

Indoor Air Quality

Basic Management for Healthy Office Environments

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Why is Indoor Air Quality (IAQ) a problem now?

- People spend more time indoors than ever before
(90% for most Americans.)
- Building design and materials
 - Energy efficiency
 - ‘Green’ building principles
 - Cheaper materials

“I am persuaded that no common air from without is so unwholesome as the air within a closed room that has been often breathed and not changed”

-Benjamin Franklin



Sick Building Syndrome

sick build·ing syn·drome

Noun

noun: sick building syndrome

a condition affecting office workers, typically marked by headaches and respiratory problems, attributed to unhealthy or stressful factors in the working environment such as poor ventilation.



Building- related illness

Evidence that IAQ has a direct relation to specific illness.

- Hypersensitivity pneumonitis
- Asthma
- Legionnaire's disease



IEQ- related problems

- *Contaminants*
- *Occupant Comfort*
- Lighting
- Noise
- Psychological

Some Symptoms of IAQ problems

- Headaches
- Fatigue or Drowsiness
- Skin Disorders
- Nausea
- Upper and lower respiratory issues.



IAQ investigation- the 'usual suspects'

Contaminants

HVAC System

Occupant Behavior

Pathways



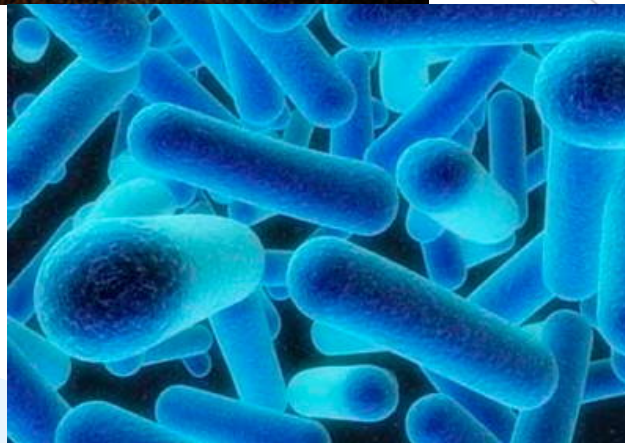
Common types of Indoor Contaminants

3 Categories :

- Biological
- Chemical
- Physical

Biological -

Sources -dust mites, insect detritus, mold, bacteria.



Chemical -

Sources - operations, housekeeping, maintenance.





Physical-

Sources

Particulate matter.
(solid, liquid)

What is 'Black Mold' or 'Toxic Mold' ?

Stachybotrys



Aspergillus/Penicillium

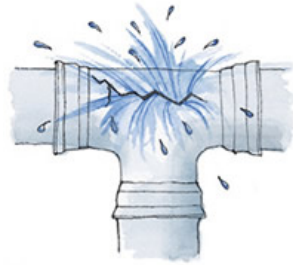




MOLD

Three things required:

- Water



- Food source

- Temperature



Food Sources

- Fungi absorb nutrients from living or dead organic matter (plant or animal stuff)
- Many building materials including:
 - Drywall
 - Paper/paper products
 - Cardboard
 - Ceiling tiles
 - Wood/wood products
 - Wallpaper
 - Insulation
 - Paints
 - Carpet
 - Upholstery
 - Fabric
 - Dust
 - Leaves
 - Soil
- *Sometimes new molds grow on old mold colonies!*

Physical



DUST



Manage sources

Vacuum frequently

Change filters in HVAC

Dust occasionally

HEPA



High - Efficiency Particulate Arrestor

Removes 99.97% of particles that have a size of 0.3 µm or larger.

Plants in the office— Good or bad for IAQ?

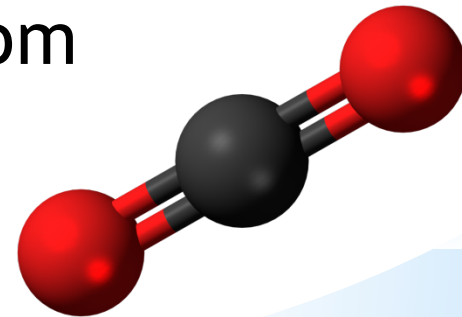


Possible adverse Health effects.

- Allergies
- Asthma
- *Hyper-sensitivity* Pneumonitis
- ‘Comfort’ issues - itchy, water eyes
- Skin irritation
- Reaction to Volatile Organic Compounds and odors.

Carbon Dioxide (CO₂)

- Colorless, odorless gas at room temperature.
- Present in exhaled human breath
- Combustion by-product
- Naturally present in unpolluted environment around 300 ppm



US EPA - Clean Air Act



National Ambient Air Quality Standard

Contaminant	Long Term Concentration / Averaging	Short Term Concentration / Averaging
Sulfur Dioxide	80 ug/m ³ / 1 year	365 ug/m ³ / 24 hours
Total Particulate	50 ug/m ³ / 1 year	150 ug/m ³ / 24 hours
Carbon Monoxide		35 ppm / 1 hour 9 ppm / 8 hours
Ozone		0.12 ppm / 1 hour
Nitrogen Dioxide	100 ug/m ³ / 1 year	
Lead	1.5 ug/m ³ / 3 months	

OSHA standards

(applies to workplace only)

Carbon Dioxide: 5000 ppm PEL

Carbon Monoxide: 50 ppm PEL

VOCs: Various

Mold : NONE

Carbon Monoxide (CO)

- Colorless, odorless, tasteless poisonous gas
- Produced as a by-product of combustion
- Deprives the body of oxygen by binding to blood hemoglobin and displacing oxygen molecules

The ‘General Duty’ clause

29 U.S.C. § 654, 5(a)1:

“Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.”





Indoor Air Quality in Commercial and Institutional Buildings



ASHRAE 62.1-2016

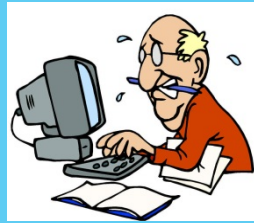
American Society of Heating
Refrigeration and Air Conditioning
Engineers.



Thermal Comfort: Follow ASHRAE standards:

30-60% Relative Humidity (RH)

68-76 degrees F°



- Not experiencing discomfort
- experiencing discomfort

The '80/20' rule

IAQ costs for Business



18.8 Million

adult Americans have asthma. **70%** of these adults have experienced a flare-up

Current asthma prevalence in adults ranges from:

12% in Maine

6.4% in Louisiana

Asthma breathing problems usually happen in "episodes" or "flare-ups," An asthma episode is a series of events that result in narrowed airways. The narrowed airway makes breathing harder and creates the familiar "wheeze."

When an adult has asthma, their lungs are extra sensitive to certain stimuli, or "triggers." Triggers can include:



Allergic reactions



Cigarette smoke



Respiratory infections and colds



Stress



Indoor and outdoor air pollutants



Exercise



Cold air or sudden temperature change



Asthma has accounted for an estimated **14.2 million** lost work days yearly

Sources: CDC, American Lung Association

Managing IAQ is a 'team effort'

EHS

Understand laws, standards and safe work practices.

Facilities/maintenance:

Often the first part of the solution, particularly with housekeeping and/or HVAC.

Managing IAQ is a ‘team effort’

Human Resources - sometimes the best bet to document or track complaints.

Medical staff- help review individual records



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An Introduction to Indoor Air Quality

Indoor Air Pollution and Health

Indoor Air Quality (IAQ) refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. Understanding and controlling common pollutants indoors can help reduce your risk of indoor health concerns.

Health effects from indoor air pollutants may be experienced soon after exposure or, possibly, years later.

Immediate Effects

Some health effects may show up shortly after a single exposure or repeated exposures to a pollutant. These include irritation of the eyes, nose, and throat, headaches, dizziness, and fatigue. Such immediate effects are usually short-

IAQ & Health

[Causes of IAQ Problems](#)

[Identifying IAQ Problems](#)

[Improving IAQ](#)

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[About the Indoor Environments Division](#)

[LINK to EPA IAQ page.](#)

Additional sources:

Burroughs, H.E and Hansen,, Shirley : *Managing Indoor Air Quality* (3rd edition.) Fairmount Press, Lilburn, GA 2004

Morawska, Lidia and Tunga Salthammer *Indoor Environments: Airborne Particles and Dust.* Wiley - VCH, Darmstadt, Germany 2003

May, Jeffrey C *My Office is Killing Me :The Sick Building Survival Guide.* (2nd edition) Johns Hopkins University Press, Baltimore, MD 2006