Asheville-Buncombe Air Quality Agency

Indoor Air Quality

Problems & Solutions

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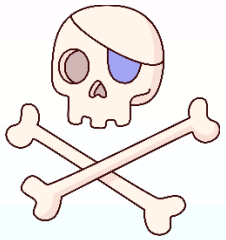
BEWARE!

Indoor Air Quality, or IAQ, is an important issue in office buildings, schools, and homes because people spend at least 90% of their time indoors where pollutant levels are often higher than those outdoors.

IAQ Risks

- US EPA has consistently ranked indoor air pollution among the top five environmental risks to public health.
- Children, the elderly, and those in poor health are most at risk for the effects of indoor air quality problems. These groups also spend most of their time indoors.

IAQ Problems are Caused By:



- environmental tobacco smoke (ETS)
- biological pollutants resulting from moisture and water damage
- chemical agents from pesticides and cleaners

- combustion products from fuel burning appliances and attached garages
- volatile organic compounds (VOCs) from building materials and consumer products
- inadequate ventilation

Common Indoor Air Pollutants

- Radon, Asbestos, Lead, Particulate Matter, environmental tobacco smoke (ETS)
- Combustion byproducts - CO, NOx, SO2, PM
- Biological Pollutants - bacteria, fungi, dust mites
- VOCs emitted from synthetic building materials include formaldehyde, xylene, toluene, ethyl benzene, benzene, styrene

Common Indoor Air Pollutants

- Formaldehyde from building materials such as pressed wood products used in cabinetry and furniture.
  - Suspected human carcinogen.
  - Symptoms include watery eyes, eye, nose, and throat irritation, nausea, chest tightness, coughing, and skin rashes.
- VOCs from fragrances found in personal care and consumer products.
  - Respiratory irritants
  - Chemical asthma trigger

Common Indoor Air Pollutants

- Terpene compounds including pinenes and limonene emitted from wood products and many consumer products.
  - Studies show that terpenes react with ozone to produce significant amounts of sub micron particles.
- Para-dichlorobenzene (p-DCB) from Air fresheners and moth repellants:
  - Causes cancer in lab animals.
  - p-DCB levels in homes have been found to be 20 times higher than outdoor levels.
- Fine particulate matter and VOCs, from Candles
  - Some older candles may have wicks containing lead

Health Effects

- US EPA's Total Exposure Assessment Methodology (TEAM) study found that for most Americans, their greatest exposure to toxic chemicals took place indoors where pollutant levels were often 2-5 times higher than levels measured outdoors.
- Consumer products and building materials were the primary sources of exposure to air toxics indoors.
- Similar results have been found in studies conducted in other countries.

Health Effects

Exposure to lead, asbestos, environmental tobacco smoke, radon, and biological contaminants indoors have been linked to various health effects including cancer, asthma, developmental defects, and cardiovascular problems.

Another common indoor air pollutant, carbon monoxide, is acutely toxic and can result in death.

Carcinogens

- Asbestos, radon, environmental tobacco smoke (ETS), benzene (known carcinogens)
- Exposure to radon in the home is responsible for an estimated 20,000 lung cancer deaths each year.
- ETS causes approximately 3,000 lung cancer deaths in non smokers each year in the U.S.
- Some chlorinated solvents, aldehydes, polycyclic aromatic hydrocarbons, and pesticides commonly used indoors are considered likely carcinogens.

Sick Building Syndrome (SBS)

- According to the World Health Organization (WHO), the sick building syndrome involves many symptoms that are common in the general population, but occur at high levels in certain buildings.
- Building related symptoms often go away when people leave the building for holidays and weekends.

Sick Building Syndrome (SBS) - Symptoms

- nose, throat, and eye irritation
- skin rash
- dizziness
- headache
- tiredness
- coughing
- wheezing
- unspecified hypersensitivity
- nausea

Asthma has also been associated with this problem.

Sick Building Syndrome (SBS)

- After WWII, there was a large demand for low cost housing. Suburbs sprang up, houses were built on smaller lots and attached garages became popular, creating an opportunity for combustion products to enter the living space.
- Homes were constructed of less expensive building materials containing adhesives and other components that off gas a wide range of pollutants.
- Over the next several years there was a demand for furnishings and products that make life easier. Carpet and other flooring material, air fresheners, personal care products, pesticides, and easy to use cleaners became popular.

Sick Building Syndrome (SBS)

While these products had advantages, the chemicals they emit are known allergens, irritants, toxicants, and carcinogens that degrade the quality of indoor air. The solution to the pollution was dilution – leaky buildings still prevalent.

Sick Building Syndrome became common after the energy crisis in the 1970's which led to "tight buildings" and a reduction in air exchange rates indoors. Tight buildings are fine as long as adequate fresh air is brought in and least toxic building materials are utilized.

The fresh air exchange is very important for diluting contaminants in the indoor environment.

US EPA has estimated that IAQ problems cost businesses $60 billion dollars a year.

IAQ IS NOT DIRECTLY REGULATED

- US EPA regulates outdoor but not indoor air.
  - EPA has no jurisdiction over the indoor environment.
- OSHA regulates indoor air in the work place.
  - OSHA published draft IAQ rules in 1994, these were withdrawn in 2001.

Radon

Why should I be concerned about radon?

- Breathing in radon is the second leading cause of lung cancer after smoking. Radon is the likely cause of more than 21,000 lung cancer deaths each year in the U.S. In 2015, lung cancer was the leading cause of cancer deaths in N.C.

How Does radon cause lung cancer?

- Radon gas decays into radioactive particles that can get trapped in your lungs when you breathe. These particles break down and release small bursts of energy. This can damage lung tissue and lead to lung cancer over the course of your lifetime. Not everyone exposed to high levels of radon will develop lung cancer, however the risk for lung cancer is increased.

Where is radon found in N.C.?

- Homes in all 100 counties of N.C. have tested at high levels for radon.

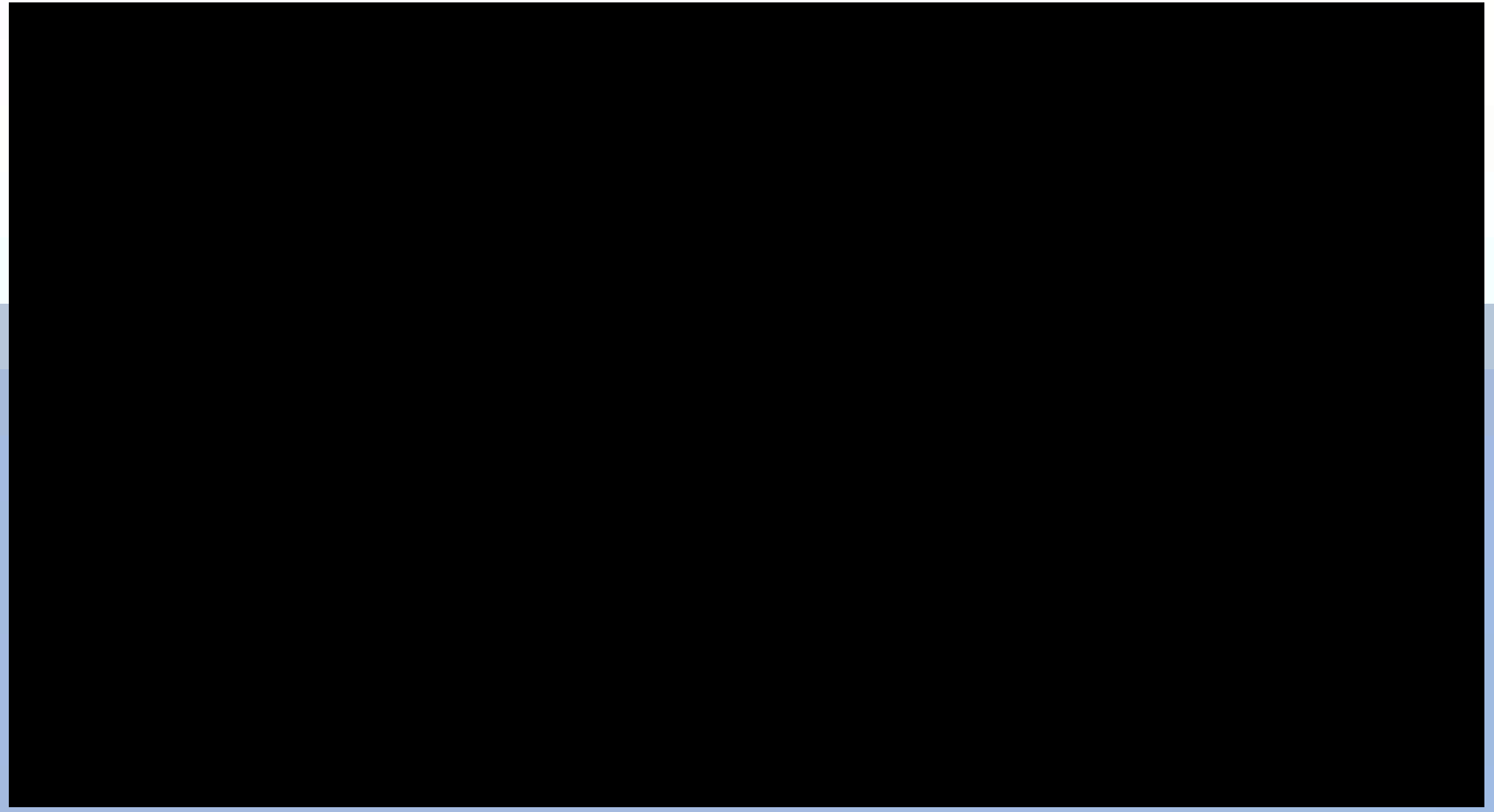
http://ncradon.org/

Radon

- January is radon awareness month. Request a free radon test kit from the NC Radon Program at www.ncradon.org.
- Use only certified radon mitigators (list at site above).
- Do you know about radon? University of Iowa and the Iowa Cancer Consortium (12 min) http://www.canceriowa.org/BreathingEasier.aspx
- Direct Link to Video:

https://youtu.be/Fuzl3Nb_ah0

Radon Video



CO

- CO is an odorless, colorless, toxic gas
- Sources: unvented kerosene and gas space heaters, leaking chimneys and furnaces, back drafting from furnaces, gas water heaters, woodstoves and fireplaces, gas stoves, auto exhaust from attached garages, tobacco smoke
- Symptoms: headaches, dizziness, confusion, nausea, impaired vision and coordination, flu-like symptoms that clear up after leaving home, fatal and very high concentrations

CO Reduce Exposure by:

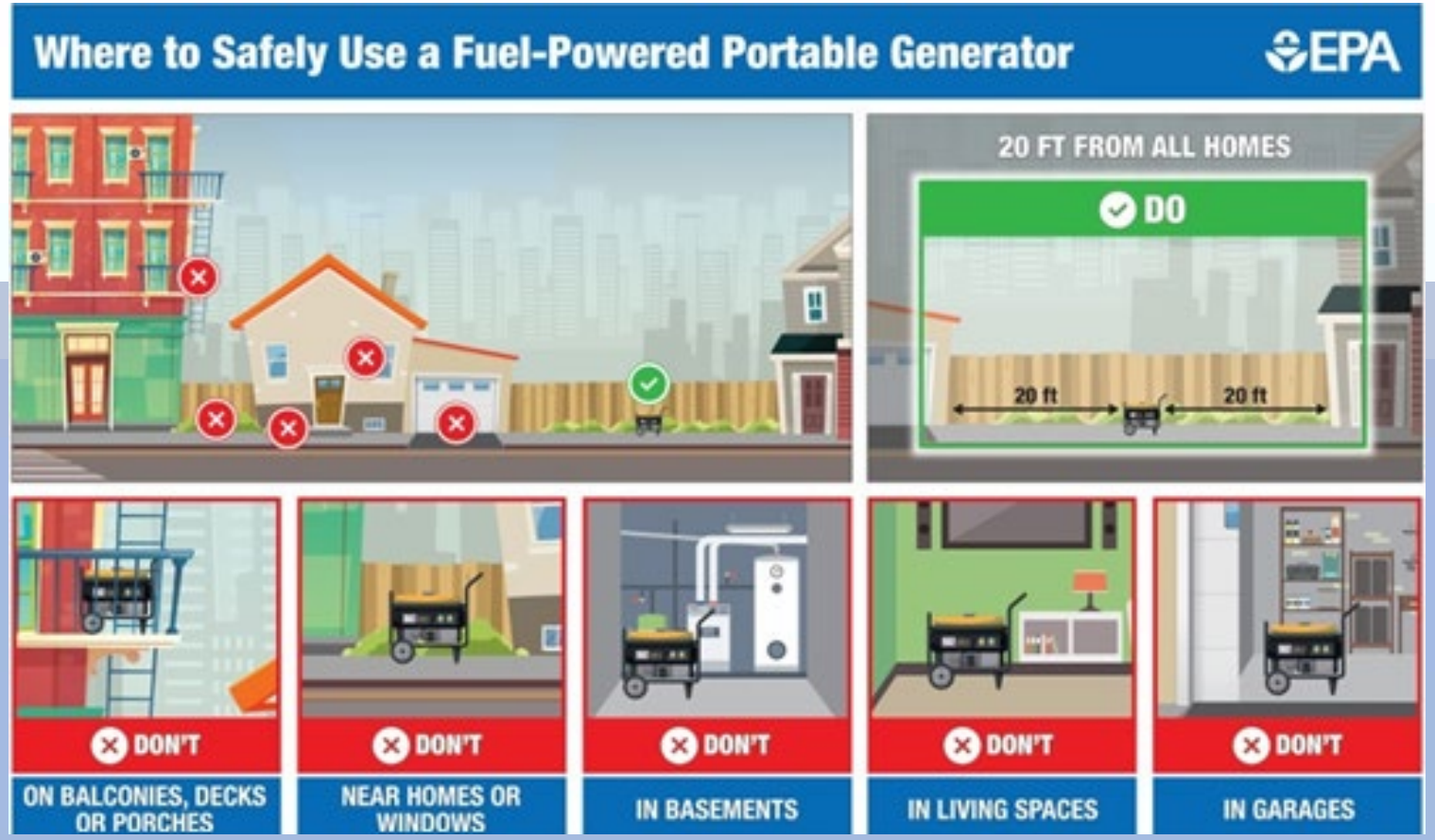
- Keep gas appliances properly adjusted
- Consider purchasing a vented space heater when replacing an unvented space heater
- Install and use an exhaust fan vented outdoors over gas stoves
- Choose properly sized wood stoves that are certified to meet EPA emissions standards. Make certain doors on wood stoves fit tightly.
- Have a trained professional inspect, clean, and tune up central heating systems (furnaces, flues, chimneys) annually
- Do not idle the car inside garage
- Have CO detectors especially if you have combustion appliances

https://www.epa.gov/indoor-air-quality-iaq/carbon-monoxides-impact-indoor-air-quality#epapubs

https://www.cpsc.gov/Safety-Education/Safety-Education-Centers/Carbon-Monoxide-Information-Center/Carbon-Monoxide-Questions-and-Answers

Prevent Carbon Monoxide Poisoning

Install carbon monoxide (CO) alarms. Change the batteries in existing CO and smoke detectors.



- During power outages, portable generators can be used to help temporarily restore power to a few key appliances like refrigerators, lights and fans. Portable generators that use fuels such as gasoline, natural gas or kerosene are widely available. However, if they are not used correctly they can be hazardous because their exhaust contains deadly fumes, like carbon monoxide. Carbon monoxide is a toxic gas you cannot see or smell but could kill you in minutes.

- Remember:

- **Do** use portable generators **outside** and far away from buildings.
- **Do not** use portable generators under any of the following conditions:
  - inside your house or garage
  - on balconies or near doors, vents or windows, and
  - near where anyone is sleeping.

Got Mold?

Get Rid of It!

EPA's Mold Remediation

Recommendations

Molds are Everywhere

- In air or settled, indoors and out
- To grow, they need:
  - Moisture
  - Food (anything organic, dirt, building materials including wood, paper, carpet, insulation, and drywall)
  - Oxygen
- Hidden growth common in water damaged areas

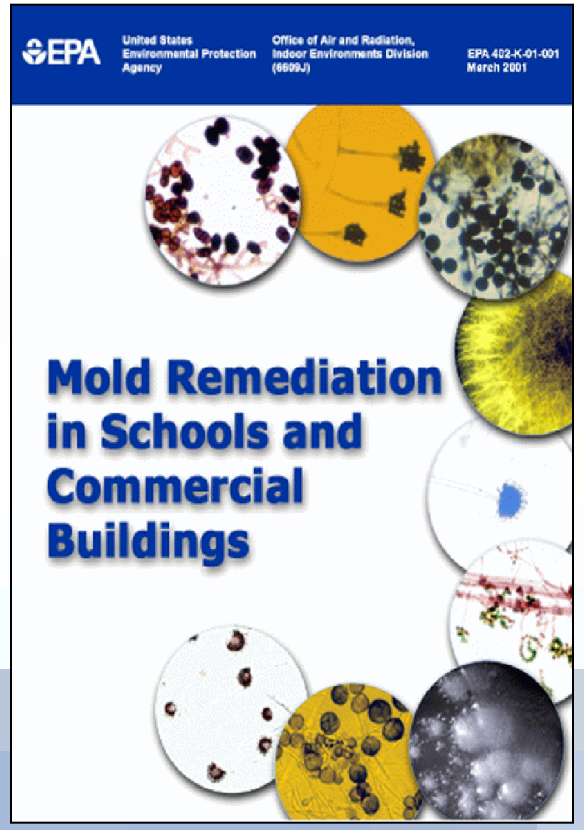
Areas in buildings where moisture may accumulate and mold commonly occurs:

- Basement walls
- Near leaky plumbing fixtures

- Bathroom tile
- Around windows where water may enter

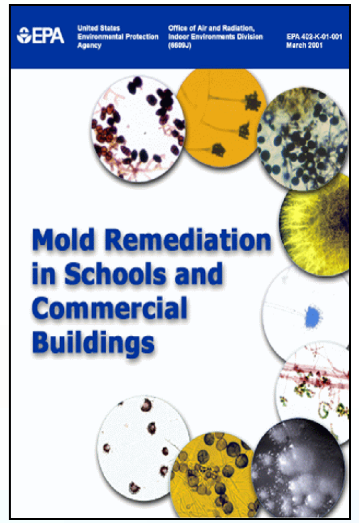
Health Effects from Molds

- Headaches, skin irritation
- Breathing difficulties
- Allergic reactions
- Aggravation of asthma symptoms
- Other symptoms likely- list not all-inclusive



Mycotoxins

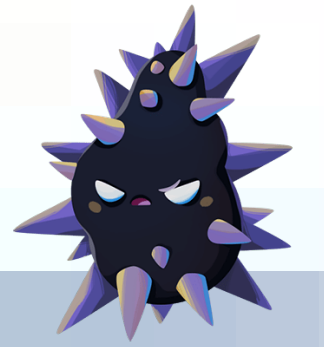
- Over 200 known. Symptoms reported:
  - mucous membrane irritation
  - skin rash
  - immune system suppression
  - liver and CNS damage
  - endocrine effects
  - cancer



Moisture and Molds

- **Control Moisture to Control Molds**
  - Leaks – roof, window
  - Drainage Problems
  - Floods
  - Condensation
  - Plumbing leaks
  - Unvented appliances
  - High Humidity

Moisture and Molds



Moisture and Molds

Mold growing on the back side of wallpaper.

Fix the Water First -- Prevent Mold Regrowth!

Fix leaky plumbing

Stop condensation, fix promptly

Keep HVAC system clean, dry

Vent moisture-generating appliances outside

Clean and dry wet/damp spots within 24-48 hrs

Cleanup Methods

- Wet Vacuum
  - Only if watery
- Damp Wipe non-porous surfaces
  - Water, soap
- HEPA Vacuum
  - High Efficiency Particulate Air
- Discard
  - Water damaged, not salvageable (porous materials)

Personal Protective Equipment (PPE)

- Gloves - protect skin from molds & cleaners
- Goggles or full-face respirator: protect eyes
- Disposable clothing on larger projects
- Respirator – Minimum NIOSH N-95

Molds & Standards

- **No Federal standards** for airborne concentrations of molds/spores
- **No EPA regulations** for airborne mold contaminants, cleanups

“However, it is clearly prudent to avoid exposure to molds and mycotoxins.”

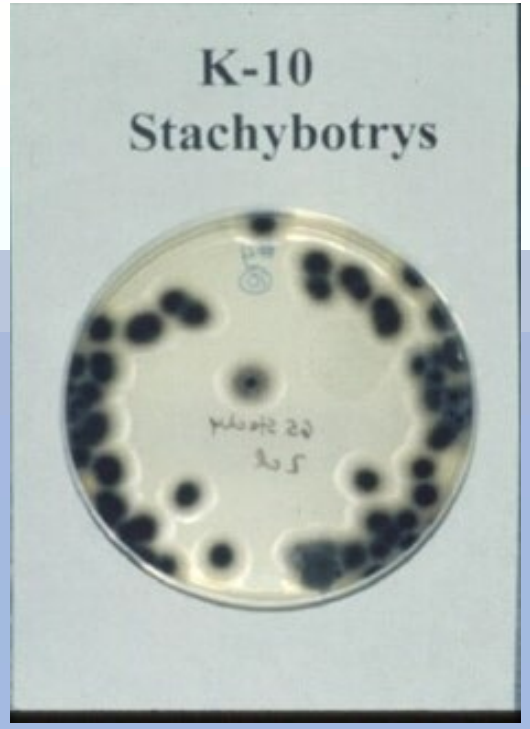
Biocides

Biocides (such as bleach) **not recommended routinely** during mold remediation

If used, ventilate the area (but don't disturb mold spores)

Ensure applicators are properly licensed

EPA on Sampling



- Sample only for medical or legal reasons, or to find hidden mold
- Sample to confirm suspected sources, exposure. Get experienced professional to interpret
- Remember, no guidelines

Sample less, save more

- No guidelines for mold levels!
  - Many molds, levels change quickly
  - Can test air, surface, spore trap, bulk, water, tape lift, dust, PCR, enzyme
- If you see mold growing, you don’t need to test --it’s there!
- Sampling only a snapshot
- Reasons not to sample: https://www.health.state.mn.us/communities/environment/air/mold/moldtest.html


MOR·FLO
GLASS-LINED
WARNING

Make Smart Choices-Consider IAQ

- Building Materials: The Greenguard certification program is a resource for identifying products and materials that have been tested regularly and found to meet VOC and particulate emissions standards. Green Seal is another similar program that is reputable.

  https://www.ul.com/resources/ul-greenguard-certification-program

- Cleaning and Consumer Products: EPA Safer Product Labeling. Look for the Safer Choice Label. https://www.epa.gov/saferchoice

More information about less toxic cleaning and consumer products:

- EPA Safer Product Labeling. Look for the Safer Choice Label http://www.epa.gov/saferchoice
- King County Washington on Choosing Safer Household Products and making green cleaners: https://kingcountyhazwastewa.gov/en/households-disposal/households-safer-home-products

Indoor Air Cleaners

- Avoiding and removing sources of indoor air pollution is the most effective way to prevent poor indoor air quality. Air cleaners can help, but they can only do so much. Read more at:

https://www.epa.gov/indoor-air-quality-iaq/air-cleaners-and-air-filters-home

For room air cleaners not part of a whole house system

- Certified air cleaners have been tested and given a clean air delivery rate (CADR). If an air cleaner is not rated, you have no way of knowing if it actually cleans the air.
- Recommend air cleaners with a CADR rating that is sufficient for the size of the room. Check CADR rated air cleaners at the following web site: https://ahamverifide.org/

Hazardous Ozone Generating "Air Purifiers"

- Note: Avoid portable air cleaners and furnace/HVAC filters that intentionally produce ozone. Ozone is a lung irritant. Note that in some cases, air cleaners that contain electrostatic precipitators, ionizers, UV lights without adequate lamp coatings, and plasma air cleaners may have the potential to emit ozone. Both the California Air Resources Board and the Association of Home Appliance Manufacturers maintain lists of air cleaners that have been tested and shown to emit little or no ozone.

https://ww2.arb.ca.gov/list-carb-certified-air-cleaning-devices

Filters for central heat/ac systems

- Look for the Minimum Efficiency Reporting Value (MERV) rating. A rating of 13 is recommended.
- Or as high a rating as your system fan and filter slot can accommodate.
- You may need to consult a professional HVAC technician to determine the highest efficiency filter that will work best for your system.

IAQ Resources

IAQ in general: www.epa.gov/indoor-air-quality-iaq

IAQ in general: www.https://epi.dph.ncdhhs.gov/oee/programs/iaq.html

IAQ in general: https://portal.ct.gov/DPH/Environmental-Health/Environmental-and-Occupational-Health-Assessment/Indoor-Environmental-Quality--IEQ

EPA Mold Site: http://www.epa.gov/mold/

EPA Radon Website: www.epa.gov/radon

NC Radon Website: www.ncradon.org

For more information about Healthy Building Practices:

Healthy Building Network:
http://www.healthybuilding.net/

Healthy House Institute:
http://www.healthyhouseinstitute.com/

U.S. Green Building Council

https://www.usgbc.org/

EPA Guidance for Home Remodels:
https://www.epa.gov/indoor-air-quality-iaq/addressing-indoor-environmental-concerns-during-remodeling

For more information about Healthy Building Practices:

Energy Savings Plus Health-IAQ Guidelines: https://www.epa.gov/indoor-air-quality-iaq/energy-savings-plus-health-indoor-air-quality-guidelines

EPA's COVID-19 and IAQ Website: https://www.epa.gov/coronavirus/

Managing Asthma Triggers-EPA

https://www.epa.gov/asthma/asthma-triggers-gain-control

EPA Indoor Air Plus for New Homes: https://www.epa.gov/indoorairplus

Green Built Homes

- Healthy Building Guidelines for new homes in NC
- Incorporates whole-systems approach
- Administered locally by the GreenBuilt Alliance
- For more information: http://greenbuilt.org/

Websites for further information

- https://www.buncombecounty.org/governing/depts/wncair/airquality/default.aspx
- https://www.epa.gov/indoor-air-quality-iaq
- https://www.chimneysolutions.com/blog/nine-things-never-burn-fireplace
- https://www.epa.gov/indoor-air-quality-iaq/interactive-tour-indoor-air-quality-demo-house
- https://www.leaf.tv/articles/what-chemicals-are-in-perfume/
- https://files.hudexchange.info/course-content/health-home-ventilation-ventilation-ventilation/Health-at-Home-Ventilation-Ventilation-Ventilation-Webinar-Slides.pdf
- https://www.epa.gov/indoor-air-quality-iaq/inside-story-guide-indoor-air-quality
- https://ahamverifide.org/about-air-cleaners/
- https://www.healthline.com/health/are-candles-bad-for-you
- https://www.webmd.com/beauty/news/20180813/essential-oils-promise-help-but-beware-the-risks
- https://www.youtube.com/watch?v=UnqIPtZt3Go (Mike Holmes on Radon, radon mitigation)