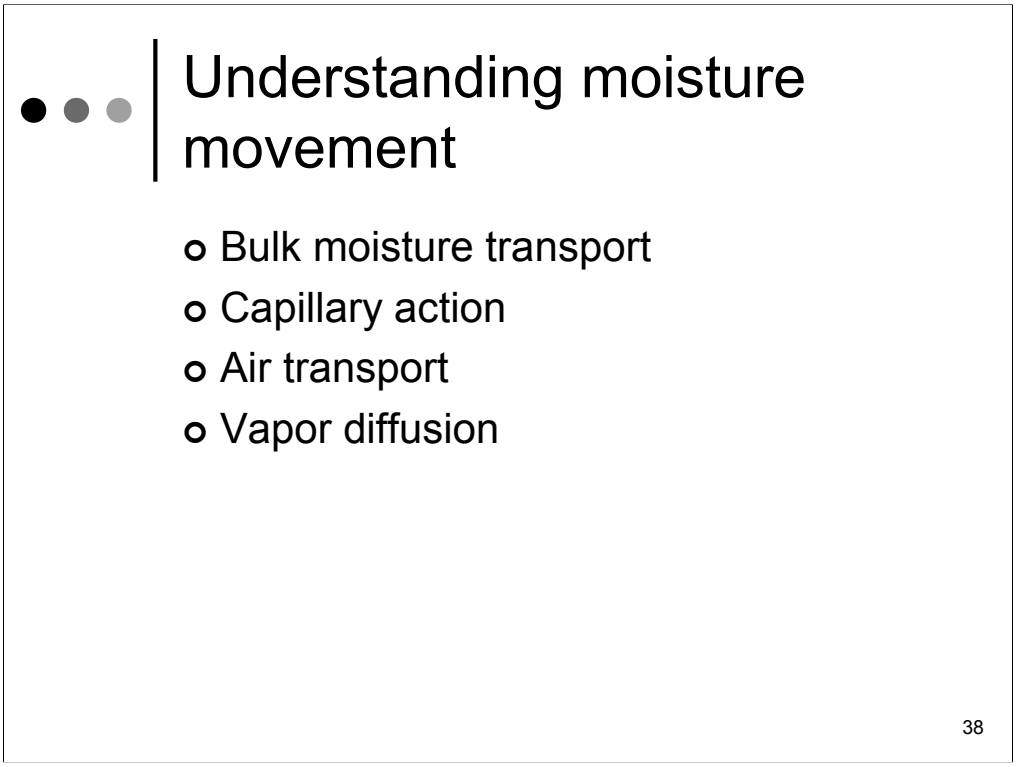
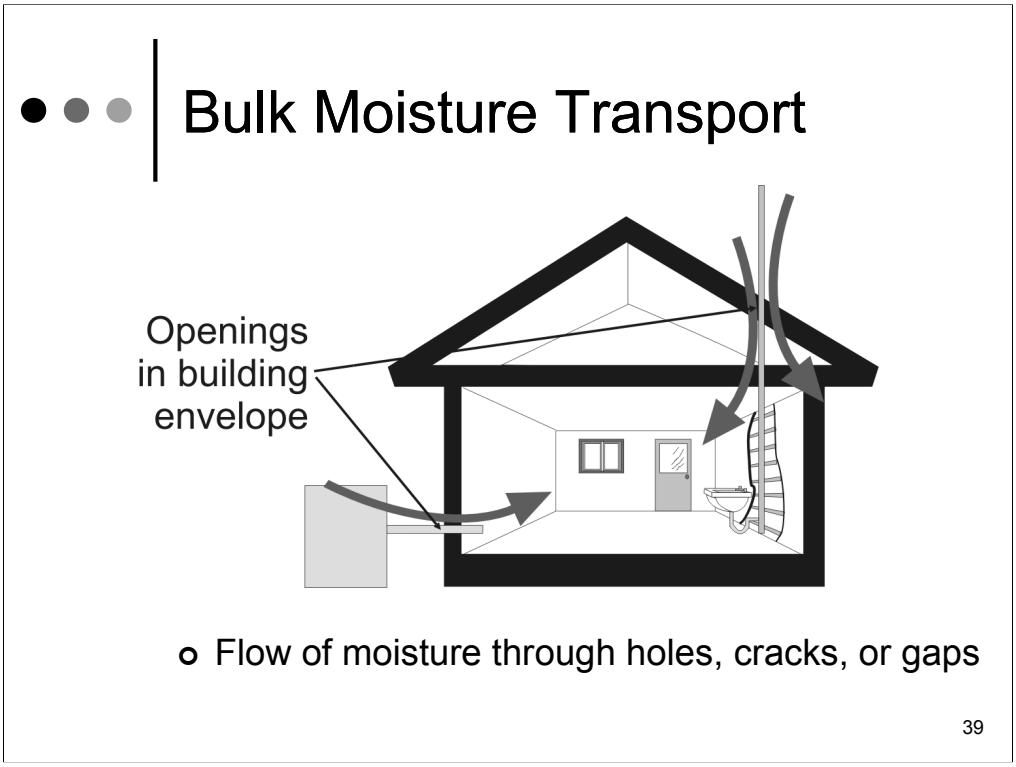


Just because you can't see it, doesn't mean it's not there.



There are four primary ways that moisture can get into buildings. Each method must be controlled to preserve comfort, health, and building integrity.



Bulk moisture transport is the flow of moisture—primarily rain—through holes, cracks, or gaps. Such openings can result from poor flashing—the materials used, as well as the process of, making roof intersections, window openings, and other places on the outside of a structure watertight. Openings can also result from inadequate drainage, and poor quality weatherstripping or caulking around joints in the building exterior (such as windows and doors). This is the most important of the four modes of moisture migration because bulk moisture leaks represent pathways for liquid water to immediately move into building cavities; the other methods generally take longer to create a significant problem.

Bulk Moisture Transport

- Primary source is rain and ground water

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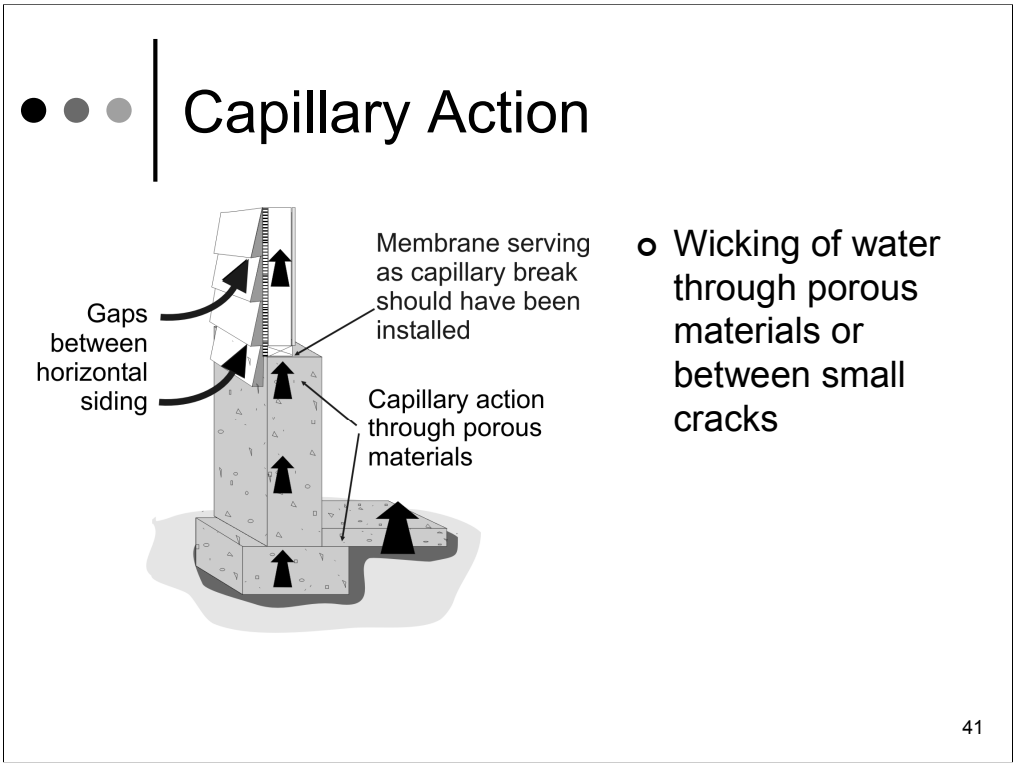
Bulk moisture transport can occur due to poor flashing, inadequate drainage, poor quality weather stripping or caulking around building joints, a major water "event" such as a plumbing leak or a hole in the roof with rain pouring in, etc.

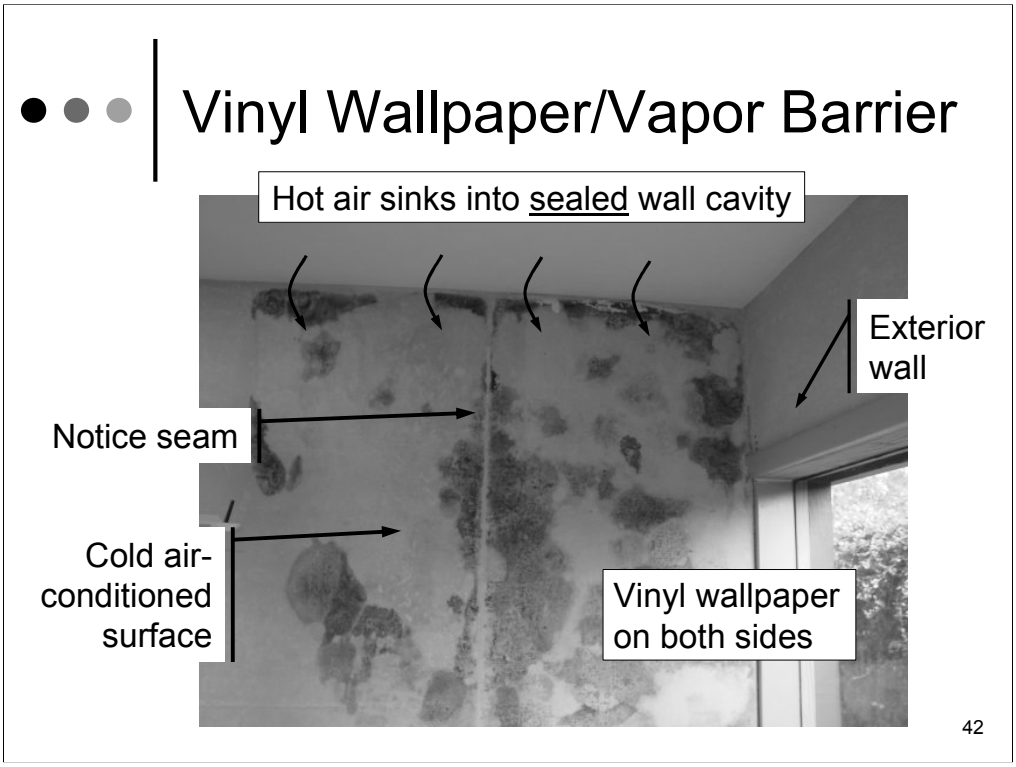
It is solved through quality construction with durable materials.



Capillary action can be caused by water seeping between overlapping pieces of exterior siding; by water drawn upward through pores or cracks in concrete slabs; and by water migrating from crawl spaces into attics through foundation walls and wall framing.

Solve the potential problem during construction by completely sealing pores or gaps, increasing the size of the gaps in some cases (usually to a minimum of one-eighth inch), or installing a waterproof, vapor barrier material (where appropriate in hot, humid climates) to form a capillary break.

Note that vapor barriers (also called vapor retarders) are materials commonly used in construction in northern climates. Building specialists, along with the Florida Building Code, indicate no requirement for vapor barriers within walls or ceilings in Florida (only under the slab). Do not confuse vapor barriers with air barriers; not all air flow retarders are vapor barriers.

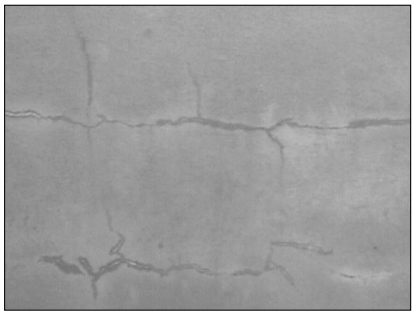


Oftentimes vapor barriers are inadvertently placed on walls in Florida. No flooding problem here.

In this case, vinyl wallpaper was placed on both sides of an interior wall. Notice the seam (free of mold) in the area between sheets of previously installed vinyl wallpaper. No mold because the seam allowed the wall area to dry to the inside of the room.

Hot air sinks into the sealed wall cavity in the presence of a cold, air-conditioned surface. Moisture, which forms behind the wallpaper due to the temperature difference, has no place to go since the vinyl wallpaper acts as a vapor barrier and doesn't allow the wall to dry. Imagine if there had been a water "event" and moisture had wicked up the wall as well.

Capillary Action



- Primary sources are rain or ground water

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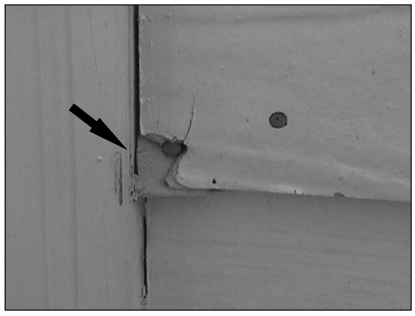
Air Transport or Movement



- Unsealed penetrations and joints between conditioned and unconditioned areas allow air containing water vapor to flow into enclosed areas.

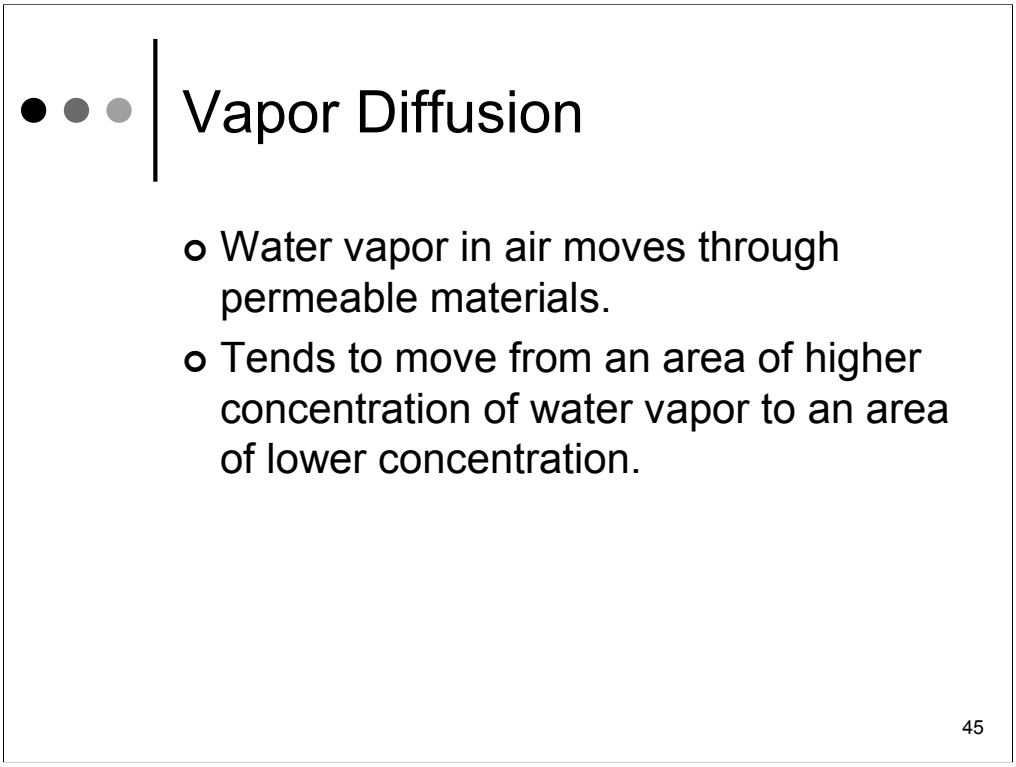
44

The primary source is water vapor in the air.

Air transport can bring 50 to 100 times more moisture into wall cavities than vapor diffusion (discussed in the next slide).

Causes include moisture-laden air leaking through holes, cracks, and other leaks between interior air and enclosed wall cavities; interior air and attics; exterior air and interior air (adding humidity to interior air in summer); crawl spaces and interior air, etc.

Solve the potential problem by creating an air barrier system.



The primary source is water vapor in the air.

Causes include exterior moisture moving into the building in the summer, interior moisture (showers, cooking, etc.) permeating wall and ceiling finish materials, and moist crawl space air migrating into the building. The amount of moisture diffused is usually relatively small unless driven by high vapor pressure and heat—such as rain-saturated walls heated by the sun on a hot, humid day.

Why is there mold?

- Mold grows because of excess moisture

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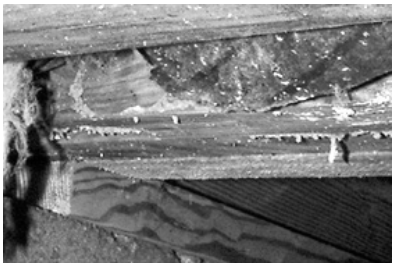
Conditions for Mold Growth

Nutrients (Food)
+ Warmth
+ Moisture or Humidity
+ Spores

= MOLD GROWTH



48

Molds are fungi that occur in nature in large quantities. When conditions are right, they germinate and develop new colonies of mold.

They feed on organic materials such as those in home construction or others found in home, such as soap residue, body oils, etc.

As temperature rises, molds grow faster; ideal temperature range for mold growth is 40 to 100 degrees Fahrenheit.

Humidity supplies the moisture for mold growth. Relative humidity (RH) is a measure of moisture in the air—lower the RH and mold growth slows.

Mold
Potential Health Effects

- Mold exposure can occur by:
  - Inhalation
  - Dermal
  - Ingestion

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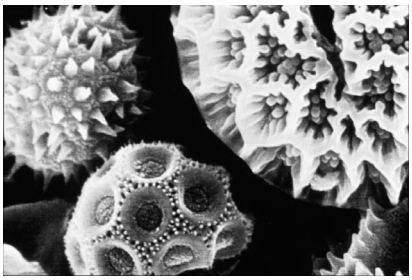
Molds

- Can be found almost anywhere and can grow on virtually any damp substance
- Key to mold control is moisture control
- Clean up the mold and get rid of excess water or moisture
- Reducing moisture also helps reduce other allergy / asthma triggers, such as dust mites and cockroaches



50

Molds can be found almost anywhere; they can grow on virtually any substance when moisture is present.

Molds produce tiny spores that reproduce, just as plants produce seeds. Mold spores waft through the indoor and outdoor air continually. When mold spores land on a damp spot, they may begin growing and digesting whatever they are growing on, in order to survive. Molds can grow on wood, paper, carpet, adhesive, soap scum, dirt, etc.

When excessive moisture or water accumulates indoors, mold growth will often occur, particularly if the moisture problem remains undiscovered or unaddressed.

There is no practical way to eliminate all mold and mold spores in the indoor environment. Keeping that in mind, it is possible to control indoor mold growth, and that is by controlling moisture. Remember that when tackling a mold problem, you need to both clean up the mold and correct any problems of excess moisture.

Inspecting the premises

- What's wrong with these pictures?

Images: NC State University

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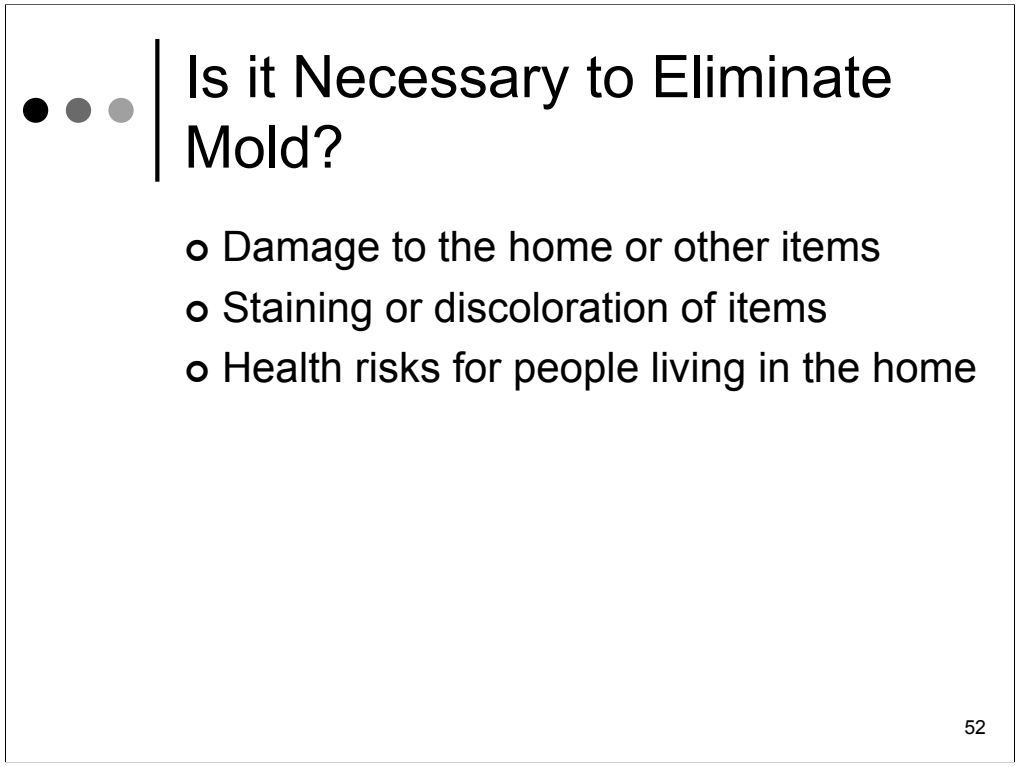
Where is their PPE?



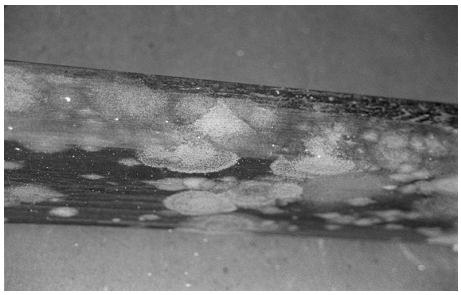
Yes.

Molds gradually destroy the things they grow on.

In the process of trying to destroy what they are growing on, they often permanently stain or discolor items.

All molds have the potential to cause health effects.

Mold and Health



- Mold growth from incomplete drying before reoccupying or rebuilding can be a health risk

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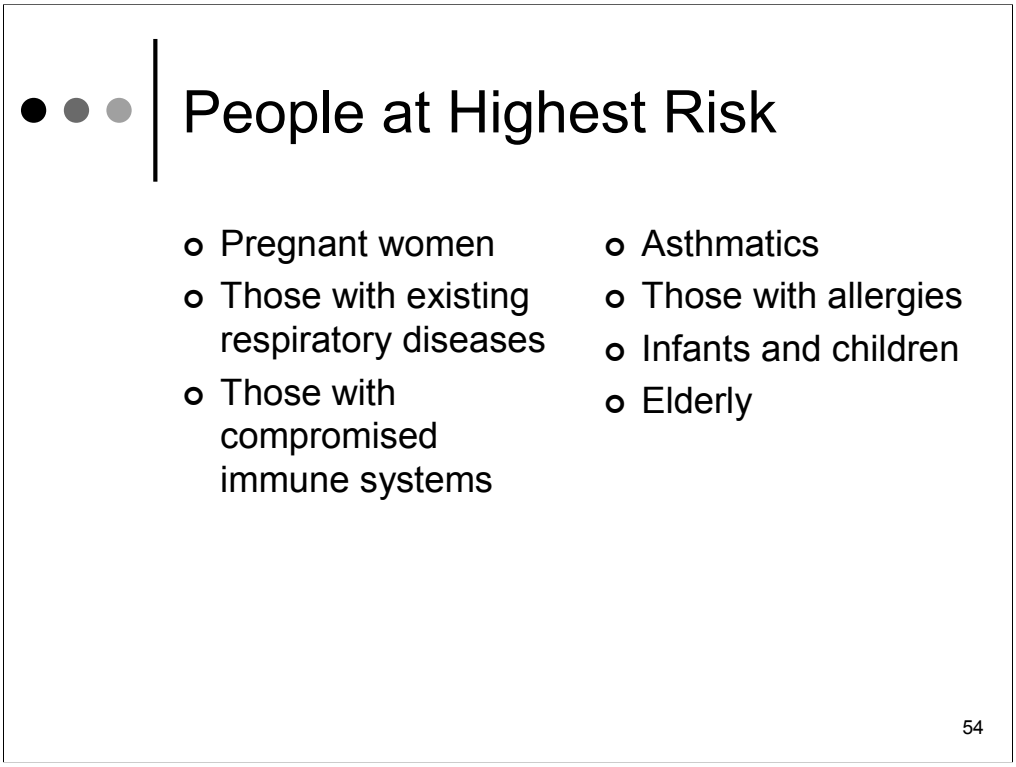
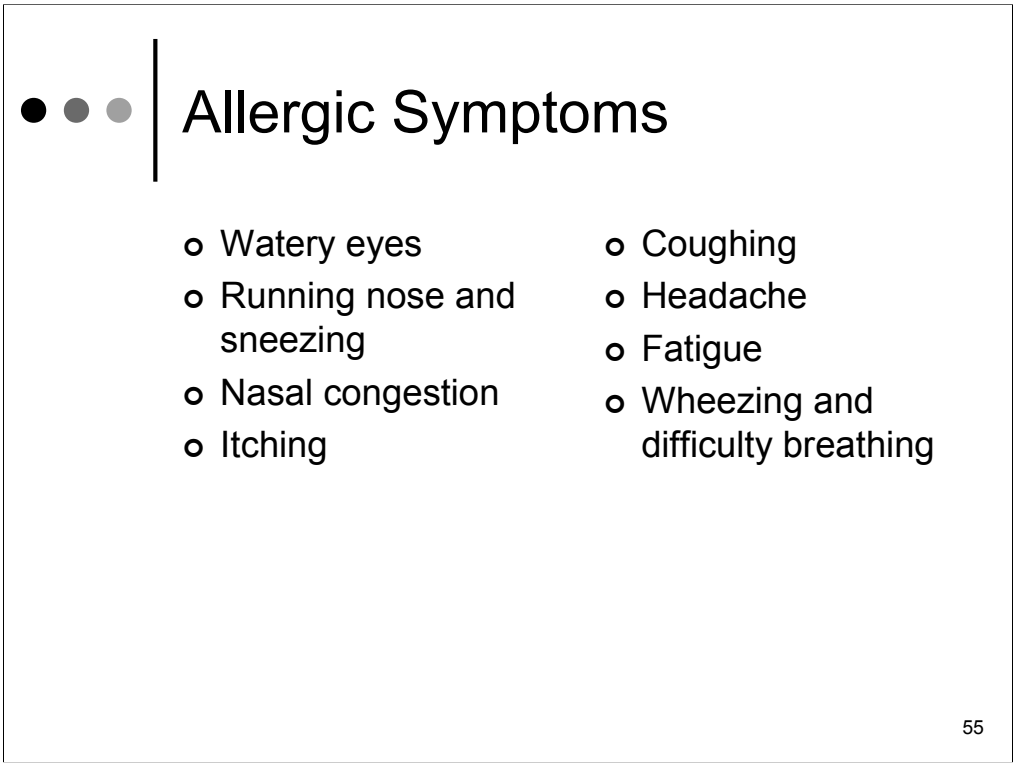
Fungi (mold) can act as allergens, toxicants (toxic agents), irritants or infectious agents. It is believed that all forms of fungi are potential allergens to man. Some fungi species are known to produce specific metabolic products (mycotoxins), which are toxic to man and animals. Some (if not most) fungal species can produce metabolic products that are irritating to the mucus membranes (eyes and the lining of the nose and throat). Some fungal species are known to be infectious to humans and animals.



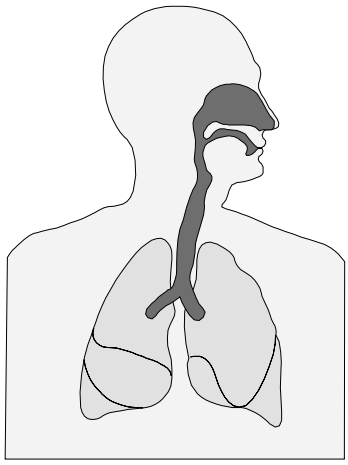
Note that the category "with compromised immune systems" can include those with HIV infection, chemotherapy patients, organ/bone marrow transplant recipients, persons with autoimmune diseases, etc.

Also, susceptibility will vary depending on:

- Genetic predisposition
- Health status
- Concurrent exposures



Some Other Possible Health Effects



- Upper respiratory irritation
- Bronchial irritation
- Asthma attacks
- Hypersensitivity pneumonitis
- Infectious respiratory disease
- Illness from general toxins
- Etc.

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For more information, check out the publication *Guidance for Clinicians on the Recognition and Management of Health Effects Related to Mold Exposure and Moisture Indoors* (September 30, 2004), published by the Center for Indoor Environments and Health at the University of Connecticut Health Center with support from a grant by the U.S. Environmental Protection Agency. It is available free on line at oehc.uchc.edu/clinser/indoor.htm

The book *Damp Indoor Spaces and Health* (2004), may also be a good resource. Available for a fee from the Committee on Damp Indoor Spaces and Health, Board on Health Promotion and Disease Prevention, Institute of Medicine. For more information, check www.nap.edu/books/0309091934/html/

How big is the problem?

Image: U.S. Environmental Protection Agency

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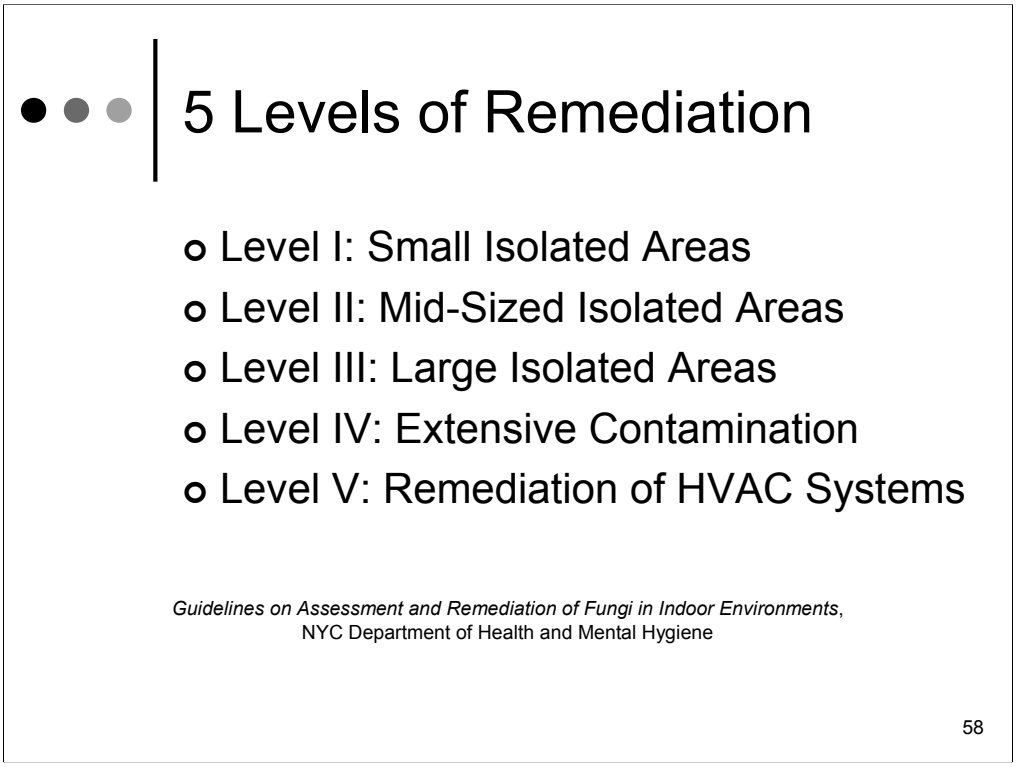
This photo shows a very big problem.

Building materials supporting fungal growth must be remediated as rapidly as possible in order to ensure a healthy environment. Repair of the defects that led to water accumulation (or elevated humidity) should be conducted in conjunction with or prior to fungal remediation. Specific methods of assessing and remediating fungal contamination should be based on the extent of visible contamination and underlying damage. The simplest and most expedient remediation that is reasonable, and properly and safely removes fungal contamination, should be used.

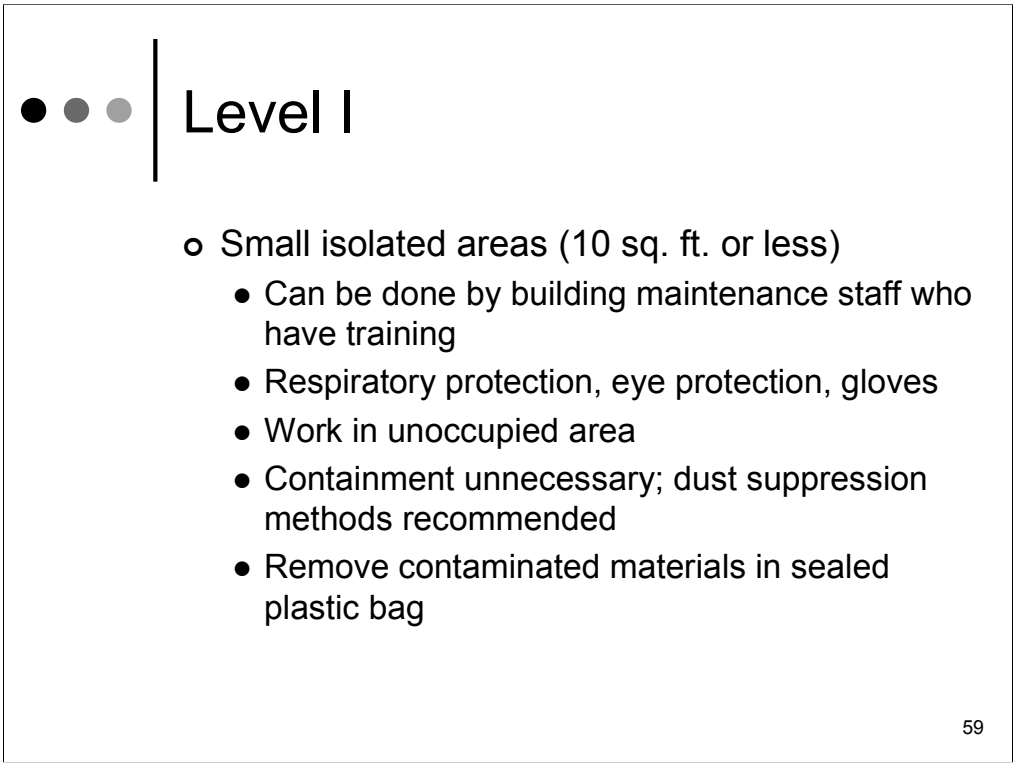
Extensive contamination, particularly if heating, ventilating, air conditioning (HVAC) systems or large occupied spaces are involved, should be assessed by an experienced health and safety professional and remediated by personnel with training and experience handling environmentally contaminated materials. Lesser areas of contamination can usually be assessed and remediated by others. In order to prevent contamination from recurring, underlying defects causing moisture buildup and water damage must be addressed. Effective communication with building occupants is an essential component of all remedial efforts.



There are no standards or laws on how mold must be removed. However, there are generally accepted guidelines that should be followed. Guidelines have been published by a number of different entities.

These five different levels of remediation are based on the New York City *Guidelines on Assessment and Remediation of Fungi in Indoor Environments* (www.nyc.gov/html/doh/html/epi/moldrpt1.shtml#remed) and, as stated in the document title are merely guidelines. In these guidelines, the size of the area impacted by fungal contamination primarily determines the type of remediation.

Keep in mind the goal of remediation, which is to remove or clean contaminated materials in a way that prevents the emission of fungi and dust contaminated with fungi from leaving a work area and entering an occupied or non-abatement area, while protecting the health of workers performing the abatement.



3.1 Level I: Small Isolated Areas (10 sq. ft or less) - e.g., ceiling tiles, small areas on walls

a. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

c. 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).

d. Containment of the work area is not necessary. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

e. Contaminated materials that cannot be cleaned should be removed from the building in a sealed plastic bag. There are no special requirements for the disposal of moldy materials.

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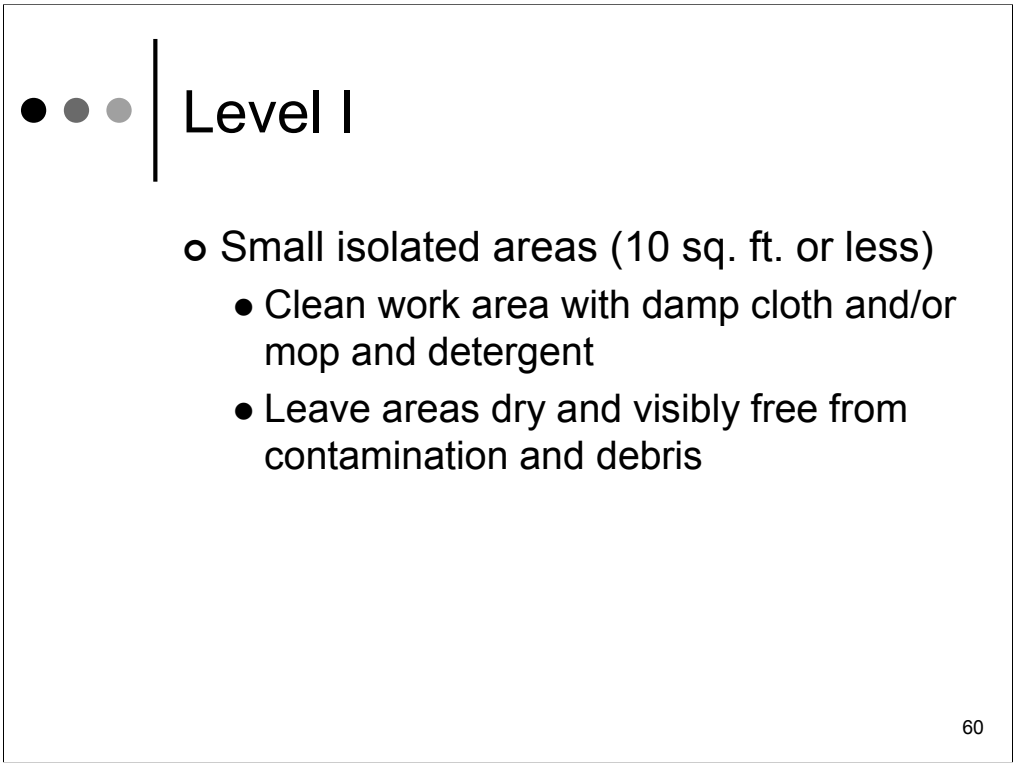

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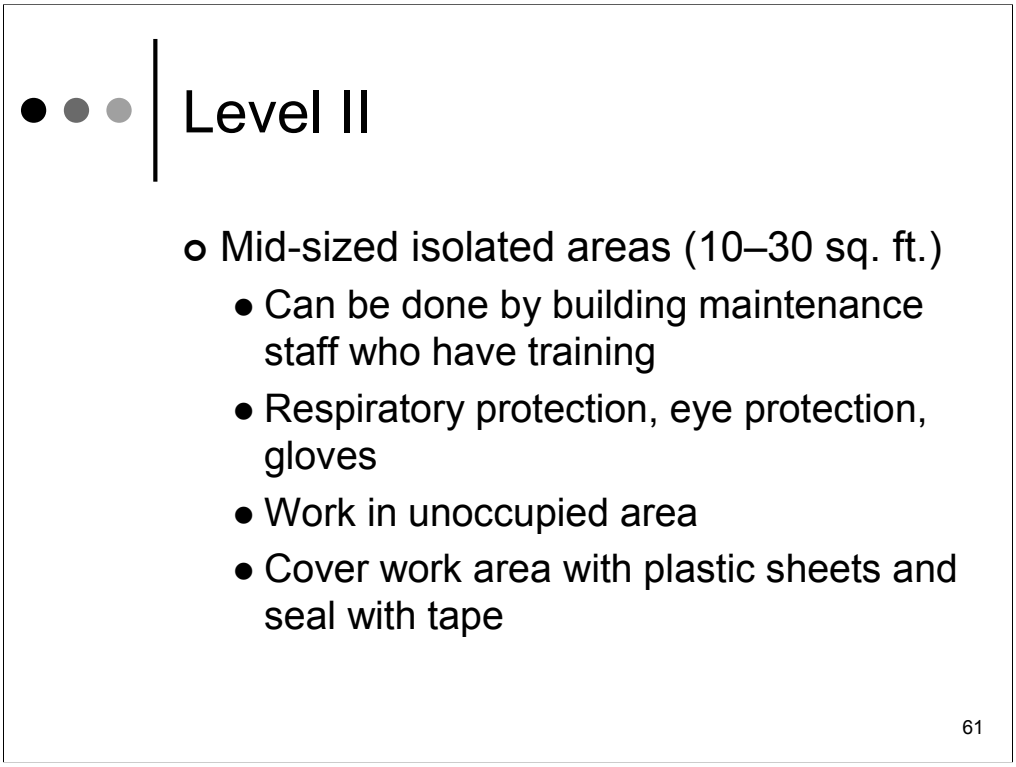
f. The work area and areas used by remedial workers for egress should be cleaned with a damp cloth and/or mop and a detergent solution.

g. All areas should be left dry and visibly free from contamination and debris.



3.2 Level II: Mid-Sized Isolated Areas (10 - 30 sq. ft.) - e.g., individual wallboard panels.

a. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

c. 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 having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

d. The work area should be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.

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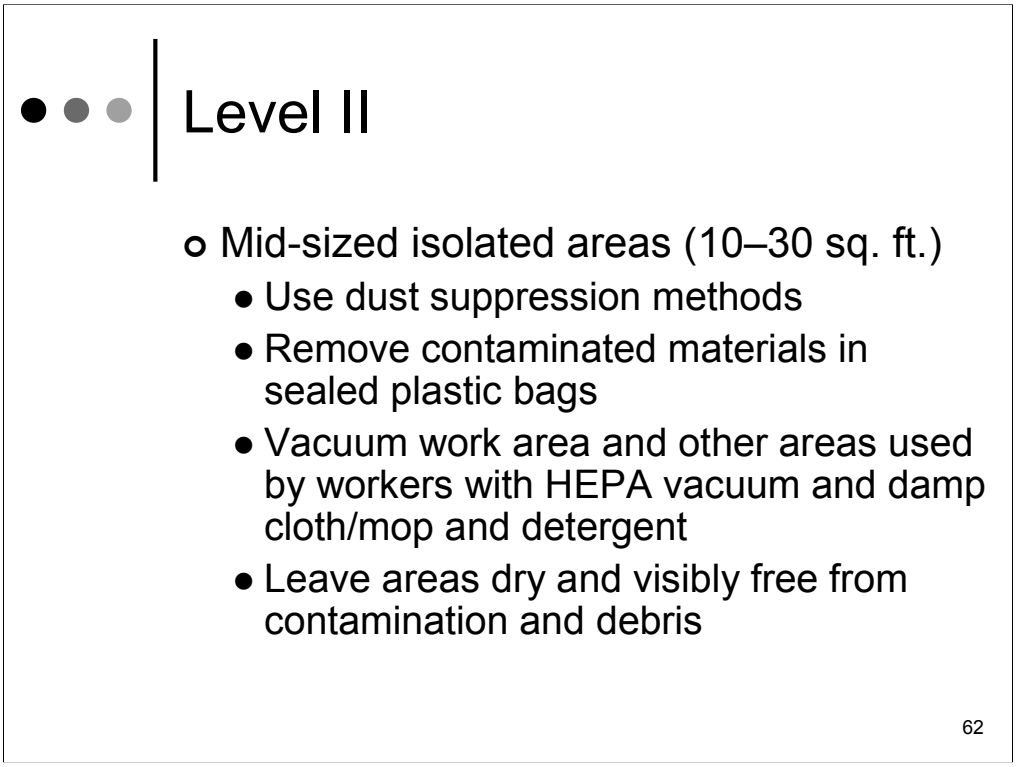

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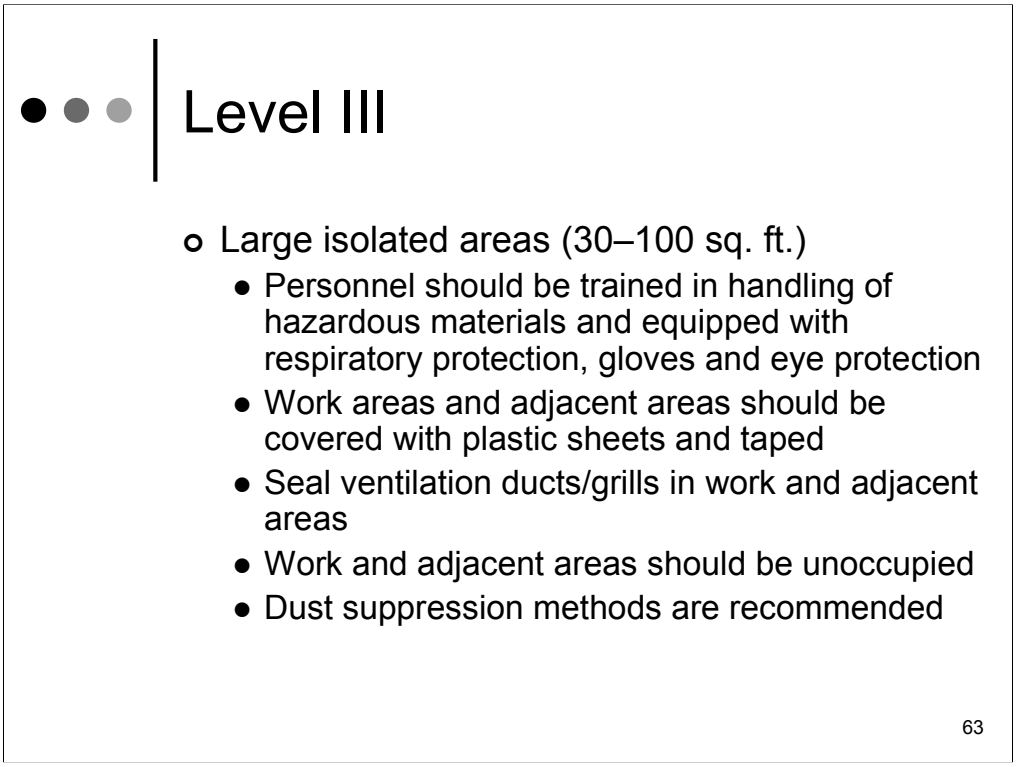
e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

f. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.

g. The work area and areas used by remedial workers for egress should be HEPA vacuumed (a vacuum equipped with a High-Efficiency Particulate Air filter) and cleaned with a damp cloth and/or mop and a detergent solution.

h. All areas should be left dry and visibly free from contamination and debris.



3.3 Level III: Large Isolated Areas (30 - 100 square feet) - e.g., several wallboard panels.

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for the project.

The following procedures *at a minimum* are recommended:

a. Personnel trained in the handling of hazardous materials and equipped with respiratory protection, (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

b. The work area and areas directly adjacent should be covered with a plastic sheet(s) and taped before remediation, to contain dust/debris.

c. Seal ventilation ducts/grills in the work area and areas directly adjacent with plastic sheeting.

d. The work area and areas directly adjacent should be unoccupied. Further vacating of people from spaces near the work area is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

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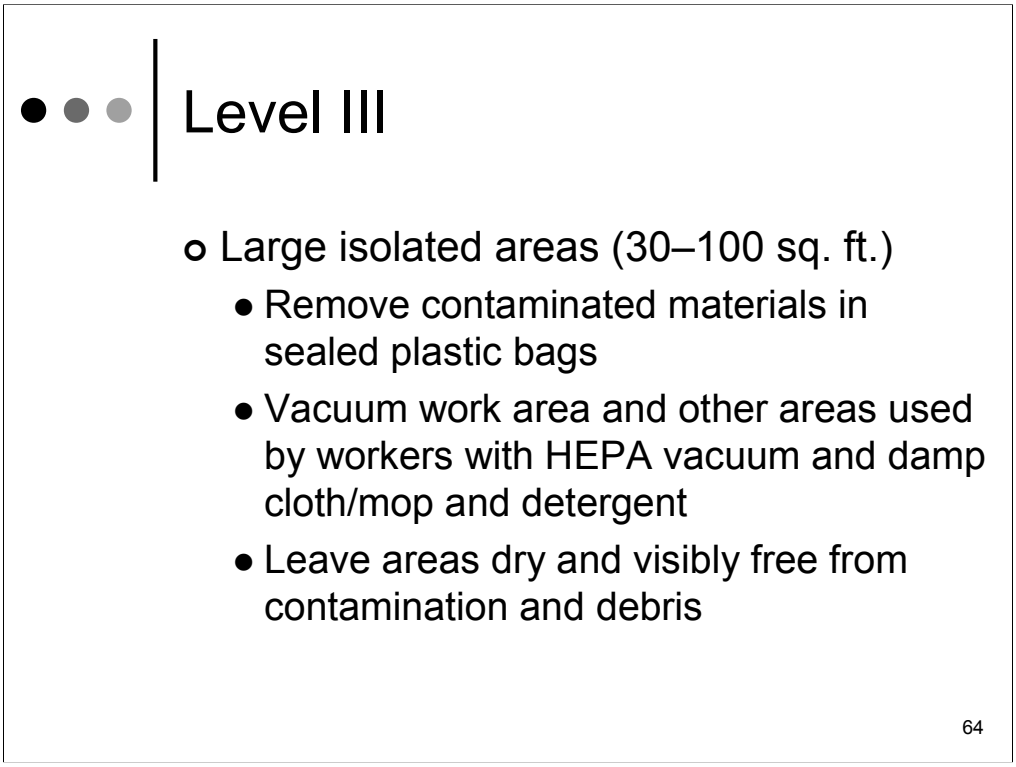

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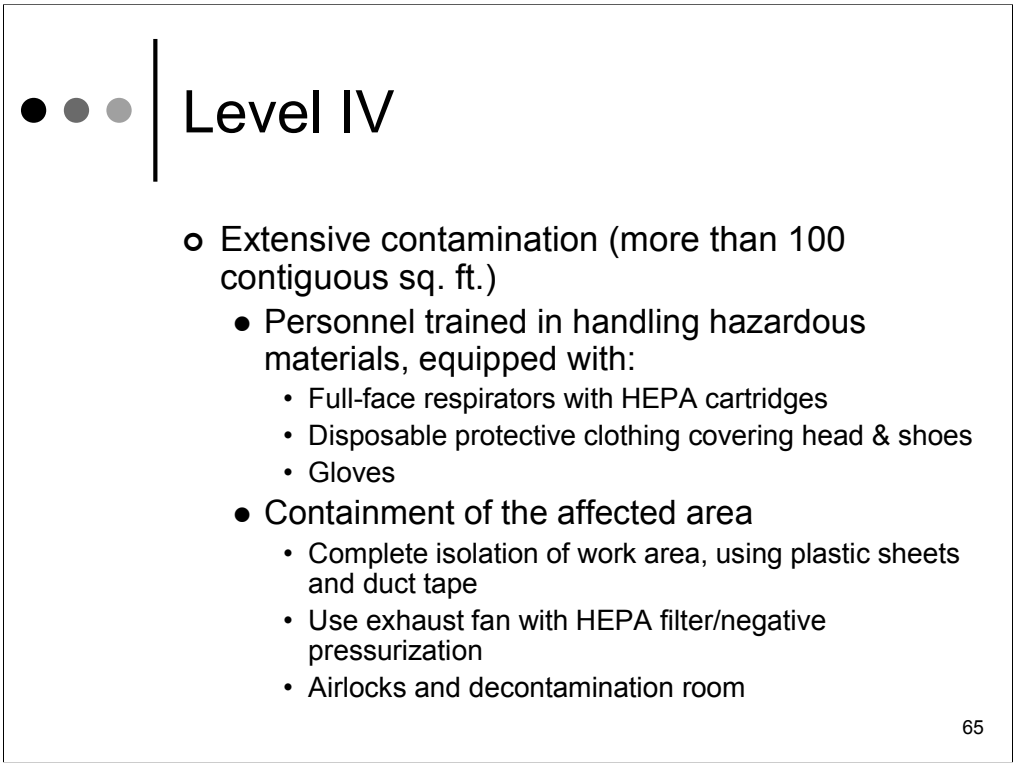
f. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. There are no special requirements for the disposal of moldy materials.

g. The work area and surrounding areas should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.

h. All areas should be left dry and visibly free from contamination and debris.

i. If abatement procedures are expected to generate a lot of dust (e.g., abrasive cleaning of contaminated surfaces, demolition of plaster walls) or the visible concentration of the fungi is heavy (blanket coverage as opposed to patchy), then it is recommended that the remediation procedures for Level IV are followed.



3.4 Level IV: Extensive Contamination (greater than 100 contiguous square feet in an area)

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for the project. The following procedures are recommended:

a. Personnel trained in the handling of hazardous materials equipped with:
   i. Full-face respirators with high efficiency particulate air (HEPA) cartridges
   ii. Disposable protective clothing covering both head and shoes
   iii. Gloves

b. Containment of the affected area:
   i. Complete isolation of work area from occupied spaces using plastic sheeting sealed with duct tape (including ventilation ducts/grills, fixtures, and any other openings)
   ii. The use of an exhaust fan with a HEPA filter to generate negative pressurization
   iii. Airlocks and decontamination room

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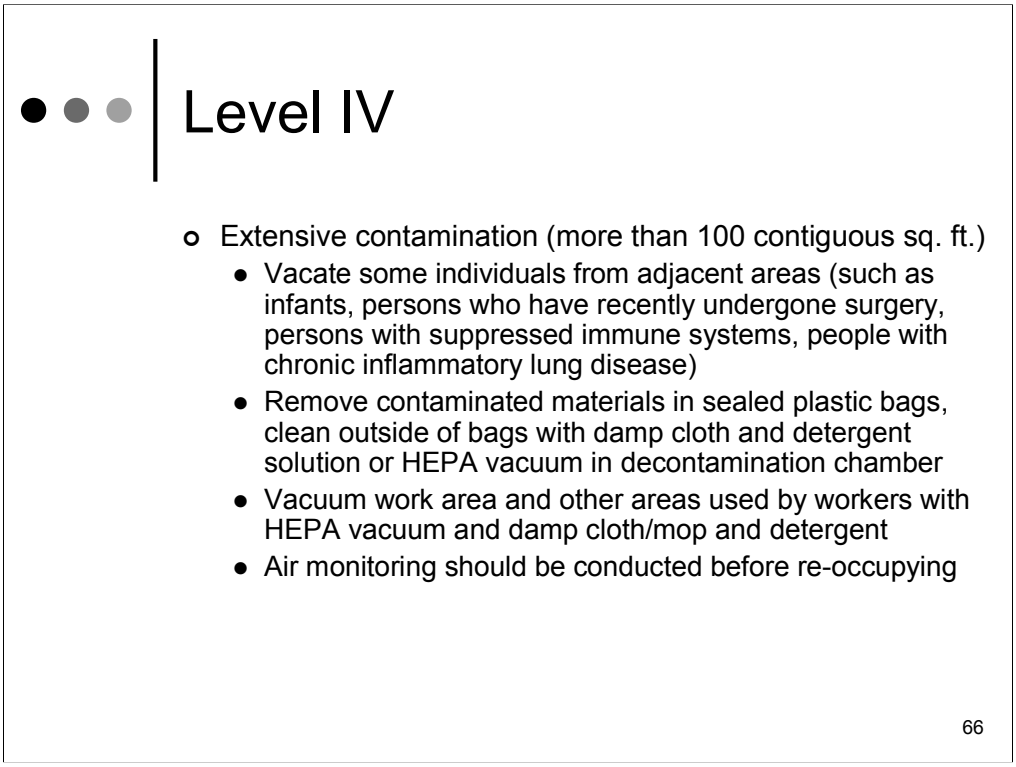

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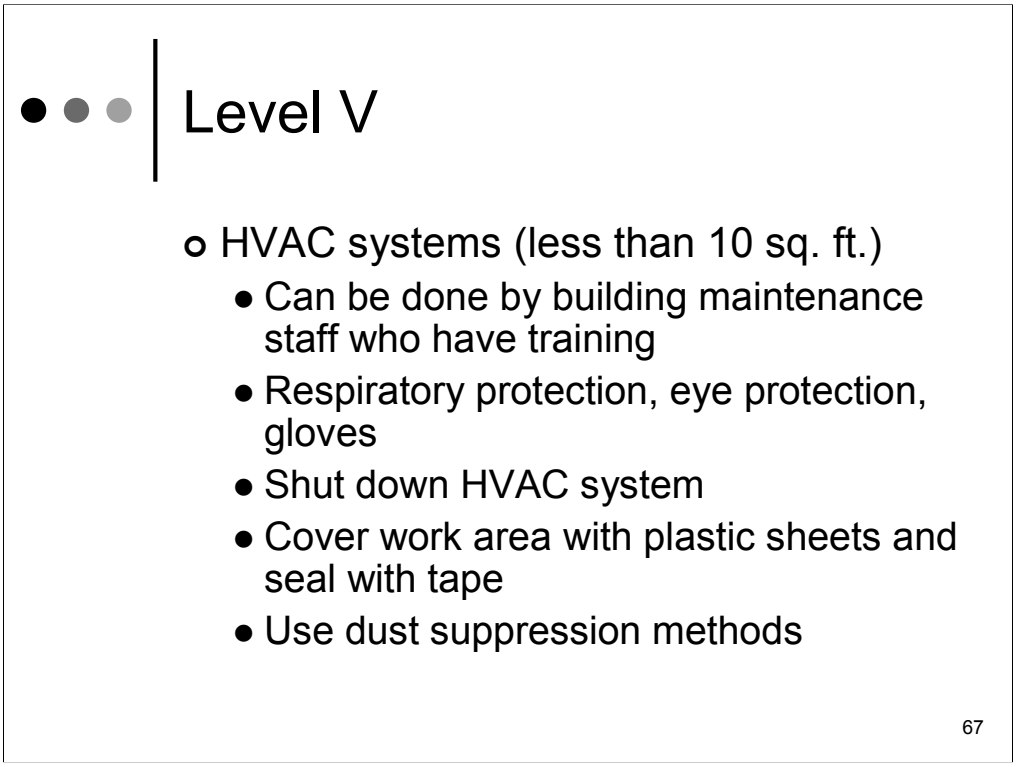
e. Vacating people from spaces adjacent to the work area is not necessary but is recommended in the presence of infants (less than 12 months old), persons having undergone recent surgery, immune suppressed people, or people with chronic inflammatory lung diseases (e.g., asthma, hypersensitivity pneumonitis, and severe allergies).

f. Contaminated materials that cannot be cleaned should be removed from the building in sealed plastic bags. The outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA vacuumed in the decontamination chamber prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.

g. The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and/or mop with a detergent solution and be visibly clean prior to the removal of isolation barriers.

h. Air monitoring should be conducted prior to occupancy to determine if the area is fit to reoccupy.



3.5.1 A Small Isolated Area of Contamination (<10 square feet) in the HVAC System

a. Remediation can be conducted by regular building maintenance staff. Such persons should receive training on proper clean up methods, personal protection, and potential health hazards. This training can be performed as part of a program to comply with the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200).

b. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended. Gloves and eye protection should be worn.

c. The HVAC system should be shut down prior to any remedial activities.

d. The work area should be covered with a plastic sheet(s) and sealed with tape before remediation, to contain dust/debris.

e. Dust suppression methods, such as misting (not soaking) surfaces prior to remediation, are recommended.

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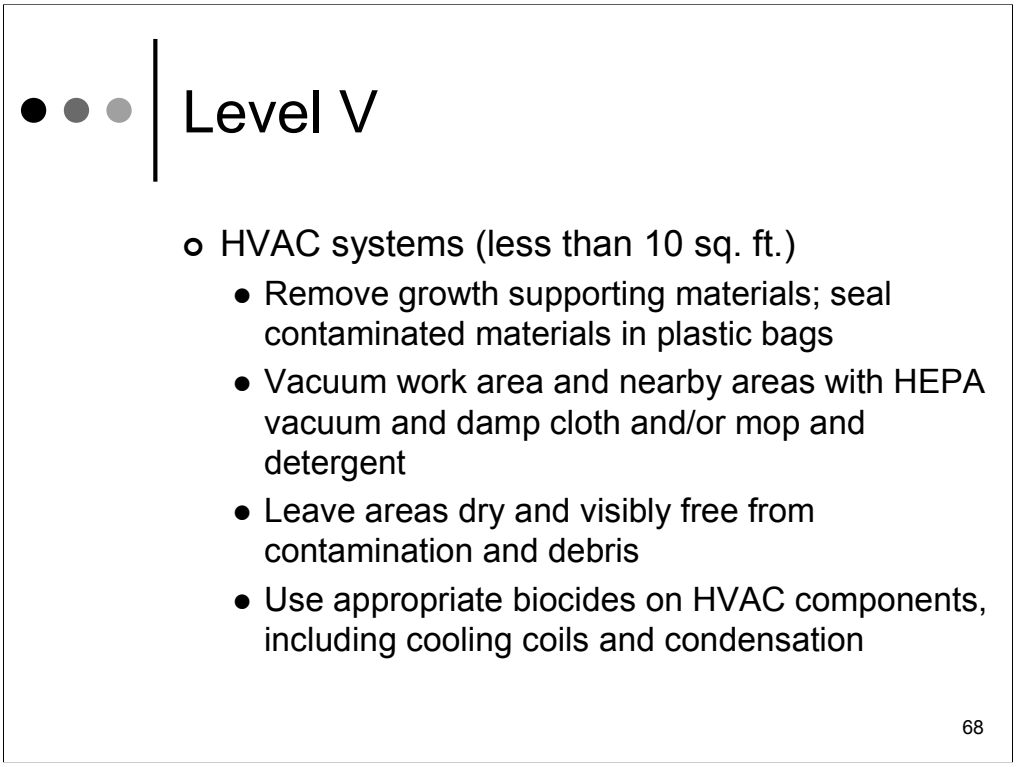

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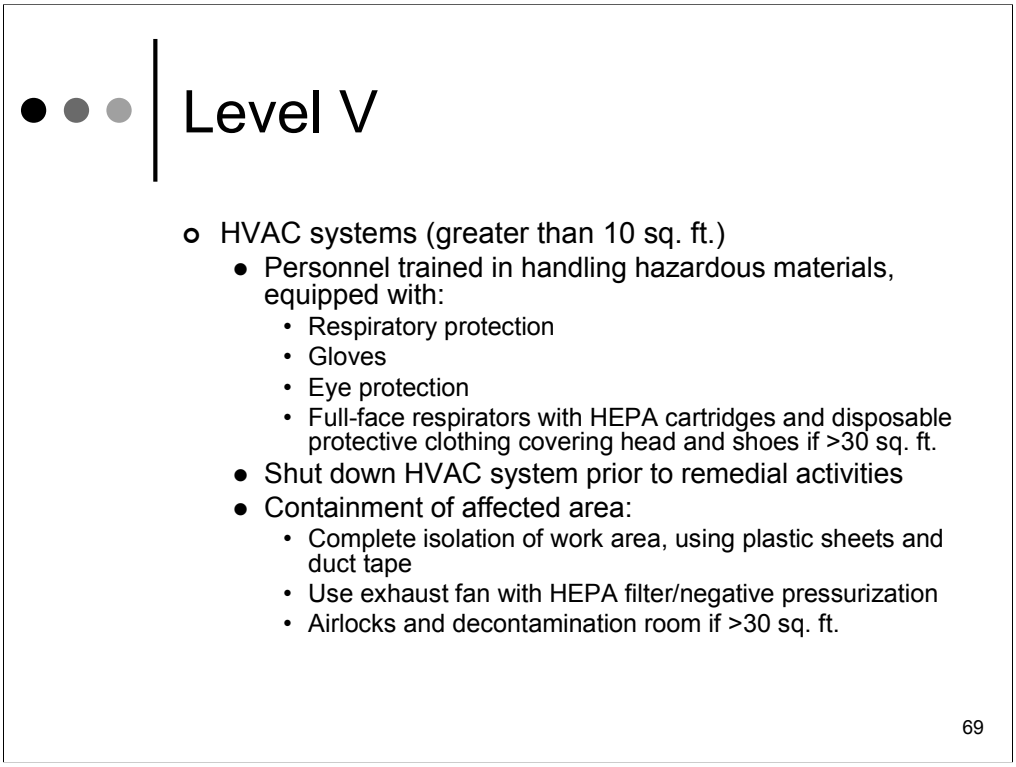
f. Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, should be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. There are no special requirements for the disposal of moldy materials.

g. The work area and areas immediately surrounding the work area should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution.

h. All areas should be left dry and visibly free from contamination and debris.

i. A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers should be consulted for the products they recommend for use in their systems.



3.5.2 Areas of Contamination (>10 square feet) in the HVAC System

A health and safety professional with experience performing microbial investigations should be consulted prior to remediation activities to provide oversight for remediation projects involving more than a small isolated area in an HVAC system. The following procedures are recommended:

a. Personnel trained in the handling of hazardous materials equipped with:
   i. Respiratory protection (e.g., N95 disposable respirator), in accordance with the OSHA respiratory protection standard (29 CFR 1910.134), is recommended.
   ii. Gloves and eye protection
   iii. Full-face respirators with HEPA cartridges and disposable protective clothing covering both head and shoes should be worn if contamination is greater than 30 square feet.

b. The HVAC system should be shut down prior to any remedial activities.

c. Containment of the affected area:
   i. Complete isolation of work area from the other areas of the HVAC system using plastic sheeting sealed with duct tape.
   ii. The use of an exhaust fan with a HEPA filter to generate negative pressurization.
   iii. Airlocks and decontamination room if contamination is greater than 30 square feet.

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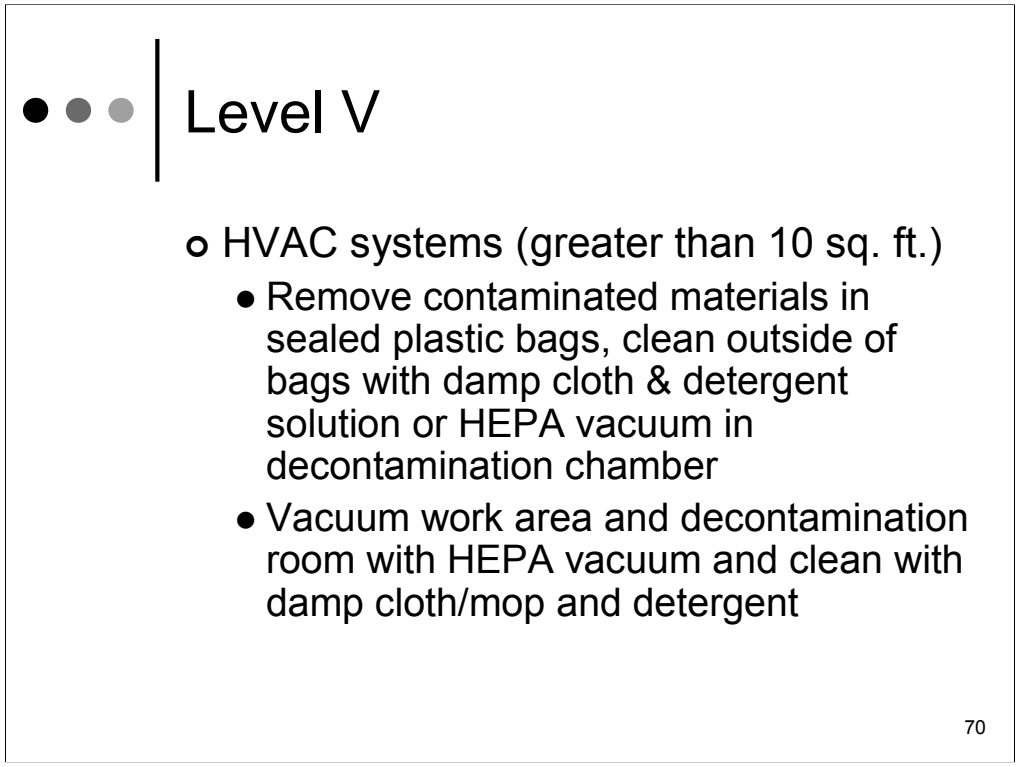

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d. Growth supporting materials that are contaminated, such as the paper on the insulation of interior lined ducts and filters, should be removed. Other contaminated materials that cannot be cleaned should be removed in sealed plastic bags. When a decontamination chamber is present, the outside of the bags should be cleaned with a damp cloth and a detergent solution or HEPA vacuumed prior to their transport to uncontaminated areas of the building. There are no special requirements for the disposal of moldy materials.

e. The contained area and decontamination room should be HEPA vacuumed and cleaned with a damp cloth and/or mop and a detergent solution prior to the removal of isolation barriers.

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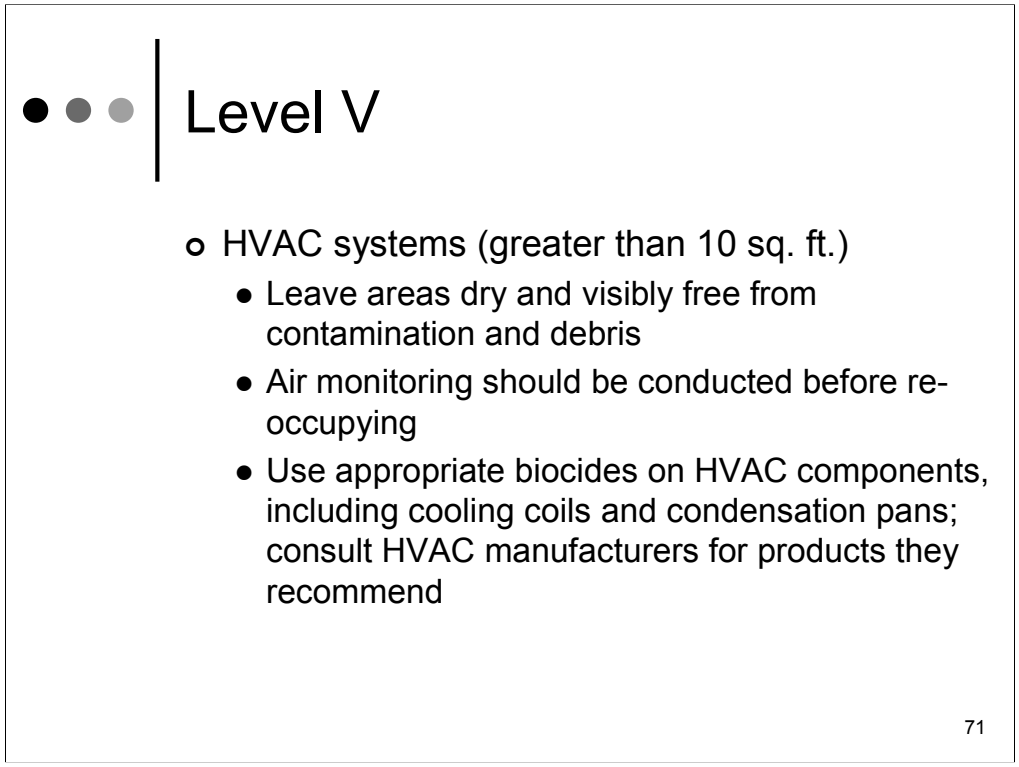

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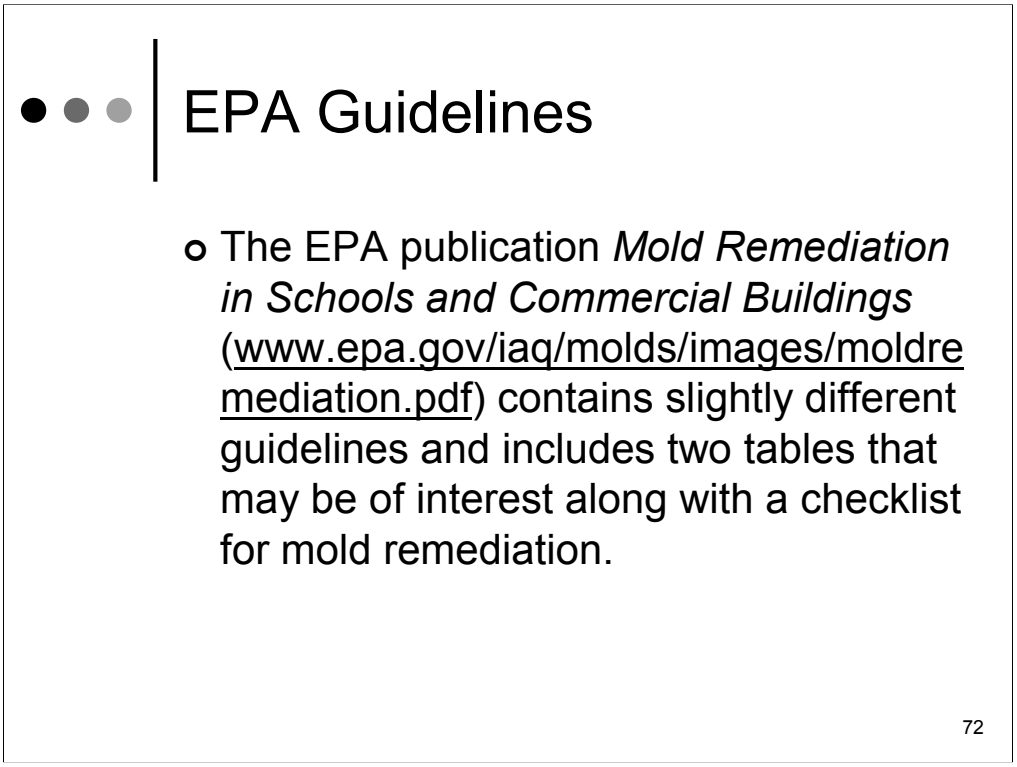
f. All areas should be left dry and visibly free from contamination and debris.

g. Air monitoring should be conducted prior to re-occupancy with the HVAC system in operation to determine if the area(s) served by the system are fit to reoccupy.

h. A variety of biocides are recommended by HVAC manufacturers for use with HVAC components, such as, cooling coils and condensation pans. HVAC manufacturers should be consulted for the products they recommend for use in their systems.



This publication can apply to residential structures as well.

Mold Remediation

- Protection varies with mold quantity
- Contain the area
- Minimize dispersal
- HVAC system bagging
- Trained personnel
- Communication / documentation / verification

Image: North Dakota State Cooperative Extension

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Keep in mind that the amount of containment required during mold remediation varies with the amount of infestation. Care should always be taken to keep the mold spores and debris from being spread. Depending on the severity of the problem, the area should be contained by keeping doors closed or enclosing the area with plastic. Remember to cover the heating, ventilation, and air-conditioning system which can spread spores and debris throughout the building. Bag the material removed if it must be carried through a non contaminated part of the building. Personnel doing the work should be trained in proper procedures.

Find and Eliminate the Source

- Find and control / eliminate the moisture source.
- Clean affected areas.
- If you clean up without eliminating the source, mold will come back.

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Is it necessary to remove all the mold?

- People react if mold is living or dead
- Mold should be removed

Image: North Dakota State Cooperative Extension

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Mold Remediation

- Porous materials (ceiling tiles, carpet, upholstered furniture, wallboard)

Image: North Dakota State Cooperative Extension

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What's your policy on porous materials?

Mold Remediation

- Semi-porous materials (wood and concrete)
- If structurally sound, clean and reuse

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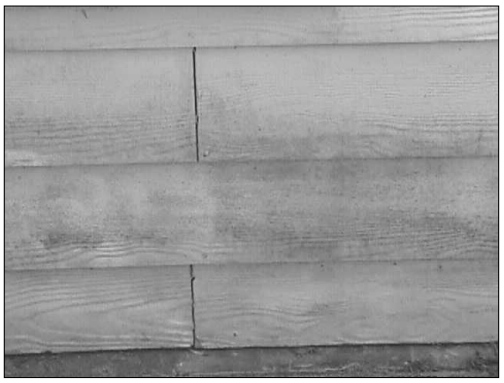
Generally, semi-porous materials can be cleaned and reused if structurally sound. But, what is your policy?

Mold Remediation



- Do not paint or caulk moldy surfaces.
- Clean up the mold and dry the surfaces thoroughly before painting.

Image: NC State University

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Mold Sampling: To Test or Not to Test?

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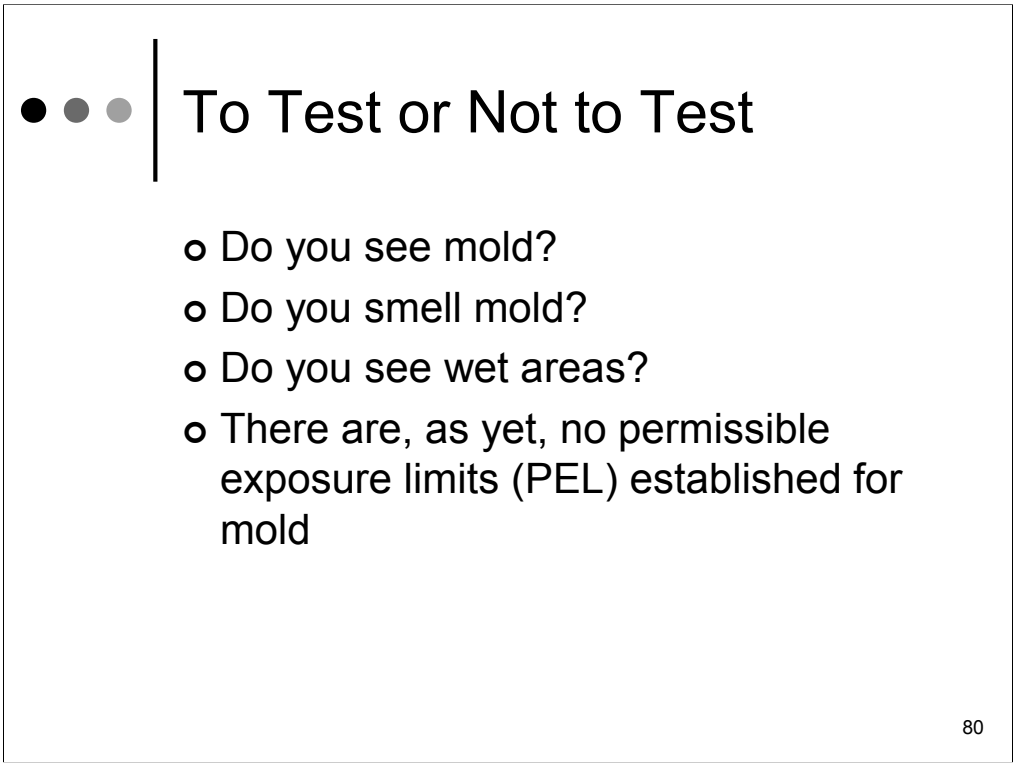

Is sampling for mold needed? In most cases, if visible mold growth is present, sampling is unnecessary. Also, you may be able to smell mold—some individuals can smell it more acutely than others. If there are wet areas, you can presume there is mold…and it will soon become more visible. Typically, risk assessment and exposure levels for hazardous substances are assessed by applying permissible exposure limits (PEL); however, no PEL exists for mold. 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.

Tools for Solving Moisture Problems

- There are a variety of tools that can help in identifying moisture problems.
- Choose the tool that best fits your situation.

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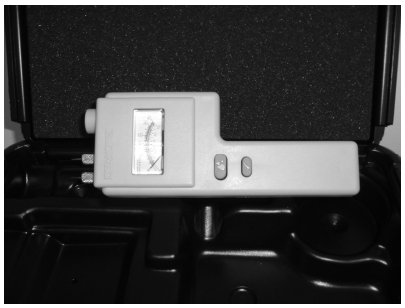
Moisture Meters



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Some moisture meters are only calibrated for wood, but may be suitable for measuring moisture levels in other non-conductive materials. The following descriptions are general in nature and may not be accurate for the moisture meter you purchase. Be certain to carefully read all directions before purchasing.

In wood, moisture meters generally measure the material's actual percent moisture content (percentage of water). When testing material other than wood, the meters measure the wood moisture equivalent (WME) value of the material. WME is the moisture level that would be attained by a piece of wood in equilibrium with the material being tested. As the critical moisture levels for wood are known, WME measurements enable the moisture meter user to establish if materials are in a safe air dry, borderline or damp condition.

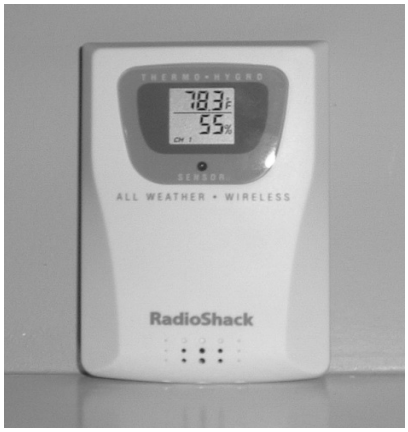
If a dry and absorbent material, such as wood or brick, is placed in a very damp environment (high relative humidity) it will absorb water and its moisture content will increase. Conversely, absorbent materials with high moisture content will lose moisture to a dry environment (low relative humidity).

The movement of moisture from material to environment and vice versa continues until the vapor pressures (within the material and the environment) have equalized. When this condition is reached, the moisture level of a material can be expressed in terms of equilibrium relative humidity (ERH). ERH techniques are very useful for assessing if structures are in a dry, borderline or damp condition.

Read the instruction sheets carefully for whatever moisture meter you choose to purchase as each one will have specific requirements for use and interpretation of the results. Keep in mind that you may record artificially high meter readings if the materials have been contaminated with salts or in materials that are conductive by their own nature. There are also kits that can be purchased to determine the level of salts (like nitrates and chlorides) in the material.

Humidity Gauges or Meters

- Used to monitor humidity indoors
- Some are combined so can measure temperature and humidity in one unit



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Ideal indoor humidity levels should be between 30%–50%.

Aim to be at least below 60%.

Indoor Air Regulations and Mold

- Standards or Threshold Limit Values (TLVs) for airborne concentrations of mold, or mold spores, have not been set.
- Currently, there are no Environmental Protection Agency (EPA) regulations or standards for airborne mold contaminants.

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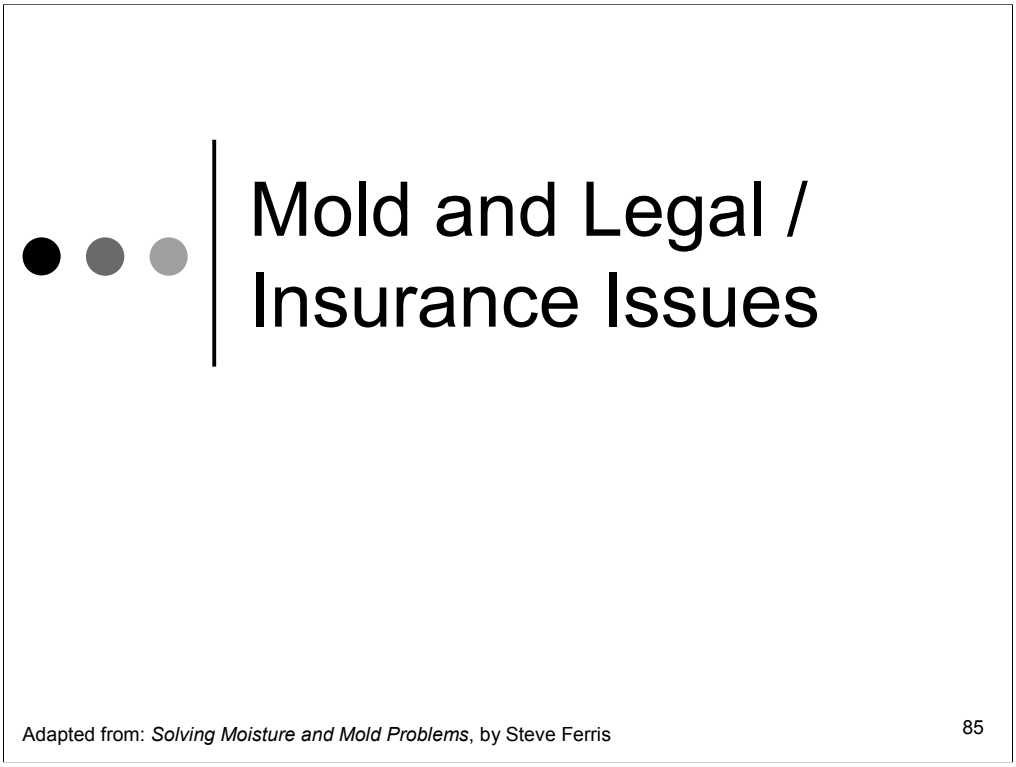

There have been several "high-profile" cases related to mold within the last few years…and many,many more cases that never make the newspaper. Don't add your name to the list.

See the *Growing Hazard of Mold Litigation*. 2003. www.instituteforlegalreform.com/resources/ILRmold.pdf by the U.S. Chamber Institute for Legal Reform for more information.

Who's Getting Sued?

- Insurance companies
- Vendors / manufacturers of products
- Contractors and subcontractors
  - Architects
  - Building contractors
  - Subcontractors
  - HVAC designers
  - Engineers
  - Etc.

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Who's Getting Sued?

- Increased focus on apartment / multifamily dwellings
  - Building owners and managers
  - Previous owners
  - Property managers
  - Landlords
  - Land developers
  - Real estate companies / agents
- Homeowners associations
- Employers

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Ways to Reduce Your Risk of Litigation

- Wise choice of replacement materials for location
- Training of key personnel
- Contractor / subcontractor documentation
- Immediate response
- Sound plan based on documented guidelines
- Communications—reassurance of action being taken
- Good record keeping

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Why Insurance Companies Don't Want to Cover Mold Claims

- Money
  - 1% = $18 billion
  - Remediation, removal, reconstruction costs >$75 per square foot
- Easy target
- No standards for number of mold spores allowable

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A lot of money has been spent by insurance companies on mold claims.

Post-Flooding Tasks

- Follow safety rules
- Stop water leak or flow
- Assess the damage:
  - Ask what is required of you—written notice, protect property, perform reasonable repairs, keep records
- Make a list of damaged property (videotape or photograph); and witnesses
- Check State, Local and Municipal Building Codes to determine if you need permits for any work you plan to do

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Work with the homeowner if you can

- Remove water-soaked materials
- Don't throw away removed or damaged materials until inspected by insurance agency; but do move them to a protected area that is outside the home
- Keep a written log
- Again, don't jeopardize your safety
- Don't exceed your physical capabilities—when people are overly tired, mistakes can happen

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Limits on Claims

- Be aware that there are probably financial limits on amount insurer pays for property damage and liability claims related to water, fungi, or bacterial damage.
- Don’t interpret the language in an insurance company policy unless you have been trained to do so
- Dry the structure as quickly as possible (within 24 to 48 hours, if possible)

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Education

- Familiarize yourself with the different guidelines and determine which one best fits your needs/abilities
- Attend seminars and workshops
- Seek certifications where appropriate or required
- Be aware of laws that may change
- Train your employees
- Keep accurate documentation
- Clearly communicate what you are doing and why – have a policy in place

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Mold-Related Websites

1. Mold-General Information

- *Conditions that Promote Mold*
  http://www.epi.state.nc.us/epi/oii/mold/conditions.html
  From Department of North Carolina Health and Human Services, Epidemiology Section

- *Where Does Mold Grow*
  http://www.epi.state.nc.us/epi/oii/mold/grow.html
  From Department of North Carolina Health and Human Services, Epidemiology Section

- *Biological Pollutants in Your Home*
  http://www.epa.gov/iaq/pubs/bio_1.html
  From the Environmental Protection Agency (EPA)

- *A Brief Guide to Mold, Moisture and Your Home*
  http://www.epa.gov/iaq/molds/moldguide.html
  From the Environmental Protection Agency (EPA)

- *Molds, Mildews, Mushrooms & Man*
  http://www.angelfire.com/wizard/kimbrough/Textbook/table_of_contents.htm
  University of Florida

- *The Condominiums Owners Guide to Mold*
  http://www.cmhc-schl.gc.ca/en/burema/gesein/abhose/abhose_ce44.cfm
  From the Canada Mortgage and Housing Corporation (CMHC)

- *Household Mold (index)*
  http://www.moldtips.com
  From the National Association of Home Builders (NAHB)

- *Molds and Fungi (Reference list)*
  http://www.osha.gov/SLTC/molds?index.html
  From the Department of Labor, Occupational Safety and Health Administration

- *Molds in the Environment*
  http://www.cdc.gov/nceh/airpollution/mold
  From the National Center for Environment Health (NCEH)

- *The Disaster Handbook*
  http://disaster.ifas.ufl.edu/
  University of Florida

- *Mold Issues*
  http://www.buildingscience.com/resources/mold/default.htm
  Building Science Corporation

- *Mold in Homes*
  http://www.health.state.mn.us/divs/eh/indoorair/mold/index.html
  Minnesota Department of Health

- *Molds*
  http://www.epa.gov/iaq/molds
  From the Environmental Protection Agency (EPA)

- *Mold Resources*
  http://epa.gov/iaq/molds/moldresources.html
  From the Environmental Protection Agency (EPA)

2. Mold Remediation

- *Clean Up and Removal of Mold*
  http://www.epi.state.nc.us/epi/oii/mold/cleanup.html
  From Department of North Carolina Health and Human Services, Epidemiology Section

- *Hiring a Mold Consultant or Contractor*
  http://www.epi.state.nc.us/epi/oii/mold/consultant.html
  From Department of North Carolina Health and Human Services, Epidemiology Section

- *Fighting Mold – the Homeowner's Guide*
  http://www.cmhc-schl.gc.ca/en/burema/gesein/abhose/abhose_ce08.cfm
  From the Canada Mortgage and Housing Corporation (CMHC)

- *Guidelines on Assessment and Remediation of Fungi in Indoor Environments*
  http://www.nyc.gov/html/doh/html/epi/moldrpt1.shtml#remed
  New York City Department of Health and Mental Hygiene, Bureau of Environmental & Occupational Disease Epidemiology

- *How Do I Clean Up?*
  http://www.moldtips.com/cleanup.htm
  Link from the Household Mold NAHB website

- *Mold Remediation in Schools and Commercial Buildings*
  http://www.epa.gov/iaq/molds/mold_remediation.html
  From the Environmental Protection Agency (EPA)

  The methodologies recommended for remediation are applicable to homes

- *Should You Have the Air Ducts in Your Home Cleaned*
  http://www.epa.gov/iaq/pubs/airduct.html
  From the Environmental Protection Agency (EPA)

3. Mold and Floods/ Water Damage

- *Dealing with Potential Moisture Problems after a Flood*
  http://www.ces.ncsu.edu/disaster/factsheets/pdf/moisture.pdf
  From North Carolina Cooperative Extension Disaster Materials

- *Water-Damaged Carpets and Rugs*
  http://www.ces.ncsu.edu/disaster/factsheets/pdf/rugs.pdf
  From North Carolina Cooperative Extension Disaster Materials

- *Flood-Damaged Wood Furniture*
  http://www.ces.ncsu.edu/disaster/factsheets/pdf/furniture.pdf
  From North Carolina Cooperative Extension Disaster Materials

- *Cleaning Flooded Upholstered Furniture, Curtains, Bedding, Table Linens, and Other Household Textiles*
  http://www.ces.ncsu.edu/disaster/factsheets/pdf/curtains.pdf
  From North Carolina Cooperative Extension Disaster Materials

- *American Lung Association Fact Sheet: Flood Clean-up*
  http://www.lungusa.org/air/flood_factsheet99.html
  From the American Lung Association (ALA)

- *The Disaster Handbook (index)*
  http://www.uwex.edu/ces/news/handbook.html
  From the University of Wisconsin, Division of the Cooperative Extension

- *Flood Cleanup: Avoiding Indoor Air Quality Problems*
  http://www.epa.gov/iaq/pubs/flood.html
  From the Environmental Protection Agency (EPA)

- *Numerous topics – search on flood cleanup or other phrases*
  http://www.fema.gov/
  From the Federal Emergency Management Agency (FEMA)

4. Mold and Health Issues (allergies, etc.)

- *Health Effects of Indoor Mold*
  http://www.epi.state.nc.us/epi/oii/mold/healtheffects.html
  From the North Carolina Department of Health and Human Services, Epidemiology Section

- *Indoor Mold and Health*
  http://www.doh.state.fl.us/environment/community/indoor-air/mold.htm
  Florida Department of Health

- *Allergic Conditions: Molds*
  http://www.aaaai.org/patients/allergic_conditions/molds.stm
  From the American Academy of Allergy, Asthma, and Immunology (AAAAI)

- *Allergies to Mold*
  http://nationaljewish.org/medfacts/mold.html
  From the National Jewish Medical and Research Center

- *Mold and Human Health*
  http://www.epi.state.nc.us/epi/oii/mold
  From the North Carolina Department of Health and Human Services, Epidemiology Section

- *Asthma and Indoor Environments (index)*
  http://www.epa.gov/iaq/asthma/index.html
  From the Environmental Protection Agency (EPA)

- *Battling Mold*
  http://www.aanma.org/homesweet/hs_battlingmold.htm
  From the Allergy and Asthma Networks/ Mothers of Asthmatics (ANNMA)

- *Mold (index)*
  http://www.cdc.gov/nceh/airpollution/mold/default.htm
  From the Center for Disease Control (CDC)

- *Fungal Contamination in Public Buildings: Health Effects and Investigation Methods*
  http://www.hc-sc.gc.ca/hecs-sesc/air_quality/pdf/fungal_contamination.pdf
  Health Canada

5. Mold and Insurance/ Liability Issues

- *Federal Insurance and Mitigation Administration*
  http://www.fema.gov/fima/
  From the Federal Emergency Management Agency (FEMA)

- *Mold Update*
  http://www.moldupdate.com/
  National Association of Mutual Insurance Companies

  *This list is not all inclusive. However this list of websites, used in combination with the other websites listed in the PowerPoint presentation, should provide you and your employees with a good background on the subject of mold in the indoor environment.

Course Evaluation

Course Title: Post-Flooding Considerations and Mold

Date: _____ **Location:** _____

Please circle your response:	**Strongly Disagree**				**Strongly Agree**
Question 1: The course objectives were accomplished.	1	2	3	4	5
Question 2: The course started and finished on time.	1	2	3	4	5
Question 3: The instructor(s) was well-versed in their topic and well-prepared.	1	2	3	4	5
Question 4: The materials presented were effective.	1	2	3	4	5
What did you like most about the course?					
What did you like least about the course?					
Please list other comments about this course, including ways to improve the course or suggestions for other courses.					