Energy CLASS Prize – Indoor Air Quality (IAQ)

Module 2 - Surveying the Building & Quantitative IAQ Measurement

November 30, 2023

Overview of the Indoor Air Quality Course

- November 28, 2023 – IAQ Terminology & Safety, Liability & Occupant Input
- November 30, 2023 – Surveying the Building & Quantitative IAQ Measurement
- December 5, 2023 – Air Moving Equipment & Hazard Mitigation
- December 7, 2023 – Identifying Interventions & Communication
- December 12, 2023 – IAQ Cohort

Paul H. Raymer

Paul H. Raymer is a Senior Advisor in Building Science with ICF and brings more than forty-five years of building science experience to the Energy CLASS Prize. He holds numerous BPI certifications and is a certified HERS Rater, IREC assessor, HARCA Board Member, full member of ASHRAE including being a voting member of the 62.2 SSPC, and a member of the AIVC Industry Advisory Committee. He is the heating and cooling sub-committee chair for NREL's Standard Work Specifications.

Agenda – November 30, 2023

Part 1

- Surveying the Building – Qualitative Analysis
- Gain an understanding of the scope of the problems
- Keep Its (Clean, Dry, Pest-free, Contaminant-free, Safe, Ventilated, Comfortable, Maintained)

Part 2

- Quantitative Analysis
- Appreciate the difference between an acute and a chronic problem
- Understanding the purpose and use of diagnostic tools
- How to select and use the right measurement tool

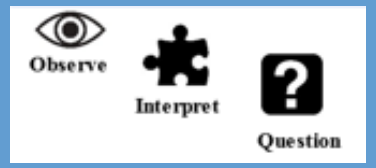
Learning Objectives

- Surveying the building – Qualitative measurements
  - Understanding building health risks from visually inspecting the premises
- Quantitative measurements
  - How to use quantitative measurements in assessing building health and finding solutions
  - IAQ measurement tools

Building Analysis Process

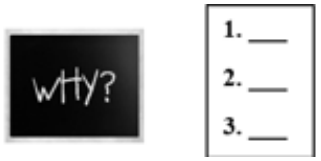
Start with the occupants

Visual (Qualitative) Analysis



Support Analysis with Quantitative Measurement

Justify & Prioritize Hazards



Identify Interventions

Communicate Findings & Plans

Some of these materials were originally produced by the National Center for Healthy Housing through grant support from HUD Office of Lead Hazard Control and Healthy Homes

Assessment Should Include Looking for a Variety of Other Contaminant Sources that may be Exposure Risks in Schools

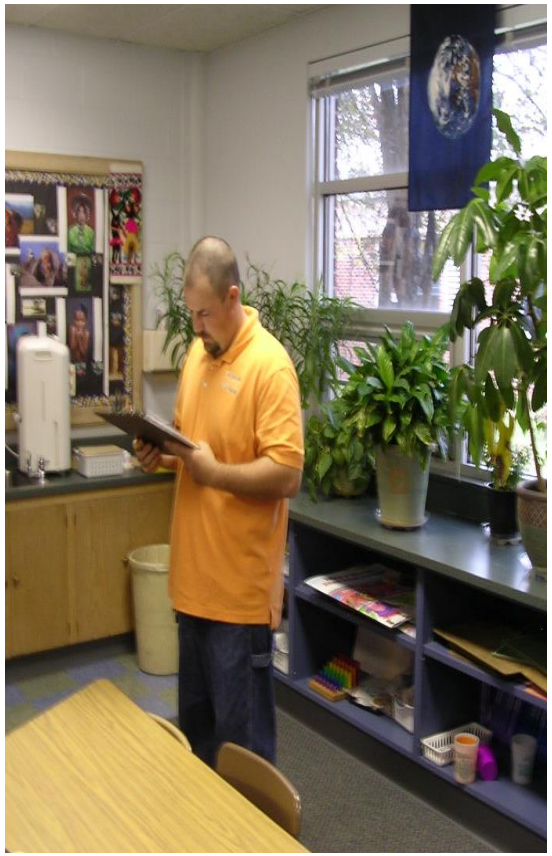
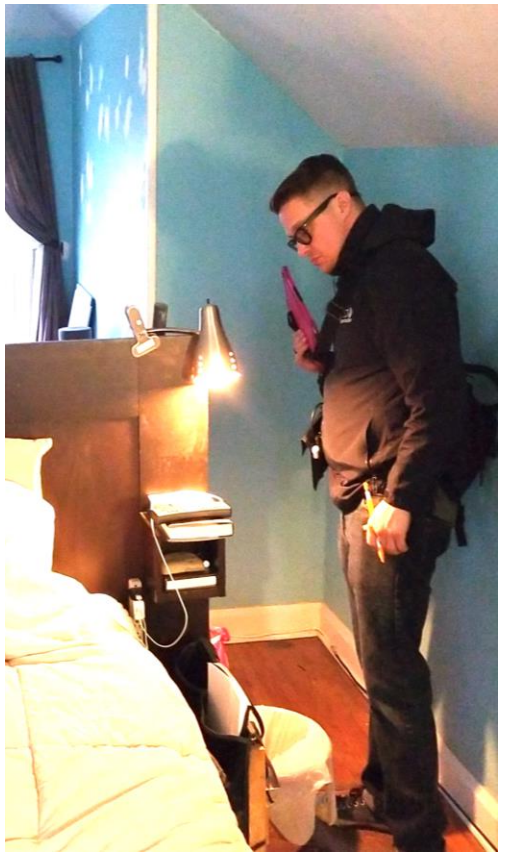


Image ©2023, used with permission from Luke Gard, Children's Mercy Kansas City Healthy Schools Program

- Excessive dust
- Gases and fumes
- Chemicals
- Fragrances
- Sewer gas
- Outdoor pollutants and fumes



Courtesy of Healthy Housing Solutions

Assessment Must Include Environmental Triggers for Asthma







Courtesy of Healthy Housing Solutions

Throughout the building analysis, it is critically important to remember that the building is a system. Unlike a crime scene investigation, we don't even know if there is a "crime scene." Hopefully, there isn't!

Diagnostics – Use Your Senses!

Brain – school as a system

Smell – existing conditions

Breathing – IAQ

See – details

Hearing – existing conditions

Communicating – clients

Trust your gut! Engage your experience! Keep an open mind!

Courtesy of Healthy Housing Solutions

Keep It Dry: Why is moisture an IAQ problem?

Moisture is a link to numerous problems:

- Mold & mildew
- Pests
- Building deterioration

Courtesy of Healthy Housing Solutions

Keep It Dry

- Is it a roof leak?
- Is it a plumbing leak?
- Is it condensation on piping or ducting?

Courtesy of Healthy Housing Solutions

Keep It Dry

Courtesy of Healthy Housing Solutions

Finding moisture and how it gets into the building is a major element of building air quality. Drain traps are vulnerable locations for leaks and vermin entry.

Keep It Dry

All images courtesy of Heyoka Solutions

Keep It Dry

Look for condensation on cold water pipes and ducting.

Energy Vanguard

Keep It Clean
Why is Cleanliness an IAQ Problem?

Filth breeds problems & hides solutions.

KQED

Keep It Clean

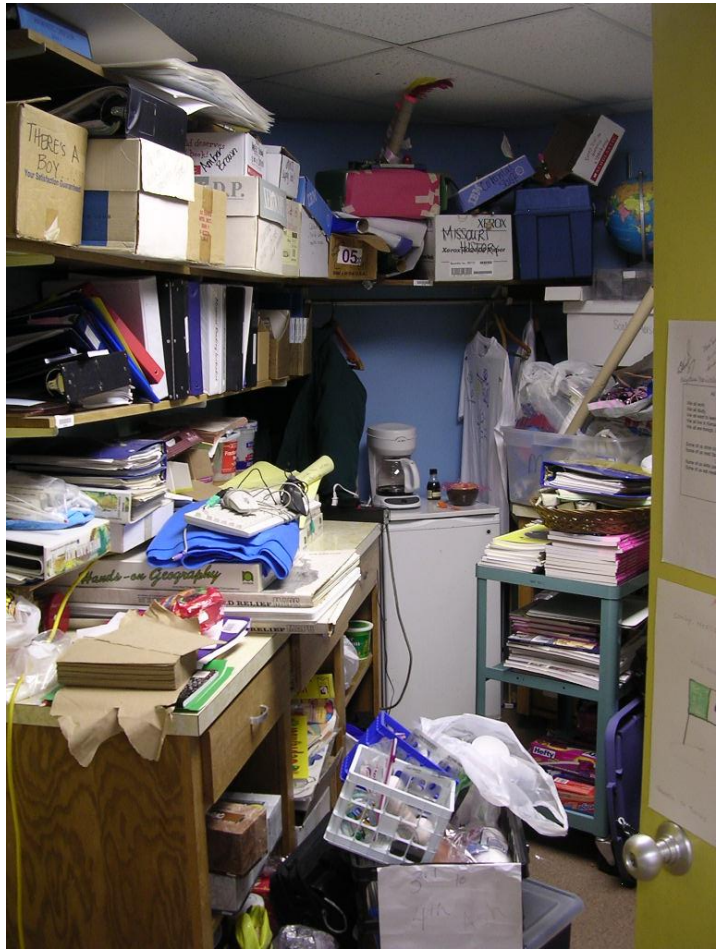
- Installed & maintained barrier mats (walk-off mats) at entrances.

Photo courtesy of ez-ier.com

Tack pads, also called tack mats, placed where workers exit the work site prevent them tracking dust and debris on their shoes.

Keep It Clean

Courtesy of Healthy Housing Solutions



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Keep It Clean

Problematic Cleaning Measures

- Pushing dust into the air increases the number of airborne particulates.
- Air fresheners may expel carcinogenic chemicals into the air.
- Antibacterial product can leave surface residues.

Courtesy of Healthy Housing Solutions

Keep It Clean

Images ©2023, used with permission from Luke Gard, Children's Mercy Kansas City Healthy Schools Program

Clutter is a problem in a school – making it more difficult to keep the spaces clean.

Keep It Clean – Waste Management

- Indoor Waste storage ventilated, protected, and clean. The simplicity of the task does not lessen its importance.
- Outdoor Waste storage protected and clean.

Square One

Courtesy of Healthy Housing Solutions

Keep It Clean – Chemical Products

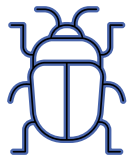
- Keep chemical products in sealed, clearly labeled containers

Photo: Callie Richmond

Cleaning products work by mixing a variety of chemicals. Understanding what they are, the harm that can occur when mixing the chemicals together, requires knowledge and label reading.

Image ©2023, used with permission from Luke Gard, Children's Mercy Kansas City Healthy Schools Program

Indoor chemistry research: https://indoorchem.org/projects/homechem/



Keep It Pest-Free

Why are Pests an IAQ Problem?

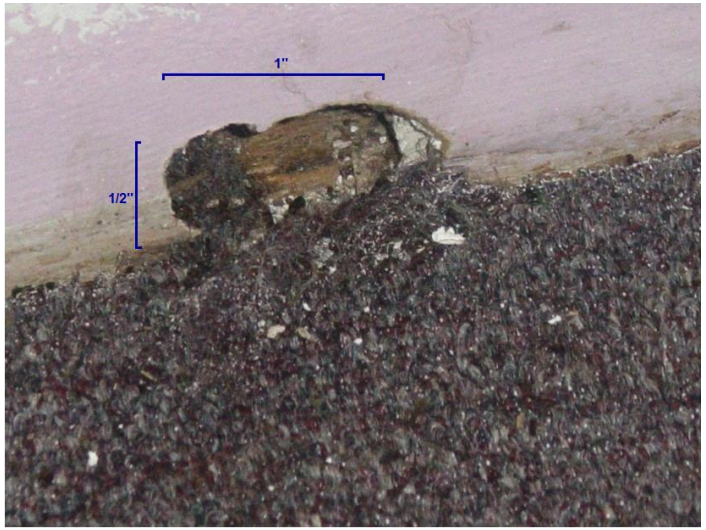
- A pest is any organism considered detrimental to humans in some manner.
- Pests create considerable waste products – saliva, feces, and shedding body parts.
- Cockroaches are a known major allergen source and asthma trigger.
- 10% of people in the U.S. have a dust mite allergy.
- Pests can be destructive to the building.
- Applying insecticide can cause allergy problems

Keep It Pest-Free

- Pests are carriers of viruses, bacteria, and molds.
- Mice can carry salmonella.
- Deer mice are carriers of hantavirus. Rats can carry the plague and murine typhus.
- Rat bites can cause serious injury.

Keep It Pest-Free

All images courtesy of Heyoka Solutions



Mice can fit through a crack or hole 16 mm in diameter – about the width of a dime. This can make it challenging to find the holes

Keep It Pest-Free

Courtesy of Heyoka Solutions

Moisture condensing on the glass is sustenance for these ants.

Ants don’t usually cause an allergic reaction, but pesticides sprayed on them might

Keep It Pest-Free

Courtesy of Heyoka Solutions

The cockroach frass behind this thermostat is bad but note that the thermostat was responding to the temperature in wall cavity when the air handler turned on and drew the space negative, sucking the air through this hole.

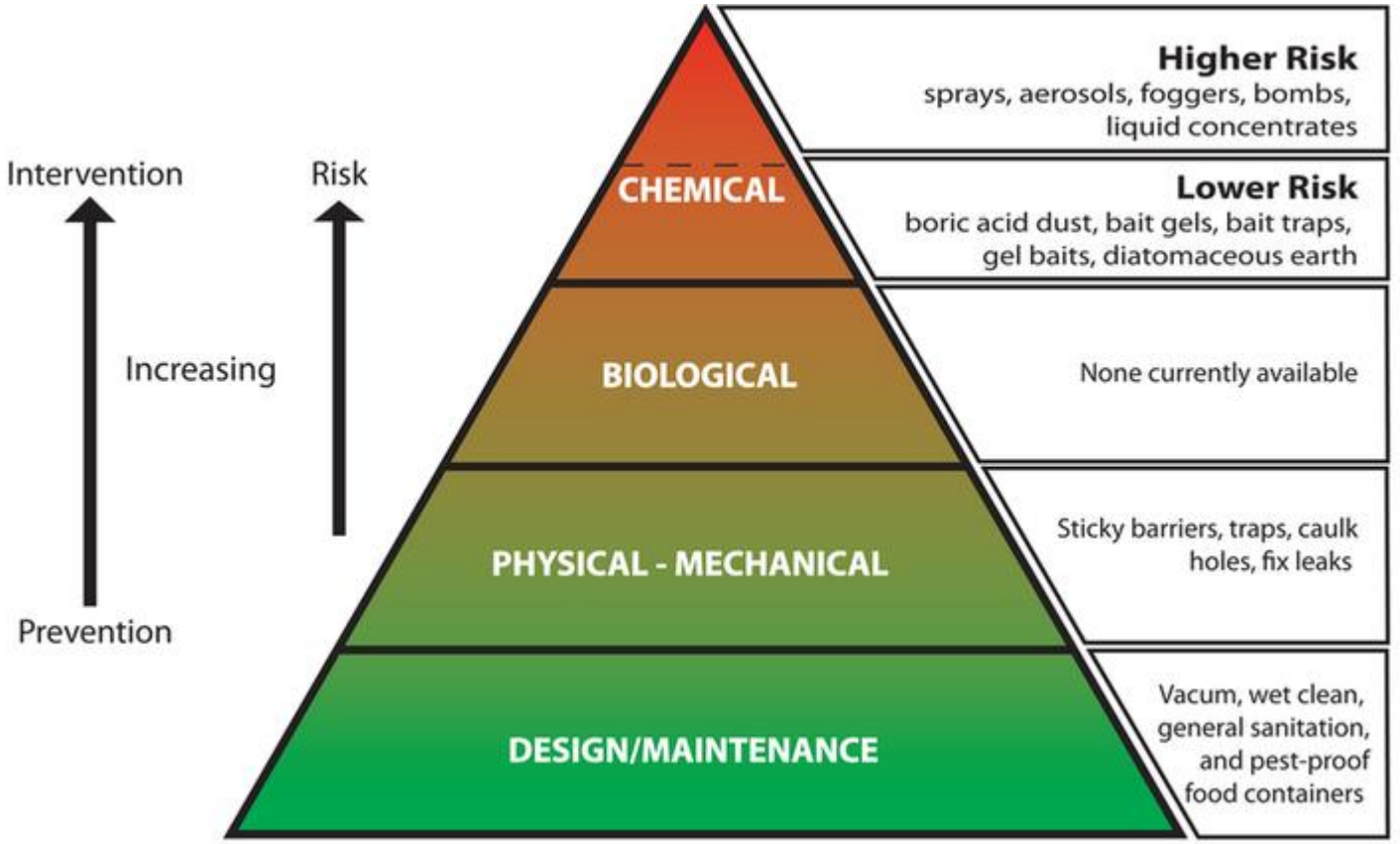
IPM – Integrated Pest Management

A good Integrated Pest Management program has three components:

1. Identifying and monitoring pest problems;
2. Selecting the best pest management tactics;
3. Record keeping and evaluating the program.

Refer to the EPA's Integrated Pest Management Principles
https://www.epa.gov/safepestcontrol/integrated-pest-management-ipm-principles

IPM – Integrated Pest Management



Keep It Contaminant-Free

Indoor Combustion Sources can be a Significant IAQ Issue (CH_4, CO, NO_2)

Consider ALL sources of combustion byproducts

- Gas Appliances and Water Heaters
- Gas Furnaces
- Gas/Fuel Space Heaters
- Candles and Incense

All images courtesy of Healthy Housing Solutions

Keep It Contaminant-Free

Food, Drugs and Cosmetics	• Food and Drug Administration
Pesticides	• Environmental Protection Agency
Other Products Containing Hazardous Substances	• Consumer Products Safety Commission (CPSC)
Material Safety Data Sheets (MSDS)	• Occupational Safety and Health Administration

Keep It Contaminant-Free

- Signal word
- Affirmative statement of principal hazard
- Statement to read other cautions on another panel if all labeling is not on Principal Display Panel

Courtesy of Heyoka Solutions

CPSC Principal Display Panel

Keep It Contaminant-Free

Courtesy of Heyoka Solutions

What's in the cleaning closet?

Warning
Caution
Danger

Keep it Contaminant-Free

- Flash Point
- Extremely Flammable
- Flammable
- Combustible

Flammables start fires. Combustibles feed fires. If you need to choose, pick a combustible.

Keep It Contaminant-Free

Labels to Look for when Purchasing Art and Craft Materials

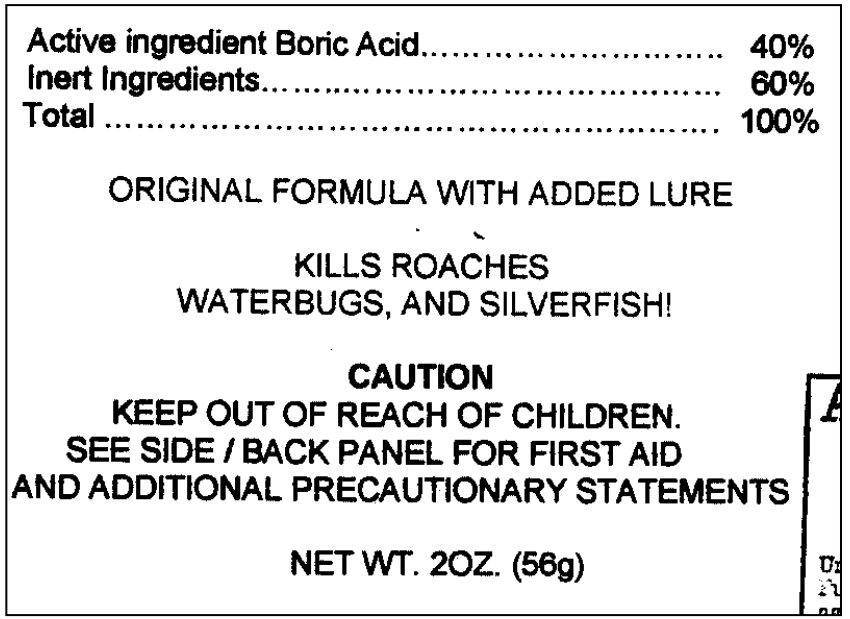
All art and craft products to be purchased must bear a statement of conformity to ASTM D-4236 to ensure proper health hazard labeling in accordance with federal law.

Materials bearing these health hazard labels must not be purchased for use by students in K-6th grades.

If a product contains a hazardous substance, the label must include a signal word to call attention to the hazard, such as DANGER, CAUTION, WARNING, HAZARD, or POISON. The label may also include the statement “Keep out of reach of children”. These are clear indications that the product is not appropriate for use by children age 12 and younger.

Keep It Contaminant-Free

- Pesticide Product Name
- Ingredients
  - Active
  - Inert / Other
- “Keep Out of Reach of Children”
- Signal Work - Poison/Danger/ Warning/Caution
- First Aid
- If Poison, then skull and crossbones
- Net contents.


Active ingredient Boric Acid..... 40%
Inert Ingredients..... 60%
Total 100%

ORIGINAL FORMULA WITH ADDED LURE

KILLS ROACHES
WATERBUGS, AND SILVERFISH!

CAUTION
KEEP OUT OF REACH OF CHILDREN.
SEE SIDE / BACK PANEL FOR FIRST AID
AND ADDITIONAL PRECAUTIONARY STATEMENTS

NET WT. 2OZ. (56g)

EPA Registration Number is Key

EPA Pesticide Product Label

Keep It Contaminant-Free

The legal definitions of "friable" and "non-friable" asbestos clearly depicts the differences between dangerous and safe asbestos-containing materials (ACMs).

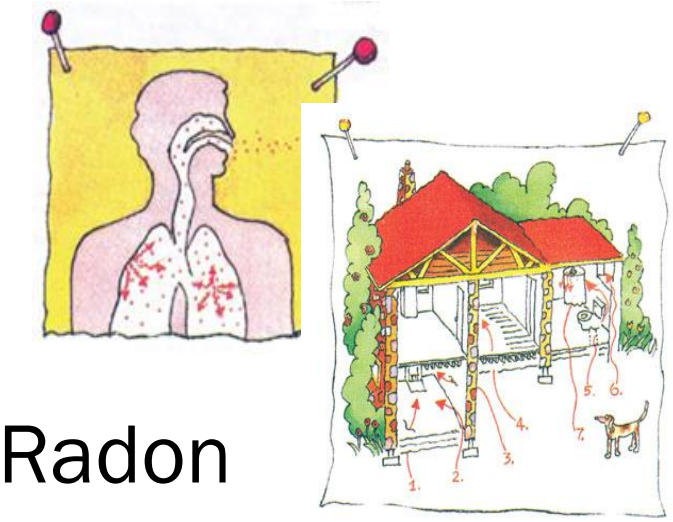
- **Friable ACM is any material that contains more than one percent asbestos by weight or area, depending on whether it is a bulk or sheet material and can be crumbled, pulverized, or reduced to powder by the pressure of an ordinary human hand.**

- **Non-friable ACM is any material that contains more than one percent asbestos, but cannot be pulverized under hand pressure.**

Courtesy of Heyoka Solutions

Friable & Non-Friable ACM

Keep It Contaminant-Free



Radon

©Armand C Magnelli, Livable Housing, Inc.

VOCs

All images courtesy of Heyoka Solutions

Keep It Comfortable/Climate Controlled

Overheated or overcooled classrooms have a significant impact on learning and Indoor Environmental Quality.

Courtesy of Heyoka Solutions

Keep It Maintained

- Ongoing building maintenance helps avoid hazards.
- Addressing lead-based paint is an extremely important maintenance task because its impact on health is so damaging

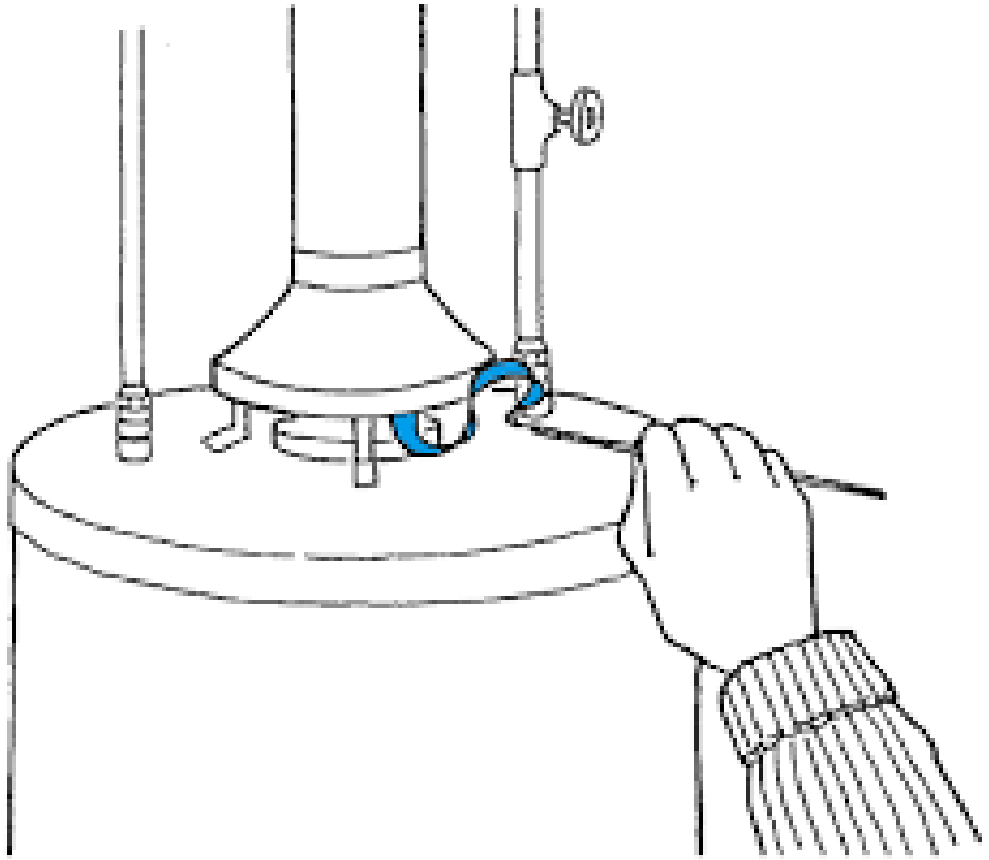
Keep It Maintained

- Pour water down floor drains
- Mineral oil for infrequently used drains

Courtesy of Heyoka Solutions

Keep It Maintained

- Check combustion appliances for backdrafting, spillage, and flame roll out.



Natural Resources Canada

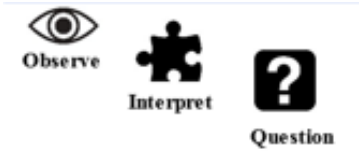
One word for the primary contaminant in your school

Quantitative Measurements

Building Analysis Process

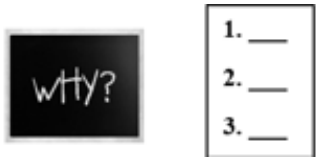
Start with the occupants

Visual (Qualitative) Analysis



Support Analysis with Quantitative Measurement

Justify & Prioritize Hazards



Identify Interventions

Communicate Findings & Plans

Quantitative Measurement

A back to the basics moment . . . . . .

What is the difference between a qualitative and a quantitative assessment?

Quantitative Measurement

Do I need to do quantitative measurement or collect a sample?

If yes, how do I select and use the right tool or sampling method?

What will my data look like?

How do I connect my results to evidence-based practice?

Basic Quantitative Measurements

- Temperature- ambient and surface (Infrared or IR)
- Moisture Bulk and Vapor (Relative Humidity or RH)
- Dew Point Temperature
- Combustion gases (natural gas, methane and propane)
- Carbon Monoxide (CO) including low levels
- Water temperature
- Pressure and flow (manometer and flow devices)
- Lighting

Advanced Quantitative Measurements

- Nitrogen Dioxide (NO_2)
- Carbon Dioxide (CO_2)
- Mold and Pollens
- Allergens
- tVOCs
- Particulates
- Water contaminants
- Chemical composition (surfaces or air)
- and…

Neighborhood IAQ Monitoring

https://www2.purpleair.com/

To dilute polluted air inside, clean fresh air must come from the outside.

Question 1: Do I need to do a quantitative measurement or collect a sample?

Question 1: Do I need to do a quantitative measurement or collect a sample?

Do I see, feel, hear or smell a possible hazard and need to confirm whether it is a problem or not?

Yes → I need to do quantitative measurement or collect a sample

No → Does the occupant report an issue even though I don't see, feel, hear or smell a hazard?

No → ⊘

Yes → I need to do quantitative measurement or collect a sample

Example 1

- You don’t see anything wrong with any of the gas appliances in the building.
- But the occupants report symptoms that sound like CO poisoning.

Do you need do quantitative measurement?

Image ©2023, used with permission from Luke Gard, Children’s Mercy Kansas City Healthy Schools Program

Example 2

Courtesy of Heyoka Solutions

You see mold on the interior of the basement wall.

Do you need to do quantitative measurement?

Example 3

- You observe a variety of surfaces in the building that are extremely damp but you don't directly observe any mold.

Do you need to support your visual assessment with quantitative measurement?

Courtesy of Heyoka Solutions

Example 4

Courtesy of Healthy Housing Solutions

- Your thermo-hygrometer measures a somewhat high level of humidity in the building you are assessing.
- A teacher told you that one student has a dust mite allergy but is pretty sure the classroom is properly maintained but she doesn't understand why her student is still having allergy symptoms.
- You think there might be a high level of dust mite allergen in the building despite the regular cleaning, but the source of the mites is not obvious.

Do you need to do quantitative measurement?

Question 2: How do I select and use the right tool or sampling method?

Question 2: How do I select and use the right tool or sampling method?

Tool Options

Basic quantitative measurement tools:

1. Combustible gas detector
2. Smoke stick
3. Carbon monoxide detector
4. Thermo-hygrometer (Portable psychrometer)
5. Infrared thermometer
6. Moisture meter

Advanced quantitative measurement tools:

1. Anemometer
2. Manometer
3. Flow hood
4. Particle counter
5. Multi-gas detector
6. Infrared camera

Premium quantitative measurement tools:

1. Formaldehyde detector
2. Carbon dioxide detector
3. Ozone detector
4. Nitrogen dioxide detector

Question 2: How do I select and use the right tool or sampling method?

Yes → I need to do quantitative measurement

Okay, what tool should I use?

1. What is the purpose of the measurement?
2. What are the characteristics of the data that I need my measurement to produce?

Question 2: How do I select and use the right tool or sampling method?

1. What is the purpose of the measurement?

2. What are the characteristics of the data that I need my measurement to produce?

I need to determine if there is enough air flow in a classroom. A teacher says it often seems stuffy in the classroom.

Maybe I'll use a smoke stick.

No, that only tells me which way the air is flowing.

I'll use an anemometer. That will tell me how much air is flowing in cubic feet per minute.
Or use a CO_2 monitor if it is available.

Question 2: How do I select and use the right tool or sampling method?

1. What is the purpose of the measurement?
2. What are the characteristics of the data that I need my measurement to produce?

I smelled a rotten egg odor in the basement, and I need to figure out if sewer gases are the problem.

A gas leak detector will produce a sound if there is sewer gas.

But that only tells me if there is any gas at all in the area.

I need a gas indicator to tell me the explosive limit of a specific gas – methane.

Question 2: How do I select and use the right tool or sampling method?

Combustible gas indicator

Combustible gas detector

Particle counter

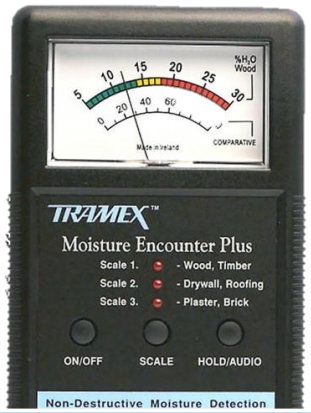
Infrared camera

Carbon dioxide detector

Manometer

All images courtesy of Heyoka Solutions

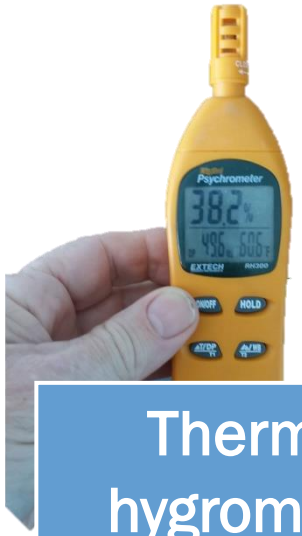
Question 2: How do I select and use the right tool or sampling method?



Moisture Meter

Smoke Stick & Vapor generator

Carbon Monoxide detector



Thermo-hygrometer

Infrared thermometer

Anemometer

All images courtesy of Heyoka Solutions

Question 2: How do I select and use the right tool or sampling method?

Tool	What it measures:
Combustible gas detector	Combustible gases, including natural gas, propane, methane
Smoke Stick	Direction of air flow
Carbon monoxide detector	Carbon monoxide gas
Thermo-hygrometer	Temperature and humidity
Infrared thermometer	Surface temperature of any object
Moisture meter	Moisture in wood or drywall
Air quality monitor	CO_2, $PM_{2.5}$, PM_{10}, HCHO

Note that sampling is an advanced step and something to turn over to a licensed or certified professional.

Question 2: How do I select and use the right tool or sampling method?

- **Understanding instrument variables:**
- **Accuracy**
  - Ability to detect true value of a measured quantity
- **Range**
  - Low and high values that encompass the purpose of measuring a given parameter
- **Resolution**
  - Increment of change an instrument can detect
- **Sensitivity**
  - Smallest increment that can initially be detected

Airflow - Smoke Stick

Airflow: To detect airflow, use special chemical smoke or a piece of tissue. Release puffs of smoke near openings between the complaint area and adjacent areas, openings include:

- Cracks
- Ducts
- Wiring and plumbing passageways
- Leaky or open doors and windows
- Release smoke near vents and grilles to determine airflow direction, if any. Do not breathe on or move quickly near puffs of smoke.

https://www.epa.gov/iaq-schools/indoor-air-quality-problem-solving-tool

Airflow - Smoke Stick

- Ventilated
- Safe
- Maintained

Courtesy of Heyoka Solutions

Duct Leakage

- Dry
- Pest free
- Safe
- Ventilated
- Contaminant Free
- Maintained

Courtesy of Heyoka Solutions

Animals in the Classroom

Animals in the classroom

- Pest free
- Safe
- Ventilated
- Contaminant Free
- Maintained

IAQ Monitor

Anemometer

Courtesy of Healthy Housing Solutions

Combustible Gas - Grounds Maintenance

- Safe
- Ventilated
- Contaminant Free
- Maintained

Combustible gas detector

Courtesy of Heyoka Solutions

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Carbon Monoxide - Food Service

- Safe
- Ventilated
- Contaminant Free
- Maintained

CO Monitors

Image ©2023, used with permission from Luke Gard, Children's Mercy Kansas City Healthy Schools Program

Pressure - Food Service

- Safe
- Ventilated
- Contaminant Free
- Maintained

Image ©2023, used with permission from Luke Gard, Children's Mercy Kansas City Healthy Schools Program

Digital manometers

Air temperature & relative humidity Thermo-Hygrometer (or Sling Psychrometer)

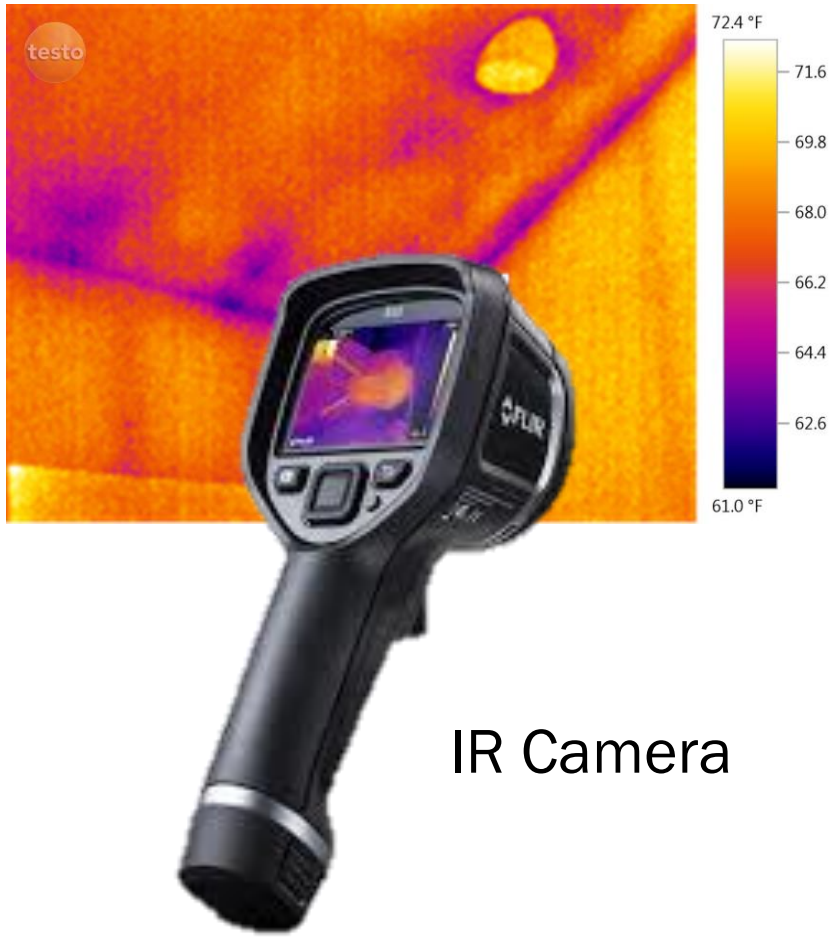
- Dry
- Ventilated
- Safe
- Contaminant Free
- Maintained
- Comfortable – Climate Controlled

Courtesy of Heyoka Solutions

Surface temperatures - Infrared Thermometer (or Camera)

- Dry
- Pest free
- Safe
- Contaminant Free
- Maintained

IR thermometer

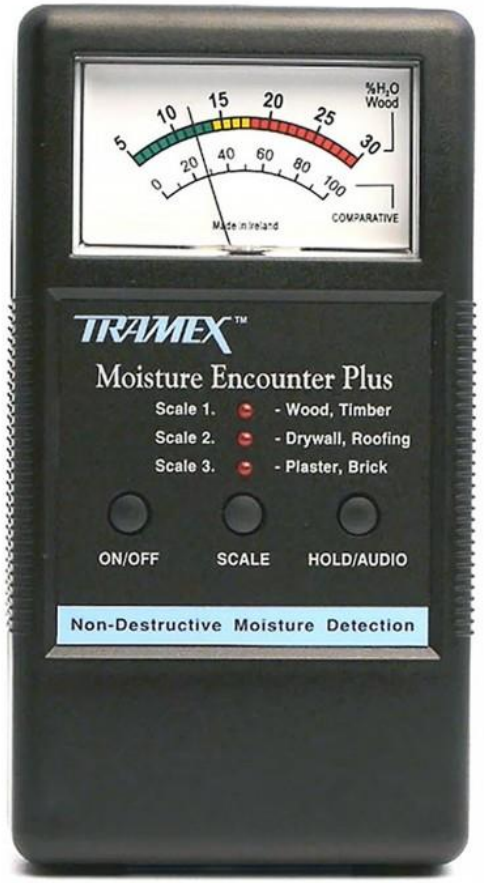


IR Camera

Courtesy of Heyoka Solutions

Moisture Meter

- Dry
- Ventilated
- Pest free
- Contaminant free
- Safe
- Maintained



Courtesy of Heyoka Solutions

Moisture meter

CO_2 Monitor

- Ventilated
- Contaminant free
- Safe

Courtesy of Aranet

CO_2 Monitor

Question 3: What will my data look like?

Question 3: What will my data look like?

1. Combustible gas detector

sound light

Level

Combustible gas indicator

2. Smoke stick

Direction of air flow

3. Carbon monoxide detector

Parts per million

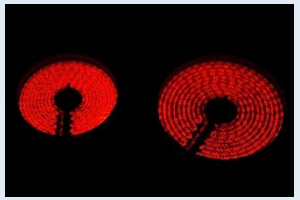
Question 3: What will my data look like?

4. Thermo-hygrometer (Portable psychrometer)

Air Temperature

% Relative humidity

5. Infrared thermometer



Surface Temperature

6. Moisture meter

Level of moisture in wood and drywall

Question 3: What will my data look like?

Units for fungal spores:

- Surface or Bulk Samples
  - TS = Total Spores
  - CFUs = Colony Forming Units
- Air Samples
  - TS/m^3 = Total spores per cubic meter
  - CFUs/m^3 = Colony Forming Units per cubic meter

Detailed Mold Report

(WATER-INDICATING FUNGI ARE SHOWN BELOW IN RED)

Analysis Method	Air Analysis			Air Analysis			Air Analysis		
Lab Sample #	52221176-1			52221176-2			52221176-3		
Sample Identification	26826572			26826576			26826571		
Sample Location	BASEMENT			KITCHEN 1st FLOOR			OUTSIDE		
Sample Type / Metric	Air-O-Cell/75.0L			Air-O-Cell/75.0L			Air-O-Cell/75.0L		
Analysis Date	Tue October 09, 2018			Tue October 09, 2018			Tue October 09, 2018		
Determination	**PROBLEM**			**NORMAL**			**CONTROL**		
Fungal Types Identified	Raw Count	Spores / m^3	% of Total	Raw Count	Spores / m^3	% of Total	Raw Count	Spores / m^3	% of Total
✳INDOOR PROBLEM FUNGI									
Penicillium/Aspergillus	9,250	123,025	99	---	---	---	---	---	---
✳✳Non-Problem Fungi									
Alternaria	---	---	---	7	93	17	3	40	1
Ascospores	---	---	---	---	---	---	23	306	14
Basidiospores	3	40	<1	1	13	2	---	---	---

Brevard County/Pure Maintenance FL

Question 3: What will my data look like?

A laboratory radon test result will provide the radon level at the moment of the test.

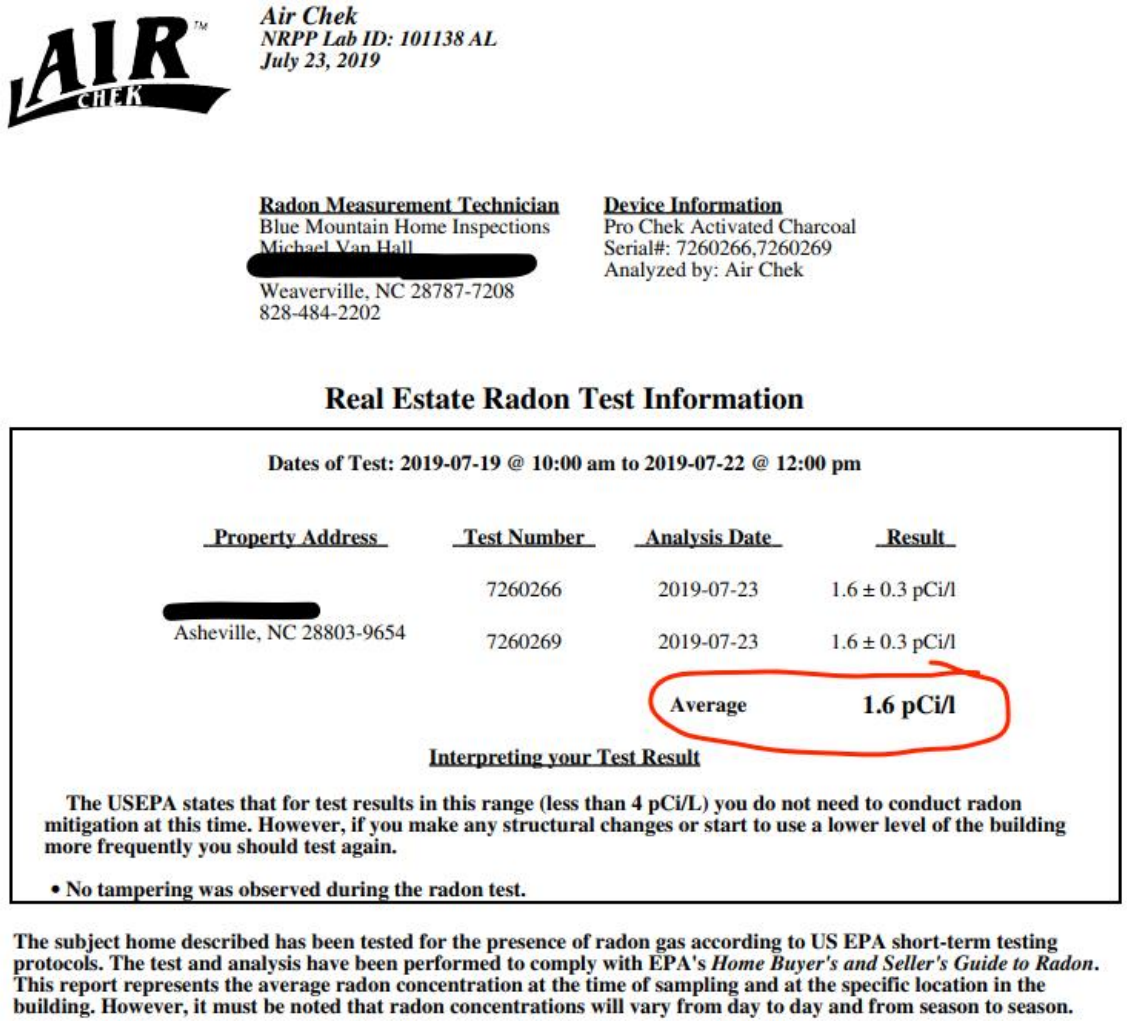
picocurie/Liter = pCi/L

EPA Radon Action Level = 4 pCi/L

World Health Organization Reference Level = 2.7 pCi/L

National Average Indoor Radon Concentration = 1.3 pCi/L

National Average Outdoor Radon Concentration = 0.4 pCi/L



Air Chek
NRPP Lab ID: 101138 AL
July 23, 2019

Radon Measurement Technician
Blue Mountain Home Inspections
Michael Van Hall
[redacted]
Weaverville, NC 28787-7208
828-484-2202

Device Information
Pro Chek Activated Charcoal
Serial#: 7260266,7260269
Analyzed by: Air Chek

Real Estate Radon Test Information

Dates of Test: 2019-07-19 @ 10:00 am to 2019-07-22 @ 12:00 pm

Property Address	Test Number	Analysis Date	Result
[redacted] Asheville, NC 28803-9654	7260266	2019-07-23	1.6 ± 0.3 pCi/l
	7260269	2019-07-23	1.6 ± 0.3 pCi/l
		Average	1.6 pCi/l

Interpreting your Test Result

The USEPA states that for test results in this range (less than 4 pCi/L) you do not need to conduct radon mitigation at this time. However, if you make any structural changes or start to use a lower level of the building more frequently you should test again.

- **No tampering was observed during the radon test.**

The subject home described has been tested for the presence of radon gas according to US EPA short-term testing protocols. The test and analysis have been performed to comply with EPA's *Home Buyer's and Seller's Guide to Radon*. This report represents the average radon concentration at the time of sampling and at the specific location in the building. However, it must be noted that radon concentrations will vary from day to day and from season to season.

Courtesy of Air Chek

Question 4: How do I connect my results to evidence-based practice?

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Hazard	Health standards
Carbon monoxide	Average level should not be above 6 parts per million. Maximum level in a 15 minute period should not be above 87 parts per million. BPI 1200* Standard - exit the building at 70ppm
Radon	Level should not be above 4 picocuries per liter of air (pCi/L).

Health standards also exist for:

- formaldehyde
- carbon dioxide and nitrogen dioxide,
- indoor particulate matter, and
- dust mite, cat, mouse and cockroach allergen levels.

Advanced and expensive measuring equipment are required to make these measurements accurately and consistently.

*BPI = Building Performance Institute

Dampness and Mold

The relationship between dampness, mold exposure and health effects cannot be quantified precisely.

There are no quantitative health-based guidelines or thresholds that can be recommended for acceptable levels of contamination with mold.

World Health Organization's Guidelines for Indoor Air Quality, Dampness and Mould, © World Health Organization 2009

American Lung Association Asthma resources: https://www.lung.org/lung-health-diseases/lung-disease-lookup/asthma/health-professionals-educators/asthma-friendly-schools-initiative/toolkit/resources-and-tools

Question 4: How do I connect my results to evidence-based practice?

Note that these numbers are reasonable averages. For example, $PM_{2.5}$ on the EPA's NAAQS table is 35.0 $\mu g/m^3$ for 24 hours. Health Canada just says, "As low as possible."

Health Parameter Guide

PM2.5	PM10	CO2(ppm)	Levels of Health Concern	HCHO(mg/m³)	Displayed Contents
0.0-12.0	0-54	0-700	Good	0-0.1	Healthy
12.1-35.4	55-154	701-1000	Moderate	>0.1	Unhealthy
35.5-55.4	155-254	1001-1500	Unhealthy for Sensitive Groups		
55.5-150.4	255-354	1501-2500	Unhealthy		
150.5-250.4	355-424	2501-5000	Very Unhealthy		
≥250.5	≥425	≥5001	Hazardous		

These are not official indoor air quality values. They are included here for general reference.

What test equipment do you have?
Select all that apply

A. Temperature – ambient and surface (Infrared or IR)
B. Psychrometer – dew point, RH
C. Combustion gas detector – (natural gas, methane and propane)
D. Carbon Monoxide (CO) detector – including low levels
E. Pressure and flow – (manometer and flow devices)
F. Moisture meter
G. Lighting meter

Phase II Report Point – Keep in Mind for Next Steps

- Identify the differences between "friable" and "non-friable" asbestos.
- Which “Keep Its” do you feel are most directly applicable to what you can do for your school?
- How can quantitative measurements be used to ensure Keep It principles are being followed?
- What are ways you could incorporate students in learning about measurements of air quality?
- When are quantitative measurements necessary?

Next time – December 5, 2023

- Air moving equipment – Keep It Ventilated – ventilate the remainder
- Hazard mitigation

Questions & Discussions