WATER DAMAGE, MOLD* GROWTH AND IAQ

*Mold and Mildew are fungi

What conditions may pose a problem & why

What to do

My name is: Jacquelyn Brown

Environmental Protection Program Specialist (Health & Safety Management),

DAS Facilities Management , 860-713-5678

References used in this slide presentation:

- *Dr. Harriet Burge EMLab P&K Chief Aerobiologist and Director of Scientific Advisory Board*
- *EPA*
- *Institute of Inspection Cleaning and Restoration Certification (IICRC)S500 Standards for water damage restoration.*

Where are Mold Spores found?

- Mold spores are ubiquitous;
- They are found both indoors and outdoors.
- Mold spores cannot be eliminated from indoor environments. Some mold spores will be found floating through the air and in settled dust; however, they will not grow if moisture is not present.

In the absence of a source of active mold growth indoors, outdoor spore levels are:

- usually higher than indoor levels during Spring, Summer & Fall
- may be less than indoor levels In the winter especially after snow fall

Exposure to Fungal Allergens

- Most exposure to fungal allergens probably occurs from inhalation of spores in outdoor air.
- All of the fungi found indoors are also part of the outdoor ecology, making separation of indoor and outdoor exposures difficult.

Possible Health Effects of Mold Exposure

- Allergic reactions which can be immediate or delayed such as headache, sneezing, runny nose, red eyes, and skin rash (dermatitis).
- Molds can cause asthma attacks in people with asthma who are allergic to mold
- Molds can irritate the eyes, skin, nose, throat, and lungs of individuals whether or not they are allergic to mold.
- May cause hypersensitivity pneumonitis, an uncommon disease that resembles bacterial pneumonia.
- May result in opportunistic infections in those with compromised immune systems.

NOTE: Allergic responses are not unique to mold. People can have similar reactions to dust mite feces, pollen, animal dander and many other particulates in the environment. So it is difficult to say which reactions can be blamed on mold.

When might the indoor environment pose a mold exposure concern?

- When conditions indoors allow mold to amplify (grow) and result in elevated concentrations of mold spores in the air

Conditions that Can Promote Indoor Mold Amplification

- (Prolonged) Relative humidity levels exceeding 60-65% can harbor biological growth including molds and dust mites.

- Presence of indoor sources of standing water, water-damaged materials, or wet surfaces which serve as a breeding ground for molds, mildews, bacteria, and insects.

In order to grow, mold needs:

- Moisture

- Food Source (any organic material)

Water-Damaged Materials

- If certain materials stay wet longer than about 24-48 hours, microbial growth including mold growth may occur.

Some common indoor materials that tend to harbor mold growth when they stay wet:

ceiling tiles, wallpaper,
wood, soiled fibrous glass
insulation, paper,
cardboard, cloth furniture,
carpets, glues, books,
painted surfaces

Some common indoor fungi

- Cladosporium grows in moist, porous areas, including wood and fabrics
- Penicillium grows in duct insulation and carpets, in addition to wallpaper and rotting fabrics in water-damaged environments
- Aspergillus grows in dust and compost piles
- Alternaria grows in damp places such as showers, windows and carpets

QUIZ

- **Question 1:**
- **The most important factor influencing mold growth is:**
- A. Temperature
- B. Light
- C. Moisture or Water
- D. Organic Matter
- **Question 2:**
- **Molds have the potential to cause health effects such as allergic reactions.**
- • True
- • False
- **Question 3:**
- **Water-damaged furnishings and building components should be dried within 24-48**
- **hours to prevent mold growth.**
- • True
- • False
- **Question 4:**
- **During the months of April through November, you are probably exposed to greater levels of mold spores outdoors**
- **than indoors.**
- • True
- • False
- **Question 5:**
- **Mold cannot be eliminated from indoor environments. Some mold spores**
- **will be found floating through the air and in dust; however, mold will not grow if**
- **moisture is not present.**
- • True
- • False

- **Recommended Water Damage Response Actions at DAS Leased Properties**

- The following actions will help minimize costs and potential indoor air quality issues associated with water damaged building components and materials.

- 1. Agency representative should contact the property manager or other landlord representative and DAS leasing agent ASAP.

- 2. Until the property manager or other landlord representative arrives, occupying agency should attempt to minimize potential damage from the water infiltration by moving state owned property from the area & controlling infiltration (ie placing container/s beneath the leak) if these actions can be done safely. Occupants should be moved from the immediate area as necessary.

- 3. Response actions must include the following:
- a. Controlling/stopping the leak ASAP.
- b. Assessment of any structural damage if situation warrants.
- c. Further evacuation of occupants as required.
- d. Protection of state owned property (equipment, files furniture etc).
- e. Determining if the leakage has affected possible asbestos containing materials (ACMs), and if so, implementation of appropriate regulatory precautions.

- 4 . If situation warrants, the landlord should contact professional cleaning contractor **immediately. G*enerally materials will need to be dried within 24 to 48 hours in order to be salvaged. Contractor should be familiar with Institute of Inspection Cleaning and Restoration Certification (IICRC)S500 Standards for water damage restoration.***

- 5. The source of water should be categorized in order to determine what materials can be saved and how cleaning must be performed.
- a. Category 3/Black water –raw sewage, toilet black flow from beyond toilet trap, ground or surface water (rivers streams), seawater, chemically contaminated water

- b. Category 2 /Gray water – (i.e. dishwasher or washing machine overflow, overflow from toilets) water with some degree of chemical, biological or physical contamination that would cause sickness if consumed by or exposed to humans. (gray water contaminated materials sources will become black water if not attended to rapidly.)
- c. Category 1/Clean Water- Water from potable water sources or other sources unlikely to pose substantial harm to humans (sink overflow w/o contaminants, potable pipe lines, snow melt, and rainwater)

- 6. In general, these rules apply regarding water damaged materials: If category 2 or 3 water, replacement of all saturated porous material including wallboard, insulation, ceiling tiles, carpet and underlying carpet cushion is typically the ONLY recourse. Removal of these materials should be done immediately to avoid potential IAQ/health issues. If sub flooring is wetted, it should be professionally disinfected and cleaned using at least two applications of appropriate biocide followed by thorough drying. Restoring carpet wetted from gray water (not the underlying cushion which must be discarded) is possible using proper application of biocide and dwell time followed by hot water extraction cleaning. If clean water:
- Pull back base cove on wallboard abutting wetted flooring areas.
- Drill holes along bottom of wallboard, direct fans to assist in drying behind wallboard.
- Use sufficient fans and dehumidifiers to dry within 24 to 48 hours.
- Clean carpet using hot water extraction method- dry within 24 48 hours.

- 7. If category 2 or 3 water, implement appropriate health and safety precautions. Do not handle materials or objects until they have been disinfected.

- 8. Use (undamaged) HVAC system and de-humidifiers to aid in reducing relative humidity levels to below 50% if possible to aid in drying of wetted materials and to prevent unaffected materials from absorbing moisture in the air. Remove undamaged paper items from affected area if high humidity exists.

- 9. Work with occupying agency as needed to inventory damaged items.

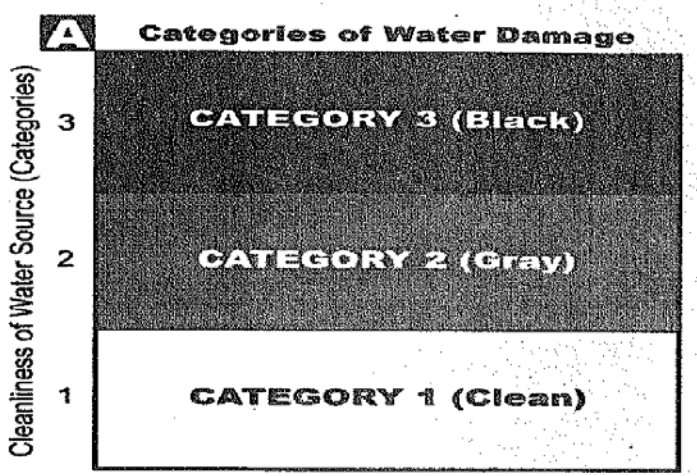
- 10. Moisture meter should be employed to determine extent of wetted areas and to verify drying process and completion.

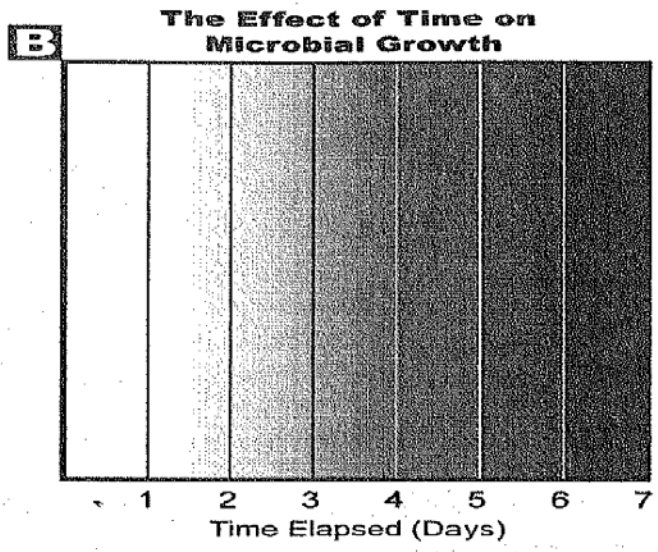
- 11. If walls or flooring or other materials are not dry within 48 hours, document areas- mark out areas and meet with DAS representatives to lay out a plan of remedial action.

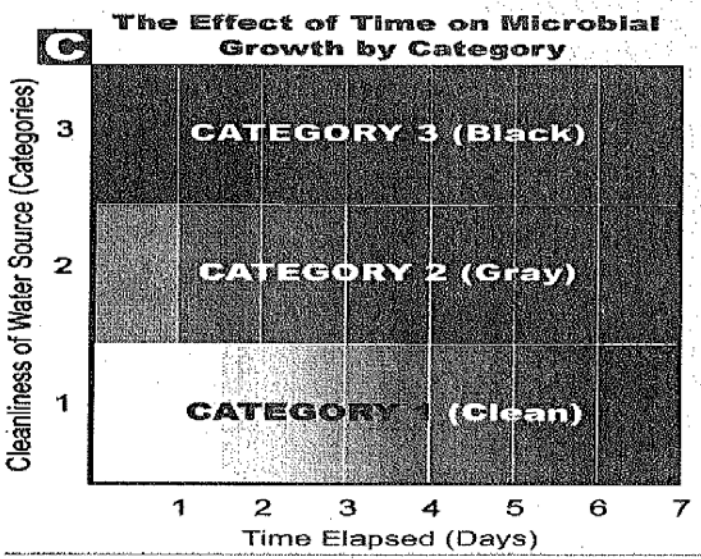
Figure 1

(see 5.1, 5.2, 10, and 11.2.10)

TO PREVENT AMPLIFICATION OF MICROORGANISMS, IMMEDIATE RESPONSE IS NECESSARY FOR ALL CATEGORIES OF WATER INTRUSION.







FACT: ***Microorganisms are always present*** *in the indoor environment.*

A ***Whether water is categorized*** *as clean, gray, or black, when there is a water intrusion and...*

B ***...if it is left unattended, microorganisms will amplify.*** *While the amplification will not be immediately noticeable, the greater the length of time, the greater the amplification.*

C ***With the passage of time,*** *microorganisms present in any category of water intrusion will begin to amplify.*

In the event of water infiltration

- We ask that you contact Bill Falletti or your Property Agent so that the proper clean up actions will get started as soon as possible to avoid possible IAQ problems due to mold
  - Materials that are wet need to be properly addressed.
  - Source of water stopped AND corrected (so it isn't likely to reoccur).

Table 1: Water Damage – Cleanup and Mold Prevention

Guidelines for Response to Clean Water Damage within 24 – 48 Hours to Prevent Mold Growth*	
Water-Damaged Material†	**Actions**
Books and papers	* For non-valuable items, discard books and papers. * Photocopy valuable/important items, discard originals. * Freeze (in frost-free freezer or meat locker) or freeze-dry.
Carpet and backing – dry within 24 – 48 hours§	* Remove water with water extraction vacuum. * Reduce ambient humidity levels with dehumidifier. * Accelerate drying process with fans.
Ceiling tiles	* Discard and replace.
Cellulose insulation	* Discard and replace.
Concrete or cinder block surfaces	* Remove water with water extraction vacuum. * Accelerate drying process with dehumidifiers, fans, and/or heaters.
Fiberglass insulation	* Discard and replace.
Hard surface, porous flooring§ (Linoleum, ceramic tile, vinyl)	* Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary. * Check to make sure underflooring is dry; dry underflooring if necessary.
Non-porous, hard surfaces (Plastics, metals)	* Vacuum or damp wipe with water and mild detergent and allow to dry; scrub if necessary.
Upholstered furniture	* Remove water with water extraction vacuum. * Accelerate drying process with dehumidifiers, fans, and/or heaters. * May be difficult to completely dry within 48 hours. If the piece is valuable, you may wish to consult a restoration/water damage professional who specializes in furniture.
Wallboard (Drywall and gypsum board)	* May be dried in place if there is no obvious swelling and the seams are intact. If not, remove, discard, and replace. * Ventilate the wall cavity, if possible.
Window drapes	* Follow laundering or cleaning instructions recommended by the manufacturer.
Wood surfaces	* Remove moisture immediately and use dehumidifiers, gentle heat, and fans for drying. (Use caution when applying heat to hardwood floors.) * Treated or finished wood surfaces may be cleaned with mild detergent and clean water and allowed to dry. * Wet paneling should be pried away from wall for drying.

*If mold growth has occurred or materials have been wet for more than 48 hours, consult Table 2 guidelines. Even if materials are dried within 48 hours, mold growth may have occurred. Items may be tested by professionals if there is doubt. Note that mold growth will not always occur after 48 hours; this is only a guideline.

These guidelines are for damage caused by clean water. If you know or suspect that the water source is contaminated with sewage, or chemical or biological pollutants, then Personal Protective Equipment and containment are required by the Occupational Safety and Health Administration (OSHA). An experienced professional should be consulted if you and/or your remediators do not have expertise remediating in contaminated water situations. Do not use fans before determining that the water is clean or sanitary.

† If a particular item(s) has high monetary or sentimental value, you may wish to consult a restoration/water damage specialist.

§ The subfloor under the carpet or other flooring material must also be cleaned and dried. See the appropriate section of this table for recommended actions depending on the composition of the subfloor.

Table 2: Guidelines for Remediating Building Materials with Mold Growth Caused by Clean Water*

Material or Furnishing Affected	Cleanup Methods†	Personal Protective Equipment	Containment
SMALL – Total Surface Area Affected Less Than 10 square feet (ft²)			
Books and papers	3	Minimum N-95 respirator, gloves, and goggles	None required
Carpet and backing	1, 3		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (Linoleum, ceramic tile, vinyl)	1, 2, 3		
Non-porous, hard surfaces (Plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3		
Wallboard (Drywall and gypsum board)	3		
Wood surfaces	1, 2, 3		
MEDIUM – Total Surface Area Affected Between 10 and 100 (ft²)			
Books and papers	3	Limited or Full Use professional judgment, consider potential for remediator exposure and size of contaminated area	Limited Use professional judgment, consider potential for remediator/occupant exposure and size of contaminated area
Carpet and backing	1, 3, 4		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (Linoleum, ceramic tile, vinyl)	1, 2, 3		
Non-porous, hard surfaces (Plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3, 4		
Wallboard (Drywall and gypsum board)	3, 4		
Wood surfaces	1, 2, 3		
LARGE – Total Surface Area Affected Greater Than 100 (ft²) or Potential for Increased Occupant or Remediator Exposure During Remediation Estimated to be Significant			
Books and papers	3	Full Use professional judgment, consider potential for remediator exposure and size of contaminated area	Full Use professional judgment, consider potential for remediator/occupant exposure and size of contaminated area
Carpet and backing	1, 3, 4		
Concrete or cinder block	1, 3		
Hard surface, porous flooring (Linoleum, ceramic tile, vinyl)	1, 2, 3, 4		
Non-porous, hard surfaces (Plastics, metals)	1, 2, 3		
Upholstered furniture & drapes	1, 3, 4		
Wallboard (Drywall and gypsum board)	3, 4		
Wood surfaces	1, 2, 3, 4		

Cleanup Methods

Method 1: Wet vacuum (in the case of porous materials, some mold spores/fragments will remain in the material but will not grow if the material is completely dried). Steam cleaning may be an alternative for carpets and some upholstered furniture.

Method 2: Damp-wipe surfaces with plain water or with water and detergent solution (except wood —use wood floor cleaner); scrub as needed.

Method 3: High-efficiency particulate air (HEPA) vacuum after the material has been thoroughly dried. Dispose of the contents of the HEPA vacuum in well-sealed plastic bags.

Method 4: Discard - remove water-damaged materials and seal in plastic bags while inside of containment, if present. Dispose of as normal waste. HEPA vacuum area after it is dried.

Personal Protective Equipment (PPE)

Minimum: Gloves, N-95 respirator, goggles/eye protection

Limited: Gloves, N-95 respirator or half-face respirator with HEPA filter, disposable overalls, goggles/eye protection

Full: Gloves, disposable full body clothing, head gear, foot coverings, full-face respirator with HEPA filter

Containment

Limited: Use polyethylene sheeting ceiling to floor around affected area with a slit entry and covering flap; maintain area under negative pressure with HEPA filtered fan unit. Block supply and return air vents within containment area.

Full: Use two layers of fire-retardant polyethylene sheeting with one airlock chamber. Maintain area under negative pressure with HEPA filtered fan exhausted outside of building. Block supply and return air vents within containment area.

Musty odors

- Musty odors =volatile organic compounds. musty odors can be caused by mold but can be from other sources…
- If there is no water anywhere then musty odors are *probably* not caused by mold. If there is water, mold probably plays a role, but may not be the entire problem.

Source of info: Dr. Harriet Burge ***EMLab P&K Chief Aerobiologist and Director of Scientific Advisory Board***

If there are reports of a lingering musty or unknown odor

- We ask that you contact Bill Falletti or Property Agent so that the situation can be investigated as soon as possible

Don’t ignore occupant IAQ concerns

- Contact DAS Leasing and report concerns so that they can be investigated and addressed

Mold Spores and Allergens

- Recent research…indicates that allergens are released from a spore during the germination process…

- So.. Exposure to allergens from airborne mold spores occurs only if the particular types of mold spores that are inhaled into the respiratory tract find the correct amount of moisture, nutrients, oxygen needed to begin the germination process…

- Different molds germinate under differing conditions…not all fungi will release allergens when inhaled

- Process may take from a few minutes to many hours.

- Non living spores may not trigger allergic reactions as previously thought

Common fungal allergens

- Basidiospores: mushrooms, rusts, smuts, brackets, and puffballs (mostly outdoors)
- *Alternaria* alternata: most common sensitizer among fungi (in spite of the fact that concentrations in air are generally much lower than for many other fungi)
- Penicillium
- Aspergillus
- Cladosporium

What is a toxigenic or toxic mold?

- A mold that produces toxins (also called mycotoxins)
- Not all types of molds produce mycotoxins
- Some are extremely poisonous/toxic when ingested..like alfatoxin

Mycotoxins…health effects

- "Health effects for most of the mycotoxins are known only from either agricultural environments, or from laboratory experiments, and virtually all of the data involves ingestion of the mycotoxins. *Article by Dr. Harriet Burge July 2005 issue of the Environmental Reporter*

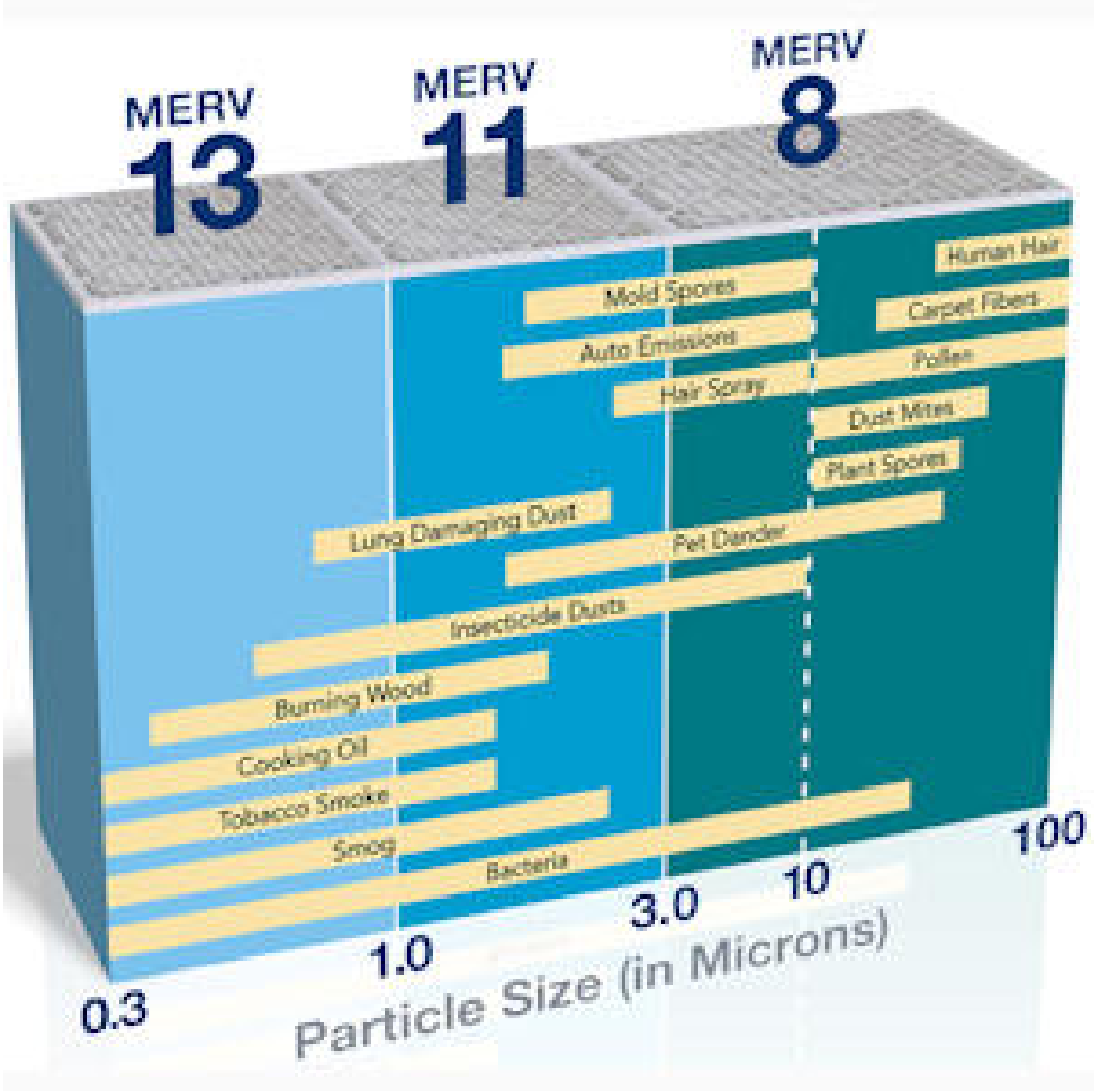
- "The fact remains that no research has documented that anyone has ever been exposed to enough mycotoxin from exposure to indoor fungal growth to actually cause any of his/her symptoms with the possible exception of agricultural environments. In fact, there are no publications that I can find that actually document the amount of mycotoxin exposure in a moldy indoor environment." Aren't Mycotoxins Part of the Indoor Air Problem?
  By Dr. Harriet Burge, *February 2011 issue* of *Indoor Environment Connections*

- "Extrapolating from the amount of toxin necessary to cause health effects by ingestion, and, given that the toxin content of individual spores is quite low, inhalation exposure in non-agricultural environments (i.e. in normal homes and offices) to enough spores of even the most toxic strains to reach a dose likely to produce human health effects is unlikely and probably very rare. "*Article by Dr. Harriet Burge July 2005 issue of the Environmental Reporter*

Central HVAC Systems Filter Supply Air

- Typically, Filters in a commercial building have a Minimum Efficiency Reporting Value rating of at least 8 (MERV 8)

  - MERV 8 is able to filter 70-85% of particles in the size range 3.0–10.0 µm which includes most mold spores, dust mite debris, cat and dog dander, pollen, some bacteria


MERV 13
MERV 11
MERV 8
Human Hair
Mold Spores
Carpet Fibers
Auto Emissions
Pollen
Hair Spray
Dust Mites
Plant Spores
Lung Damaging Dust
Pet Dander
Insecticide Dusts
Burning Wood
Cooking Oil
Tobacco Smoke
Smog
Bacteria
0.3
1.0
3.0
10
100
Particle Size (in Microns)

What helps to provide a healthy work environment?

- Adequate volume of filtered outdoor air
- Routine housekeeping including vacuuming with high efficiency particulate air (hepa) filtered vacuum
- Rapid response to water infiltration incidents
- Minimizing surface dust (so keeping work surfaces and floor surfaces as free of paperwork, knick knacks, cardboard file boxes etc to allow for better housekeeping)
- Elimination (or minimize number of) live plants
- Minimize use of personal products in the work place
- Properly maintained HVAC system

QUIZ

- **1. Quick action to address a moisture problem may make an extensive mold remediation effort unnecessary.**
- A. True
- B. False
- **2. In a leased building who should be contacted right away in the event of water infiltration?**
- A. Property manager
- B. DAS Leasing
- C. Both of the above
- **3. As a tenant agency in a leased building, you have the authority to direct landlord in proper water clean up response.**
- A. True
- B. False
- **4. Which of the following types of materials may have to be discarded when contaminated with mold or mold spores?**
- A. Hard surfaces such as linoleum or tile
- B. Cellulose or fiberglass insulation
- C. Plastics and metals
- D. All of the above
- **5. Employees have general IAQ complaints in a leased building that never has experienced significant water infiltration. As a first step, it is always a good idea to perform airborne mold testing to rule out possible mold problems.**
- A. True
- B. False
- **6. Which of the following steps are necessary for determining the effectiveness of a mold removal project?**
- A. Determine that the moisture problem has been corrected
- B. Visually ensure that water damaged and moldy materials have been removed from the site
- C. Check to see that individuals returning to the site are not experiencing any health complaints or physical
- symptoms
- D. All of the above
- **7. Remediation and cleanup activities should be scheduled for off-hours, when building occupants are less**
- **likely to be affected.**
- A. True
- B. False
- **8. You should take inventory of all state property damaged by a water infiltration event.**
- A. True
- B. False