



*Responding to Inquiries About Indoor  
Environmental Quality, Dampness, and Mold*

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# Outline

Why Indoor Environmental Quality (IEQ), building dampness, and mold growth are public health concerns

Describe the Principles of Healthy Homes, a model to

- Investigate concerns and improve IEQ across a variety of buildings
- Increase collaboration with and between stakeholders -- Occupants, Tenants, Owners, Managers, Builders, Realtors, other stakeholders,
- Provide accurate, informative, and useful information to assist stakeholders to make evidence-based, realistic, affordable, durable and sustainable solutions to improve indoor environments

Describe mold, mold growth, and why indoor mold growth occurs

Review potential health hazards from indoor dampness and mold growth

Discuss the information and guidance we provide to address inquiries about dampness, mold growth, and other IEQ concerns



# *Indoor Environmental Quality (IEQ) is public health concern*

- Most Americans spend >90% of time indoors
- Water is the number one cause of damage to buildings including mold, rot, corrosion, durability, and sustainability
- The concentration and exposure patterns to indoor pollutants differ than industrial and outdoor environments
- Sensitive and susceptible populations
- COVID pandemic has enhanced awareness of good IEQ
- Healthy Building Principles aligns with 10 Essential Public Health Services
- <https://www.cdc.gov/publichealthgateway/publichealthservices/essentialhealthservices.html>
- *Major challenge is the disconnect, lack of communication and cooperation between stakeholders*



# *Principles of Healthy Buildings*

## *Model -- Keep buildings*

1. *Dry*
2. *Clean*
3. *Well ventilated*
4. *Thermally controlled*
5. *In good repair*
6. *Properly Maintained*
7. *Pest free*
8. *Contaminant free*
9. *Safe*

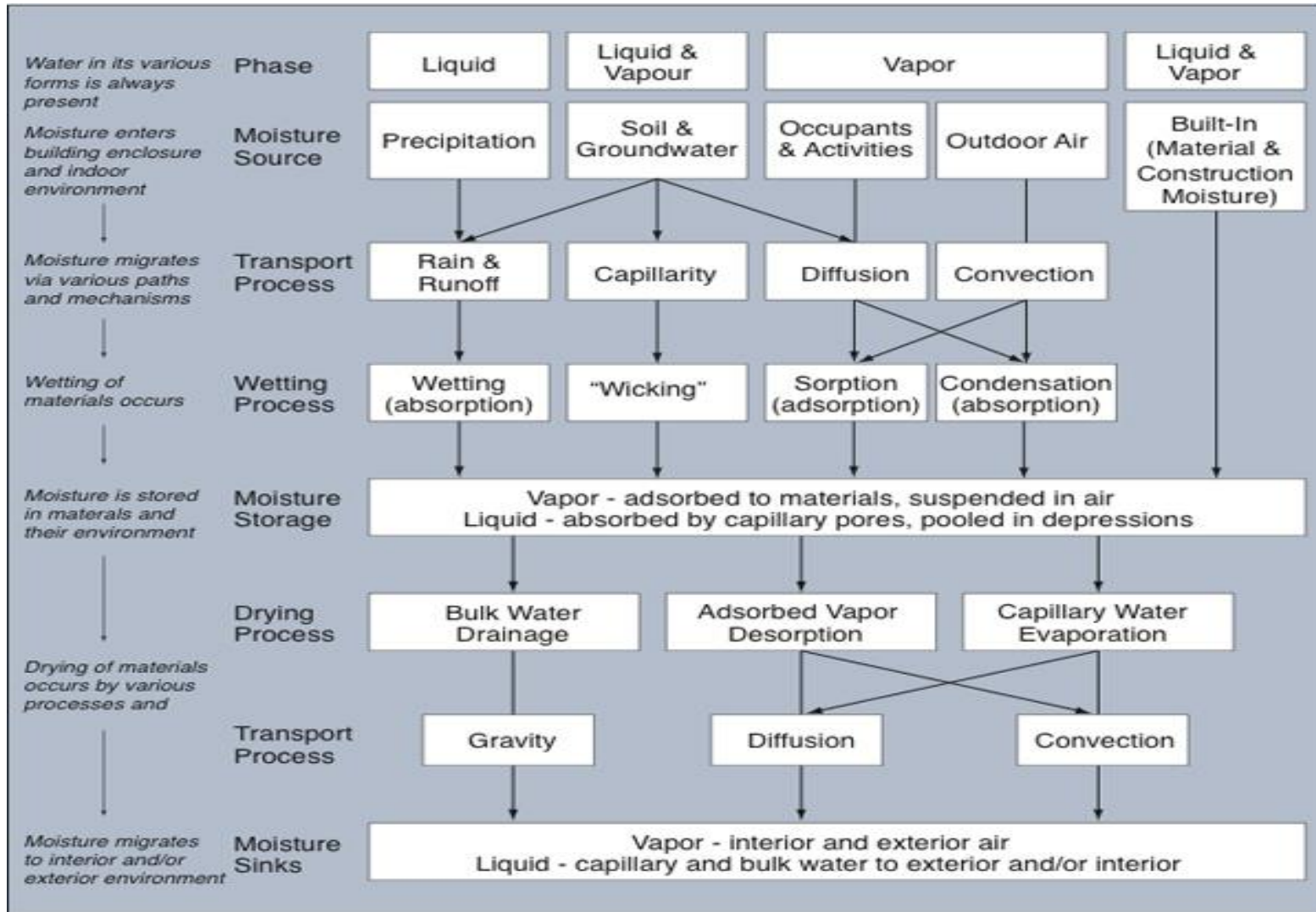
## *Principles-- interactive and dynamic*

- All hazards and interactive
- Adaptable and flexible to varying audiences, settings, residential, and commercial buildings
- Process oriented
- Enable stakeholders to share common goals
- Corrective actions that address multiple hazards tends to lead to improved outcomes
- **Create conditions that tend to promote health and wellbeing**



# Principle 1--Dry

Sources, phases, transportation, and storage of water in buildings



# *Moisture in air and materials*

## *Air*

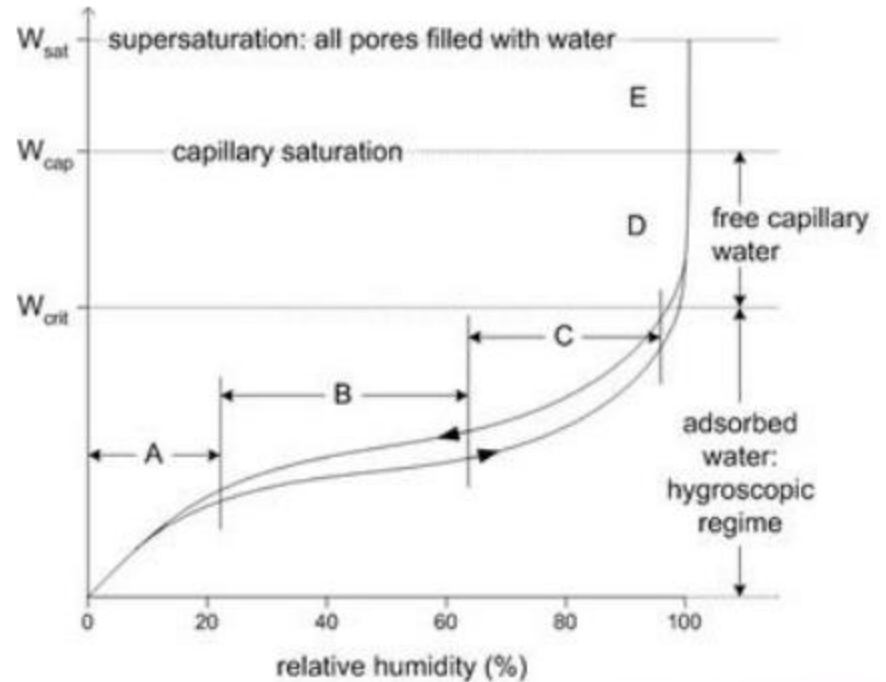
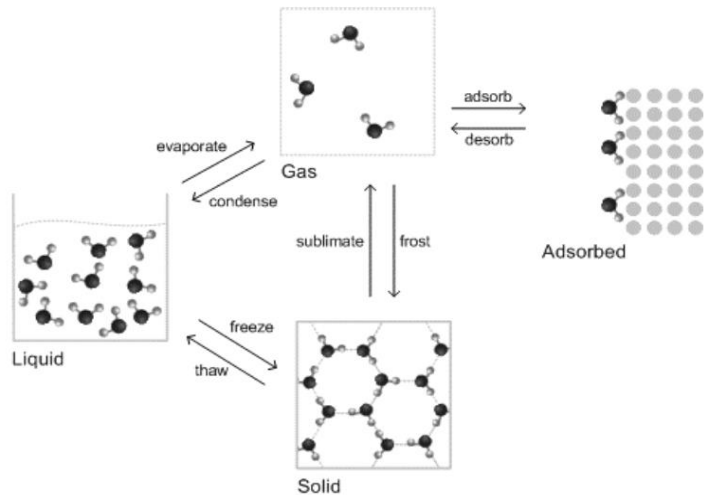
- Absolute humidity – the concentration of water vapor in air in terms of mass or volume (  $\text{mg}/\text{m}^3$  , grains/pound of air, parts per million parts of air)
  - Relative humidity – the amount of moisture in air at a given temperature compared to the amount of moisture air could hold at that temperature
    - At constant absolute humidity, the relative humidity decreases as temperature increases
    - At constant absolute humidity, relative humidity increases as temperature decreases until air becomes saturated (100% relative humidity) increases relative humidity until
  - Dew point -- the temperature at which air is saturated (100%) relative humidity
- Rule of 20° for temperature, relative humidity and dew point

## *Materials – Equilibrium Moisture Content*

- Like relative humidity, the amount water adsorbed, absorbed, and free water in a material compared to the amount of moisture the material could hold when saturated at a given temperature
- Materials come to an equilibrium moisture content based on the temperature and relative humidity of the surrounding air



# 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

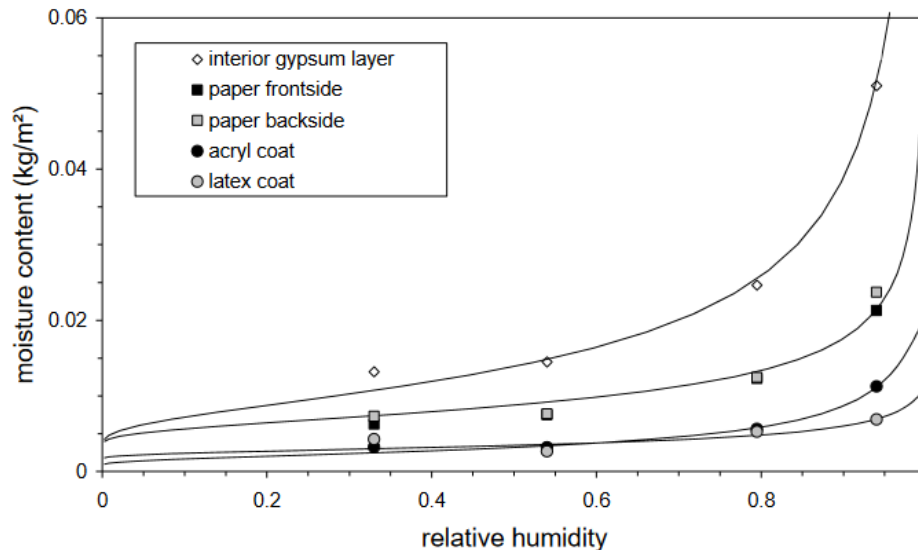


## Materials

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





# *Principle 2--Clean*

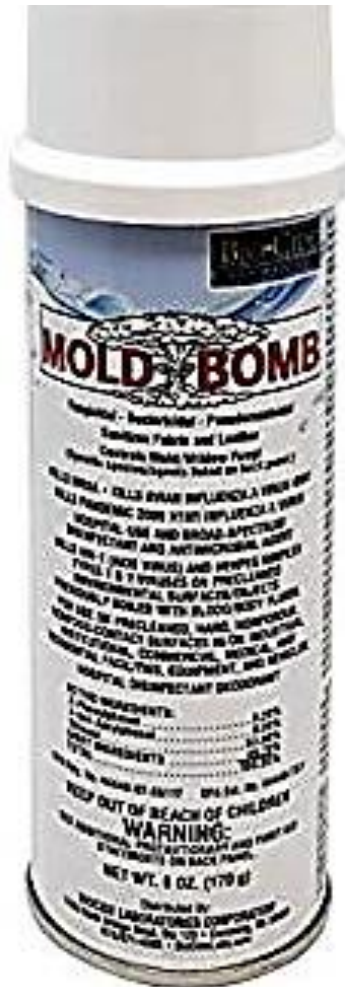
Cleaning for health is an environmental management process

- 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/required is dependent on site and situation



# Cleaning versus sanitizing and disinfecting

- Sanitizers and disinfectants reduce the number of germs on clean hard surfaces often represented as a log reduction
- 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

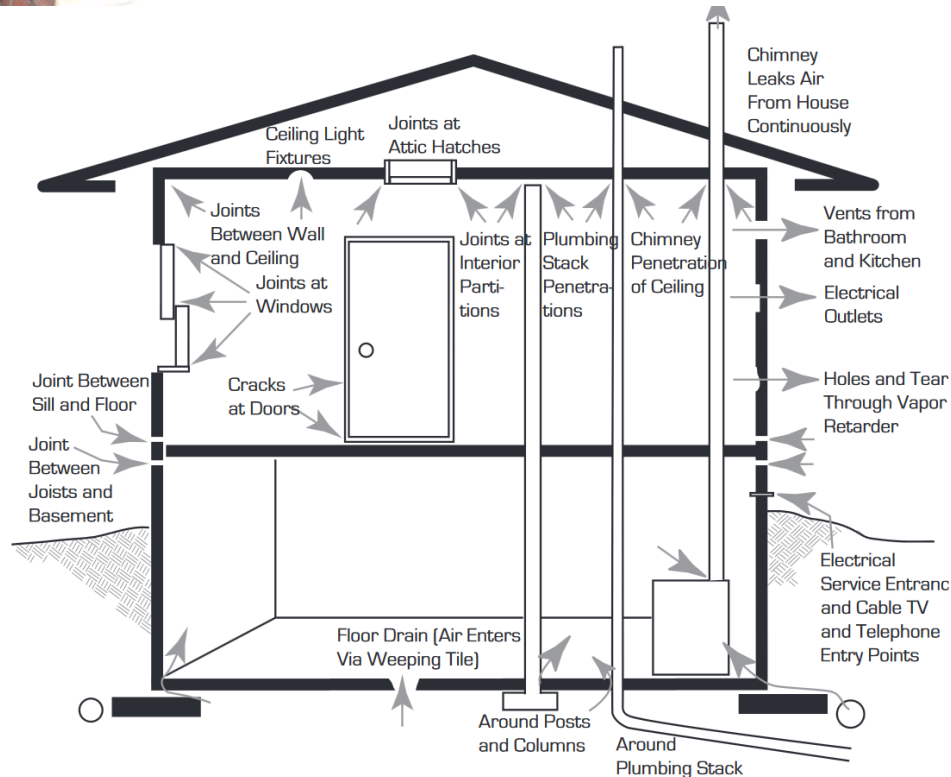


# Principle 3--Properly Ventilated



## Purpose of ventilation

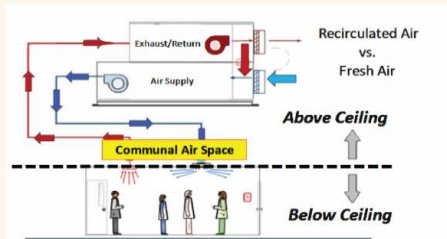
- Supply *clean* air to a space
- Remove contaminated air from space
- Dilute contaminants, control temperature, and humidity



# Direction, distribution, pattern, and amount of air flow

## COVID-19: Airflow Patterns Matter

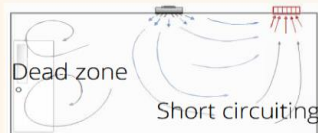
### BUILDING VENTILATION SYSTEMS ARE NOT DESIGNED TO REMOVE PARTICLES EMITTED FROM AN INFECTIOUS SOURCE



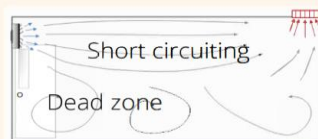
Instead, their purpose is for comfort and general air quality.

Interventions above the ceiling can yield benefits, but may not be sufficient to prevent exposure in occupied spaces below the ceiling.

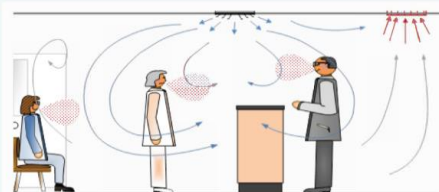
### AIRFLOW PATTERNS ARE IMPORTANT



Placement and design of inlets and outlets can cause poor mixing, dead zones, short circuiting and concentration build-up.

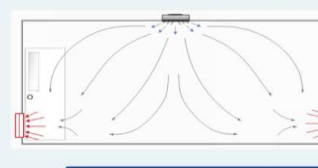


### WHAT'S THE EXPOSURE?



- Anyone can be a source of infectious particles.
- Particles follow air currents.
- Particle concentrations increase over time.
- Exposure may result from the transport of particles from an infectious person to an uninfected person.

### PROPER SUPPLY AND EXHAUST CAN SIGNIFICANTLY REDUCE THE RISK OF EXPOSURE



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

For more fact sheets and resources, scan this QR code.



Additional Information on "Airflow Patterns Matter" – <https://www.acgih.org/covid-19-fact-sheet-airflow-patterns-matter>

Created by the Pandemic Response Task Force.  ACGIH  
Leading Science for Better Health

Amount of outdoor air may be in building codes – based, type of structure, occupancy type, and on assumed occupant density

Air exchange rate per hour – number of times that the total air volume in a room or space is completely removed and replaced in an hour

# Types of Heating Ventilation & Air Conditioning

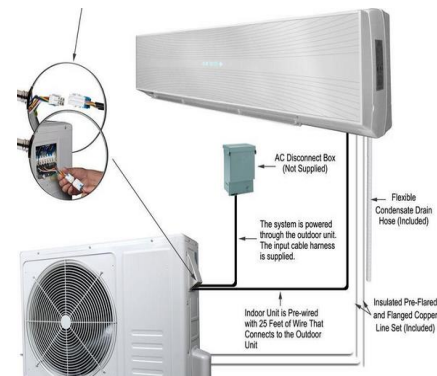
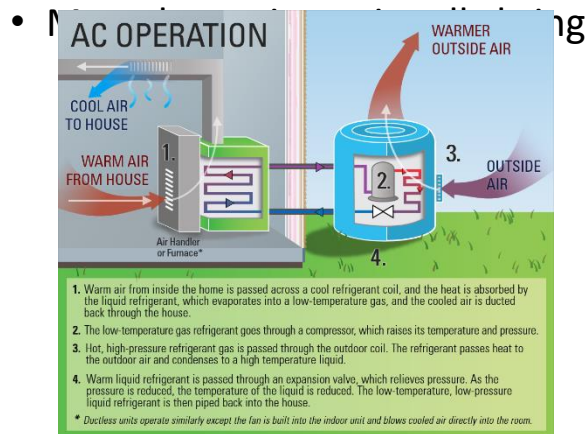
## Natural ventilation

- Air flow by natural and thermodynamic processes through purpose-built openings like windows, doors, attic vents and crawlspace vents or through unintended “holes” in the building envelope

## Mechanical ventilation in commercial buildings

- Heat, cool, dehumidify, clean, and distribute indoor air with varying introduction of outdoor air through purpose-built systems, depending on building codes or other requirements

## Residential heating air conditioning –central systems, PTAC, and mini-split



# *Exhaust ventilation- removal of contaminants from point sources*

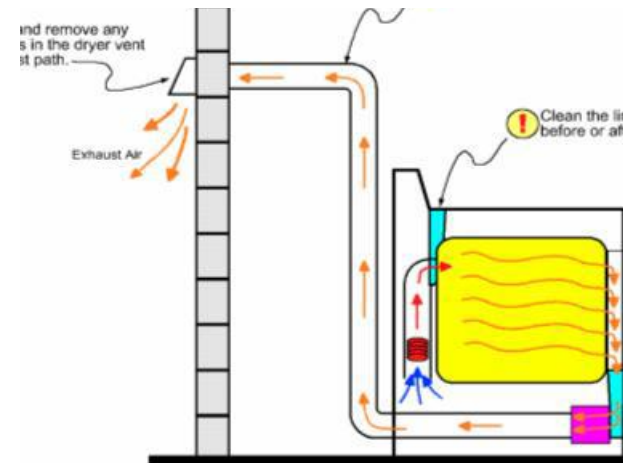
## Bathroom exhaust fan

- Vapor equivalent of 1 pint of water per 10-minute shower
- Flow rate should be 1 cfm/square foot, no less than 50cfm
- Continuous operation can depressurize the building



## Clothes Dryer exhaust

- Must vent to the outside
- Should use rigid metal ducts, corrugated semi-rigid ducts at elbows are permissible
- Clogged dryer vents decrease dryer efficiency, cause moisture problems, and can be fire hazard



# Filtration

Filter type	Capture Efficiency	Contaminant
MERV 8	<20 % of 0.3 to 3.0 $\mu$ particles 70-95% of 3-10 $\mu$ particles	hair, carpet fibers, pollen, and dust mites
MERV 13	>75% 0.3-10 $\mu$ particles	mold spores, pet dander, and smoke



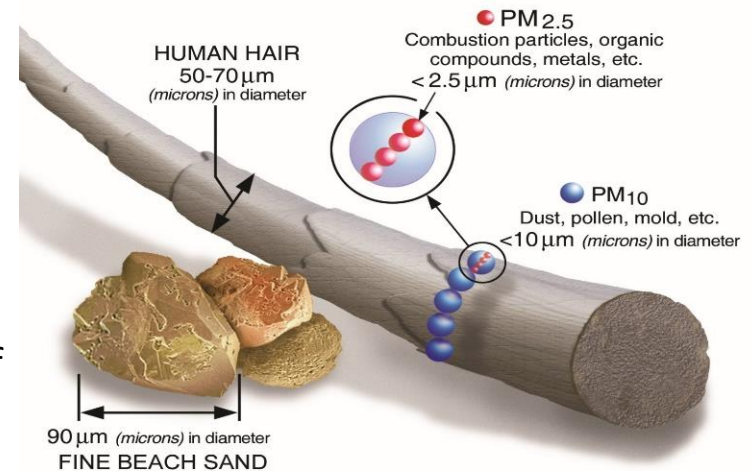
- Fan must be operating for filter to work
- Larger particles may settle from air before being captured by the filter
- Higher efficiency filters are more costly and have higher resistance to air flow

## High Efficiency Particulate Air (HEPA)

- 99.997% efficient at capturing 0.3  $\mu$ m particles, most penetrating particle size (MPPS).

## Select portable air cleaners based on

- Use Clean Air Delivery Rate (CADR) to compare volume of filtered air delivered by different air cleaners, Rule of thumb CADR= 2/3 of room area
- Noise, placement, direction of air flow, cost of replacement filters, and electrical supply



# *Consumer Advocacy -- Portable Air Cleaners*

Educate and inform people about evidence-based interventions that are realistic and affordable

Assist callers to evaluate potential technical solutions that may cause harm or have limited effectiveness. Limited availability for safe and effective air cleaners to remove gases and vapors

<https://www.epa.gov/pesticides/pesticide-devices-guide-consumers>



Ozone generators should never be used in occupied spaces



Ultraviolet light on HVAC coil. Can be used along with good filtration to keep coil from fouling

Consensus is to avoid air purifiers that use photocatalytic oxidation, ionization or other “additive technologies”



# *Heating Ventilation & Air Conditioning*

The case of the poorly ventilated room

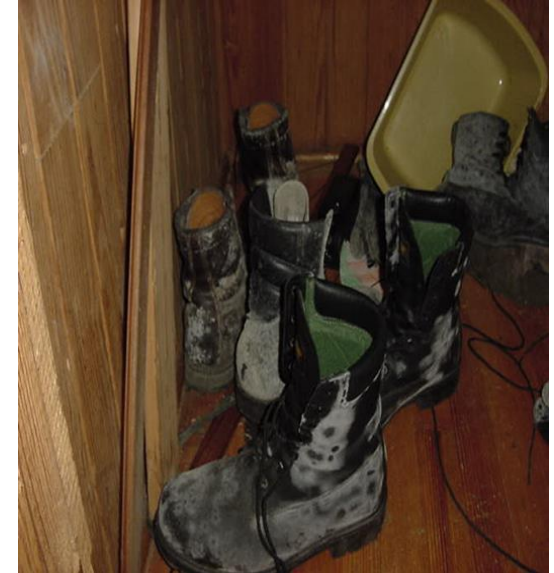
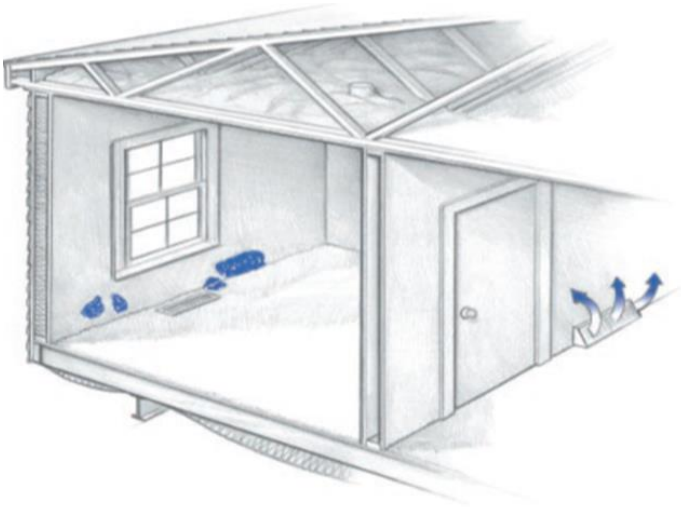


Image from MHRA Moisture Problems in Manufactured Homes:  
Understanding their causes and finding solutions



# *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.

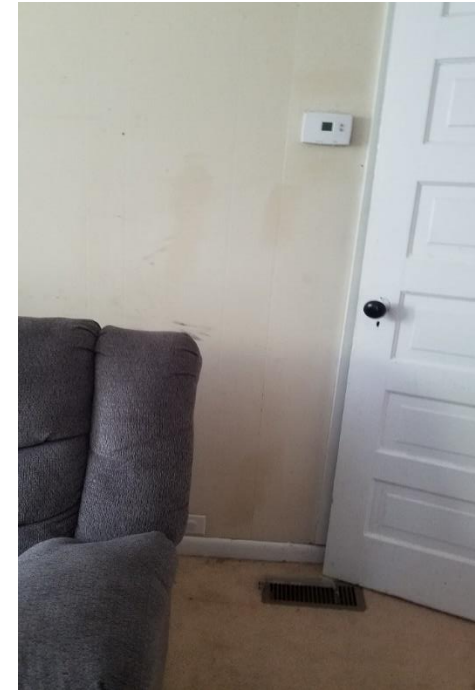
- Does not account for heat sinks, radiant sources or air drafts
- Assume light sedentary activity with appropriate clothing
  
- Comfort is subjective- ideal comfort criteria satisfy 80-95% of people

*Early warning sign in air-conditioned spaces*

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

*Heat Index*

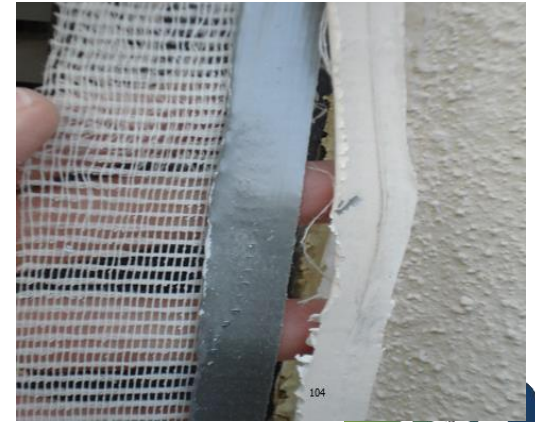
- Calculated by weather service as apparent temperature based on temperature and humidity
- <https://www.weather.gov/ama/heatindex>



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--Maintained*

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



# *Design & construction issues*



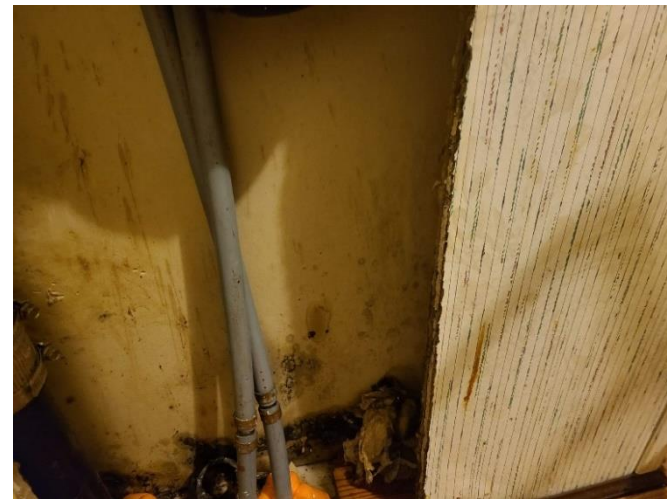
Poorly designed condensate drain



Poor condensate drainage

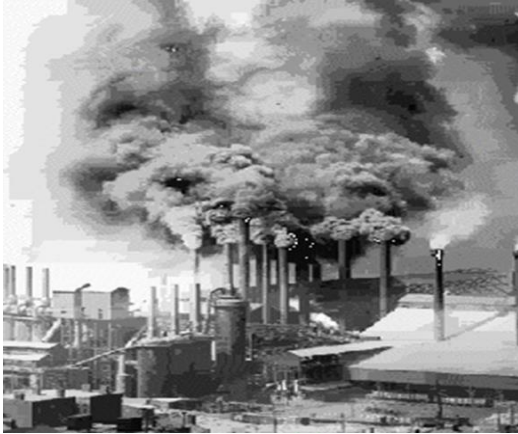


Poorly installed clothes dryer vent



Polybutylene pipe

# 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 people's exposure



# *Principle 9--Safe*



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



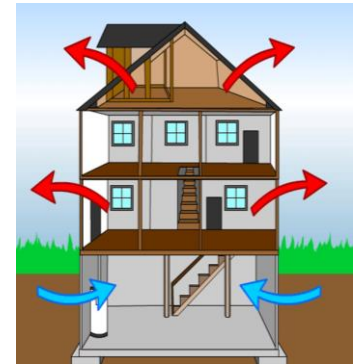


*Most IEQ problems involve multiple principles*



# Crawlspaces

## Problem Crawlspace



Possible Solution- closed, sealed and conditioned crawlspaces



Section R408 of NC Residential Energy Code for crawlspaces



# *Outside grading, drainage & wall design*



## The Four D's of Wall Design

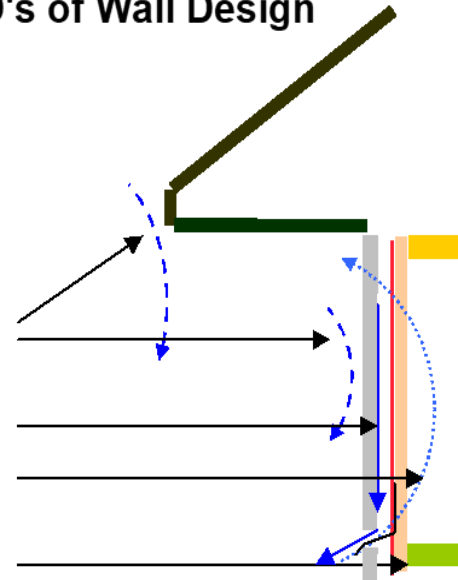
Deflection

Drainage

Drying

Decay

Resistance



# *The perfect storm – vapor retarder on interior side of exterior wall*

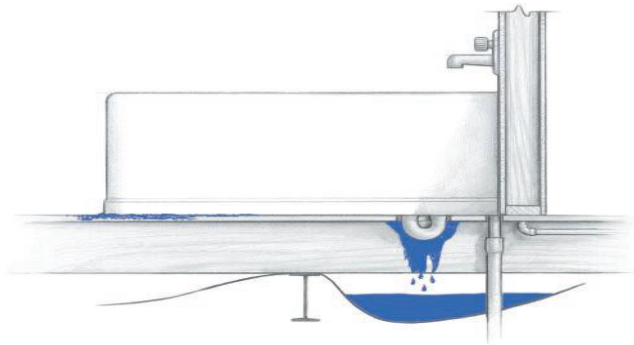
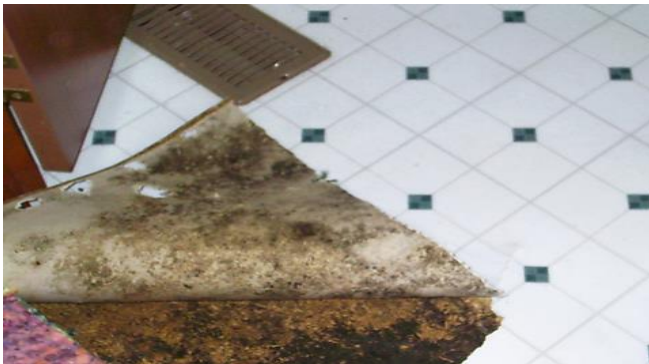


- Vinyl wallpaper – vapor retarding surface
- Hot and humid outdoor air
- Cool wall surface –Packaged Terminal Air Conditioner (PTAC)
- Room depressurized by continuously operating bathroom exhaust fan

# *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



## Equity issue

Is a mobile home Real or Personal property?

Who owns the manufactured home?

Who owns the lot?

Mobile homes are considered real property when:

- Used as a residential structure
- On a permanent foundation
- Owner of home also owns land

*Putting it all together to address indoor  
environmental quality, dampness, and mold  
growth*



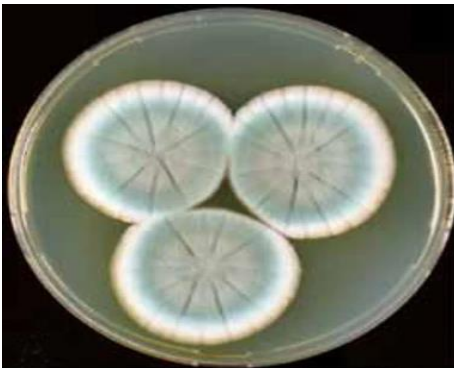
# What are molds?



*Penicillium roqueforti*



Mold/mildew on floor joist



*Penicillium chrysogenum (notatum)*

- Kingdom of Fungi
- Yeasts, mildews, and mushrooms
- Decay organisms--require external food sources
- One of many parts of the indoor microbiome
- Named by Genus and species
- Ubiquitous -- more than 100,000 species worldwide
- About 50 species typically colonize indoor environments

# *Mold growth versus mold*

Growth means the fungi have colonized the substrates (surfaces on which they grow).

Mold growth contains

*Spores*

- Reproductive structures

*Hyphae*

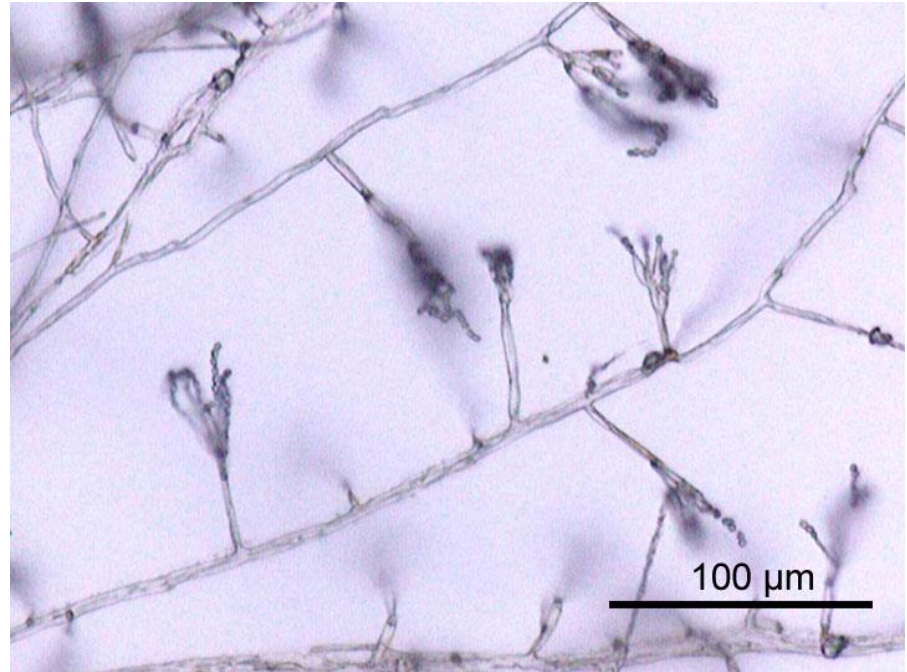
- Branching filamentous vegetative growth structures with rigid cell walls

*Substances released into the environment*

- Enzymes, metabolic waste products (volatile organic compounds -for odors) and other substances including mycotoxins .
- Secondary metabolites and mycotoxins under some conditions

Health symptoms from exposure to indoor mold growth are independent on whether mold is living (viable), dormant, or dead (nonviable)

***Goal -- prevent indoor mold growth***



Hyphae and conidiophores of *Penicillium*



# *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 or contents or organic dust, dirt, debris, or other residues on inorganic surfaces

Temperature

- Many indoor molds grow well between 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 are niches for other types of microbiological growth, allergy, and asthma triggers like dust mites, insect pests, and rodents

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



# *Health hazards associated with indoor dampness and mold growth*

Epidemiological association between visible mold growth, moldy odors, water damage, and persistently damp indoor environments with:

- Developing asthma, triggering asthma episodes
- Respiratory infections
- Rhinitis, wheeze, cough, difficulty breathing and other respiratory symptoms
- Other more serious illness in immune compromised individuals

Dose-response effect

*From a public health view, epidemiological associations, dose response, and reports of symptoms are enough to trigger investigations and interventions*

Epidemiological associations are insufficient or unavailable to make an association between dampness and mold growth and variety of other disorders reported by people “exposed” to mold

*Specific causation*, a person’s exposure to mold at a specific site and situation is the cause an individual’s illness is difficult to prove. Interactions between personal factors, other agents found in damp environments, other environmental exposures, and difficulty of assessing an individual’s exposure and dose to mold confound causation



# *Mechanisms for health impacts*

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

Mechanisms may act alone, in series, as a cascade, or in any combination

# *Mycotoxins*

Some molds under some conditions produce mycotoxins

- Some mycotoxins are beneficial to people e.g., the antibiotics
- most important exposure pathway is ingestion of foods contaminated with mycotoxins
- Mycotoxins are relatively large and heavy molecules that do not evaporate readily
- Only very small quantities of mycotoxins are produced. Can be present in spores, hyphae and in substrates
- “Toxigenic molds” only produce mycotoxins under specific environmental conditions and/or phases of their life cycles.

Some physicians advocate for Chronic Inflammatory Response Syndrome (CIRS) related to biotoxin related exposures but

- Syndromes of “biotoxin illness” may not have a pathogenic or toxic causes
- No International Classification of Diseases (ICD) Code for CIRS
- No increases or clusters of CIRS after major floods like Hurricane Katrina
- Some 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

- Category of source waters-- Degree that source water is contaminated
- Types of affected materials
- Location and size of affected area(s)
- Degree of mold colonization or water damage
- Class of water damage – reflects the degree of effort required for restorative drying
- Pathways for people to be exposed to mold growth or biological agents
- Frequency and duration of exposure,
- Presence of sensitive or susceptible people



# After a flood

<https://www.epa.gov/flooded-homes>

## What Can I Keep?

### Keep it & Clean it



Metal Furniture



China Dishware  
Ceramics



Silverware &  
Kitchen Utensils



Plastic Furniture



Jewelry



Glass

### It's a Maybe



Photos & Books



Bedding & Blankets



Rugs



Solid Wood Furniture

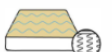


Clothing



Appliances &  
Electronic Devices

### Best to Remove It



Mattresses



Leather Furniture



Medicine



Cloth Upholstered  
Furniture



Cushions & Pillows



Wood Veneer Furniture

Learn more on how to treat and clean different material at [epa.gov/flooded-homes](https://www.epa.gov/flooded-homes)



### Coming home

- before you enter
- entering your home
- what to wear
- tools
- renters

### Do it your self

- Roofs window and door tarps
- Removing standing water
- Wall cleanup/removal
- Floor cleanup/removal

### Protect your health

- Asbestos
- Lead
- Mold and bacteria
- Generators

### Additional Resources

- Funding
- Create a safe workplace
- First aid
- Things to keep clean or remove
- Trash disposal
- Family information
- Drinking water and food



# *Risk assessment, risk 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 as acceptable or unacceptable when viewed as

- 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 is intended to the audience with knowledge to make informed, reasoned, and independent judgments about risks to their health, safety and the environment. 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

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

## *If environmental testing is proposed*

- *North Carolina does not require licensing, certification or registration for mold inspection and mold remediation services*
- Prior to sampling or testing --essential to conduct an informed, and systematic inspection of the site and situation
- What will sampling and testing prove or disprove by sampling and testing?
- Will sampling and testing assist to identify of sources mold growth?
- What is the sampling strategy and what analytical (testing) methods be used?
- How will results be interpreted -- limitations, uncertainties, and how results might be help to infer about other times and conditions?
- 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*

- Collecting a subset of something to estimate characteristics the whole. Sampling strategies/methods describe when, where, how, and number samples to collect to make reasonable inferences about the whole or other times and conditions.
  - A small number of indoor and outdoor short-term air samples (grab samples) for airborne molds are a “snapshot” that may not represent other times and conditions, what a person inhaled, or correlate with observations of visible mold growth on contents and materials.
- No single sampling method for every constituent of mold growth and other biological agents associated with damp and deteriorated environments

Surface samples are often collected to confirm that an unknown material on a surface is mold growth. Context like is important

## *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.



# *Interpreting sampling and testing results for indoor mold*

*No authoritative standards for acceptable levels of airborne mold spores and other components of mold growth to protect against hypersensitivity, irritant, infectious, toxic, or other adverse health outcomes*

American Conference of Governmental Industrial Hygienists Threshold Limit Values for Chemical Substances and Physical Agents. No quantitative Threshold Limit Values for:

- Total countable or culturable mold spores and fragments
- Specific countable or culturable mold spores
- Assayable products of mold growth
  - Endotoxins
  - Mycotoxins
  - Microbial Volatile Organic Compounds

Environmental Relative Moldiness Index (EMRI)

- Collection of settled dust for analysis by Mold Specific Quantitative Polymerase Chain Reaction, (DNA) for comparison with 26 mold species associated with water damage and 10 species found in every home.
- EPA has licensed technology to commercial laboratories for research purposes but has not endorsed, approved, or validated as a tool to evaluate indoor mold.

*Laboratory reports often contain information about hazards of molds identified in the samples but often provide little information to characterize risks.*



# *Mold Cleanup and remediation*

## Steps for mold cleanup and remediation

- Find and fix source(s) of water intrusion and accumulation
- Determine the category of the source water(s)
- Determine class of water damage
- Follow water movement through building assemblies
- Assess types of affected materials and the degree they are colonized with mold or water damaged
- Remove/replace hygroscopic and organic materials colonized with mold growth, water damaged, are not cleanable, or that will not perform as intended
- Dry remaining affected contents and materials
- Clean hard surfaces, remaining materials/contents and adjacent areas
- Limit generating airborne dusts to protect workers, occupants, and adjacent areas using containment, isolation, and work practices
- North Carolina does not require licensing,

## Government and Industry Guidance

- EPA Mold Remediation in Schools and Commercial Buildings
- Institute for Inspection Cleaning Restoration and Certification S520 Standard and Reference Guide for professional mold remediation



# *Mold remediation – questions, judgements, and agreements*

Are guidance and standards

- 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?

What kinds of engineering controls, work practices, and personal protective equipment are needed to limit dust generation and protect workers ?

General agreement that projects become more complex requiring more effective controls

- As category of source water deteriorates
- As class of water damages increases
- The presence of mold growth 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)



# *How we assist people concerned about 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

- 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 and contractors who can apply evidence-based and achievable methods to improve indoor environments



# *Ways assist to renters*

Landlords and tenants need to communicate cooperate, work together, understand their respective obligations and responsibilities, and take actions to promote healthy indoor environments

Action steps for tenants NC GS§ 42-43 Tenant to maintain dwelling unit

- Keep home clean, prevent unsanitary conditions from occurring, periodically inspect dwelling, inform landlord when repairs are needed and pay the rent

When maintenance and repairs are needed -- NC GS§ 42-42 Landlord to provide fit premises

- General requirements and 12 conditions defined as imminently dangerous
- Be persistent. Keep detailed records, diaries, photos, texts, emails about requests to and responses from landlords
- Negotiate, enforce, or litigate terms and conditions of leases/rental agreements
- [landlord-tenant-booklet-rev-June-2018.pdf](#)



# *Who to call when for assistance*

## *Tenants*

- Minimum housing code officials/ building inspectors, Article 12 Minimum Housing Code §160D-1201 allows Local code officials to order repair, closure or demolition of dwellings unfit for human habitation due to dilapidation or serious safety and health hazards
- Cities and counties can adopt local minimum housing codes for maintenance of dwellings  
[North Carolina Association of Housing Code officials](#)
- [North Carolina Legal Aid](#) Good Resources in tenant's rights clinic, and self-help library
- In affordable rental housing – tenants may contact funding sources including but not limited to North Carolina Housing Finance Agency, Public Housing Authorities, HUD Multifamily Housing Complaint Line

## *Health Department*

- Adult Care and Childcare facilities
- Some health care systems provide in-home assessments for children with severe persistent asthma by identifying and assists to in controlling environmental asthma triggers.

## *Low- income homeowners*

- Weatherization Assistance Programs, Urgent Repair Programs, Single Family Housing Rehabilitation Programs, and Volunteer Organizations



# *Ways to assist owners, landlords and managers*

Educate about consequences of failure to maintain and repair

- Accelerated deterioration of materials, equipment and contents
- Structural damaged and decay, infestations of wood destroying organisms and termites
- Increased repair costs and decreased service life
- Possible reduction in property values
- Negative publicity and strained tenant relations
- Avoid unnecessary government involvement

Help landlords and property managers to understand how customer service is good for business

- Recommend evidence-based, realistic and affordable strategies to improve indoor environments
- May be required by law to perform certain activities
- View tenants as customers
- Obligations to themselves
- Effective maintenance and repair programs reduce lifetime costs
- Implementing healthy homes principles can help organization to achieve long term goals
- Obligations to community -- safe, decent, and affordable housing help communities thrive





# *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 recommendations– some examples

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

Industrial Hygienists --Trend 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

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

- North Carolina does not license or require certifications for these specialists

*Caveat Emptor.* Is fixing the underlying reasons that materials became damp enough to support mold growth a better use of resources than environmental sampling and testing?

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

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



# *Final remarks*

Healthy Homes offers a systems-based model to improve indoor environments and promote health and wellbeing

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

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

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



## *OEE's Role*

Mold/moisture inquiries can range from simple to complex technical and social problems

Scope of indoor air quality problems is often driven by perception of risks

OEE would like to move from “retail” to “wholesale” customer service model and provide training, education and consultation to partners to solve problems

OEE will provide technical support to environmental health staff and other organizations and members of the community interested in healthy homes, IEQ, dampness and mold growth



# *References*

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[Gypsum Association Assessing Water Damage to Gypsum Board](#)

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[HUD and CDC Healthy Housing Reference Manual](#)

[National Academy of Sciences, Damp Indoor Spaces and Health](#)

[CDC NIOSH Preventing Occupational Respiratory Disease from Exposures caused by Dampness in Offices Schools and other Nonindustrial Buildings](#)

[World Health Organization, WHO guidelines for indoor air quality: dampness and mould](#)

[Creating Healthy School Environments Tools for Schools](#)

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

[NC GS 42-42 Landlord to provide fit premises](#)

[NC GS 42-43 Tenant to Maintain Dwelling](#)

[NC Attorney General's Office Renting a Home](#)

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# *Questions?*

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