Mold, Water and Building Codes: A Review in 1 Hour

Code Enforcement in-service training program

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Why are we talking to Code Enforcement Officers about mold?

- Mold is the HOT topic
- Mold is not a regulated contaminant
- Mold is a symptom of water problems
- Water problems can be regulated through Building Codes
Black Mold Exposure
Health Effects of Mold

- Allergy and Irritation symptoms
  - Nasal and sinus congestion
  - Itchy, red, watery eyes
  - Wheezing
  - Difficulty breathing
  - Cough
  - Throat irritation
  - Skin irritation, rash
  - Headache
Rare Health Effects

- Mold Infections
  - Common minor infections – e.g. athlete’s foot
  - Serious infections – quite rare
  - Mostly in people with compromised immune systems
    - HIV/AIDS, organ transplant, chemotherapy patients, invasive procedures
  - Only a few molds cause serious human infections
  - Often serious/fatal infections
Mold Toxins

Mycotoxins – mold toxins

- More than 200 known mold toxins, some of which affect humans
- Produced by molds growing under certain conditions
- Most known health effects are from eating moldy food
“Toxic” Mold – the beginning

- Cleveland, Ohio – Jan. 1993 to Dec. 1994
- 10 infants – Idiopathic Pulmonary Hemosiderosis (IPH)
- CDC Investigation [*Pediatrics*, 1997; 99(1)]

In every case:

- The infants’ homes had water damage within 1 month before they became ill
- The water damage had not been cleaned up
- The source of the water had not been fixed
“Black” Mold
Stachybotrys chartarum (S. atra)

Three scientific papers:

- Higher levels of *S. chartarum* in the homes of infants with IPH than in other (healthy) infants’ homes in Cleveland (*Arch Pediatr Adolesc Med* 1998;152:757-762)

- Association between IPH and *S. chartarum* was not proven. (*MMWR* 2000;49:180-184)

- *S. chartarum* detected in the lung and home of a child with IPH in Houston (*Pediatrics* 1999;104:964-966)

- *S. chartarum* detected in the home of an infant with IPH in Kansas City (*Environ Health Perspect* 1999;107:927-930)
Molds are different!

Animal Kingdom

Fungi Kingdom

Plant Kingdom

Molds
yeast
mildew
mushrooms
puffballs
Hyphae, Mycelium, and Spores
Mold Food in Buildings

- Wood
  - Boards
  - Plywood
  - OSB
  - MDF
  - Paper
- Sheetrock
  - Paper on a “sponge”
- Most organic materials
  - Glue
  - Carpet pads
  - Ceiling tiles
Water in and on Buildings

- **Vapor**
  - Steam, humidity
- **Liquid**
  - Water, rain, fog
- **Solid**
  - Ice, snow, frost
- **Adsorbed**
Water and Moisture Movement

- Liquid Flow
  - Gravity
- Air Movement
  - Pressure
- Capillary Flow
- Vapor Diffusion
Movement of Vapor

- **Mass Transport**
  - Building Pressures
  - Stack Effect
  - Mechanical Ventilation

- **Vapor Diffusion**
  - High to Low humidity
  - Through microscopic spaces
  - Slow, long-term process
How much water is in the air?

- Temperature
- Relative Humidity
- Dew Point

Example:
- 70° F
- 40% RH
- 46° F Dew Point
Wetting

- Materials get wet in stages
  - Adsorbed water molecules
    - Bound to the material
  - Free water in capillary pores
    - AVAILABLE TO MOLDS
  - Saturated – pores full and free water on the material’s surface
    - Usually visible dampness and water beads
Drying

- Materials get dry in stages
  - Free water on the material’s surface
    - Wipe or drain it off
  - Free water in capillary pores
    - Evaporates at room temperature with air movement
  - Adsorbed water molecules
    - Usually can not be removed without heating
What’s happening in this room?
What's happening in this room?
What Gives You the Right?

- **Title 19 NYCRR Part 1203**
  - Every jurisdiction “shall provide for administration and enforcement by local law, ordinance or other appropriate regulation”

- **Part 1203.3 Inspections**
  - 1203.3(h)(2)(i) Procedures shall be established for addressing bona fide complaints which assert that conditions or activities fail to comply with the Uniform Code
Housing and Building Codes

- 75 Water and Moisture specific Codes
  - 10 in Property Maintenance Code
  - 17 in Residential Code
  - 36 in Building Code
  - 4 in Energy Conservation Code
  - 8 in Mechanical Code
Exteriors

- Grading and Drainage
- Foundations
- Building Envelope
  - Walls
  - Roofs
  - Windows, Doors and Skylights
Grading and Drainage RR§401.3
PMC§302.2

- Graded and maintained
- Prevent soil erosion
- Prevent stagnant water
Foundation Drainage §RR405

- Drainage is required unless foundation is well-drained (Group I soils)
- Install drains at or below level to be protected
- Discharge to an approved drainage system
- Drain - Gravel - Membrane
Water/Damp-proofing §RR406

- Dampproofing for habitable or usable spaces below grade
- Waterproofing where high water table or other soil-water conditions exist
- from top of footing to finished grade
- Acrylic cement, hot-mopped felt, roll roofing, 6-mil poly, 40-mil poly-asphalt
Building Envelope
Vapor Barriers

§RR318.1 Moisture control.

- In all framed walls, floors and roof/ceilings comprising elements of the building thermal envelope, a vapor retarder shall be installed on the warm-in-winter side of the insulation.
As warm moisture-laden air is forced into the wall cavity, it will start to cool and eventually reach the dew point. In the diagram above this is 46°F (Point C). From this point on, the air being pushed out through the wall can condense and release moisture inside the wall cavity (area shaded in blue).
Roof Flashing and Drainage §RR903
§PM304.7 Roofs and drainage
Flood Construction

- §R322 Flood-Resistant Construction.
  - Table R301.2(1) for established flood hazard areas.
- Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE (American Society of Civil Engineers) 24-05.

FEMA Flood map

Map-based search for the exact address to determine a flood hazard area.
https://msc.fema.gov/webapp/wcs/stores/servlet/FemaWelcomeView?storeId=10001&catalogId=10001&langId=-1
Preparedness

- Community emergency plans, warning signals, evacuation routes, and locations of emergency shelters
- Disaster Supply Kit
  - Water, food, communications, medicines, clothing, blankets, tools, pets
  - Critical documents, cash, keys
- Utilities – Gas, Electric, Water, Septic/Sewer
  - Phone numbers, shutoffs, repair contractors
- Chemicals and Fuels
  - Oil tanks, Gasoline, Propane tanks (Campers, boats, garden sheds)
  - Empty or Full, Anchored or not?
Flood Response

1. **Take Care of Yourself First** - Before you can rebuild your home you need to make sure you and your family are safe and healthy.

2. **Give Your Home First Aid** - Make sure it is safe to go back to your home. Don’t enter your home if standing water is still present or if the structural integrity of your home appears compromised.

3. **Get Organized** - Contact your insurance agent. Record damage to the building, contents and keep receipts for all expenses.

4. **Dry Out Your Home** - Open the house, use fans (if electricity is available), remove soaked items (couches, carpet, books, mattresses, insulation)

5. **Restore the Utilities** - Check with the local building department on who can ultimately turn power back on.

6. **Clean up/Removal** - “when in doubt throw it out”

7. **Check on Financial Assistance** - Four sources of financial assistance: insurance; government disaster programs; voluntary agencies; and businesses.
Why does this building smell?
Interiors

- Ventilation
  - Attics, Crawlspace
  - Bathrooms
- Clothes Dryer Exhaust
- Plumbing System
- Sanitary System
- Bathtubs and Showers
Crawlspaces

- Vapor barriers
- Ventilation
- Floor insulation
- Pipe insulation
- Seal floor penetrations
Bathroom Ventilation

- §PM403.2
- Fans are required when no windows are present
- Exhaust must discharge to the outdoors
Plumbing System §PM504.1

- properly installed and maintained...
- capable of performing the function for which such plumbing fixtures are designed...
- All plumbing fixtures shall be maintained in a safe, sanitary and functional condition.
Bathtubs and Showers
§PM107.1 General. When a structure or equipment is found to be unsafe, or when a structure is found *unfit for human occupancy*, or is found unlawful, such structure shall be condemned pursuant to the provisions of this code.
Sanitary Condition or Lifestyle Choice?
§PM301.2 Responsibility

- The owner of the premises shall maintain the structures and exterior property...

- Occupants... are responsible for... that part which they occupy and control
Investigating Mold

- Visual Inspection
  - Mold
  - Moisture and Water damage

- Odor Evaluation
  - Follow your nose

- Sampling and Analysis?
Visual Inspection

- Visible mold
- Water/moisture
- Hidden areas
- HVAC Systems
- Overall cleanliness
- Instruments
Odor Evaluation

- Microbial Volatile Organic Compounds (MVOCs)
- Persistent versus Transient Odors
- Musty, earthy odor
- Stale air
Sampling and Analysis

- Sampling
  - Tape Lifts
  - Bulk
  - Wipe/Swab
  - Air
Sampling and Analysis

- Analysis
  - Microscopy
  - Culture
  - DNA
Sampling and Analysis

- Rarely done adequately
  - Should compare impacted against non-impacted areas
- There are no standards
  - What kinds of mold are “bad”? 
  - What do the concentrations mean?
- The results don’t change the recommended actions...
You’ve Got Mold!

Fix the leaks!

Dry
- Drain, Mop, Wipe off standing water
- Remove moisture with fans or dehumidifiers

Clean
- Discard damaged carpets, clothes, paper
- Wash with Soap and Water

Disinfect
- 1:10 Bleach Water
Look for and fix Exterior Leaks

- Grading and Drainage
- Foundations
- Building Envelope
  - Walls
  - Roofs
  - Windows, Doors and Skylights
Look for and fix Interior Leaks

- Ventilation
  - Attics, Crawlspace
  - Bathrooms
- Clothes Dryer Exhaust
- Plumbing System
- Sanitary System
- Bathtubs and Showers
Drying

- **Surface Water**
  - Drain, Mop, Wipe off visible water

- **Moisture and Dampness**
  - Remove with fans or dehumidifiers

- **Adsorbed Water**
  - Avoid excessive drying
  - May damage some materials – buckling and cracking
Cleaning

- Discard materials that can’t be cleaned
  - Carpets and backing
  - Sheetrock
  - Clothing
  - Paper

- Clean surfaces with soap and water
Disinfect

- **Bleach water**
  - About 1 cup bleach in 1 gallon water (1:16)
  - Cheap and effective

- **Specialty chemicals**
  - Quaternary Ammonium cleaners
    - Generally no more effective than bleach
  - Borate solutions
    - Leaves a residue which can prevent future mold growth
Construction Management

- Use Good Containment Practices
- Dust Control
  - Barriers
  - Ventilation
- Avoid Tracking
- PPE
  - Avoid unnecessary exposure
Is this mold?
References

NYSDOH
• www.nyhealth.gov/environmental/indoors/air/mold.htm

EPA
• www.epa.gov/mold

NYCDOHMH – Mold Assessment Guidelines

Building Science Corporation
• www.buildingscience.com/index_html

Whole Building Design Group
• www.wbdg.org

Conservation Physics
• www.conservationphysics.org
Conclusion

- Mold indicates Water
- Water indicates Building Problems
- Building Problems can be resolved through Code Enforcement
Questions and Comments

Please fill out the evaluation form (front and back)