Mold & Moisture Speed Dating

WSHSC
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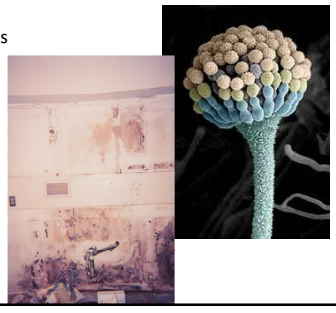
Introduction

Larry Lee, CIH

- Certified Industrial Hygienist
- Indoor air quality
- Sewage flood '96
- Specialize in healthcare construction & infection prevention

Fundamental equation

Water
Building materials
+ Time
Mold growth

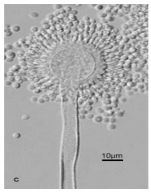


Water

- Water is the precipitating event
  - Excess moisture + time + food (carbon) = growth
  - Time is typically 5 to 15+ days
  - Less than 5 is unusual
- An ounce of prevention is worth gallons and gallons of cure
- All hospitals have leaked, do leak, and will leak

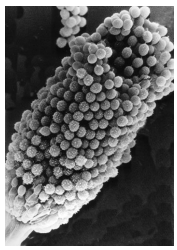
Mold is?

- Fungi
  - Allergic & irritating
    - *Stachybotrys chartarum* – "Toxic black mold"
    - *Chaetomium*
    - *Alternaria*
  - Opportunistic fungi
    - *Aspergillus* species
    - *Fusarium* species
    - *Scedosporium* species
    - Zygomycetes
    - Others
  - Characteristics for infection
    - Grow at body temperature
    - Need compromised host



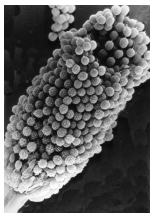
Aspergillus species

- Ubiquitous & prolific
- In dust and air indoors and out
- Can grow on wet building materials
- Small spores (2-3 microns) readily inhaled



Aspergillus species of concern

Aspergillus fumigatus (~90% invasive illness worldwide)
A. flavus
A. niger
A. terreus
A. ustus
A. nidulans
A. lentulus



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Courtesy Aspergillus website

Aspergillus sources in healthcare environments

Wet building materials
- Gypsum wallboard
- Fireproofing
- Ceiling tile
- Flooring material mastics
- Wood & wood products
- Dust accumulations
- Etc.

Day to day activities

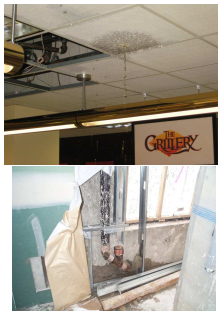
- Cleaning & floor covering failures
- Internal condensation

Hidden & maintenance sources

- Sprinkler system charging
- Thermal weld failure

Construction & water

- Construction water sources
  - Large-scale construction projects average 3 water events
  - Weather – rain & flooding
  - Pipe & hose leaks/breaks
  - Mechanical failures (e.g. sump pump)
  - Pressure testing drains
  - Building envelope & roof failure
  - Discovery of pre-existing condition
    - Cove base failure (e.g. OR floor)
    - Floor or wall panel failure (e.g. scullery)

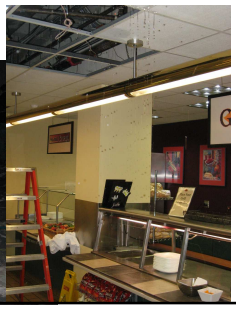


Construction & water

- Roof leaks
- Windows

Construction & water

- Severe weather events



Water response plan

- The Art & Science of Drying
  - "Drying, how hard can it be?"
- Basics
  - Remove bulk water
  - Determine the water footprint
  - Use the air to dry
    - Turn water to vapor
    - Remove vapor from air
  - Air circulation

Step 1. Remove the bulk water

- d

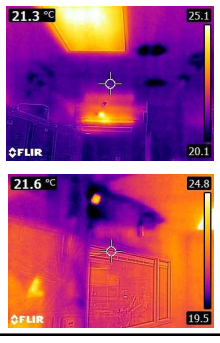
Step 2. Temp the structure

Step 3. Determine the water footprint

- Pin-type moisture meters
  - Insert pins/probe
  - "See's the material only"
- Pad-type moisture meters
  - Place on surface
  - "See's" through and behind the material

Step 3. Determine the water footprint

- Infrared cameras



Step 3. Determine the water footprint

- Water hides

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- Water hides

Step 4. Drying

Drying simplified

1. "Drying the air"
   - Refrigerant dehumidifiers
2. Providing "dry air"
   - High temperature, low % r.h. air
   - Dessicant dryers

Supplemental air circulation

- Increases contact of "dry air" with wet surfaces

Step 4. Drying

- Using the air to dry
  - Heat – breaks H2O bonds
  - "Drying the air"
    - Lowering % relative humidity draws water to the air
    - Refrigerant dehumidifiers
  - Providing "dry air"
    - High temperature, low % r.h. air
    - Dessicant dryers
  - Air circulation
    - Increases contact of "dry air" with wet surfaces

Step 4. Drying

- Refrigerant dehumidification
  - Portable
  - Air passes by cooling coils
  - Water vapor condenses on coils
  - Water pumped to drain
  - Air often HEPA-filtered

Step 4. Drying

- Large-scale dessicant drying
  - "Closed loop"
  - 90 to 95° F air at 10 to 20% r.h.
  - Remove water & return

Step 4. Drying

- In-line dessicant with HVAC system

Step 4. Drying

Impediments to drying

- Vinyl wall covering
- Vinyl flooring

Step 4. Drying

Case work is an impediment to drying

Step 4. Drying

- Impediments
  - Cove base
  - Insulation

Step 4. Drying

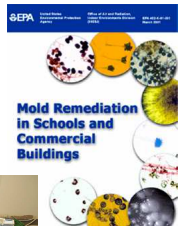
- Infection prevention concerns
  - Isolate footprint
    - Barriers & negative pressure
  - Air circulation
    - 1,000 cfm fans aerosolize dust
  - No "Air scrubbers"
    - HEPA-filtered, 2,000 cfm fans
    - Suspend more dust than they capture
  - Drying contractors do not understand hospitals
    - They need coaching and watching

Step 5. Not dry in time

- Not identified in the water footprint

Step 5. Not dry in time

- What is the policy?
- Most have adopted EPA Guidelines
  - > 48 hours wet – remove and replace
  - Overly cautious
  - Based on growth in pure culture media
- Mold is mold
  - All mold is addressed the same



Step 5. Not dry in time

- Overly cautious
  - Test project
  - No growth @ 3 & 8 days

Step 6. Mold growth present

- Visible mold growth can appear 5 to 15 days later
  - Odors can occur in the same time frame
- Mold cleaning & removal is a standard construction activity
- Conduct PCRA/ICRA
  - Barriers, depressurization & standard controls
  - Emphasis on worker hygiene & clothing
    - Control spread of dust
  - Household bleach (10 water: 1 bleach)
    - Other cleaning compounds
  - HEPA-filtered vacuum cleaners
  - Bag or seal waste

Standard ICRA Control Measures

- Patient relocation/protection
- Physical barriers
- Negative pressure
  - HEPA-filtered negative air machines
- Personal hygiene
- Tacky walk-off mats
- HVAC system protection
- Clean waste containers
- Infection prevention commissioning