



Energy CLASS Prize – Indoor Air Quality (IAQ)

Module 1 - IAQ Terminology & Safety, Liability & Occupant Input

November 28, 2023

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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.



Overview of the Indoor Air Quality Course

- November 28, 2023 - 1:00-3:00 pm Eastern – IAQ Terminology & Safety, Liability & Occupant Input
- November 30, 2023 - 1:00-3:00 pm Eastern – Surveying the Building & Quantitative IAQ Measurement
- December 5, 2023 - 1:00-3:00 pm Eastern – Air Moving Equipment & Hazard Mitigation
- December 7, 2023 - 1:00-3:00 pm Eastern – Identifying Interventions & Communication
- December 12, 2023 - 1:00-2:00 pm Eastern – IAQ Cohort

Agenda – November 28, 2023

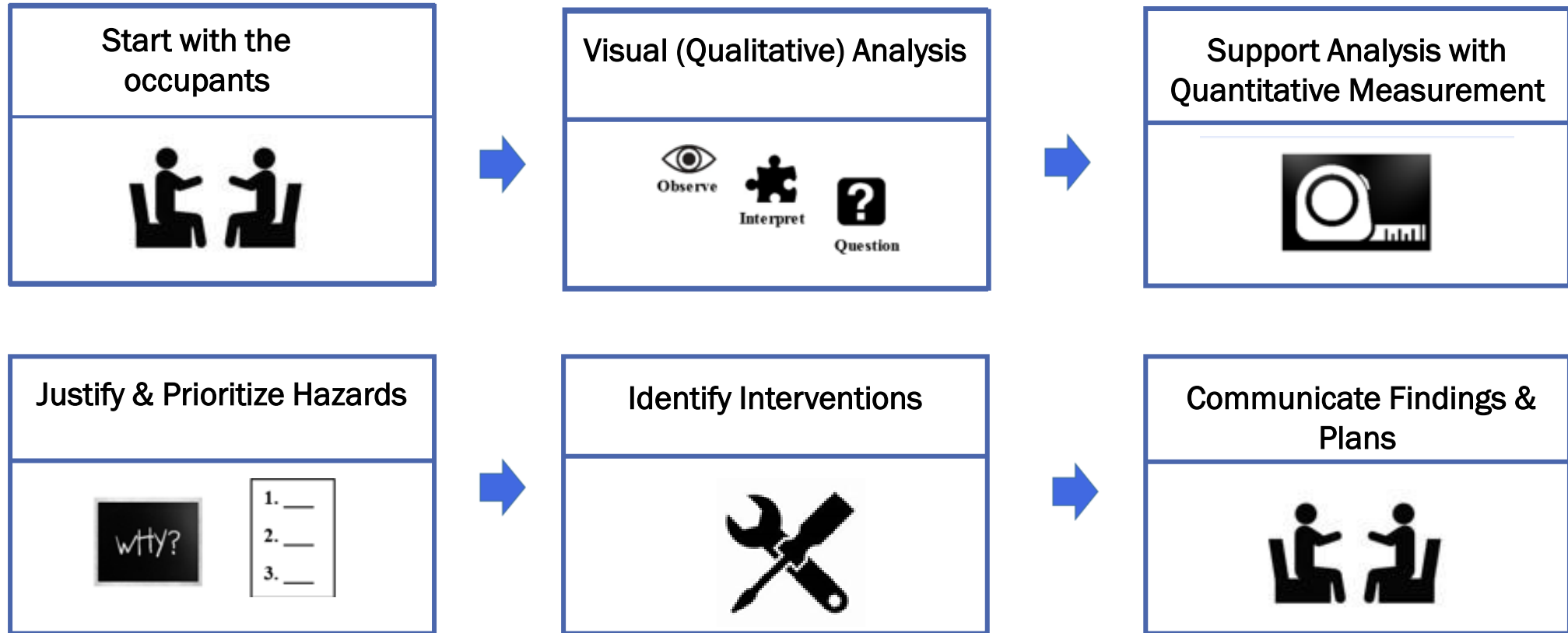
Part 1 - Building Science Fundamentals

- Safety
- Fundamental elements of indoor air quality – where it starts
- Intro to moisture
- Intro to air movement

Part 2 - Safety, liability, & occupant input

- Hazards & Liabilities
- Safety concerns during the analysis of school buildings
- Poor IAQ and common dangers
- Preventative measures

Building Analysis Process



What is one word you associate with IAQ/IEQ?

Audience Makeup Poll 1

What is your role with your schools? (Select all that apply)

- a) Teacher
- b) Administrator
- c) Custodial
- d) Other

IAQ in Schools

The goal of these courses is to build “capacity within local educational agencies to identify and implement energy and health improvements in public school facilities.” These modules are designed to identify, prioritize, intervene, and communicate information about air quality issues.

<https://www.epa.gov/iaq-schools/framework-healthy-indoor-environments-schools>

Unique Aspects of Schools

- Occupants are close together, with the typical school having approximately four times as many occupants as office buildings for the same amount of floor space.
- Budgets are tight, with maintenance often receiving the largest cut during budget reductions.
- The presence of a variety of pollutant sources, including:

- Art and science supplies
- Industrial and vocational arts
- Home economic classes
- Gyms.



All images courtesy of Heyoka Solutions

- A large number of heating, ventilating and air-conditioning systems place an added strain on maintenance staff.
- Concentrated diesel exhaust exposure due to school buses. (Students, staff and vehicles congregate at the same places at the same time of day, increasing exposure to vehicle emissions.) Long, daily school bus rides may contribute to elevated exposure to diesel exhaust for many students.

Unique Aspects of Schools

- As schools add space, the operation and maintenance of each addition are often different.
- Schools sometimes use rooms, portable classrooms, or buildings that were not originally designed to service the unique requirements of schools.

Three Fundamental Steps

The process is fundamentally simple:

- Identify the sources of bad IAQ.
 - Remove the sources of bad IAQ.
 - Ventilate the remainder.
-
- Remember: A building is a system, and everything is connected to the air quality in one way or another.

Why is IAQ Important?

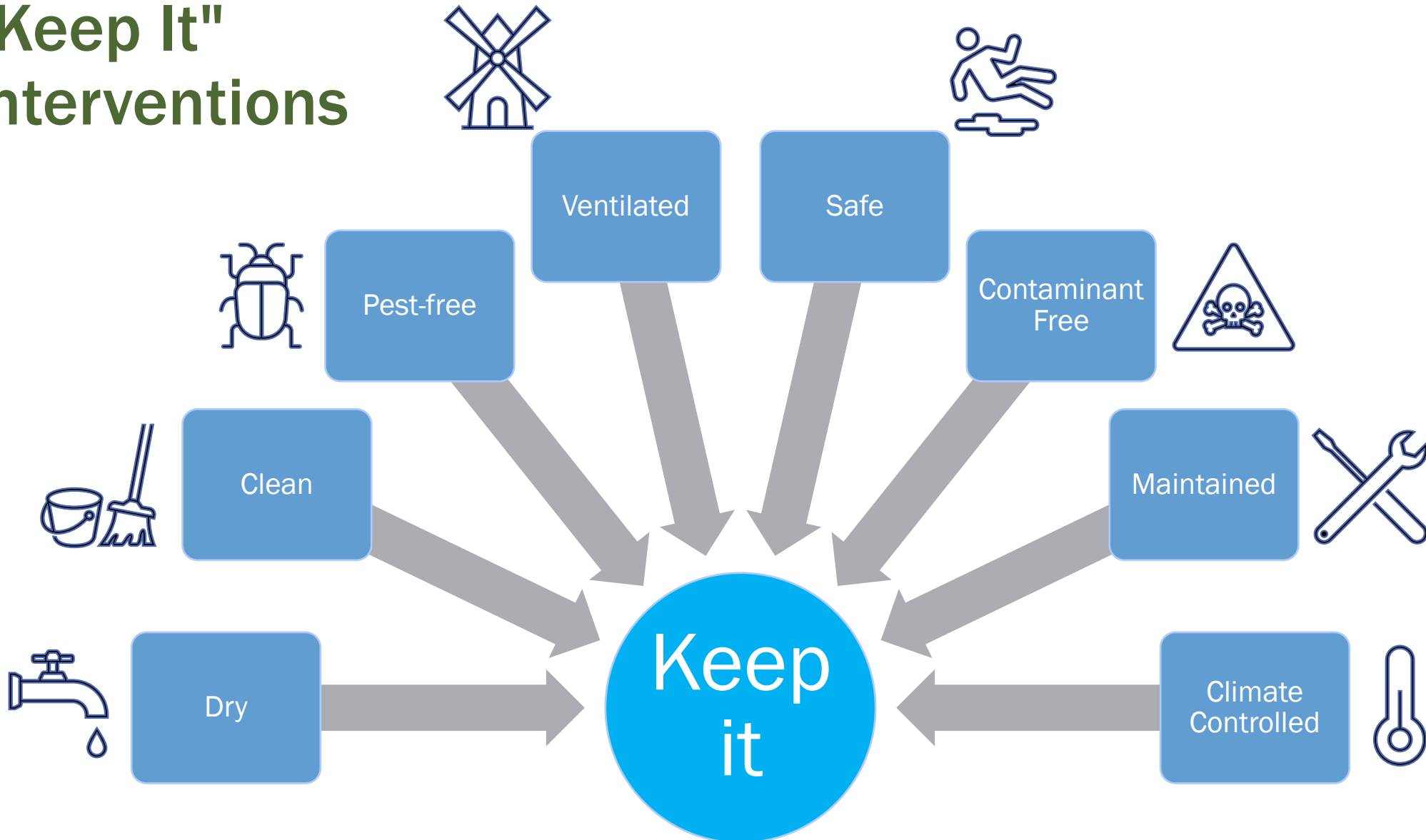
- **Why is IAQ important?**
 - The EPA's Science Advisory Board ranks IAQ among the top 5 environmental risks to public health.
- **Failure to respond to IAQ problems can:**
 - Increase long and short-term health problems for students & staff;
 - Aggravate asthma and other respiratory illnesses;
- The developing bodies of children might be more susceptible to environmental exposures than adults.

- “Good IAQ contributes to a favorable environment for students, performance of teachers and staff and a sense of comfort, health and well-being. These elements combine to assist a school in its core mission — educating children.”

- <https://www.epa.gov/iaq-schools/reference-guide-indoor-air-quality-schools>

- What are the health risks for the participants/evaluator

"Keep It" Interventions



Keep Its are here so you can make the connections with other IAQ slides

Health & Safety

1 Priority in Building Analysis:

Do No Harm – to yourself, to the occupants, to workers, or to the building.

“Should I walk out on the roof to measure the airflow from the vents?”

“Should I crawl under the pipes in the boiler room?”

“Should I grab the tail of the rat that just ran under that pile of cardboard?”

Health & Safety

- Occupational Safety and Health Administration (OSHA)
- You will be going in some tight spaces – crawl spaces, attics, under the stairs.



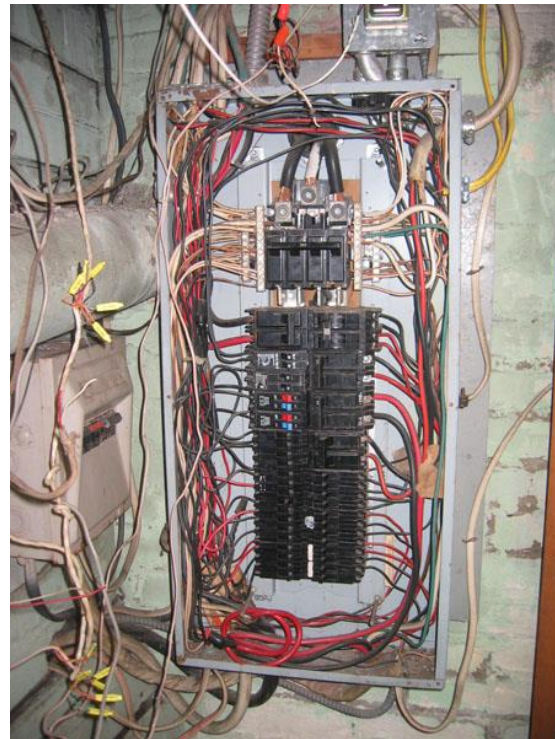
All images courtesy of Heyoka Solutions

Health & Safety

Check for asbestos, uncovered electrical boxes, and loose wiring.



Asbestos insulation



All images courtesy of Heyoka Solutions

How are these issues connected to IAQ?

The asbestos connection is clear. Dangerous wiring can lead to fires, places for critters to nest, melting wires emit VOCs.

Health & Safety

Safety Data Sheets

- What is it?
- Where can you get it?
- Where should you keep it?



A safety data sheet (SDS), material safety data sheet (MSDS), or product safety data sheet (PSDS) is a document that lists information relating to occupational safety and health for the use of specific substances and products.

Dura-Chem, Inc. THERMOBOND 3

Material Safety Data Sheet

Section 1 - Product and Company Identification

Product Name: THERMOBOND 3

Product Description: POWDER COATING FILLER

Sold By: DURA-CHEM INC
19327 PASADENA ST.
LAKE ELSINORE, CA. 92530

Telephone Numbers:

Section 2 - Composition, Information on Ingredients

Ingredient	C.A.S. Number	Percent	T.L.V.	P.E.L.
DIETHYLENTRIAMINE	111-40-0		1 PPM SKIN	
QUARTZ SILICA	14808-60-7	<4	0.1 MG/M3 (respirable)	
MICA	12001-26-2	<3	3 MG/M3 (respirable)	
TITANIUM DIOXIDE	13463-67-7	<3	5 MG/M3 (respirable)	
C. I. PIGMENT GREEN 7	1328-53-6	<1	1 MG/M3 (respirable)	
4,4-ISOPROPYLDIENEDIPHENOL	25036-25-3	<20	5MG/M3	

NOTE: ABOVE INGREDIENTS ARE HARMFUL AS RESPIRABLE AIRBORN PARTICLES. AIRBORN DUST ARE PARTICLES ARE NOT EXPECTED IN THIS PASTE FORM.

Section 3 - Hazards Identification

Potential Health Effects

Routes of Entry: SKIN, EYE, INHALATION IF AIRBORN DUST IS GENERATED.

Inhalation: NOT EXPECTED AS THIS PRODUCT IS A THICK PASTE

Eye Contact: PRODUCT MAY CAUSE MILD IRRITATION.

Skin Contact: MAY CAUSE MILD IRRITATION

Ingestion: MAY CAUSE ABDOMINAL PAIN, NAUSEA, DIARRHEA AND VOMITING.

Chronic effects: LONG TERM RESPIRATION OF AIRBORN DUST MAY CAUSE LUNG DAMAGE.

Carcinogenicity: QUARTZ SILICA COMPONENT IS KNOWN HUMAN CARCINOGEN BUT ONLY AS RESPIRABLE AIRBORN PARTICLES. RESPIRATION OF PRODUCT IN THIS PASTE FORM UNLIKELY. AVOID BREATHING DUST IF GRINDING OR SANDING CURED PRODUCT.

Section 4 - First Aid Measures

Inhalation: REMOVE PERSON TO FRESH AIR. WHEN SANDING OR GRINDING BAKED SURFACE AVOID BREATHING DUST. WEAR PROTECTIVE GEAR TO AVOID RESPIRATION.

Eye Contact: FLUSH EYES WITH LARGE AMOUNTS OF WATER. SEEK MEDICAL ATTENTION IF IRRITATION OCCURS.

Skin Contact: FLUSH SKIN WITH LARGE AMOUNTS OF WATER. SEEK MEDICAL ATTENTION IF IRRITATION OCCURS. WASH CONTAMINATED CLOTHES AND SHOES BEFORE REUSING.

Ingestion: EFFECTS UNKNOWN. SEEK MEDICAL ATTENTION AT ONCE.

Printed August 18, 2006 - Last Updated 8/11/2006 Page 1 of 3

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IAQ Fundamentals

What are the principal drivers of the systems?

Thermodynamics

2nd Law: Energy flows from higher concentration to lower concentration:

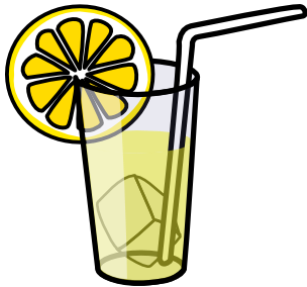
- Hot moves to Cold
- Wet moves to Dry
- High pressure moves to Low pressure

These driving forces are so common and so familiar that they are generally invisible.

IAQ Fundamentals

- 2nd Law: Everywhere in a building.
- Truly fundamental.

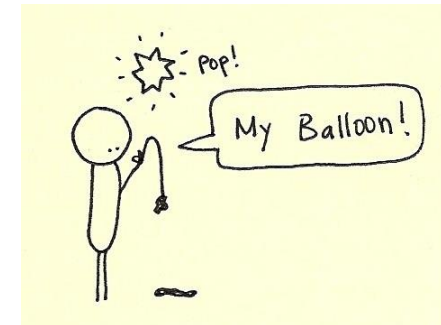
How are these connected to IAQ?
Surfaces below the dew point condense the moisture in the air.
Moisture moving up building materials can be a fertile ground for mold growth.
Pressure differences are a driving force for air movement.



Surrounding heat melts the ice.



Dry towel absorbs the moisture.



High pressure in the balloon moves rapidly to the surrounding lower pressure.

Fundamentals - Pressure

Building pressures drive energy through a building.

Intentional pressure –

- Air in ducts;
- Air rising through chimneys;
- Water moving through pipes.

Unintentional pressure –

- Stack effect;
- Infiltration and exfiltration;
- Hydrostatic pressures in the foundation.

Fundamentals – Pressure

Air pressures in the building are commonly measured in Pascals (Pa). (Heating system pressures are often measured in Inches of Water Column (IWC).)

One Pascal is very, very small about the same as a **gnat burp!**

1 Pascal = 0.004 IWC

25 Pascals = 0.1 IWC (or “ W.C. or in. w.g.)

1 IWC \approx 250 Pascals

BUT in a building, a water heater can backdraft at - 3 PA!

The point is that 1 Pascal is very, very, very, very small. Like a single bubble in a glass of soda

Fundamentals - Pressure

Air pressure measurement is accomplished with a manometer.



Retrotec



Energy Conservatory



Courtesy of Heyoka Solutions



Fundamentals - Heat movement

Heat moves in a building by:

- Conduction
 - Convection
 - Radiation
-
- Heat movement is a driving force.
 - A hot surface can force VOCs out of the paint.
 - Convection is what drives gases up a flue.
 - Radiant heat does not cause air movement.



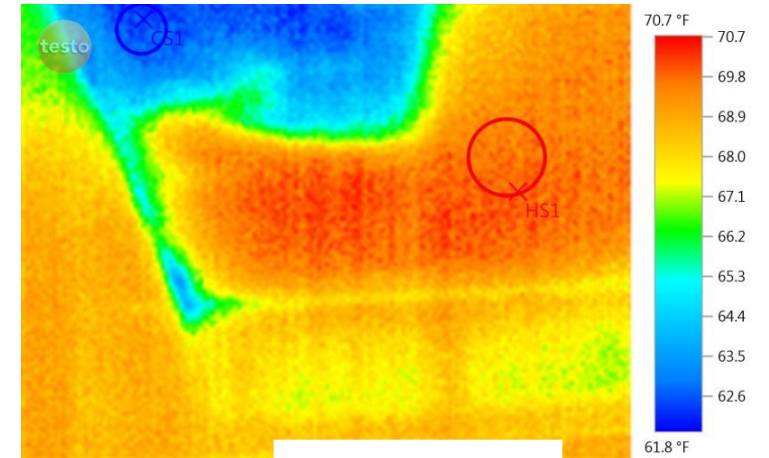
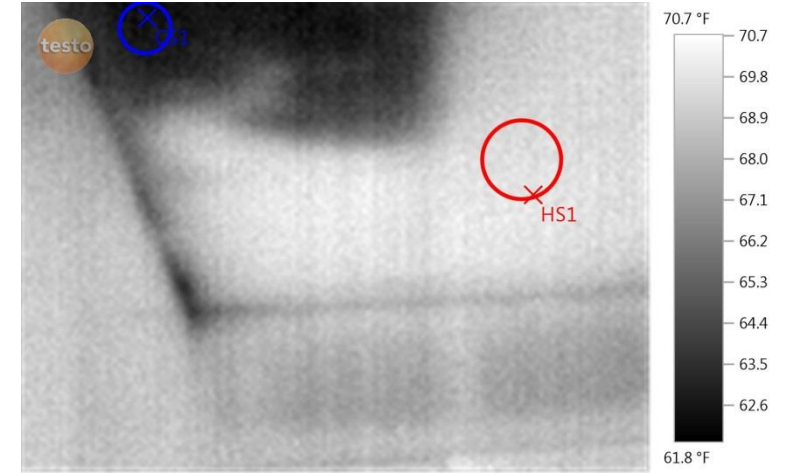
All images courtesy of Heyoka Solutions

Fundamentals - Conduction



Ceiling

The missing insulation in this ceiling may have caused mold growth ... or it may be dust attracted to the surface via static charge.



All images courtesy of Heyoka Solutions

Fundamentals - Convection

Air needs three elements to move:

- Air
- A hole
- A force

Remove any one of them and the convective flow stops.

Closing the hole is the simplest . . . in buildings.

Note that the larger the hole, the larger the flow volume.

Fundamentals - Moisture

2nd Law: Wet moves to dry

Moisture is the largest pollutant in the building.

Three things needed for mold growth:

- Mold spores
- Mold chow
- Moisture



Courtesy of Heyoka Solutions

Moisture

Water doesn't always flow down.
It can get sucked up by capillary action.



All images courtesy of Heyoka Solutions

Fundamentals - Moisture

Types of moisture movement:

Bulk moisture:

- Plumbing leaks
- Roof Leaks
- Streams running through the basement
- Moisture from poor site drainage

Water vapor:

- Cooking
- Showers
- Plant evaporation



All images courtesy of Heyoka Solutions



Relative Humidity

- Air can only hold a certain amount of water per cubic foot. The amount of water relative to the volume of air is called “Relative Humidity” (RH). Cold air is denser and can hold less moisture.
- Relative humidity is a measurement of the amount of moisture in a sample of air relative to the total amount of moisture the sample could hold at a given temperature.
- Cold air is denser and has less room for moisture.
- Warm air can hold more moisture before it becomes saturated at 100% RH.



All images courtesy of Heyoka Solutions

Moisture & Relative Humidity

If you bring air that is 20° F and 100% RH into a heated building, does the RH go up or down?

If the building is too dry in winter, is it too air-tight or too drafty?

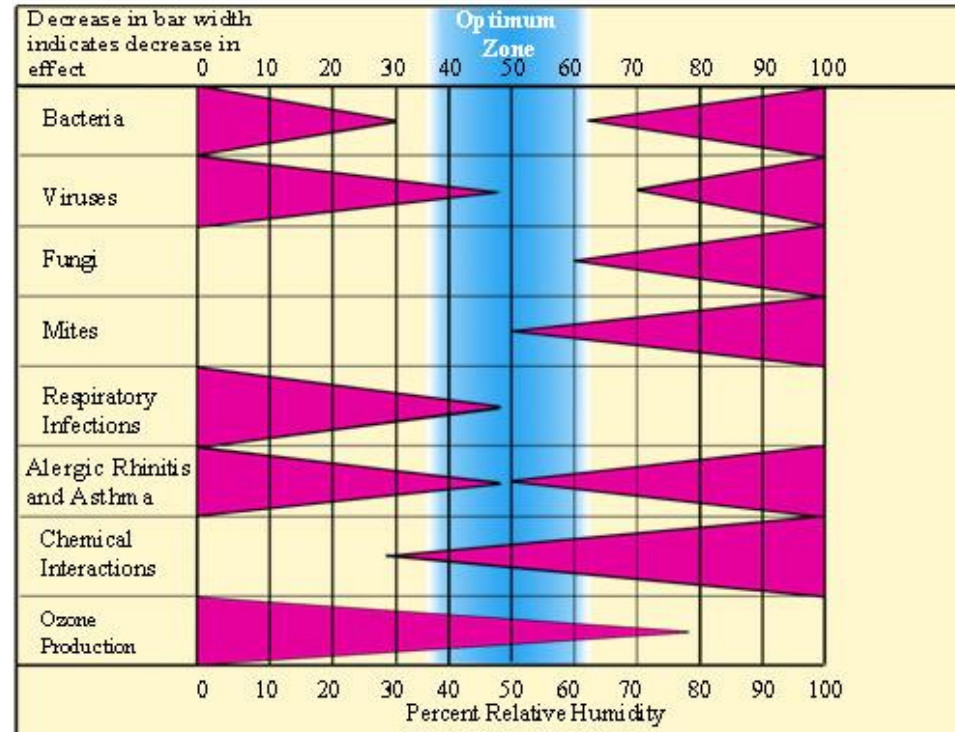
What is a comfortable humidity range in the building?



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

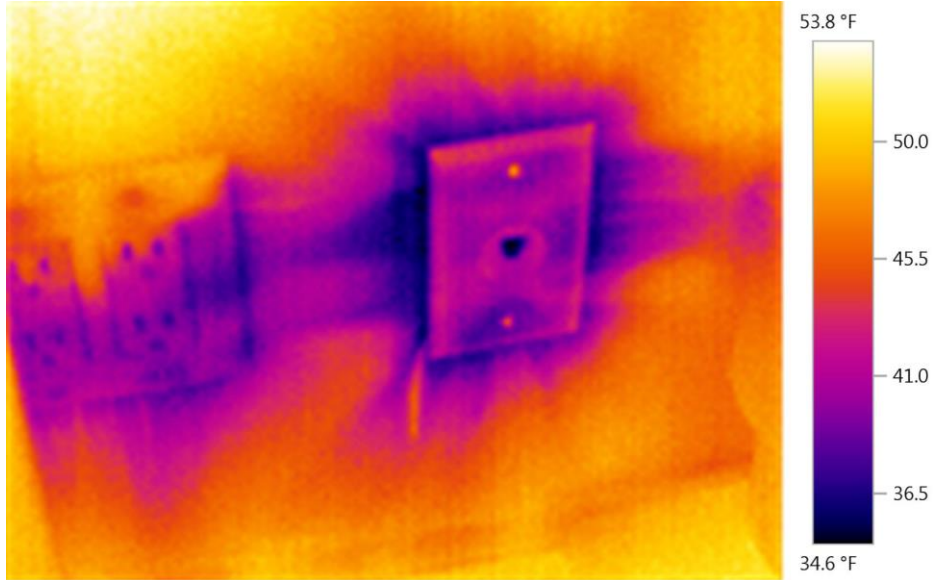
Moisture & Relative Humidity

- One of the few places where/when it is better for humans its not so good for others!
- We need to carefully analyze the cause of unacceptable RH since it is a symptom and not a cause. You don't put a bandage on a runny nose!



Source: Theodor D. Sterling and Associates, Ltd., Vancouver, B.C.

Fundamentals – Airflow



Courtesy of Heyoka Solutions

- Air is needed in buildings for:
 - People to breathe;
 - Appliances to work;
 - Maintenance of comfort.

Moisture - Convection

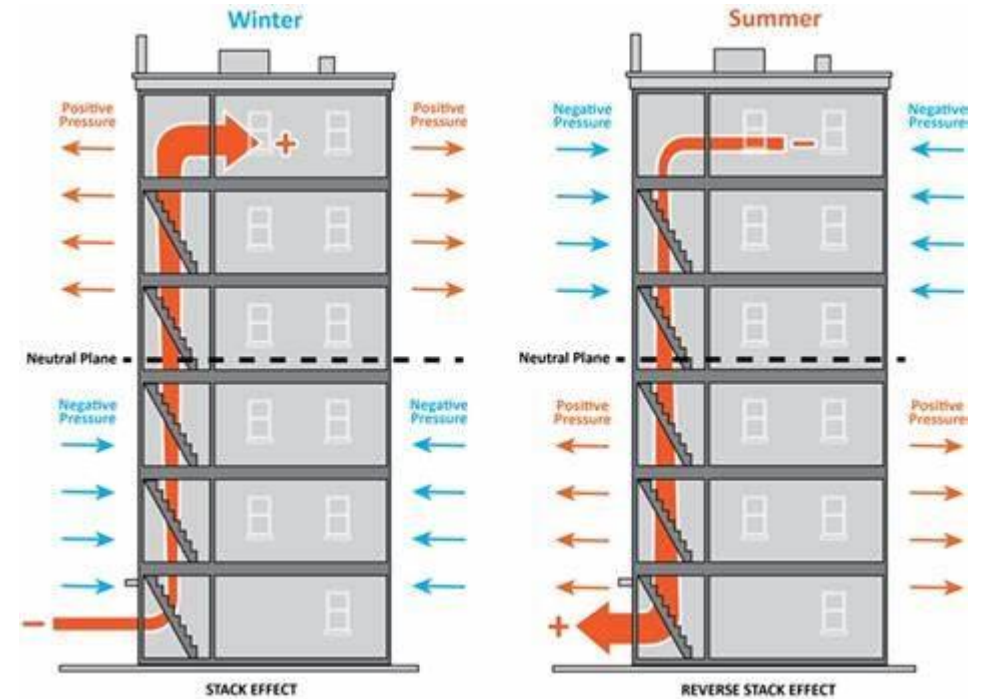
The primary moving force for moisture in a building is convection.

Fundamentals - Convection

Stack effect

- Warm air rising is the force.
- When the house is heated, low holes let the air in, and high holes let the air out.
- Close the holes and air doesn't flow.
- The greater the Delta T the greater the force.

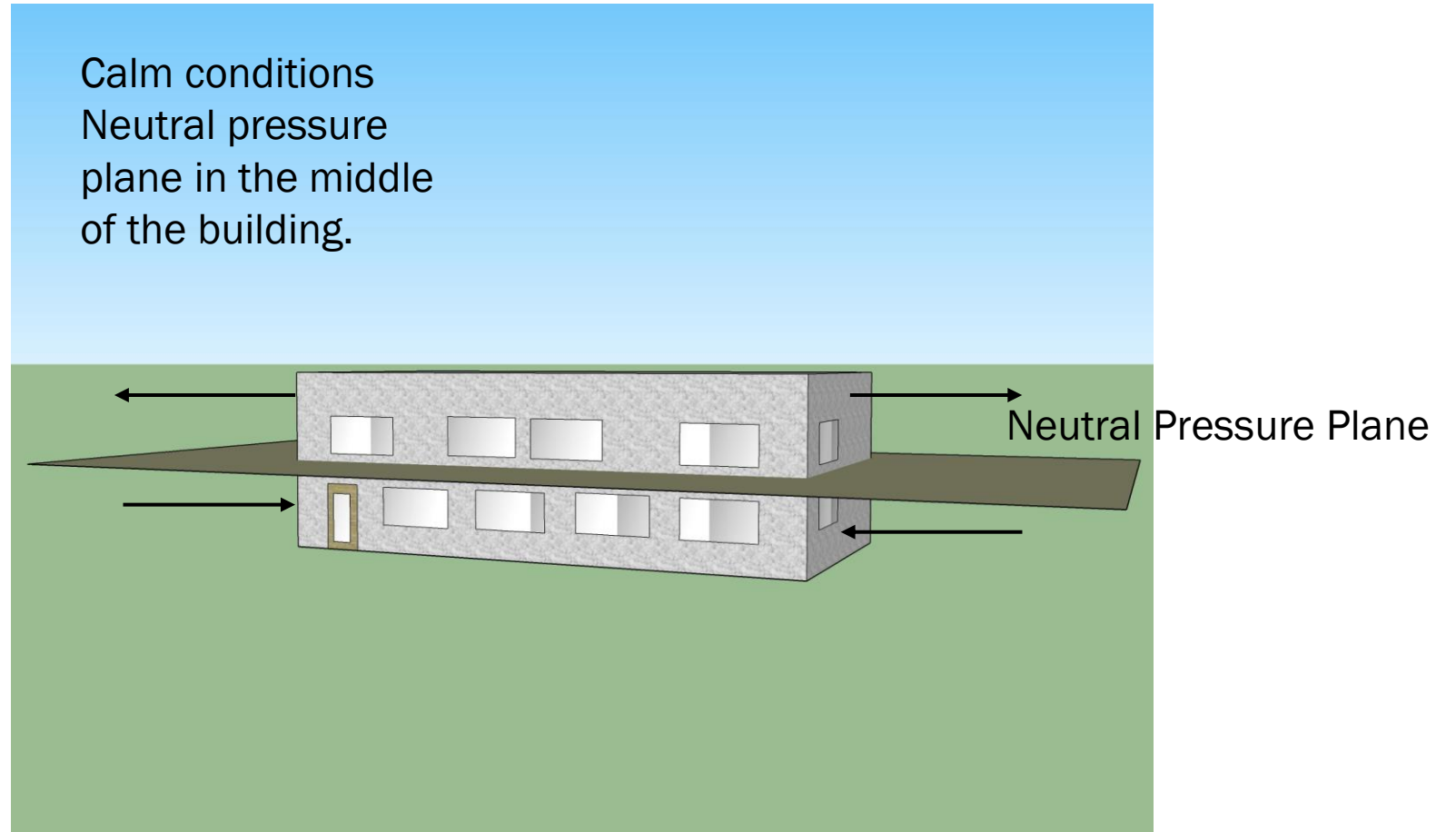
One cubic foot in = one cubic foot out.



Fire Dynamics Training/CA

Airflow – Passive airflow

Calm cold day – warm building.

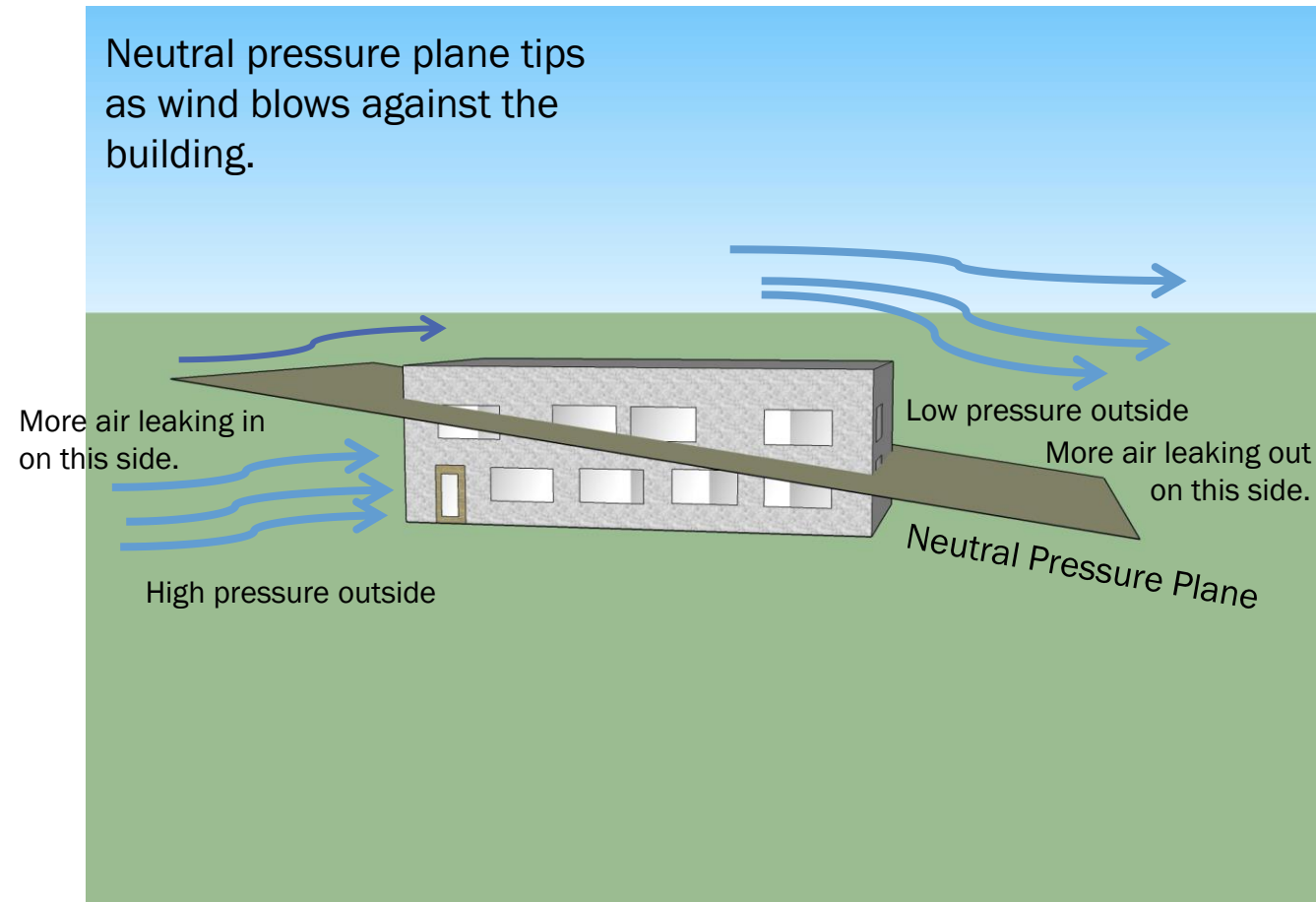


Courtesy of Heyoka Solutions

Airflow – Passive airflow

Cold weather stack effect + wind effect

One cubic foot in =
one cubic foot out.



Courtesy of Heyoka Solutions

IAQ Fundamentals Poll

2. On a calm cold winter day in a heated two-story building if you open window on the first floor would the stack effect cause the air to enter or leave?

- a) Enter
- b) Leave
- c) Neither

Module 1-Part 2

From Fundamentals to Hazards

With the Fundamental tools in the toolbox, what are we looking for?

Refer to the “Framework for Effective School IAQ Management” from the EPA
[Framework for Effective School IAQ Management | US EPA](#)

Learning Objectives for Part 2

- Preparation for assessing facility status
- Universal nature of a building as a system
- Basic appreciation of the issues of assessment safety
- Understand the importance of mitigating health risk
- Knowledge of dangers of common pollutants

Hazards = Health Problems

Problems:

- One in five schools has at least one room (more than 70,000 school rooms) with short term radon levels above 4pCi/L,
- In 2019 more than 15 million students were enrolled in school districts that found lead-based paint in their buildings.
- Cost of preventable asthma hospitalizations for asthma was \$1.4 billion (2004).
- Preventing lead exposure among children result in economic benefits ranging from \$110 to \$319 billion dollars annually.

Health insurers are starting to realize the scope of these costs . . .

Personal Safety During Building Assessments

Personal protective equipment to consider:

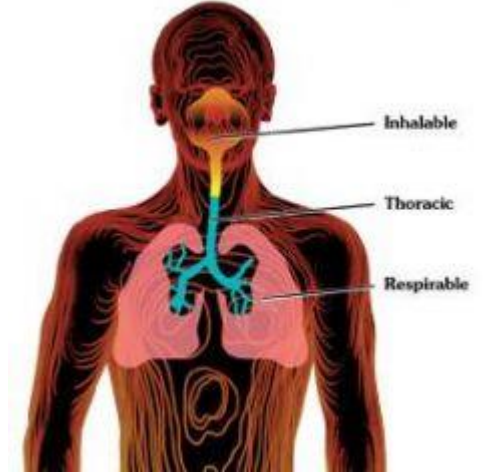
- Tyvek coveralls
- Respirator
- Booties
- Gloves
- Safety glasses
- Hard/Bump hat



Courtesy of Healthy Housing Solutions

Health Risks for the Assessor

- Respirable particles are less than 10 microns in size;
- The human eye cannot see particles smaller than about 20 microns in size;
- The most common airborne particle size is 2.4 microns;
- The most harmful particle size is less than about 1 micron.



Courtesy of Healthy Housing Solutions

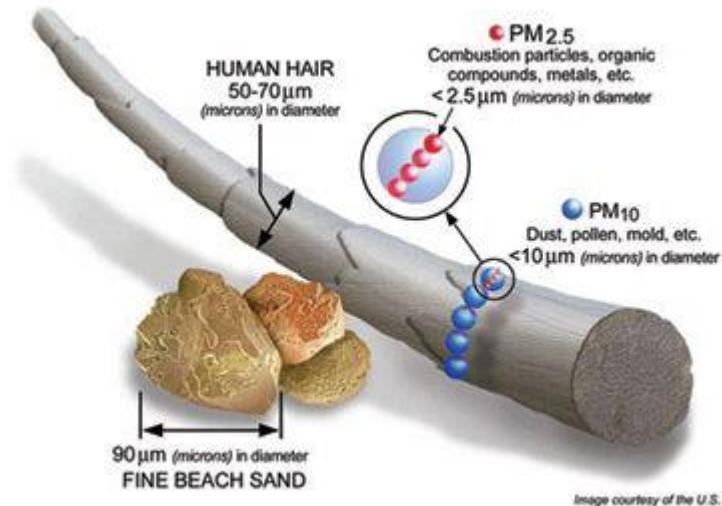


Image courtesy of the U.S. EPA

Air Quality Index - AQI

Air Quality Index (AQI) Values	Levels of Health Concern	Colors
<i>When the AQI is in this range:</i>	<i>..air quality conditions are:</i>	<i>...as symbolized by this color:</i>
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Note: Values above 500 are considered Beyond the AQI. Follow recommendations for the Hazardous category. Additional information on reducing exposure to extremely high levels of particle pollution is available [here](#).

<https://www.airnow.gov>

N-95 Respirator Minimum protection if high concentrations of unknown particles are observed



Courtesy of Healthy Housing Solutions

Dust, mold, or smoke – each is made up of particles. The first line of defense for protection from particles is a NIOSH approved N-95 rated respirator.

Particle respirators do not provide any protection from carbon monoxide or other toxic gases.

Respirators are only a part of personal protective equipment (PPE).

Note: this discussion is about professionals who go into commercial buildings and people's homes. Occupation-related personal protective equipment (PPE) is covered by OSHA with specific regulations regarding medical monitoring and guidance on worker protection.

What you Can and Cannot say

- Do not say: “Do [this intervention] and children's [illnesses] will improve.”
- Do say: “We can recommend [this intervention]. Published evidence shows an association between [this intervention] and reduced symptoms.”

Be very careful of what you say and how you say it.

Health Advice vs Healthy Building Advice

What you Can and Cannot say

Review State information pages.

Refer to your Department of Health and Human Services for the rules.

Use common sense but never assume.



Courtesy of Heyoka Solutions

Never be afraid to ask IAQ questions but be aware that not everyone will want to hear the answers!

- What if you find out that the air quality is bad?
- How long have the students been subjected to these conditions?
- How about the staff?

Liability Principles

“There are no problems until there are problems.” -Anonymous Lawyer

“Rules of Thumb”

Legal Issues and liability

- Follow Laws
- Exercise caution when making recommendations for building treatments
- Recommend professionals when needed
- Use applicable standards when available

Liability Exposures

Healthy Buildings

- Multiple sources and types of exposures;
- Limited research and data;
- Lack of clear standards and guidelines;
- Developing testing methods, tools, and controls.

There are very few – if any – direct cause and effect relationships.

Keep the entire system in mind.

It Comes Down to Three Steps

1. Identify the sources of bad IAQ.
2. Remove the sources of bad IAQ.
3. Ventilate the remainder.

Remember that a building is a system. Air quality is a combination of many factors.

Step 1: Start with the occupants

1. Start with the Occupants



“If you get rid of the dust mites in this classroom, the children’s asthma symptoms will decrease.”



“There is scientific evidence that dust mites can trigger asthma symptoms. We can talk to you about ways to decrease dust mites in the building. Make sure you consult a doctor about whether the children’s asthma is related to dust mites.”

*All Images Courtesy of
Heyoka Solutions*

Which one should you use?

1. Start with the Occupants

An important note about asthma:

- 60% of people with asthma have allergic asthma
- Triggers for those with allergic asthma include:
 - Cockroaches
 - Dust mites
 - Mold
 - Pets
 - Pollen

Start with the Occupants - Moisture

Health impacts from **moisture and mold** impact the lungs through:



Courtesy of Healthy Housing Solutions



Keep it Dry

1.Asthma

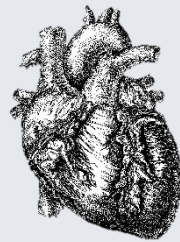
2.Infections

- Bronchitis
- Fungal infections

3.Allergies

Start with the Occupants - ETS

Health impacts from **environmental tobacco smoke** (ETS)



Coronary
heart disease

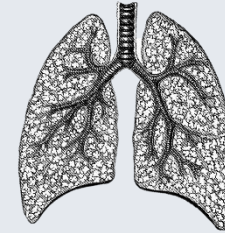


Ear
problems

All images courtesy of Healthy Housing Solutions



**Keep it
Contaminant-free**



- Acute respiratory infections,
- More severe asthma,
- Lung cancer,
- Chronic Obstructive Pulmonary Disease,
- Pneumonia, and
- Bronchitis

Start with the Occupants

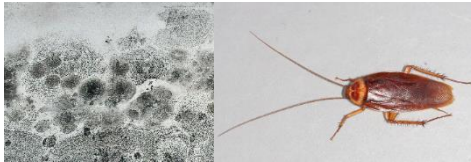
SANITATION – Cleaning reduces exposure to:



Environmental tobacco smoke



Pesticides



Asthma and allergy triggers such as mold and pests



Lead-based paint

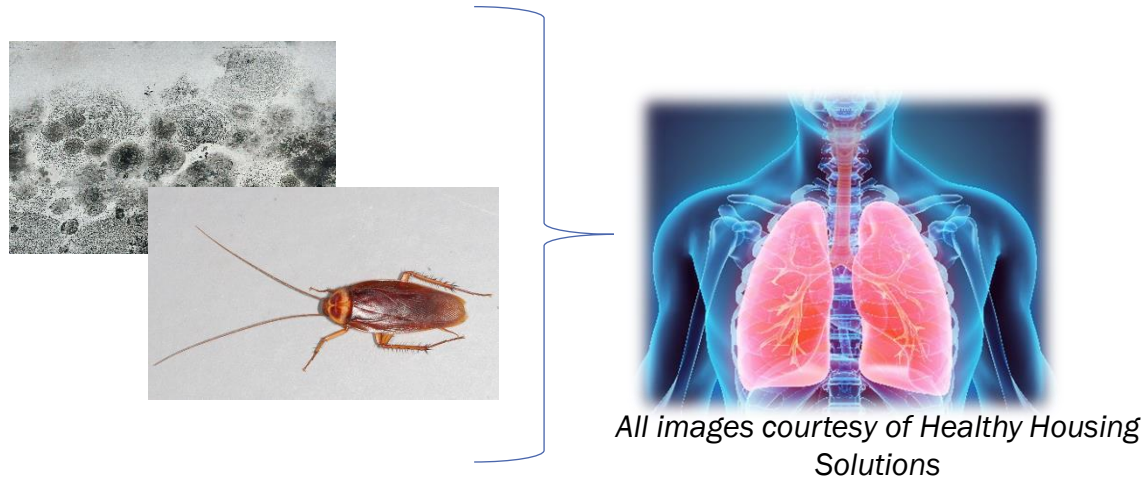
All images courtesy of Healthy Housing Solutions



Keep it Clean

Start with the Occupants

Health impacts from **asthma/allergy triggers** :



- Respiratory disease,
- Asthma symptoms
- Development of asthma



Keep it Clean

Start with the Occupants - Pesticides

Health impacts from **pesticide poisoning**:



All images courtesy of Healthy Housing Solutions



Headache



Nausea or
loss of
appetite



Moodiness,
restlessness,
mental
confusion



Skin, eye,
nose and
throat
irritation



Difficulty
breathing



**Keep it
Contaminant-free**

Severe poisoning can include vomiting, uncontrollable muscle twitches, convulsions inability to breathe and unconsciousness.

Start with the Occupants - Lead

Health impacts from **Lead-based paint**:



All images courtesy of Healthy Housing Solutions

Reduced IQ, reduced attention span, increased antisocial behavior and reduced educational attainment

Damaged hearing and speech

Slowed growth and anemia (too few red blood cells – individual feels tired or weak and may have shortness of breath, dizziness or headaches)



Keep it Clean

Start with the Occupants – Lead-based Paint

Health impacts from **lead-based paint** on adults:



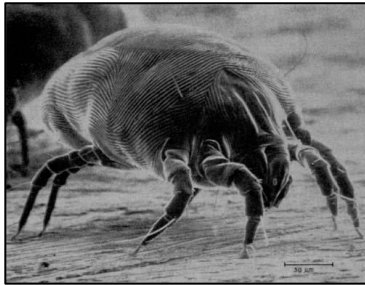
Keep it Maintained

All images courtesy of Heyoka Solutions

Start with the Occupants - Pests

Health impacts from pests.

All images courtesy of Healthy Housing Solutions



Dust mites

Asthma trigger



Cockroaches

Asthma trigger, and carry bacteria, viruses, and fungi



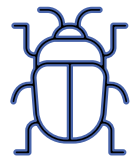
Mice (and rats)

Asthma trigger, and carry bacteria, viruses, fungi, salmonella and hantavirus



Bedbugs

Disturb sleep and mental health

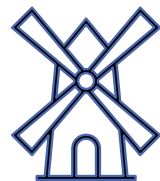


Keep it Pest-free

Start with the Occupants - Ventilation

Health impacts from **VENTILATION** problems.

- Various pollutants can be found in concentrations 2-5 times higher indoors than outdoors.
- Lack of adequate ventilation can result in a CO₂ build up



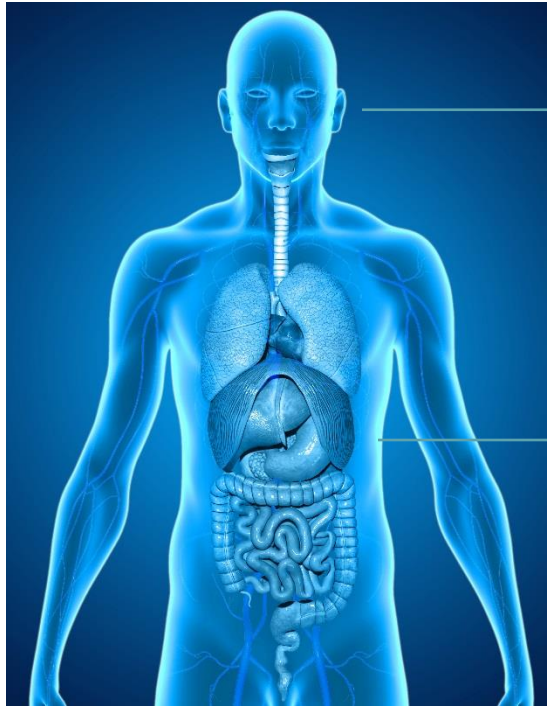
Keep it
Ventilated

Start with the Occupants – VOCs and PM2.5

Other pollutants that can be concentrated indoors without proper ventilation:

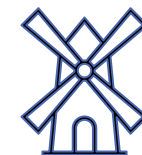
Volatile Organic Compounds (VOCs)

Chemical compounds that evaporate when exposed to the air.



- Eye, nose and throat irritation
- Headaches
- Loss of coordination

- Damage to liver, kidneys and central nervous system
- Risk of cancer



**Keep it
Ventilated**

Courtesy of Healthy Housing Solutions

Start with the Occupants - VOCs

Other pollutants that can be concentrated indoors without proper ventilation:

Particulate Matter VOCs & PM_{2.5} particles

What is it?

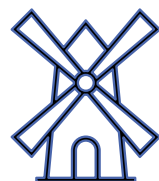
A mixture of solid particles and liquid droplets found in the air.

Sources?

Dust, dirt, soot, and smoke sources, chemical reactions from industry

Health impacts?

Exacerbate heart and lung disease, aggravate asthma, decrease lung function, increase respiratory symptoms



**Keep it
Ventilated**

Start with the Occupants - VOCs

Other pollutants that can be concentrated indoors without proper ventilation:



Courtesy of Heyoka Solutions

- Benzene
- Xylene
- Naphthalene
- Phenol
- Formaldehyde

Particulate Matter

Global Market Share, Size & Demand Forecasts

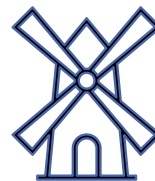


Market projected to reach US\$10.4 billion by 2020



Europe: The Largest Market
Asia-Pacific: The Fastest Growing Market at 7.4% CAGR

Global Industry Analysts, Inc.
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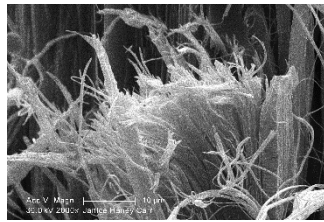


**Keep it
Ventilated**

Start with the Occupants - Asbestos

Health impacts from **CONTAMINANT** problems. **Asbestos**:

Asbestos



Courtesy of Heyoka Solutions

What is it?

Naturally occurring mineral fiber

Sources?

Roofing shingles, floor tiles, insulation

Health impacts?

Lung cancer, mesothelioma, asbestosis

Mesothelioma: A cancer of the lining of the chest and the abdominal cavity

Asbestosis: Lungs become scarred with fibrous tissue, leading to shortness of breath and persistent cough



Keep it Contaminant-free

Asbestos

Materials in schools that may contain asbestos:

- Ceiling tiles
- Vinyl flooring including backing and glue
- Wallboard
- Duct work for heating and cooling systems
- Pipe wrap insulation (particularly steam pipes)
- Boiler insulation
- Cement sheets
- Textured paint or “popcorn” ceilings.



Courtesy of Healthy Housing Solutions

Start with the Occupants - Radon

Health impacts from **CONTAMINANT** problems. **Radon:**

What is it?

Naturally occurring radioactive gas that comes from the breakdown of uranium in soil, rock and water and gets into the air you breathe.

Sources?

Radon comes from the soil. It can also enter the home through well water.

Health impacts?

Radon causes lung cancer



Courtesy of Heyoka Solutions



Keep it Contaminant-free

What Does Radon Do to Us?

- Long term cumulative exposure to radon increases our risk of developing lung cancer.
- There is no “safe” level of radon. *4pCi/L is an action level not a safe level.*
- The only way to know the radon level is to test.



Kansas State University

Step 2: Visual Identification of Hazards

School IAQ Assessment Mobile App



Use the EPA's School IAQ Assessment
Mobile App

Visual identification of hazards

Sample interview tools are also sample
visual identification tools

The building is a system!

Visual identification of hazards

- Start with a hypothesis that covers the purpose of that assessment
- Observe, interpret and question

Visual Identification of hazards

Why is there a water stain on this deck?

- a. Something spilled
- b. Rock salt was stored here
- c. Roof is leaking
- d. Pipes are leaking in the wall
- e. Pipes are leaking in the floor

Location is under a roof.



Seattle Home Inspectors

More on Interpretation



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What are the problems here?

Next Time – November 30, 2023

- Qualitative Analysis – Looking for IAQ problems – a bit of “crime scene investigation”
- Sorting the chronic problems from the acute
- Quantitative Analysis – Are they really problems and how bad are they?