When GOOD Buildings Go BAD

Recognition, Evaluation, and Control of Building Indoor Air Quality (IAQ) Issues
Common IAQ Issues

- Microbial Contamination
- Ventilation: Fresh Air Supply / HVAC Related Problems
- Specific Sources: Chemical Contaminants
- Building Envelope Review (typically moisture)

“There are no sick buildings – only mismanaged ones”

Dr. Mike Berry – USEPA (ret.)
Molds and Mildew

Common terms for organisms in the Fungi Kingdom – also includes yeasts, mushrooms, puffballs, truffles, bracket fungi, etc.

Molds are everywhere on the planet!
– critical for recycling organic materials that allow plants and animals to live

Cheeses and antibiotics (e.g. penicillin) are two useful products of molds
Common Reservoirs

- Carpets
- Floors
- Upholstered Furniture
- HVAC Components
- Indoor Plants
- Crawlspace
- Basements
- Ceiling Tiles
- Insulation
Hidden leaks
Cleaning activities - healthcare
Factors in Mold Growth

- Water-saturated or flooded areas:
  - wet carpet
  - plumbing leak
  - roof leak
  - wet crawlspace / basement

- Indoor Relative Humidity Level >65 % = potential concern

- Food sources:
  - ceiling tiles
  - drywall
  - wood/paper products
  - most cellulose-based or organic materials
Examples of Fungi

Some Common Molds Include:

- *Aspergillus sp.* - Aspergillosis
- *Stachybotrys sp.* - “Toxic Mold”
- *Penicillium sp.*
- *Chaetomium sp.*
- *Cladosporium sp.*
Mold in Buildings

Aspergillus and Gliocladium on Crawlspace Floor Joist

Stachybotrys on Basement Wall

Aspergillus on Closet Drywall
Mold – What is the Problem?

- In 2004, the Institute of Medicine (IOM – part of National Academy of Sciences) found there was sufficient evidence to link indoor exposure to mold with upper respiratory tract symptoms such as coughing and wheezing in otherwise healthy people;
- The IOM also found limited or suggestive evidence linking indoor mold exposure and respiratory illness in otherwise healthy children. (from CDC 2011 – Potential Health Effects from Molds in Buildings and Homes)
Mild transitory responses to severe chronic illness

- Effects dependant on a variety of factors:
  - age
  - health
  - individual sensitivity
  - genetic predisposition

- Estimated Percentage of American Allergy Sufferers:
  - 14% - Sinusitis
  - 10% - Asthma
  - 9% - Dermatitis
  - <1% - Hypersensitivity Pneumonitis

-from Institute of Medicine, 1993
Mold Health Effects II

Infection - not a common occurrence — Hospitals more an issue however

- Most At Risk:
  - Immuno-compromised individuals

- Hospital environments:
  - *Aspergillus sp.* a particular concern

- Animal Borne / Windborne Contamination
  - *Coccidioides, Histoplasma, Blastomyces*
Molds produce chemicals (VOCs) during metabolism:
- alcohols
- aldehydes
- acidic compounds

Exposure may cause irritation to mucous membranes in eyes and respiratory system

These chemicals are responsible for “moldy” odors:
- “rotten” or “musty” smells

Odors may cause perception of health concerns
Products of secondary metabolism in molds - act as “poisons” to hinder or kill competing molds and/or bacteria - also toxic to humans, birds, and livestock

Exposure through inhalation and skin contact: - effects depend on the toxin produced - can be widespread - may target respiratory, vascular, reproductive, and nervous systems

Glucans - major constituent of fungi cell walls - may have irritant effects similar to endotoxins
Examples of Bacteria

Commonly Encountered in IAQ Testing:

*Micrococcus sp.*

*Staphylococcus sp.*

*Bacillus sp.*
**Legionnaires Disease** (pneumonia)
Contracted by inhalation of water droplets or mist with *Legionella* bacteria

**Pontiac Fever**
milder form of Legionnaires disease (w/o pneumonia)

Associated with standing or stagnant water: condensate pans, cooling towers, unused drinking fountains, etc.

- Water droplets with bacteria become aerosolized
- Inhaled into lungs
- Immune-compromised individuals most at risk
Sewage Back-Flow in Buildings

- **Coliform bacteria:**
  - *E. coli*
  - *Salmonella sp.*
  - *Shigella sp.*

- **Viruses:**
  - Rotavirus
  - Enteroviruses
  - Hepatitis A

- **Parasites:**
  - *Giardia*
  - *Cryptosporidium*
Microbial Exposure Standards for Testing

- Federal and State Regulatory Standards 
  DO NOT EXIST 
  (currently)

- Industry and Organizational Standards Vary

- Professional Judgment and Experience is Critical
Microbial Exposure Levels

- **Air Samples**
  - Colony-forming units per cubic meter (cfu/m$^3$)
  - Spores count/m$^3$

- **Exposure Level Risk Assessment**
  - Genera/Species Identified
  - Levels Detected
  - Environmental Setting / Population
    e.g. Hospital: Lower Tolerance for Microbial Contamination vs. Office Building
Microbial Assessment

- Physical Inspection & Moisture survey - considered primary means of assessing if mold present

- Air sampling and other testing (swabs or directs) – secondary means of assessment
Need to Regulate?

- **Water damage and mold** – multi-billion dollar industry

- **Includes hundreds of firms in Virginia**
Federal Regulations (no-not really)

No real federal regulations –
Attempts in 2003 and 2005 in Congress to regulate mold (Toxic Mold Protection Act) - unsuccessful

Other Regulations/Guidance Documents

- State Programs – Florida, Texas, California, New York, DC, Maryland (on hold) – other states in process of setting up programs
- Virginia mold licensing program - eliminated by Governor McDonald
- Other “Guidance” Documents
- American Conference of Governmental Industrial Hygienists/American Industrial Hygiene Association
Other Regulations/Guidance Documents

- Institute of Inspection, Cleaning, and Restoration Contractors (IICRC)
- IICRC – S-500/ S-520
- New York City Guidelines
- World Health Organization (WHO)
- Center for Disease Control and Prevention (CDC)
EPA Guidance Document:

*Mold Remediation in Schools and Commercial Buildings*
*March 2001*

- Not required, but serves as a “defacto” industry standard

**Recommended Cleanup Methods:**

- Wet Vacuum
- Damp-wipe Surfaces
- HEPA Vacuum
- Discard Materials
OSHA Mold Guidelines

- Is not mandatory – meant to address lack of regulations on part of OSHA in addressing mold

- Very similar in structure to the EPA guidelines.

- Enforce via General Duty clause
Mold and HVAC-Related Issues

- Improperly / poorly maintained ventilation units can lead to microbial contamination by generation of bioaerosols

- Regular HVAC maintenance and cleaning is critical - check coils, condensate pan, filters, ductwork
“I’m not sure, but I think he’s acting as a consultant.”

Christopher J. Chapman, CIH
Senior Principal
ECS Mid-Atlantic.