

Town Health Officer Training Indoor Air Quality in Rental Housing

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Why Indoor Air Quality (IAQ) Matters

- Americans spend up to 90% of their time indoors, and “dose” is a function of exposure over time
- Indoor air pollutants can be 2-5 times higher than outdoors, and “dose” also depends on the concentration an individual is exposed to
 - New houses are being built more airtight for improved heating and cooling efficiency
 - Old houses are becoming better sealed through weatherization efforts
 - Many homes lack appropriate ventilation due to age, error or malfunction

Health Effects of Poor Indoor Air quality

- Asthma
- Allergy
- Irritation
- Lethargy
- Physical discomfort
- Chemical sensitivity
- Cancer
- Death

Contributors to Poor Indoor Air Quality

- Asthma & allergy triggers – many are “biologicals” but they can also be chemicals or particulates
- Lead
- Radon
- Combustion byproducts – includes environmental tobacco smoke, CO, NOx, SOx
- Pests – insects and rodents
- Pesticides
- Mold & moisture
- Asbestos
- Temperature – often overlooked, temperature is an important “physical” exposure
- Chemicals
 - Cleaning products
 - Cosmetics
 - Personal care products
 - Hobbies
 - Home repair
 - Maintenance

Vermont Healthy Homes Principles – The goal for every Vermont house

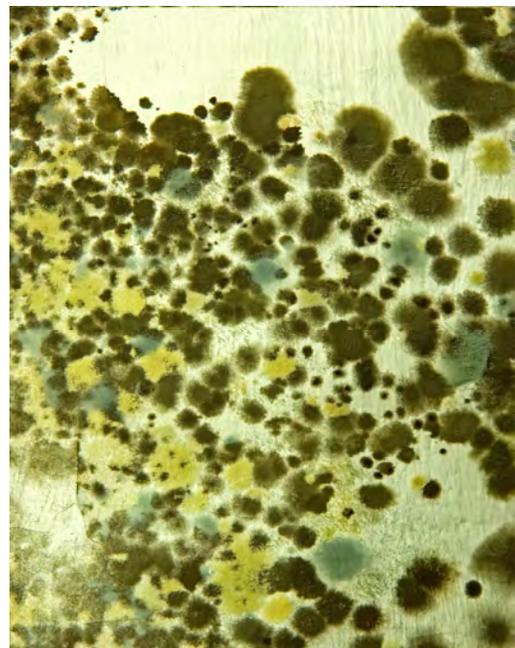
- Well ventilated
- Dry
- Clean
- Safe
- Maintained
- Environmentally sustainable
- Free of
 - Pests
 - Toxins
 - Dangerous gases

The Vermont Rental Housing Health Code (RHHC) and Indoor Air Quality

- The Vermont RHHC addresses a limited number of IAQ measures directly and indirectly
 - Asthma, allergy and biological exposures
 - Chemical exposures
 - Physical exposures
- However, many IAQ problems are weakly or not addressed at all in the RHHC
- This presentation will discuss IAQ issues directly related to the RHHC and draw attention to other provisions that indirectly influence IAQ

Asthma and Allergy Triggers

- Animal dander
- Cockroach parts / feces
- Chemicals
 - Pesticides
 - Cleaning products
- Dust
- Strong odors
- Mold



“Mold” and “Mildew” – are general terms used to describe fungus

- There are many different types of fungi (over a million?) and many have yet to be described
- Fungi are common throughout nature
- They are nature’s “decomposers”
- Fungi vary in color and appearance



Fungi need “food” and water to grow

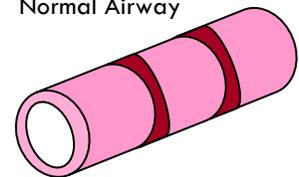
- Fungi are heterotrophic and need organic matter to “eat”
 - Food
 - Furnishings, linens, clothing
 - Dust
 - Building materials: carpet, wallboard, wood
- Water / moisture
 - Flood water
 - Plumbing or roof leaks
 - Relative humidity
 - Condensation



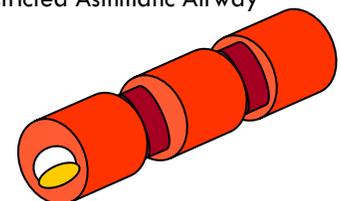
The health effects of environmental mold depend on the type of mold, and individual sensitivity:

- “Is this mold safe?” – You cannot predict if a mold is “dangerous.” Maybe an occupant is sensitive to a particular mold, maybe they are not. The answer is to treat all mold as “bad” and address / correct the problem. It is not the role of the THO to infer susceptibility and to identify the mold to predict a health risk.
- Irritation
 - Eye
 - Nose
 - Throat
- Allergic symptoms
 - Runny nose
 - Congestion
 - Sneezing
- Asthma exacerbation
 - Constriction of airways
- Fungal infections, when fungus colonizes body tissue is rare, but possible
- Refer the tenant to their physician for all health effects or symptoms

Normal Airway



Constricted Asthmatic Airway



What Town Health Officers should know about “Toxic Black Mold”

- The phrase “toxic black mold” isn’t really meaningful because:
 - Many molds can be black
 - A so-called “black mold” can be present in colors other than black
- “Toxic black mold” usually refers to the fungus species *Stachybotrys chartarum*
 - S. chartarum* is associated with “toxic health effects” and death due to high amount of publicity and litigation
- The toxicity of *S. chartarum* in residential exposure scenarios is controversial

The primary strategy for Identifying a mold problem should be a building investigation – not air testing

- Ask tenant or landlord about mold or moisture problems to guide your search
- Use your eyes and nose to identify a mold problem
 - If mold can be seen or smelled there is no need for air testing
- Find the source of water or moisture
 - Sight, touch, moisture meter (if available, but not necessary)
 - Evidence of water or moisture damage in the absence of visible mold is actionable
- Increasingly invasive building investigation methods may be required to find the mold growth
 - Example: drilling a test hole to see mold in a suspect wall cavity
 - Best left to the building owner or their representative

Places to Look for Mold

- Basements
- Attics
- Flooded areas
- Bathrooms
- Kitchens
- Closets
- Furniture
- Mattresses
- Windows and windowsills
- Carpeting
- Food storage areas
- Between furniture and outside walls
- Around appliances
 - Refrigerators, air conditioners, dehumidifiers
- Where have other THOs found mold?



Air Testing should not be the first step

- Air Testing is unnecessary if mold is visible – if you can see it, you know it's there
- Testing includes sampling, culturing and identification – all are complex steps and processes that can introduce error
- Results typically show the presence of mold because it's everywhere
- Interpretation of results is difficult because there are no health standards or laws to compare results to
- Scientific testing by private consultants is typically expensive
- Rarely does mold testing reveal the clear answer the occupant is looking for

Fixing Mold Problems Properly

- There are no government licenses or certifications for mold abatement contractors recognized in Vermont
- The water or moisture intrusion must be fixed in order to prevent the re-growth of mold
 - Plumbing
 - Roof
 - Windows
 - Drainage
- Indoor relative humidity (RH) must be managed to discourage mold growth
 - RH should be between 30 – 60%, ideally 50%
- Remove damaged building materials and items that cannot be cleaned
- Clean hard building materials and items

Remove Damaged Soft Building Materials and Items

- If materials / items were not dried within 48 hours of becoming wetted, consider them damaged
 - Ceiling tiles
 - Wallboard
 - Mattresses
 - Furniture
 - Carpeting
- Items that can be and are laundered do not need to be discarded
 - Linens
 - Clothes



Clean Hard Building Materials and Items

- Hard or nonporous materials and items can be washed to remove mold unless they are structurally damaged
 - For example, studs or subflooring rotten from years of water leaks
- There are different opinions and recommendations on the best practice for cleaning mold from hard surfaces even between US federal agencies:
 - Environmental Protection Agency (EPA): soap and water
 - Centers for Disease Control and Prevention (CDC): bleach and water
- The Vermont Department of Health recommends soap and water
- Biocides (fungicides) are not recommended

Applicable Rental Housing Health Code for Mold

- RHH, § III, C: Non Absorbent Surfaces –

The floor and counter surfaces of every bathroom and kitchen in dwelling units and rooming houses shall be constructed and maintained to be a smooth, noncorrosive, nonabsorbent and waterproof covering. This shall not prohibit the use of carpeting for floors in kitchens and bathrooms, nor the use of wood for floors in kitchens, provided the following qualifications are met:

1. Carpeting must contain a solid, nonabsorbent, water repellent backing which will prevent the passage of moisture through it to the floor below; and
2. Wood flooring must have a water resistant finish and have no cracks to allow the accumulation of dirt and food, or the harborage of insects.

- RHHC, § III, D(6): Water Supply / Wastewater disposal –
All plumbing systems shall be maintained in good repair.

•RHHHC, § III, E: Garbage, Rubbish and Sanitary Conditions –

1. Facilities

a) Garbage and rubbish which are placed outside a dwelling or rooming house shall be stored in durable, cleanable, watertight receptacles with properly-fitting covers.

b) The owner of any dwelling or rooming house shall provide and maintain appropriate receptacles for the removal of garbage and rubbish.

2. Collection of Garbage and Rubbish.

a) The owner of any dwelling or rooming house shall assure that arrangements are made for the removal of garbage and rubbish.

b) Garbage and rubbish shall be removed from dwellings and rooming houses as often as is necessary to maintain a sanitary structure, not less than once every week.

3. Responsibilities

a) Owner Responsibilities: The owner of every dwelling or rooming house shall be responsible for maintaining in a clean and sanitary condition free of garbage or rubbish all common areas as well as any other part of the premises not used as a dwelling space.

b) Occupant Responsibilities: The occupant of every dwelling unit or rooming unit shall be responsible for maintaining in a clean and sanitary condition and free of garbage or rubbish that part of the premises which he or she exclusively occupies.

•RHHHC, § VI, A(4): Natural and Mechanical Ventilation –

Every bath, toilet or shower room shall be ventilated by direct access with the external air either by window, airshaft or ventilation fan. If a ventilation fan is used, it shall be vented directly to the exterior of the building and be of sufficient size to prevent the buildup of moisture.

•RHHHC, § VIII, A: Structural Elements –

Every owner of a dwelling or rooming house shall provide and maintain the foundation, floors, walls, doors, windows, ceilings, roof, staircases, chimneys and other structural elements of his or her dwelling, dwelling unit, rooming house or rooming unit so that it is weathertight, watertight, rodent proof and in good repair.

•RHHHC, § VIII, C: Structural Elements –

Every dwelling, dwelling unit, rooming house or rooming unit shall be maintained to be free from the regular or periodic appearance of standing water or excessive moisture which may result in visible mold growth.

Sources of Carbon Monoxide

- Incomplete combustion of fuels
 - Kerosene or gas space heaters
 - Backdrafting chimneys
 - Woodstoves and fireplaces
 - Gas water heaters
 - Gas ovens and stoves
 - Attached garages (internal combustion engines)



Health Effects of Carbon Monoxide

- Carbon monoxide binds to the hemoglobin of red blood cells and prevents oxygen from binding
- Low concentrations
 - Fatigue
 - Chest pain in people with heart disease
- Moderate concentrations
 - Impaired vision and coordination
 - Headaches
 - Dizziness
 - Confusion
 - Nausea
 - Flu-like symptoms that clear up after leaving house
- High concentrations
 - Death

Applicable Rental Housing Health Code for Carbon Monoxide

- RHHC, § V, B: Heating –

Heating facilities shall be properly functioning and in good repair.

- RHHC, § V, D: Heating –

Heating facilities shall be vented to the outside of the building. Un-vented fuel fired space heaters are prohibited in dwellings or rooming houses.

Ventilation

- Ventilation introduces fresh outdoor air and removes indoor air containing accumulated pollutants
- Mechanical ventilation
 - Forced air system
 - HVAC
- Natural ventilation
 - Windows
 - Doors
 - “Trickle vents” – small passive vents, more common in commercial buildings

Ventilation in Rental Housing Health Code

- RHHHC, § VI, A (1): Natural and Mechanical Ventilation –

A. The owner of dwellings and rooming houses shall provide ventilation to the outdoors as follows so as to not endanger the health and safety of the occupants:

1. Every habitable room shall include at least one window or door in good repair located on an outside wall that is capable of being opened to admit fresh air.

Temperature

- Temperature is sometimes overlooked in assessing indoor air quality
- Comfort and health are affected by indoor air temperature
- Potentially serious health problems are caused by cold temperatures, such as hypothermia
- Mental health may also be affected by an under heated house

Temperature in the Rental Housing Health Code

- RHHHC, § V: Heating –

Heating facilities in all dwelling units and rooming houses shall meet the following standards:

A. Heating facilities shall be provided when the outside temperature is less than 55°F (13°C).

B. Heating facilities shall be properly functioning and in good repair.

C. Heating facilities shall be able to maintain a room temperature of at least 65°F (18°C) in all habitable rooms, kitchens, and bathrooms. The maintenance of required heating levels shall be accomplished without overheating one room as a means of meeting minimum heating requirements for adjacent rooms. The temperature may be read and the requirement shall be met at a point three feet above floor level and three feet from an exterior wall.

D. Heating facilities shall be vented to the outside of the building. Un-vented fuel fired space heaters are prohibited in dwellings or rooming houses.

E. Every owner who provides heat as part of the rental agreement to occupants of dwelling units or rooming units shall maintain the provided heat at all times to all habitable rooms, kitchens, and bathrooms when the outside temperature is less than 55°F (13°C).

Pests

- Rodents and insects can contribute asthma and allergy triggers to indoor air
 - Animal dander
 - Protein(s) in body fluid (saliva, urine)
 - Cockroach body parts
- Commonly controlled by using pesticides which reduce indoor air quality

Pesticides

- Over 75% of US households report using pesticides indoors
- Products used to control
 - Insects
 - Termites
 - Rodents
 - Fungi
 - Microbes
- Pesticides are sold as
 - Sprays
 - Liquids
 - Sticks
 - Powders
 - Crystals
 - Balls
 - Foggers



Health Effects of Pesticides

- Poisoning
 - 79,000 childhood exposures or poisonings reported in 1990 to poison control
- Possible effects are highly dependent on active and “inactive” ingredients which can be organic chemicals
 - Neurological effects
 - Headaches
 - Dizziness
 - Muscle twitching
 - Weakness
 - Tingling sensations
 - Nausea
 - Cancer
 - Central nervous system and liver damage



Pests and Rental Housing Health Code

•RHHC, § IV. Insects and Rodents –

A. Owner Responsibilities

1. The owner of a dwelling shall maintain all common spaces free from rodent and insect infestation.
2. The owner of a dwelling shall be responsible for extermination of rodent and insect infestation in all common spaces.
3. The owner of a dwelling shall be responsible for extermination of any rodent and insect infestation in any dwelling unit when infestation in a dwelling unit is caused by his or her failure to maintain the dwelling or infestation exists in two or more of the dwelling units in any dwelling.
4. The owner of a rooming house shall maintain all rooming units and common spaces free from rodent and insect infestation, and shall be responsible for extermination.

B. Occupant Responsibilities. The occupant of each dwelling unit shall maintain that part of the dwelling he or she exclusively occupies free from rodent and insect infestation and shall be responsible for extermination when the infestation is caused by his or her failure to maintain the dwelling unit except as provided for in Section IV, A(3).

C. Extermination of Rodents and Insects. Extermination shall be accomplished by eliminating the harborage place of insects, rodents, vermin or other pests, by removing or making inaccessible materials that may serve as their food or breeding ground and by poisoning, spraying, fumigating or trapping.

Radon in Air

- THO inspection checklist recommends houses be tested for radon
- Radon is a naturally occurring radioactive gas found in bedrock and soil
- Colorless, odorless, tasteless
- No apparent short-term effects
- Leading cause of cause of lung cancer in US among nonsmokers
 - Estimated ~20,000 lung cancer deaths per year in the US
- Entry from soil into house depends on:
 - Presence of uranium in underlying soil and bedrock
 - Building construction
 - Pressure differences and airflow
- Radon is also found dissolved in water, and through normal activities, can be liberated from water into the indoor air
 - Shower
 - Dishwasher
 - Washing machine

Radon in Air Testing

- Radon must be tested for to know if a problem exists
- A site can't be tested before a house is built
 - New home radon resistant construction features are recommended
- Short-term test describes "radon potential" or the worst case scenario
- Long-term test better describes actual long term exposure
- Free test kits available from the Department of Health

