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Mold and Moisture Awareness

Presented by:
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Right People. **Right** Perspective. **Right** Now.

About

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  - Senior Project Manager at Forensic Analytical Consulting Services
    - Environmental Health Consulting Company
  - Masters of Public Health at UCLA
  - Certified Industrial Hygienist

An Introduction to Environmental Health

Environmental Health Science

- The study and management of the human health impacts of physical, biological and chemical agents in the community and workplace

- The focus is on characterizing these risks and developing practical means for their control

A Multitude of Agents….

CHEMICAL

- Asbestos
- Silica
- Lead
- VOCs
- Gases & Vapors
- Particulates & Fibers
- Chemical Products

PHYSICAL

- Noise
- Vibration
- Radiation
- Heat/Cold Stress
- Ergonomic

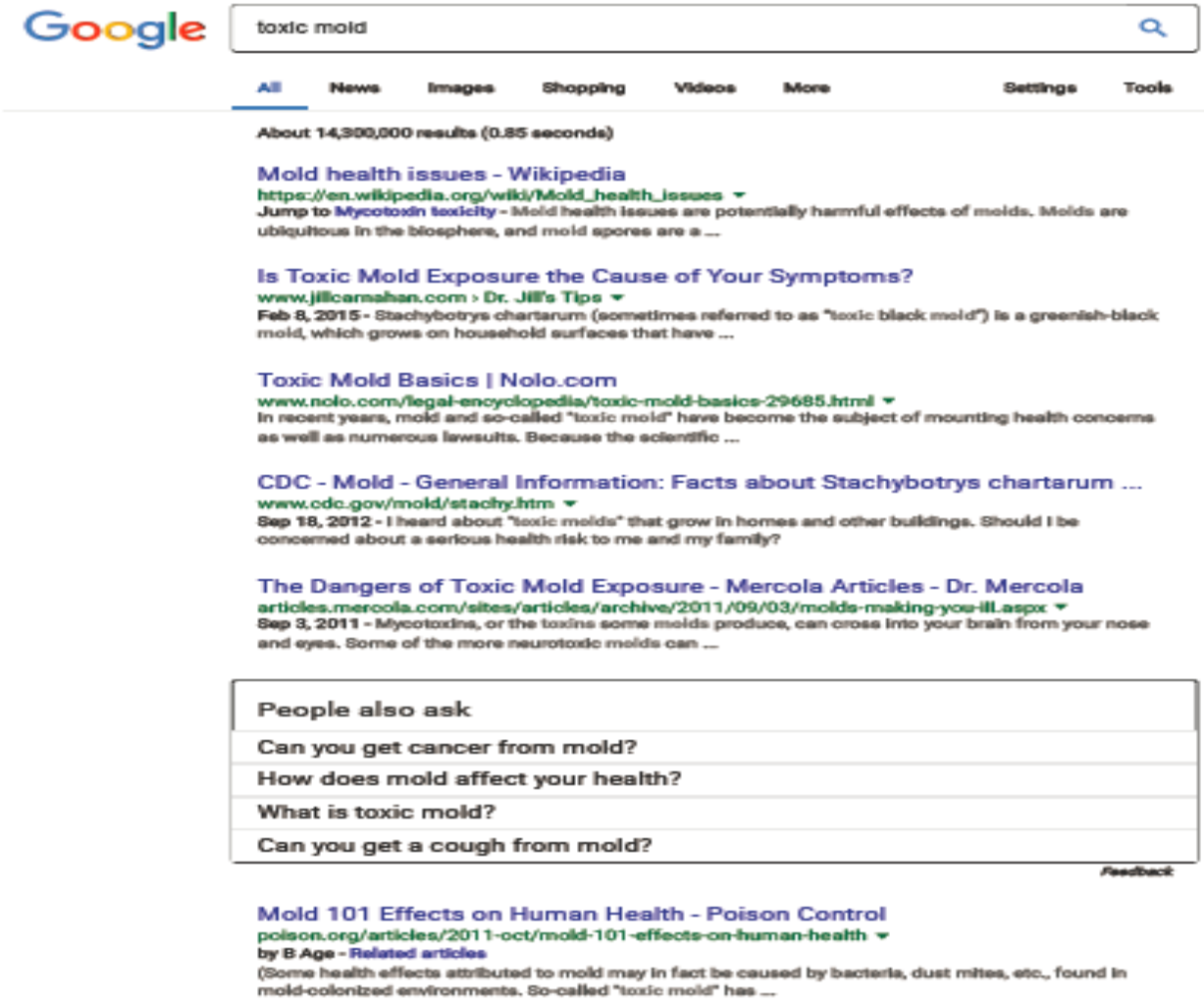
BIOLOGICAL

- **Mold**
- Legionella
- MRSA
- Norovirus
- Allergens
- Viruses & Bacteria
- Bloodborne Pathogens

Agenda

- Mold Basics
  - What's special about mold?
  - Mold 101
  - Who is who???
- Mold Investigations
  - Initial Assessment
  - Sampling
  - Data Interpretation
  - Conclusion
- Remediation
  - Removal Recommendations
  - Post Remediation Assessment

Mold Basics



Why is Mold an Issue?

- People have a greater awareness of hazards in their environment.
- Construction boom.
  - Materials
  - Quality
- Nationwide increase in adult onset and childhood asthma.
- Media attention.
    - "Toxic Black Mold"
- Litigation

Why Be Concerned?

- Potential adverse health effects.
- Property damage.
- Negative publicity.
- Lost productivity.
- Lack of scientific consensus.
- Lack of regulated control mechanisms.
- Liability and litigation.

Mold 101

Definitions

- Fungus Organisms of the kingdom fungi. Role is to decompose organic matter.
- Mold A layperson's term for fungi typically observed in the indoor environment.
- Mildew 1) A technical term describing types of fungi associated with specific plant disease, 2) A layperson's term for a thin layer of fungal growth commonly found in a built environment (i.e. grout)

- Rot condition caused by specific types of fungi associated with the decomposition of wood (e.g., white rot, brown rot, soft rot).

Definitions

- **Lumber Yard Mold** 1) A layperson's term for fungal growth existing on wood structural members prior to installation in a building. Typical background condition existing in virtually all wood structure buildings. 2) A pseudo-technical term describing the types of fungi expected to be found growing in wood in the natural environment (e.g., ophiostoma, ceratocystis).
- **Black Mold, Toxic Mold** Terminology emerging from the media in the mid-nineties used to describe fungi with the potential to produce harmful mycotoxins.

Growth Conditions

- Readily available needs:
  - Temperature between 32 to 122 ºF. Most fungi grow optimally at about room temperature.
  - Nitrogen
  - Most need oxygen
  - Light or dark conditions
  - Various minerals

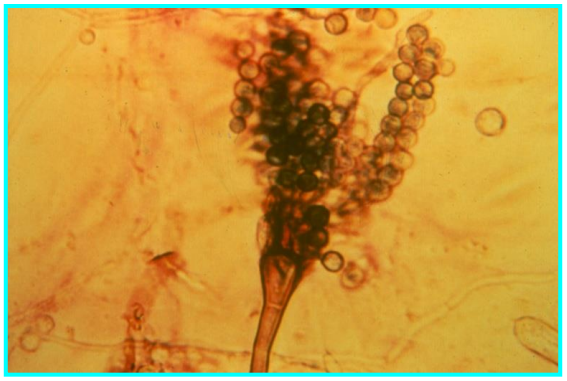
Growth Conditions

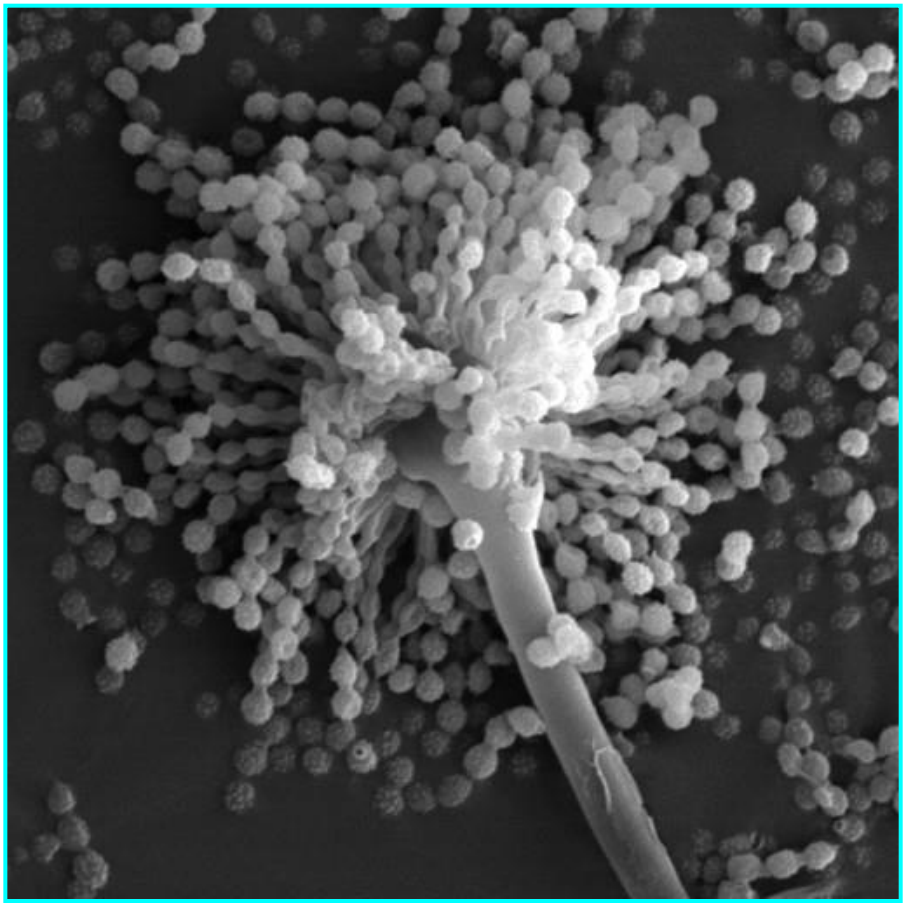
- Limiting factors in the built environment:
  - Carbon-based food source (e.g., wood, drywall paper, dust, leather, paper, etc.).
  - Moisture (water source)

Nomenclature and Prevalence

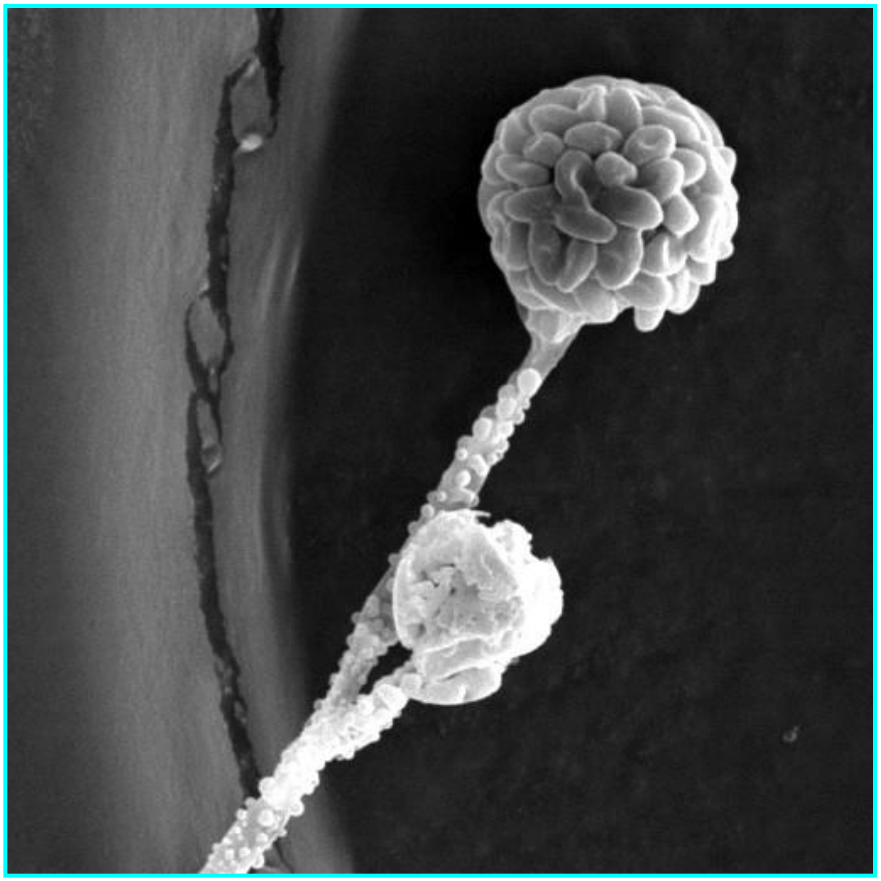
- Format is genera followed by species:
  - *Aspergillus fumigatus*
  - *Aspergillus flavus*
- Common in ambient air (California):
  - *Cladosporium, Basidiospores, Alternaria, Ascospores*
- Associated with water intrusion events:
  - *Aspergillus, Penecillium, Stachybotrys, Chaetomium, Scopulariopsis, Ulocladium*

Aspergillus





Stachybotrys



Health Effects

Health Effects - Allergic

- Occurrence
  - Approximately 5% of the population expected to have allergic symptoms upon exposure.
- Sensitivity
  - Varies from person to person and can be acquired over time (sensitization).
- Common Symptoms
  - Allergic asthma or allergic rhinitis (hay fever).
  - Runny nose, scratchy throat, etc.

Health Effects - Infectious

- Generally does not occur in healthy individuals.
- Sometimes seen in healthy populations:
  - Valley Fever (Coccidioides)
  - Histoplasmosis (Histoplasma)
  - Farmer's Lung (Aspergilliosis)
- Immune compromised at higher risk:
  - cancer patients (undergoing chemotherapy)
  - organ transplants (immunosuppresive drugs)
  - uncontrolled diabetes

Health Effects - Toxic

- Accepted
  - Ingestion of moldy foods causing harmful illness.
  - Inhalation causing short-term fever-like illness.
- Debated
  - Serious adverse health effects from low level exposures in buildings.
  - “There are very few case reports that toxic molds inside homes can cause unique or rare, health conditions such as pulmonary hemorrhage or memory loss. These case reports are rare, and a causal link between the presence of the toxic mold and these conditions has not been proven.” -CDC

Who is Who???

- Industrial Hygienist (IH)
  - Professionals that specialize in environmental hazards. IH's attempt to identify areas of water intrusion and mold growth and make recommendations regarding corrective actions.
- Microbiologist/Mycologist
  - Laboratory personnel that analyze the samples.
- Remediation Company
  - Those that remove the mold growth in accordance with industry guidelines.

Investigation Strategies – Initial Assessment

When to Investigate?

- Initiating factors:
  - visible mold growth observed
  - musty odors observed
  - visible water stains/ moisture problems
  - reported physical symptoms of occupants

When to use an outside consultant?

1. Inexperience with microbial growth?
2. Cause of microbial growth is unknown
3. Extent of growth and contamination unknown
4. Remediation will significantly disturb growth
5. Documentation, specifications desired
6. Liability issues, 3rd party needs

Basic Strategy for an Initial Assessment

- Testing of hypotheses (i.e. sampling, visual assessment, destructive testing)
- Data interpretation criteria
- Acceptance or modification of hypotheses

Basic Strategy for an Initial Assessment

- Develop a building history
  - occupant complaints/symptoms
  - occupant observations
  - incidents of water intrusion
  - prior investigations

Basic Strategy for an Initial Assessment

- *Visual inspection – Non Invasive*
  - Observation of conditions
    - What do you see?
  - Formulation of hypotheses
    - Is there mold growth?
    - Is there a potential for mold growth?
  - Moisture meter readings

Basic Strategy for an Initial Assessment

- Where to look (destructive/non-destructive)?
  - Occupied & unoccupied visible space
  - Under/behind coverings (i.e. baseboards)
  - Wall cavities
  - Attics/plenums/crawlspaces
  - Under/behind/within contents
  - HVAC system
  - Outdoor space
  - Plumbed areas (eg. Sinks, tubs)

Destructive Testing – Invasive Inspection

- Opening a portion of the building material for further investigation
- Testing the hypothesis

Sample Methods

To Test or Not to Test?

- *"You're the expert, you tell me."*
  - What is your budget?
  - How definitive do you want conclusions to be?
  - How much evidence do you want for support?
- Only test defined hypotheses.
  - Well planned testing leads to useful data and supportable arguments.
- Can you handle the results?
  - Analyze the potential scenarios emerging from testing results.

Sample Types

- Surface Sampling
  - Microvacuum (PCM cassette)
  - Tape lifts
  - Swabs
- Bulk Sampling
- Air Sampling
  - Spore trap
  - Viable (petri dish)
  - Polycarbonate Filter

Laboratory Analysis Choices

- Common:
  - Spore Trap
  - Viable
  - PCR (**P**olymerase **C**hain **R**eaction)
- Specialized:
    - mVOC (**m**icrobial **V**olatile **O**rganic **C**ompounds)
    - Mycotoxin
    - Allergen

Data Interpretation

Challenges

- No accepted exposure standards.
    - lack of clear dose-response relationships
- Vague industry guidelines.
    - non-specific case/control comparisons
- Weak statistical power.
    - small sample sizes, short sampling times
- Decisions need to be made anyway!
    - data stretched to the limit

Reaching Conclusions

- Depends on questions being asked:
  - Is mold present in the building and where?
  - Are contents contaminated?
  - Was remediation done properly?
  - What was occupant exposure?
- Data characterization:
  - Indicating factors
  - Modifying factors
- Balancing data points:
  - History
  - Observations
  - Sampling data

Sample Interpretation
(General Guidelines)

- Air samples:
  - indoor/outdoor, affected/non-affected comparison
  - comparison levels: 1-2x = normal, 2-10x = elevated
- "What is it?" samples:
  - tape: trace/minor = normal, major/abundant = elevated
  - swabs: <1k cfu/in.^{2} = normal, 10-100K = elevated

Reaching Conclusions

- Confirmed/Suspected Mold Growth
  - visible, sampled, data suggest presence of growth
  - e.g, elevated samples, extrapolation from D.T.
  - Recommendation: remediate

- Potential Mold Growth
  - conditions conducive to growth, limited other data
  - e.g., staining, moisture, history of intrusion
  - Recommendation: investigate

Reaching Conclusions

- Mold Growth Not Suspected (Potential Remains)
  - none visible, data suggests absence of growth
  - e.g, no elevated samples, extrapolation from D.T.
  - Recommendation: no actions or investigate
- No Significant Evidence of Potential Mold Growth
  - no conditions conducive, no data suggestive
  - Recommendation: no actions

Guideline Documents (1)

- American Industrial Hygiene Association (AIHA)
  - Field Guide for the Determination of Biological Contaminants in Environmental Samples (1996)
- Institute of Inspection, Cleaning and Restoration Certification (IICRC)
  - S500 Standard and Reference Guide for Professional Water Damage Restoration (1999)
- American Conference of Governmental Industrial Hygienists (ACGIH)
  - Bioaerosols: Asssessment & Control (1999)
- Environmental Protection Agency (EPA)
  - Mold Remediation in Schools and Commercial Buildings (2001)

Guideline Documents (2)

- New York City Department of Health
  - Guidelines on Assessment and Remediation of Fungi in Indoor Environments (2002)
- Occupational Safety & Health Admin. (OSHA)
  - A Brief Guide to Mold in the Workplace (2003)
- Institute of Inspection, Cleaning and Restoration Certification (IICRC)
  - S520 Standard & Reference Guide for Mold Remediation (2008)
- More on the way…..

Remediation

Remediation Elements:

- *Scope of Work.* Determine the what the correct scope of work that is necessary to successful remediate the issue (via consultant or qualified individual). Including the proper personal protective equipment and containmant provisions.
- *Regulated Materials*. Prior to commencing remediation activities, building materials that may be disturbed should be assessed for asbestos and lead-based paint hazards per applicable regulations.

Remediation Elements:

- *Personal Protective Equipment*
    - Protect workers from elevated exposures.
- *Containment*
    - Control the release of fungal spores & fragments.
    - Ensure ventilation provisions in the area are turned off.

Remediation Elements:

Work Practices

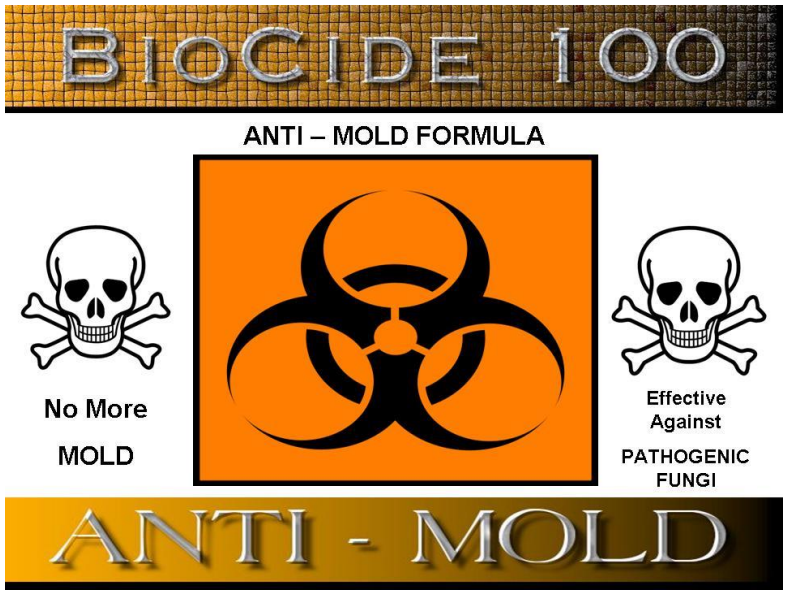
- Removal and cleaning while minimizing disturbance.
- Negatively pressurize the work area and exhaust out of the work area with HEPA filtration

Remediation Methodology

- Fix the underlying cause of moisture intrusion and microbial growth.
- Remove microbial growth and contamination.
- Dry out affected materials.
- Confirm proper remediation.
- Reconstruction.

Work Practices

- Removal
  - HEPA vacuuming, vacuum assisted tools, damp-wiping, scrubbing (i.e. wire brushing), material discarding
  - 18” past any visible growth, staining or damage
- Encapsulants
  - Targeted use



- Biocides
  - "ACGIH and others discourage the use of biocides and antimicrobial agents without appreciating their limitations and potential hazards of their use instead of removing microbial contamination from building environments." (Chap 16-1)

Contamination of Contents

- Clean horizontal and vertical surfaces in place.
- Wet-wipe hard, non-porous surfaces.
- HEPA vacuum soft, porous surfaces. Disposal of porous materials exhibiting growth may be necessary.
- Launder or dry-clean textiles.

Post Remediation Assessment

Post Remediation Assessment

- Containment provisions in place
  - Isolate subject area
  - Zipper entry
  - Neg pressure
- Moisture content of selected building materials within recommended ranges.

Post Remediation Assessment

- Scope of removal in accordance with specification (SOW)
- Area reasonably free of visible mold growth, dust, and debris.
- Air Samples: Types and concentration of spores less than outdoor controls

Where Remediation Goes Wrong

- Incomplete drying.
- Blowers spreading mold contamination.
- Mold is painted over or bleached.
- Failure to use containment.
- Failure to determine full extent of growth.
- Failure to properly clean.
- Failure to address cause of moisture.

Thank You!

Forensic Analytical Consulting Services, Inc.

Right People.

Right Perspective.

Right Now.