Indoor does not mean pollution-free

Pollutants can build up when indoor sources release them faster than they are removed. Identify the source and physical form first: a gas, a particle or a mixture may require different controls.

1. THREE SOURCE GROUPS

NATURAL SOURCES

Radon from rocks and soil; mold in damp areas; dust from natural materials. Dust may also contain human-made contaminants.

MATERIALS AND PRODUCTS

Some insulation can release fibers. Furniture, paneling, carpets and building products can release VOCs such as formaldehyde; old lead paint can produce dust.

COMBUSTION

Stoves, heaters, fireplaces and tobacco burning can release carbon monoxide, nitrogen oxides and particles. Sulfur-containing fuels can also produce sulfur dioxide.

2. CARBON MONOXIDE: AN ASPHYXIANT

CO is a colorless, odorless gas formed during incomplete combustion. It binds strongly to hemoglobin, reducing the blood's ability to deliver oxygen. Exposure can cause headache, dizziness or confusion, and severe poisoning can be fatal.

CO is not CO_2, and it is not a particulate. You cannot judge its presence by smell.

3. EXTENSION: PREVENT COMBUSTION EXPOSURE

Maintain fuel-burning appliances and vent exhaust outdoors; keep indoor spaces smoke-free and use CO alarms. Never run generators or charcoal grills indoors or in garages. Opening a window does not make this safe. If a CO alarm sounds or poisoning is suspected, leave for fresh air and contact emergency services.

CO sources, oxygen delivery and prevention: US EPA, Carbon Monoxide and Indoor Air.
Indoor sources and ventilation: US EPA, Introduction to Indoor Air Quality.

Scope: College Board AP Environmental Science CED, Topic 7.5, pp. 145-146.

Radon: from the ground to the lungs

Radon-222 is a naturally occurring radioactive gas in the uranium decay chain. It can accumulate indoors without a visible haze or warning odor. Its major health concern is lung cancer.

1. TRACE THE ENTRY PATHWAY

ROCK AND SOIL

Uranium decay produces radon through a series of radioactive steps.

→

BUILDING ENTRY

Soil gas moves through cracks, joints and gaps in the foundation.

→

INDOOR AIR

Radon accumulates when entry exceeds removal. Any home may be affected.

Another route: radon dissolved in groundwater can enter through well water and be released into indoor air during use. Soil gas is usually the main source.

2. WHY EXPOSURE INCREASES CANCER RISK

Radon decays into radioactive products that can be inhaled and deposited in the lungs. Their radiation can damage cells. EPA identifies radon as the second leading cause of lung cancer in the United States and the leading cause among nonsmokers. Smoking and radon together increase risk further.

3. OTHER NATURAL SOURCES: MOLD AND DUST

Mold grows where moisture is available and releases spores and fragments that may trigger allergies or asthma. Fix leaks and control moisture; hiding mold with paint does not solve its cause.

Dust is a mixture of particles, not one chemical. Its contents may include soil, fibers and biological material. Radon needs a dedicated test: a CO alarm or a dust measurement cannot establish a home's radon level.

Soil gas, cracks and well water: US EPA, How Radon Gets into Your Home.
Lung cancer and testing: US EPA, Health Risk of Radon.
Moisture and biological particles: US EPA, A Brief Guide to Mold.

Scope: College Board AP Environmental Science CED, Topic 7.5, pp. 145-146.

Match the control to the pollutant

Material-related pollutants can be released as gases, dust or fibers. Preventing release is often more effective than trying to clean the air after contamination has occurred.

1. VOCs AND FORMALDEHYDE: GASES FROM PRODUCTS

Some furniture, pressed-wood paneling, carpeting, adhesives and finishes release volatile organic compounds into air. Formaldehyde is one example, not a synonym for every VOC. Effects depend on the chemical and exposure; they can include eye and airway irritation, and some VOCs are carcinogenic.

2. ASBESTOS: AIRBORNE MINERAL FIBERS

Some older insulation and other building materials contain asbestos. Damage or disturbance can release inhalable fibers; intact material is different from fibers floating in air. Exposure can cause serious lung disease and cancer.

Do not drill, sand or sample suspected asbestos yourself. Use qualified professionals.

3. LEAD PAINT: DUST, NOT A PAINT GAS

Deteriorating or disturbed lead-based paint can produce contaminated dust and chips. People may inhale dust or swallow it from hands and surfaces. Lead harms the nervous system, especially in children. Avoid creating dust and use appropriately qualified lead-safe professionals for renovation.

4. EXTENSION: SOURCE CONTROL + VENTILATION + TESTING

Choose lower-emission products and use suitable outdoor-air ventilation when outdoor air quality permits. Repair moisture problems, maintain combustion equipment, and test for radon; elevated radon requires appropriate mitigation.

A HEPA filter captures particles, not CO or radon gas. Air cleaning supplements source control; it cannot make an unsafe combustion source or disturbed asbestos safe.

Products and VOC effects: US EPA, Volatile Organic Compounds and Indoor Air.
Disturbance and professional handling: US EPA, Protect Your Family from Asbestos.
Lead paint dust and exposure: US EPA, Reduce the Risk of Lead Exposure at Home.
Filtration limits and source control: US EPA, Air Cleaners and Air Filters in the Home.

Scope: College Board AP Environmental Science CED, Topic 7.5, pp. 145-146.