



Indoor Environmental Quality -- Dampness and Mold Growth

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Outline

- Introduction –Why Indoor Environmental Quality is important
- A systems approach to indoor environmental quality
- Why mold grows in buildings
- Potential health effects
- Cleanup recommendations
- Using community partnerships to address concerns about dampness and mold growth



Background– How does Indoor Environmental Quality (IEQ) fit with public health

- First building codes were health based
 - Clean drinking water, wastewater disposal, fire protection (means of egress), overcrowding, ventilation, overcrowding, adequate lighting
- Indoor Environments are a Public Health Issue
 - Americans in urban and suburban areas spend 90% of time indoors
- Addressing indoor environments meets several categories of the 10 essential public health services
 - Diagnosing and investigating health problems and health hazards in the community
 - Providing unbiased information/education to empower people to make choices that improve indoor environments
 - Developing partnerships at the local level to identify and solve problems
 - Enforcing of laws and regulations that protect and ensure public health and safety (not necessarily public health law)



Why is IEQ important

Consequences of poor IEQ, including dampness and mold occur are society wide in homes, schools, public, and commercial buildings

Exposures indoors are different indoors that at work or outdoors

Economic consequences

- Water is the number one cause of damage to buildings
- Eventually mold causes damage decay and lost of structural integrity and ability to perform as designed and intended
- Health care costs
- Growth of mold assessment and remediation industry and costs to repair including property insurance
- Potential health hazards of damp and moldy buildings/protect vulnerable populations
 - Children
 - Economically disadvantaged
 - Elderly
 - People with weaken immune systems

Lack of information, awareness, education and interest in root causes



Economic Consequences

- Health care costs attributable to dampness and mold and allergic rhinitis in North Carolina \$81 million
- Health care costs attributable to dampness and mold and acute bronchitis in North Carolina \$ 13 million
- Health care costs attributable to dampness and mold and asthma in North Carolina 32 Million

Valuing the Economic Costs of Allergic Rhinitis, Acute Bronchitis, and Asthma from Exposure to Indoor Dampness and Mold in the US, Journal of Environmental and Public Health Volume 2016, Article ID 2386596,

Sampling and testing for airborne Mold costs about \$100-150 per sample, minimum of three samples

Mold Professionals hourly rate is between \$80-100. CIH >\$120 per hour

Mold remediation services \$30/square foot not including repairs to correct underlying water sources and 'put back'-- replacement of finishes and furnishings



A systems approach to promote healthy indoor environments

Consider Buildings as interactive systems based on how the outdoor conditions and How buildings designed, constructed, operated, repaired, maintained and used (occupant activities)

Consider interactions between building components (the building envelope) systems (plumbing, heating, ventilation, and air conditioning), equipment, and people

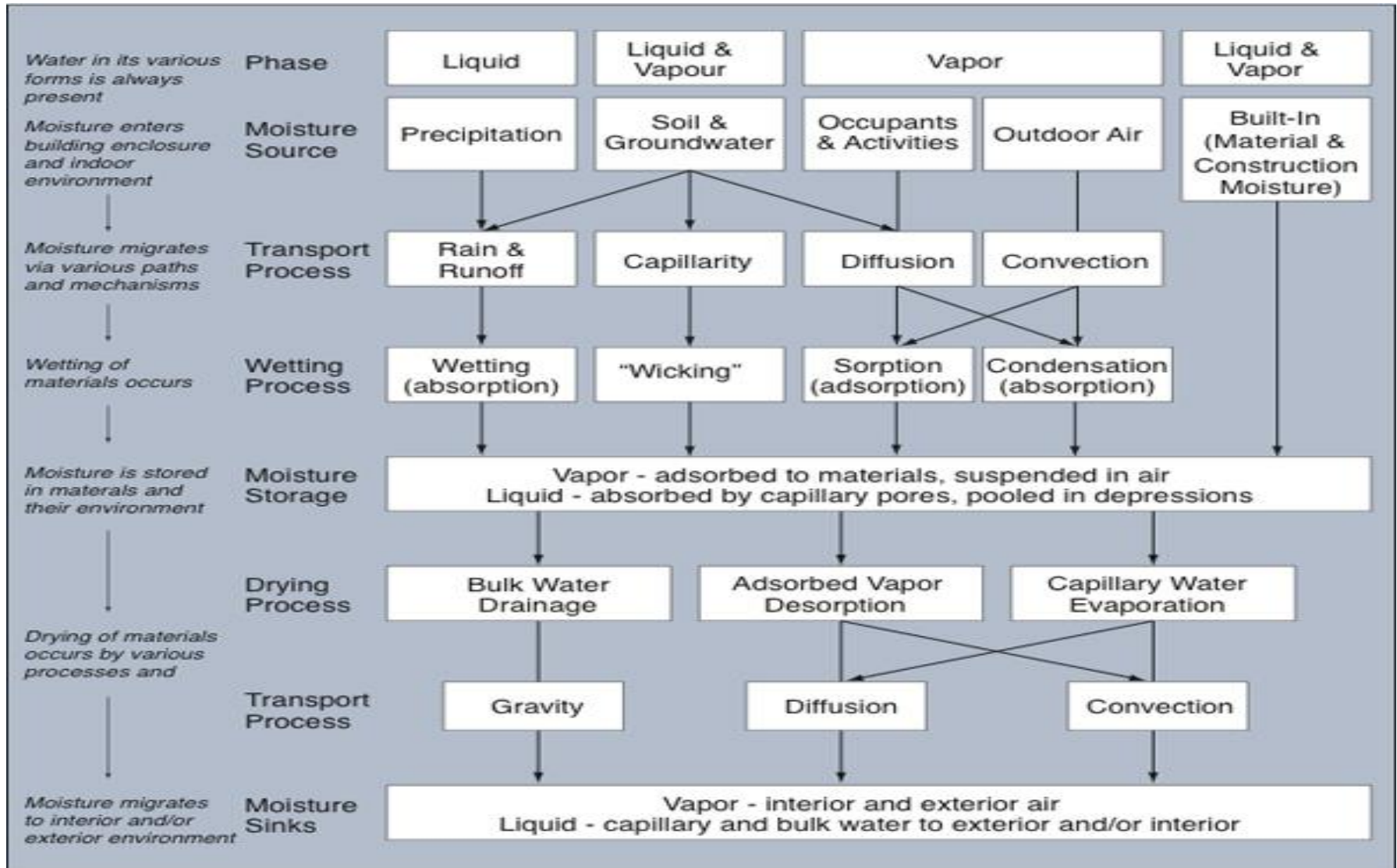
All the stakeholders must communicate and cooperate to achieve common goal of creating indoor environments that tend to promote health and well being– “Healthy Buildings”

Buildings that tend to promote health and wellbeing are:

- **Dry**
- **Clean**
- **Properly Ventilated**
- **Thermally controlled**
- **In good repair**
- **Well Maintained**
- **Contaminant Free**
- **Pest Free**
- **Safe**



Principle 1 --Dry



Straube, Moisture in Buildings, ASHRAE Journal January 2002, Moisture sources, transport and storage in buildings

Water in buildings

- Water exists as a solid (ice), liquid or vapor
- Bulk water intrusion (rain, snow, or groundwater)
- Capillary action (wicking)
- Air transported moisture
- Vapor diffusion

Materials and contents can get wet and dry out based their characteristics and surrounding environmental conditions

Sources

- Rainwater and groundwater
- Infiltration of hot and humid air
- High relative humidity and condensation surfaces
- Plumbing or fixture leaks
- Water vapor generated by occupants
- Poorly designed, operated and maintained Heating Ventilation and Air-Conditioning (HVAC) Systems



Ways to express water in air and in materials

Relative Humidity (RH) – shortened to Humidity

- Ratio (percentage) of amount of moisture in air compared to amount air could hold if saturated *at a given temperature*
- Warm air holds more moisture than cool air.
- *Always measure both temperature and relative humidity*

Dew Point (DP)—*Temperature at which air is saturated, RH = 100%;*

- *Water condenses on surfaces cooler than the dew point of surrounding air*
- *Used to calculate mass or absolute humidity, (milligrams/cubic meter) of water vapor in the air*

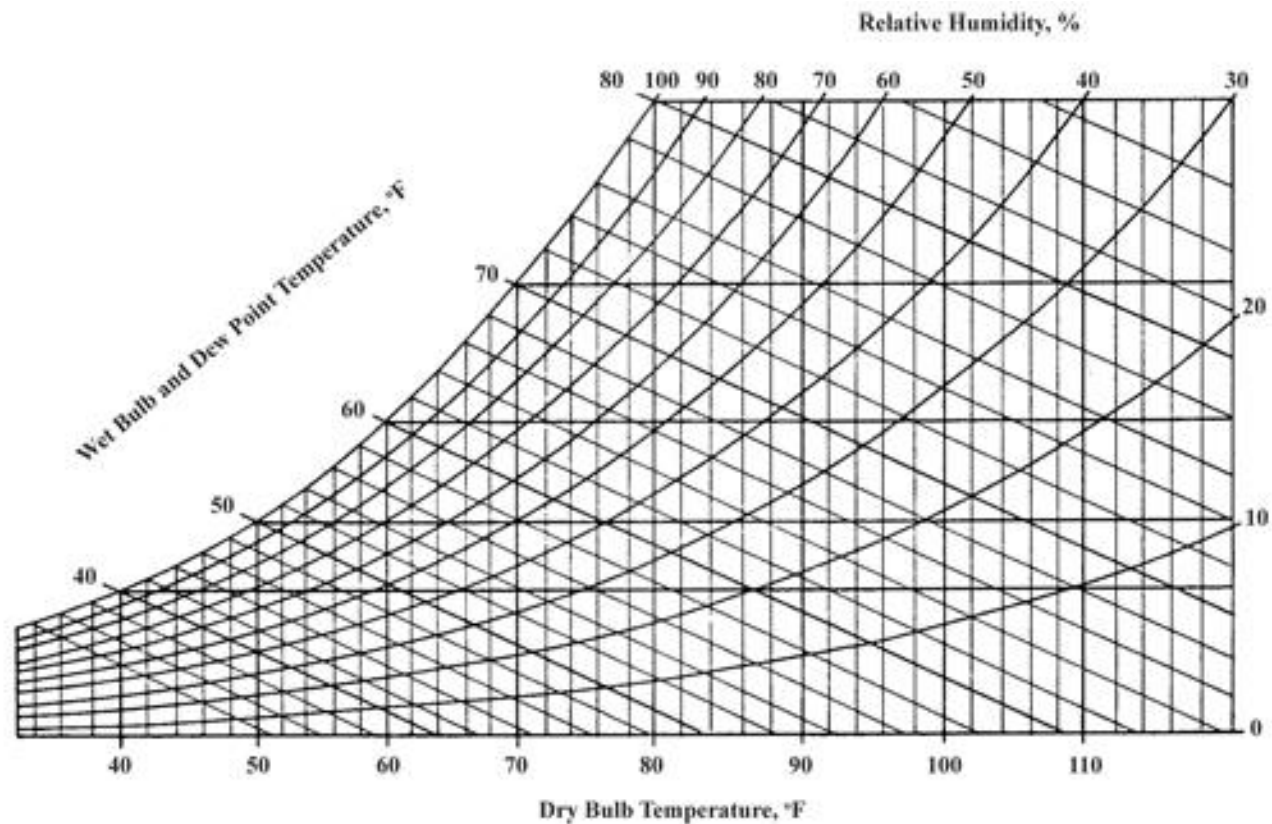
Absolute Humidity --Measure of water vapor (moisture) in the air, independent of temperature. Expressed as grams/m³

Equilibrium Moisture Content (EMC) in materials

Also known as Available water (Aw). The amount of moisture in a material compared to the amount of moisture the material could hold when saturated



Simplified Psychrometric Chart

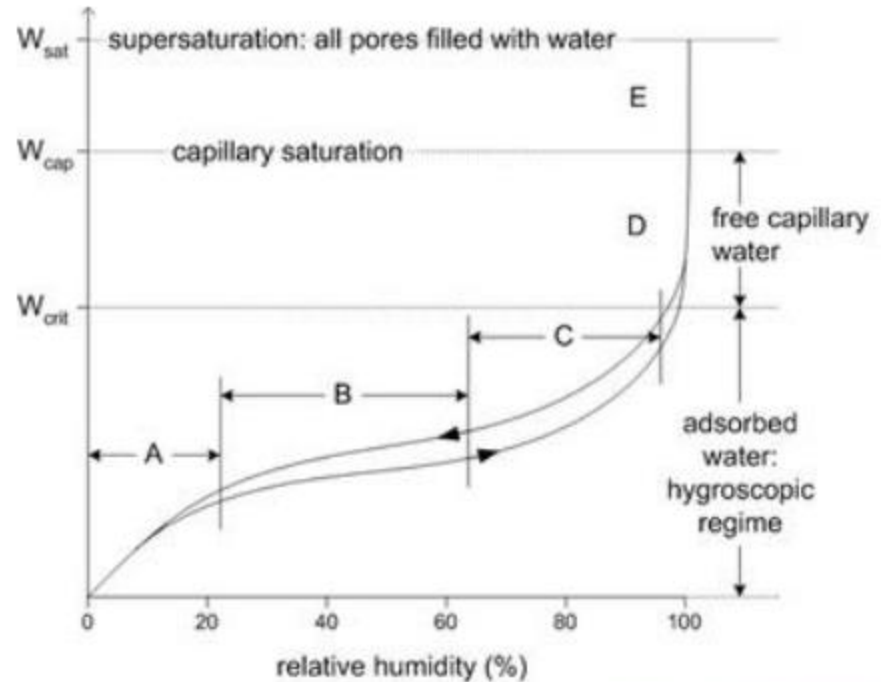
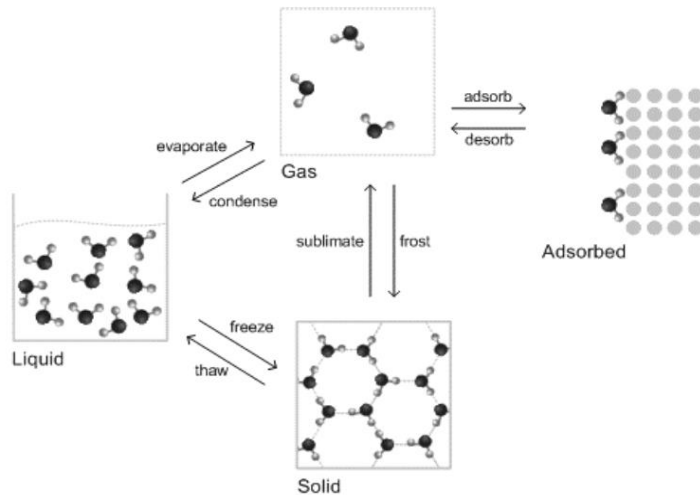


X axis at base of graph in F°

Dew point Temperature in °F are horizontal lines

Curved lines are for relative humidity in %

Moisture states , adsorption, absorption, capillarity



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- A: Single-layer of adsorbed molecules
- B: Multiple layers of adsorbed molecules
- C: Interconnected layers (internal capillary condensation)
- D: Free water in Pores, capillary suction
- E: Supersaturated Regime

Measuring moisture in air and materials

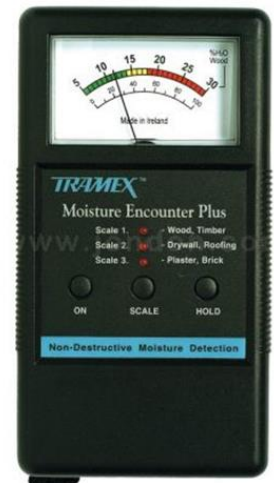
- Air
- Always measure temperature and humidity
- Measure surface temperature to predict condensation surfaces

Materials

Quantitative measurements --Best data is for solid wood

- <16% acceptable
- 16% – 20% Possible elevated surface molds may be present
- 20% – 28% – Border-line for wood decay
- 28% – Wood decay and rot likely to be present

Qualitative measurements – Measure areas thought to be wet to compare against similar materials known to be dry



Design & construction issues



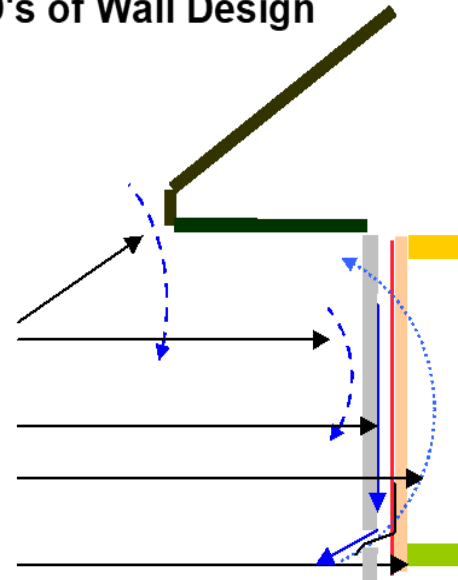
Poor condensate drainage

Outside grading, drainage & wall design

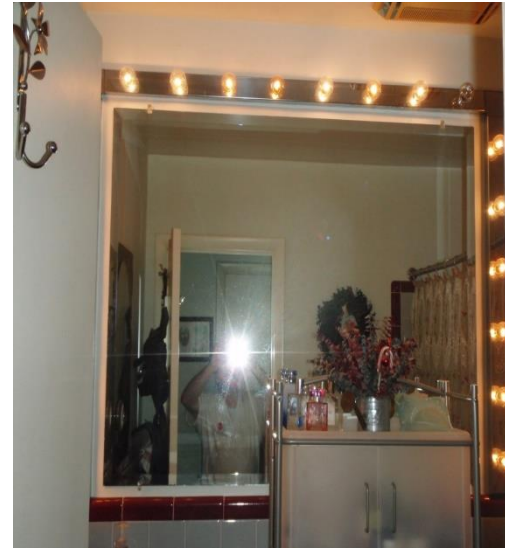


The Four D's of Wall Design

- Deflection
- Drainage
- Drying
- Decay Resistance



Condensation



Principle 2 --Clean

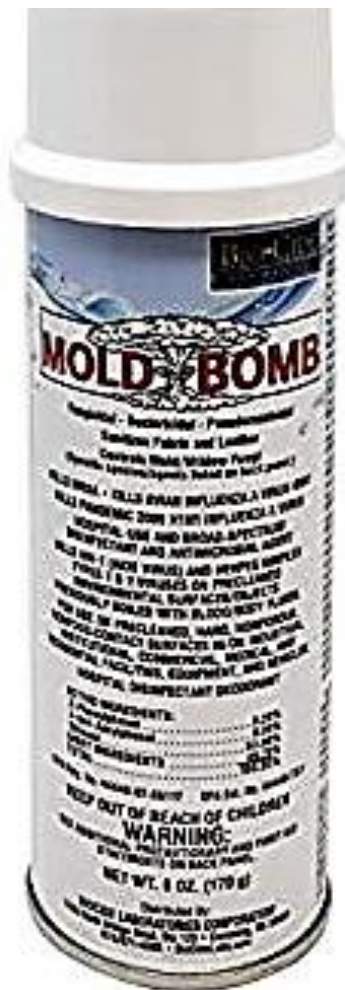
Cleaning for health is an environmental management process

- Prevents pollutants from entering the indoor environment
- Finds, identifies, captures, contains, removes, and disposes indoor contaminants
- Leaves minimal residues of contaminants, cleaning agents, and moisture behind
- The level of cleanliness desired or required is dependent on site and situation



Cleaning versus sanitizing and disinfecting

- Sanitizers and disinfectants reduce the number of germs on clean and hard surfaces and are Registered as by Environmental Protection Agency (EPA) as anti-microbial pesticides



May contain hazardous ingredients

Will using the products provide added value beyond cleaning and drying?

Will benefits exceed risks from exposure?

Follow label instructions for safety and efficacy. The label is the law

Current guidance is that cleaning and drying is sufficient to remove mold growth from most environmental surfaces



Principle 3--Properly Ventilated



Ventilation

- Supply adequate amounts of *clean* (outdoor) air to a space
- Remove contaminated air from space (general or local exhaust ventilation)
- Dilute contaminants
- Filter air
- Air treatment
- Pressurization to control air flow direction
- Control temperature, and humidity

Required amounts of outdoor air

Building codes require minimum amounts of outdoor air based on use of the space, occupant density and square footage at the time the building was designed

Current NC Building Code

- Day care (<4) 10 CFM/person based in 25 occupants/1000ft +0.18/ft²
268 CFM of outdoor air
- Classroom (5-8) 7.5 CFM/person based on 25 occupants per 1000/ft²
187 CFM of outdoor air
- Classroom (>9) 7.5 CFM per person based on 35 occupants per 1000/ft²
262 CFM of outdoor air

Most commercial systems recirculate some indoor – can calculate minimum opening for outdoor air intake based on flow through system If total flow is 500 CFM

Day care (0.4) 0.53

Classroom (5-8) 0.37

Classroom (>9) 0.52

Air Changes per Hour

Number of times air is completely replaced in a room per hour

Example day care

268 CFM per minute X 60 Min = 15720 cubic feet per hour

room area is 1000 ft² with 8-foot ceilings = volume 8000 ft³

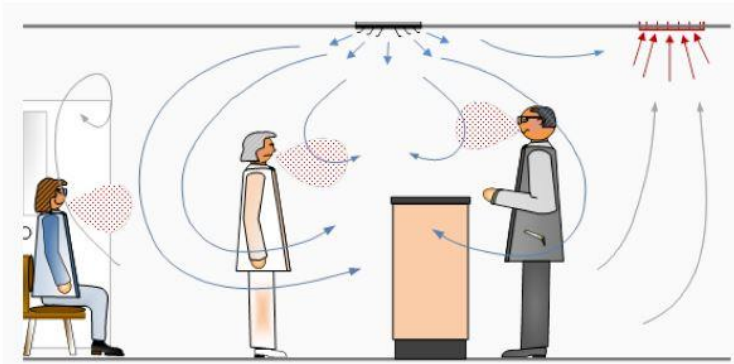
approx. 2 air changes per hour or one air exchange in 30 minutes

CDC recommends 5 air changes per hour for controlling infectious aerosols based on central ventilation system, natural ventilation or air cleaners

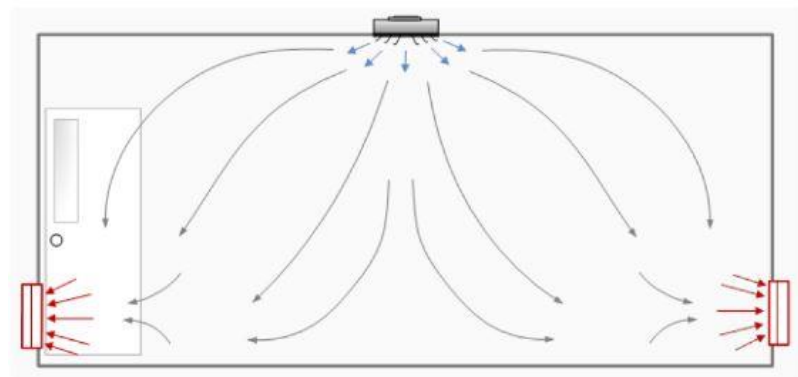
5 ACH would be equivalent to 40,000 cubic feet per hour or 666 equivalent CFM/min

Could achieve equivalent air exchange with 2 portable air cleaners with a Clean air delivery rate of 350 CFM appropriately placed in the classroom

Air flow-- Directions matter



- Any one can be a source of infectious particles
- Particles follow air currents



Consider optimizing the type and location of supply and exhaust to enhance airflow, mixing, dilution and removal of contaminants.

Heating ventilation & Air conditioning

Heating Ventilation and Air Conditioning (HVAC) systems can be complicated complicated

- Some buildings were never designed for mechanical cooling
- Some buildings have many additions or renovations at different times with different types of HVAC systems
 - Split system heat pumps
 - Wall mounted heat pumps
 - Central systems
 - Chilled water systems for cooling
 - Hot water systems for heating
- HVAC equipment and building envelope designed to meet current applicable codes at the time of construction
- Some buildings have variable occupancy on daily basis
- Most common refrigerant R-22 is being phased out, no new refrigerant can be manufactured or imported

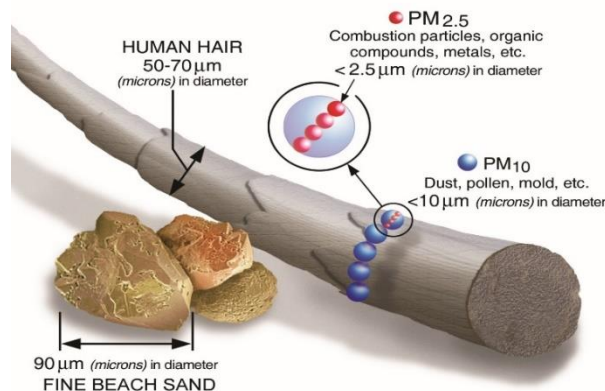
Filtration

Filter type	Capture Efficiency	Contaminant
MERV 8	<20 % of 0.3 to 3.0 μ particles 70-95% of 3-10 μ particles	hair, carpet fibers, pollen, and dust mites
MERV 13	>75% 0.3-10 μ particles	mold spores, pet dander, and smoke
HEPA	99.997% of 0.3 μ particles	Most penetrating particle size

Fan must be operating for filter to work

Larger particles may settle from air before being captured by the filter

Higher efficiency filters are more costly may have higher resistance to air flow



Air Cleaners and Antimicrobial Pesticide Devices

Despite aggressive marketing, the consensus is to avoid air cleaners that use bipolar ionization, negative ion generation, cold plasma, or other additive technologies

- <https://www.epa.gov/pesticides/pesticide-devices-guide-consumers> for issues concerning efficacy of disinfecting the air
- Unknown and uncertain about secondary pollutants or byproducts from reactive species and organic compounds normally found in air

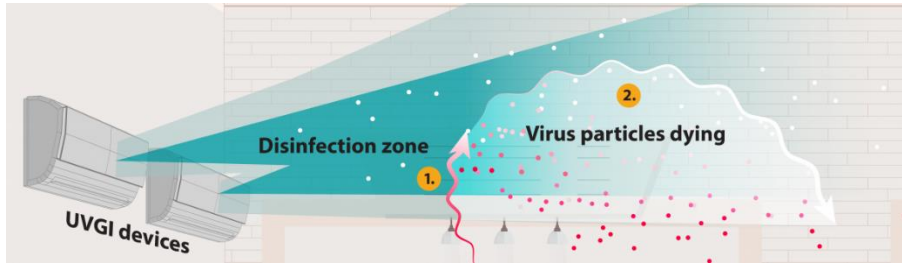


Ozone generators should never be used in occupied spaces

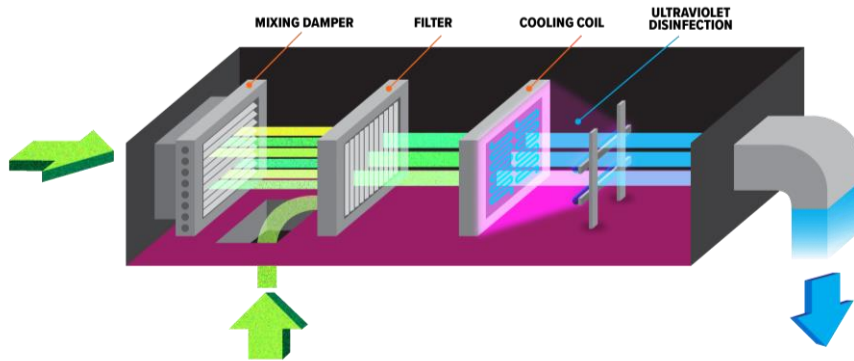
Ultraviolet germicidal irradiation

- Along with good filtration can be effective to protect HVAC coils from fouling and microbial growth
- Less evidence of effectiveness of in-duct Ultraviolet light disinfection systems

Ultraviolet Germicidal Radiation



Upper air UV germicidal irradiation



In duct UV Radiation



UV radiation at coil

The case of the poorly ventilated room

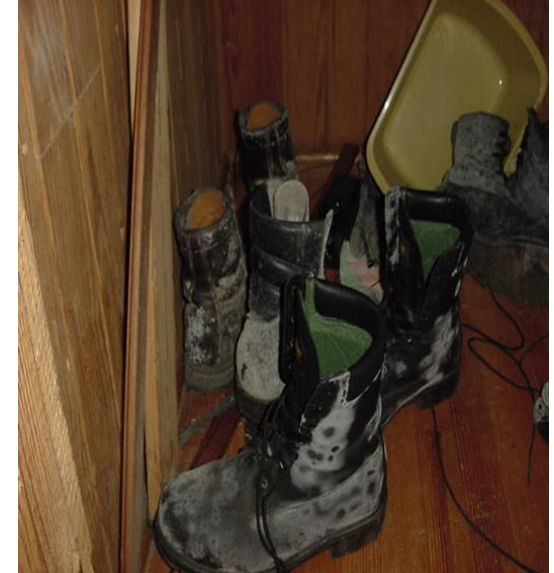
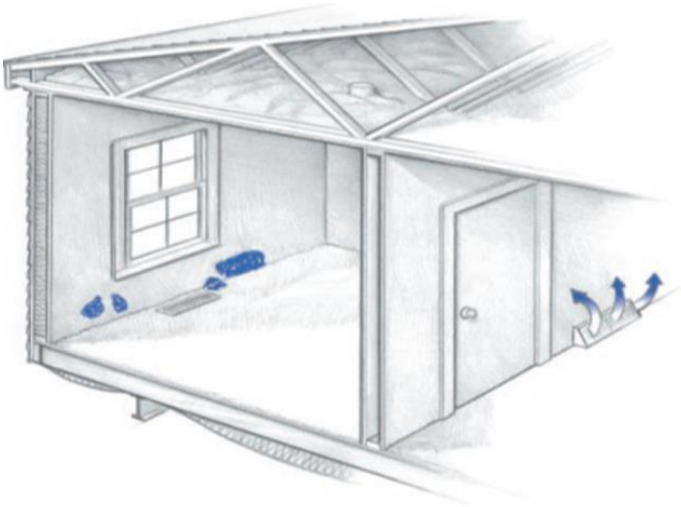


Image from MHRA Moisture Problems in Manufactured Homes:
Understanding their causes and finding solutions

Principle 4--Thermally controlled

Comfort Criteria American Society of Heating
Refrigeration and Air-Conditioning Engineers (ASHRAE)
Standard 55

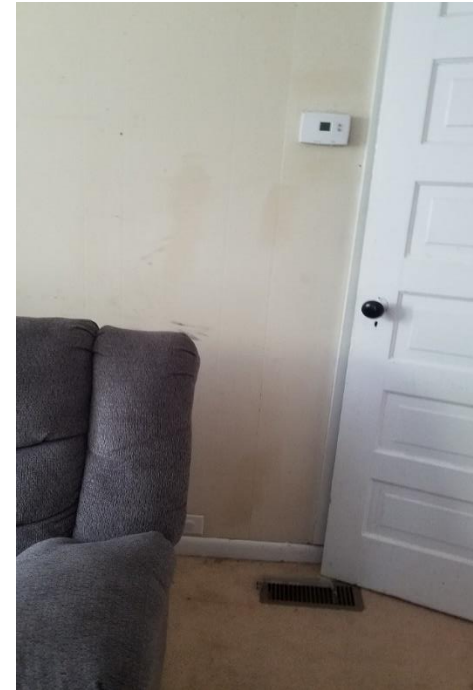
Winter -- 30% to 60% and 65°F - 76°F.

Summer-- 30% to 60% and 74.0°F - 80.0°F.

- Does not account for heat sinks, radiant sources or air drafts
- Assume light sedentary activity with appropriate clothing
- Comfort is subjective- ideal comfort criteria satisfy 80-95% of people

Early warning sign in air-conditioned spaces

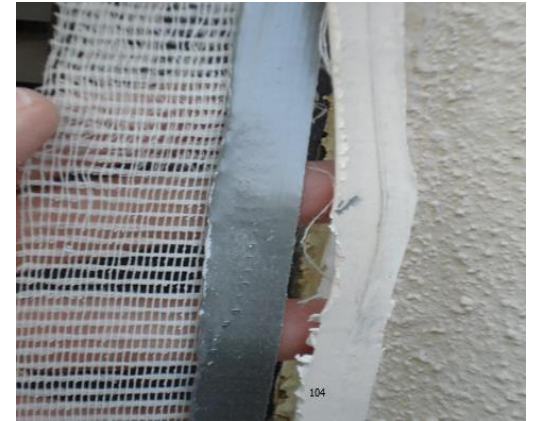
- Persistent dew point temperature > 60°F with mechanical cooling



Poor location for thermostat

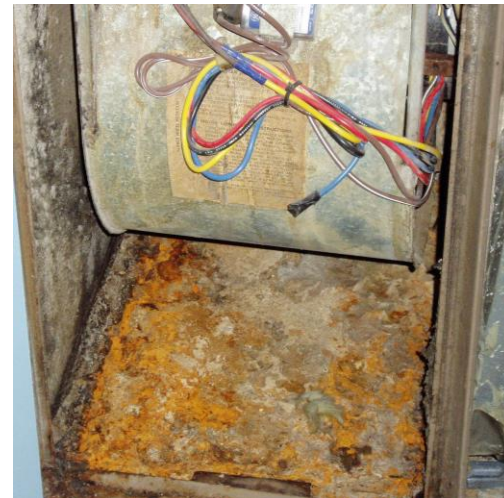
Principle 5--In good repair

Repairs occur when systems facilities and equipment are damaged, deteriorated, corroded and will not perform as designed and intended



Principle 6—Well maintained

Maintenance keeps systems, equipment, and facilities working as designed and intended



Principle 7--Contaminant Free

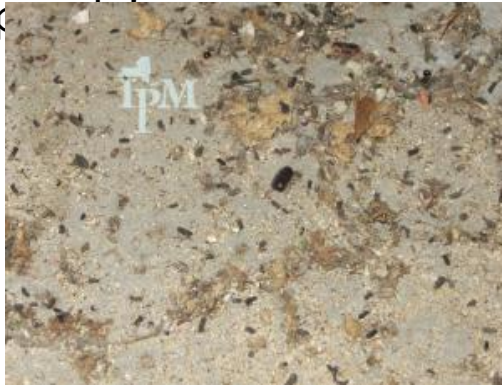


Principle 8 --Pest-free

Other irritants and allergens -- roaches, mites and rodents

Integrated Pest Management aligns with healthy homes model

- Establish for acceptable levels for control of pests
- Use practices that keep pests out, deny pests food and water, and limit harborage
- Take advantage of the pest's biology and behavior.
- Use chemicals (pesticides) when nonchemical treatments fail to provide acceptable control in a manner that targets the pest, limit effects on nontarget pests, and limit



Principle 9--Safe



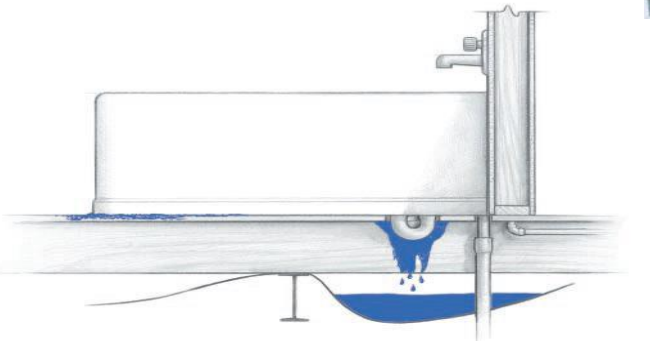
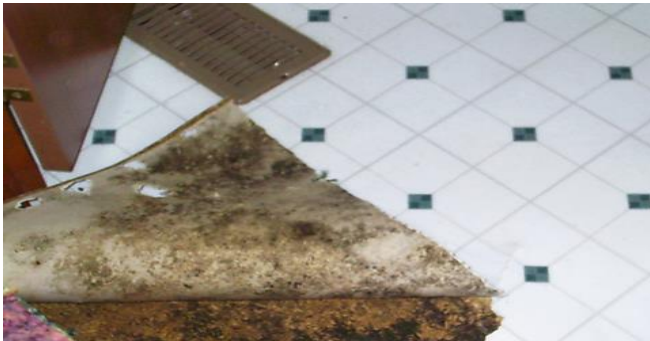
- Slips, trips and falls
- Fires and burns
- Drowning
- Choking, suffocation and strangulations
- Poisoning



Manufactured homes

Design and construction

- Materials sensitive to water damage
- Integrated floor system with plastic barrier “bottom board”
- Installed quickly at the site by several contractors
- Often set-up with poor exterior drainage, lack ground vapor retarder and poorly installed skirting



Demographics

- About 13% of NC residents live in manufactured housing, about 497,000 dwellings
- Up to 30% of dwellings in NE NC live in mobile homes

Equity issue

Real or Personal property?

Who owns the manufactured home?

Who owns the lot?

Mobile homes are considered real property when: 1) Used as a residential structure, 2) On a permanent foundation and 3) Owner of home also owns land



Dampness and Mold



What are molds?

Kingdom of Fungi

- Yeasts, mildews, and mushrooms
- Decay organisms
- One of many parts of the indoor microbiome
- Ubiquitous -- more than 100,000 species worldwide
- About 50 species typically colonize indoor environments
- Latin names by Genus and species
 - *Aspergillus fumigatus*
 - *Stachybotrys Chartarum*

Mold contains:

Spores --Reproductive structures

Hyphae –

- Branching filamentous vegetive growth structures
- Rigid cell walls
- Hyphal fragments re present in household dusts

Other products of molds

- Hyphae secrete enzymes and other substances to break down organic matter for uptake
 - Metabolic waste products -- volatile organic compounds responsible for odors
- Secondary metabolites – mycotoxins



Examples of Mold Growth



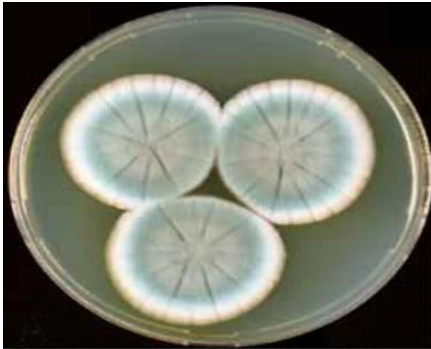
Blue cheese



Mold on windowsill



Mold growth in drywall



Penicillium Chrysogenum



Mold on crawlspace floor joist



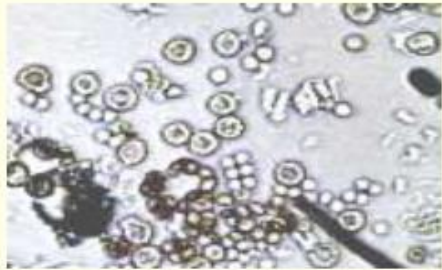
Mold inside a wall cavity



Cladosporium



Ascospores



Penicillium/Aspergillus/hyaline



Alternaria



Bipolaris-like



Epicoccum

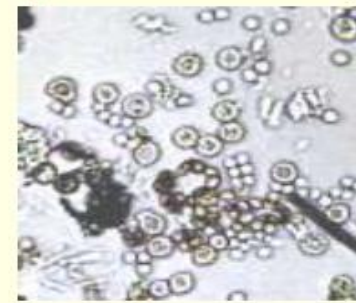


Curvularia



Smut-like

Spores most commonly associated with indoor growth (amplification)



Penicillium/Aspergillus
Other hyaline spores



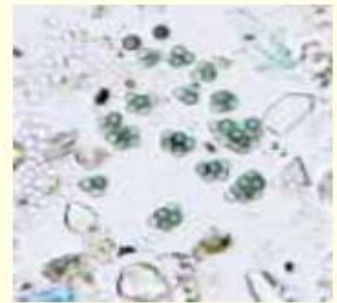
Stachybotrys



Chaetomium



Pithomyces & Ulocladium



Trichoderma-like

Environmental conditions that promote mold growth

Presence of mold spores –a few mold spores are everywhere and unavoidable

Food sources—

- Abundant, can be any organic building materials, contents or organic dust, dirt, debris, or other residues on inorganic surfaces

Temperature

- Many indoor molds optimum temperature for grow 68°F- 86°F

Adequate moisture – free, and adsorbed moisture available for uptake by the fungi

- Most molds require water activity greater than 0.7 at the surface

Persistently damp materials are prone to decay, deterioration, corrosion, structural damage, and loss of function

Environmental conditions that promote mold growth promote environmental bacteria (actinomyces), dust mites, insect pests, and rodents

Chemical vapors from household items like sanitizers and disinfectants may contain irritants, allergy, and may be asthma triggers



Water accumulation on flat roof



Moisture problems from site grading and landscaping



Moisture Problems in basements and crawlspaces



Water damage and mold from plumbing leak wicking



Poorly vented clothes dryer



Health hazards of damp and moldy indoor environments

Mold and Health Effects-- NIOSH Alert (2012) Sufficient epidemiological evidence that occupants of damp and moldy buildings are at greater risk of developing :

- Upper and lower respiratory tract symptoms - cough and wheeze
- Respiratory infections
- Asthma, and exacerbation of asthma,
- Shortness of breath (dyspnea)
- Allergic rhinitis

Limited evidence of an association between damp and moldy buildings and bronchitis

Clinical evidence that exposure to mold and other microbial agents in damp buildings increases the risk of hypersensitivity pneumonitis, chronic rhinosinusitis, and allergic fungal sinusitis

Insufficient or unavailable evidence to determine evidence of an association between damp buildings and: fatigue, weakness, muscles aches, cramps, joint pains, morning stiffness, abdominal pain, diarrhea, headache, memory loss, difficulty concentrating, confusion, learning difficulties, disorientation, mood swings, anxiety or panic

Association is not causation



Mechanisms for health impacts

Hypersensitivity -- allergic reactions, like chronic rhinosinusitis,
Irritation and inflammation

Allergy, irritation, and inflammation may act alone, in series, as a cascade, or in any combination

Toxic effects –ingestion of foods contaminated by mycotoxins are well documented, whether a person can inhale an effective doses of mycotoxins to cause a health hazards is unclear

Opportunistic infections in immune compromised persons

- Histoplasmosis
- Blastomycosis
- Coccidiomycosis
- Candidiasis

Sensitive and susceptible persons

Children and elderly
Preexisting disease –Asthma, COPD
Hypersensitive persons
Diabetes
Burn patients

Transplant patients
Medications –Steroids,
Chemotherapy, treatment
for autoimmune diseases



Mycotoxins and toxic black mold

Mycotoxins are substances produced and released by molds as secondary metabolites

- >200 mycotoxins identified including aflatoxin (*Aspergillus sp*), tricothecenes (*Stachybotrys sp*), and Penicillin (*Penicillium chrysogenum*)

1993-1997-- CDC case reports on infants with acute pulmonary hemorrhage associated with exposure to toxic black mold, *Stachybotrys chartartum*

2000 -- CDC Update: review 1993- 1997 investigations concluded that earlier association between exposure to *Stachybotrys chartarum* was not proven.

Most important exposure pathway to mycotoxins is from ingestion

Mycotoxins are relatively large and heavy– do not readily become airborne, are attached to mold particles

- Inhalation in most environments is unlikely to be significant exposure risk
- Standard cleaning practices to remove mold and mold particles also remove mycotoxins

No Diseases (ICD) Code for Chronic Inflammatory Response Syndrome CIRS

- No increases or clusters of CIRS after major floods like Hurricane Katrina
- Laboratories can accurately and reliably analyze urine for mycotoxins or metabolites, but tests have not been approved by the FDA for diagnostic purposes and may not be clinically valid or useful.



Hazard assessment

Hazards are potential harms from a condition

Thorough and Informed inspection

Degree that source water is contaminated

Locations where damp materials may have been, are present, or will be occur if moisture sources are not corrected,

Types of affected materials

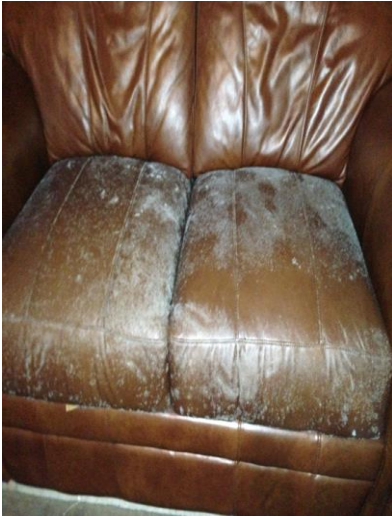
Size of the affected areas

Degree that materials and contents are damaged by water or colonized with mold growth

Type of occupancy, perceptions of occupants and presence of sensitive occupants



Many faces of mold



Many faces of mold



Risk assessment, perception, and communication

- Risk is the probability and severity of harm from hazard- qualitative or quantitative
- Risk Perception -- Risk = Hazard X Outrage – how people perceive risks --risks tend to be less acceptable when
 - Involuntary
 - Uncontrolled
 - Unfamiliar
 - Unfair
 - Costs > benefits
 - Catastrophic potential
 - Poorly understood
 - Uncertain
 - Victim identity
 - Dreaded outcome
 - Mistrusted
 - Media attention (sensationalized)
 - Unethical
 - Caused by human activity
 - Previous history or experience
 - Effects on children
 - Delayed effects

Risk communication –Provide the audience with knowledge to make informed, reasoned, and independent judgments about risks to their health, safety and the environment

- Who is audience
- Risk communication should be meaningful, understandable, and actionable



Mold sampling and testing

Government Guidance

- EPA – if visible mold growth, water damage or moldy odors are present, in most cases sampling is not necessary
- CDC does not recommend routine sampling for molds
- Division of Public Health –LEA letter 2001

Sampling *might* be useful to prove/ disprove testable theories, for post remediation verification, or may be required for litigation/insurance purposes

Do not collect samples or test for molds if any answers to these questions are NO

- Has there been an informed, and systematic inspection of the site/conditions?
- Has the inspection been used to develop testable theories?
- Will sampling and testing assist to identify of sources mold growth?
- Are there pre-determined criteria to interpret results?
- Are limitations/uncertainties in sampling and testing considered and explained?
- How will results inform, change or modify the remedial actions beyond fixing moisture sources and removing mold growth?



Sampling and testing for indoor molds

Sampling

- Sampling strategies and methods describe when, where, how, and the number samples to collect for data quality assurance
- How will results be interpreted? Can a grab sample in time and space be useful to infer about the whole, any other time, or any other conditions?



Testing (analysis)

- Physical measurements, identifying and counting mold spores, fragments and other particles under a microscope
- Culture-based sampling grow spores to identify genus and species
- Assays for chemical compounds or products associated with mold, microbial growth, or biological contamination.



Misconceptions about mold sampling and testing

Caveat Emptor. Fixing the underlying reasons that materials became damp enough to support mold growth may better use of resources than environmental sampling and testing

Will sampling and testing assist to identify of sources mold growth?

- No -- Not without the context of the through informed inspection and testable hypothesis

Does sampling and testing sampling and testing represent an exposure assessment?

- NO -- A sample collected in an area does not represent what a person may have inhaled, There is no single sampling method for every constituent of mold growth and other biological agents associated with damp and deteriorated environments

Is sampling and testing a health risk assessment?

- NO -- Since the samples do not represent what a person inhaled; they cannot be a health risk assessment. More than a small amount of mold growth in normally damp places is unacceptable independent of the type of mold



Interpreting sampling and testing results for indoor mold

No standards for acceptable levels of

- airborne mold spores,
- other components of mold growth or
- other bioaerosols

Spore trapping –Most common sampling methods. Test results provide a comparison of the levels, types, and relative abundance of mold spores in air at the times and places the samples were collected

Laboratory reports often contain information about hazards of molds identified in the samples but have no knowledge of site-specific conditions

The person who collected the samples has knowledge about the site-specific conditions is the only person who should interpret the results based on the thorough and informed inspection

General Principles of Mold Remediation

- *Goal is to restore the building to a clean and dry condition*
- Identify potential sources of excess moisture
- Follow moisture flow through materials and contents to find mold growth and water damage
- Fix sources of moisture intrusion or accumulation
- Develop cleanup/remediation plan – get mold growth out of space
 - Isolate, contain work areas based on probability that moldy dusts will be generated and dispersed to protect workers, occupants, and non-impacted areas
 - Use work practices to limit generation and dispersal of moldy dusts
 - Remove and dispose organic and porous materials
 - Clean hard surfaces in work areas and adjacent areas

EPA Guidance [Mold Remediation in Schools and Commercial Buildings](#).

Industry Standards, example Institute for Inspection, Restoration, Cleaning Certification (IICRC) S520 Standard for Professional Mold Remediation



Mold remediation – questions, judgements, and agreements

- Recommendations, Industry standards, or regulation?
- Applicable to every site/situation?
- Realistic, evidence-based, and affordable?
- Maintenance or repairs?
- D-Y-I or an “in house activity”?
- When to call a professional?
- What kind of professionals should be selected?
- Professional Judgement on when and what kinds of environmental controls are needed?

General agreement as projects become more complex, levels of environmental controls increases

- As source water becomes more contaminated
- As difficulty to dry materials increases
- When mold growth is present in places that increase exposure (inside HVAC systems)
- As scope of work trends away from cleaning and toward removal of moldy materials
- When there are sensitive and susceptible people who require a higher level of control (health care facility)



When is remediation complete?

- Underlying moisture problem identified and eliminated
- Isolation of the work area was appropriate and effective
- Mold removal and worksite cleanup performed according to the site-specific plan
- Any additional moisture or water damage or mold damage found during remediation was properly addressed
- Upon completion, surfaces in the work area and adjacent areas are:
 - Dry
 - Free from visible dust and debris.
 - Without any musty or moldy odors



Assisting people concerned about IEQ and mold

Demystify mold– Assist people to understand the biology and “behavior” of indoor mold growth

Use Healthy Homes to transform dampness and mold growth into maintenance, repairs and operations and how buildings are used

- Consider other conditions that might be related, contributing, or aggravating symptoms
- Remember definitions of maintenance and repairs

Coordinate responses with partners

Inform, educate, and empower people to

- Understand the benefits diligence in effective maintenance and repairs
- Better use existing laws, codes, and resources
- Set realistic goals to improve IEQ
- Recommend consulting with healthcare providers– environmental exposure histories

Advocates – Assist consumers seeking outside help to select consultants, contractors and others for evidence-based and achievable ways to improve indoor environments



Where to get help

- HUD multi-housing family complaint 800 number
- Legal aid of North Carolina
- North Carolina Human Relations Commission
- Local Social Services
- Urgent Repair, Rehabilitation and Weatherization Programs



Who to call for help to investigate “mold”

General shortage of trained, experienced, unbiased, and affordable professionals who provide high quality surveys with evidence-based and realistic recommendations

Licensed Home Inspectors --Must report signs of abnormal or harmful water penetration, condensation, and deterioration of structural components

Industrial Hygienists –Expensive and trending away from taking on residential clients

Pest Control Professionals –Crawlspace/basement moisture control services

Registered professional engineers, forensic engineers, licensed architects

Specialty or general contractors & biohazard/crime scene contractors

Indoor Environmental Professionals (IEP) – Mold Inspectors and Mold Remediators

• *North Carolina does not require licensing, certification or registration for mold inspection and mold remediation services* <https://www.ncbold.com/license>

• <https://www.nclbgc.org/protecting-yourself-after-a-disaster/>

• <https://www.nclbgc.org/remodeling-home-improvement-contracts/>



Selecting and Air Quality Consultant

Find a professional who will provide service(s) that lead to an evidence-based action plan that promotes health and wellbeing.

Review the experience, reputation, and training and experience. Ask for references

Review proposals to ask about how the consultant will:

- Collect pertinent information about the history and current conditions
- Identify potential sources of contaminants and determine how the contaminants could move through the building.

If environmental testing monitoring proposal must explain

- The specific theory being tested
- The sampling strategy and analytical plan
- How the results will be interpreted
- How the results will inform the next actions



Two additional considerations during remediation

Asbestos and Lead-based Paint are regulated by the Health Hazards Control Unit by statute and rule

- Asbestos Containing Materials
 - Could be disturbed during renovation and demolition activities
- Lead-Based Paint Renovation Repair and Painting Rule (RRP) may be applicable in pre-1978 child occupied facilities



*Guidance for tenants with dampness
and mold problems in rental homes*



Regulation of Housing

Article 12. § 160D-1201 Minimum Housing Codes

Building inspectors can condemn as unsafe each building that appears to him to be especially dangerous to life because of its liability to fire, bad conditions of walls, overloaded floors, defective construction, decay, unsafe wiring or heating system...

- Legal order,
- Must follow agency procedures,
- Must provide for due process,

Evictions are a court order compelling tenant to vacate

Reasons for Evictions

- Nonpayment of Rent #1 cause
- Willful neglect of a property (not cleaning or maintaining the property responsibly)
- Code violations so severe that renovations or repairs require that the tenants be displaced



Minimum Housing Codes and General statutes

Minimum Housing Codes--Structure

- Space, use and facility standards
- Exit standards.
- Structural standards.
- Electrical standards
- Plumbing standards.
- Heating standards.

Minimum Housing Codes --Maintenance

- Grading and drainage
- Protective treatments such as painting and coatings
- Sanitation
- Garbage and Rubbish
- Exterior Areas
- Pest Control

§ 42-42 Landlord to provide fit premises.

Fit premises – structural condition

Keep systems and facilities in good repair

Smoke detectors and carbon Monoxide

12 conditions defined as Imminently Dangerous

§ 42-43. Tenant to maintain dwelling unit.

Clean premises as clean as condition permit

Prevent unsanitary conditions with tenant's control from developing



Public, affordable and subsidized housing

Purpose is to assist low-income families with children, the elderly, and disabled to live in safe decent and affordable housing—affordable housing is not an entitlement

- Housing assistance has many forms
 - Public housing is owned and operated by local Public Housing Authority (PHA)
 - Section 8 – Housing Choice Voucher –Administered through the PHA
Tenant applies for and receives a voucher and pays what they can.
The PHA pays remainder
 - Low Income Tax Credit Affordable Housing owned and operated by individual landlords, for profit corporations and not-for profit corporations who receive subsidies, tax breaks or tax credits in exchange for renting to low- and moderate-income people.



Tenant options when dampness and mold is present

1. Common ground with landlord
2. Minimum Housing codes
3. Fitness and habitability law

Tenant Option--1

- Transform “mold” into maintenance and repairs. Both parties want a home that is dry, clean, properly-ventilated, well-maintained, contaminant-free, pest-free, and safe
- Educate landlord of consequences
 - Accelerated deterioration of materials, equipment and contents;
 - Structural damaged and decay by infestations of wood destroying organisms and termites and;
 - Increased repair costs and possible reduction in property values.
 - Be specific about maintenance and repair needs
- Best outcome occurs when tenants and landlords communicate and cooperate



Tenant Option 2

Contact Minimum Housing Code Officials if available

- Emphasize structural, maintenance, and repair items that may be code violations instead of mold
- Be as specific as possible about needed maintenance or repairs that would prevent dampness or related to water damage
- Mold is not directly regulated by minimum housing codes
- Code Officials react poorly when complaint is about mold



Tenant Option-3

Enforce terms of lease agreement

- ***Don't withhold rent to force landlord to make repairs***
- Read the lease agreement
- Landlord must perform repairs
- Keep dwelling as clean and sanitary as conditions permit
- Keep records and documentation
- Negotiate a new terms of lease or rental agreement
- Can negotiate new terms (get any agreements in writing)
- File claim in small claims court to break lease, rent abatement or rent recoupment



Other related statutes

Fair Housing Law

- Reasonable accommodations or modifications for tenants with disabilities

Retaliatory Eviction

- General Statute 42.37.1 states residents can't be evicted for:
 - Requesting repairs
 - Filing a complaint to a government agency
 - Complaining to landlord
 - Exercising their rights under a lease agreement
 - Joining or participating in a tenant's rights group



OEE's Role

- OEE receives more than 1400 calls per year about dampness and mold in residential, school and commercial settings
- Need to move from “retail” to “wholesale” customer service model
- OEE will continue to provide support and get feedback from local health departments about
 - Technical expertise,
 - Best practices guidance
 - Training
 - Questionnaires
 - Materials for in-house training
 - Material for public



Final remarks

Healthy Homes offers a systems-based model to improve indoor environments

Indoor dampness, mold growth and other IEQ problems are complex technical and social problems

- Confusion about hazard characterization, risk assessment, and risk perception
- Lack of knowledge, understanding, poor communications and disconnect between
 - Designers,
 - Builders,
 - Building owners,
 - Managers,
 - Employers, and
 - Occupants
- How buildings are designed and constructed
- How buildings are operated, maintained, repaired, and used

Current evidence recommends observations of visible mold growth, moldy odors and water damage as the best indicators of probability and severity of health hazards.

How much mold is too much? Metrics for assessing dampness and mold are not refined enough for health risk assessments or to set explicit health-relevant guidelines or standards

