Indoor Air Quality

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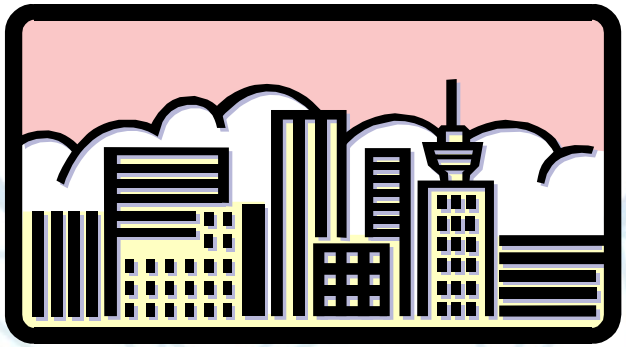
WHAT IS **IAQ?**

Indoor Air Quality refers to the nature of conditioned (Heat/Cool) air that circulates throughout the space/area where we **live**, **work**, **make our food** and **treat our patients**

i.e. the air we breathe during most of our lives.

What's in indoor air ?

EPA* RANKED **I**NDOOR **A**IR **P**OLLUTION ONE OF THE TOP 5 ENVIRONMENTAL RISKS TO PUBLIC HEALTH



*(EPA) : Environmental Protection Agency

Energy Efficiency Measures Help Save Energy but Sometimes Unintended Consequences May Result

- Reducing natural ventilation
  - Can increase carbon monoxide levels
  - Can increase moisture loading
- May create back drafting of combustion appliances
  - Increases carbon monoxide levels

Energy Efficiency Measures Help Save Energy but Sometimes Unintended Consequences May Result

- Caulking and Sealing Penetrations in Envelope
  - Can increase carbon dioxide, carbon monoxide levels
  - Can decrease ability of walls to dry
  - Off gassing of volatile organic compounds
- Disturbing existing insulation and installing new insulation
  - Increases airborne dust, fiber glass and asbestos

BASIC **IAQ** FACTS

- Air Pollutants 2 – 5 (sometimes 1,000) Times Higher Than Found Outside
- Illness and Lost Productivity Costs Over $60 Billion Annually
- Childhood Asthma is Increasing
- Inadequate Ventilation and Control of Moisture Are Directly Related to Construction Defect Claims

EXPOSURE TO **I**NDOOR **A**IR **P**OLLUTANTS HAS INCREASED DUE TO

- Inadequate Ventilation and Filtration
- Use of Synthetic Building Materials and Furnishings
- Use of Chemically Formulated:
  - Personal Care Products
  - Maintenance and Cleaning Products

IAQ IS CREATED BY THE INTERACTION OF 4 MAIN ELEMENTS:

- Building Envelope
- HVAC System
- Occupants and Their Activities
- Outdoor Environment

IAQ, refers not only to comfort, which is affected by:

- Temperature
- Humidity
- VOCs (Volatile organic compounds)

But also to harmful **BIOLOGICAL AND NON BIOLOGICAL AIR BORNE PARTICLES**

present in the conditioned spaces where we

Poor **IAQ**

Live

- Sick building syndrome (SBS)
- Building related illness (BRI)

Work

- Sick leave
- Costs for care health
- Diminished performance at work caused by adverse health
- Costs of investigations

Make our food

- **Salmonella**
- **Listeria**
- **E. coli**
- **Molds**
- **Fungi**

Treat our patients.

- **Hospital Acquired infection prevention**
- **CRSs**
- **BMT**
- **Isolation rooms**

Health Effects

- **Building related illness (BRI)**
  - Clinically recognized disease
  - Exposure to indoor air pollutants
  - Recognizable causes

SICK BUILDING SYNDROME (SBS)

- A persistent set of symptoms in > 20%
- Cause(s) not recognizable
- Complaints/symptoms relieved after exiting building

Financial cost

Fisk & Rosenfeld noticed improved productivity by changing indoor environment.

Potential annual benefits were:

- ✓**10-30%** reduction in acute respiratory infections ,allergy & asthma
- ✓**20-50%** reduction in acute non-specific health symptoms
- ✓**0.5-5%** increase in the performance of office work
- ✓Annual cost savings

& productivity gains **US$30-170** billion.

Make our food

GMP*

- Proper safety measures can help prevent the growth of **microorganisms** and the accumulation of particulates such as **dust.**

As a best practice for food manufacturers, facilities should safely remove airborne contaminants and improve the air quality of the building.

*GOOD MANUFACTURING PRACTICE

HAIs *

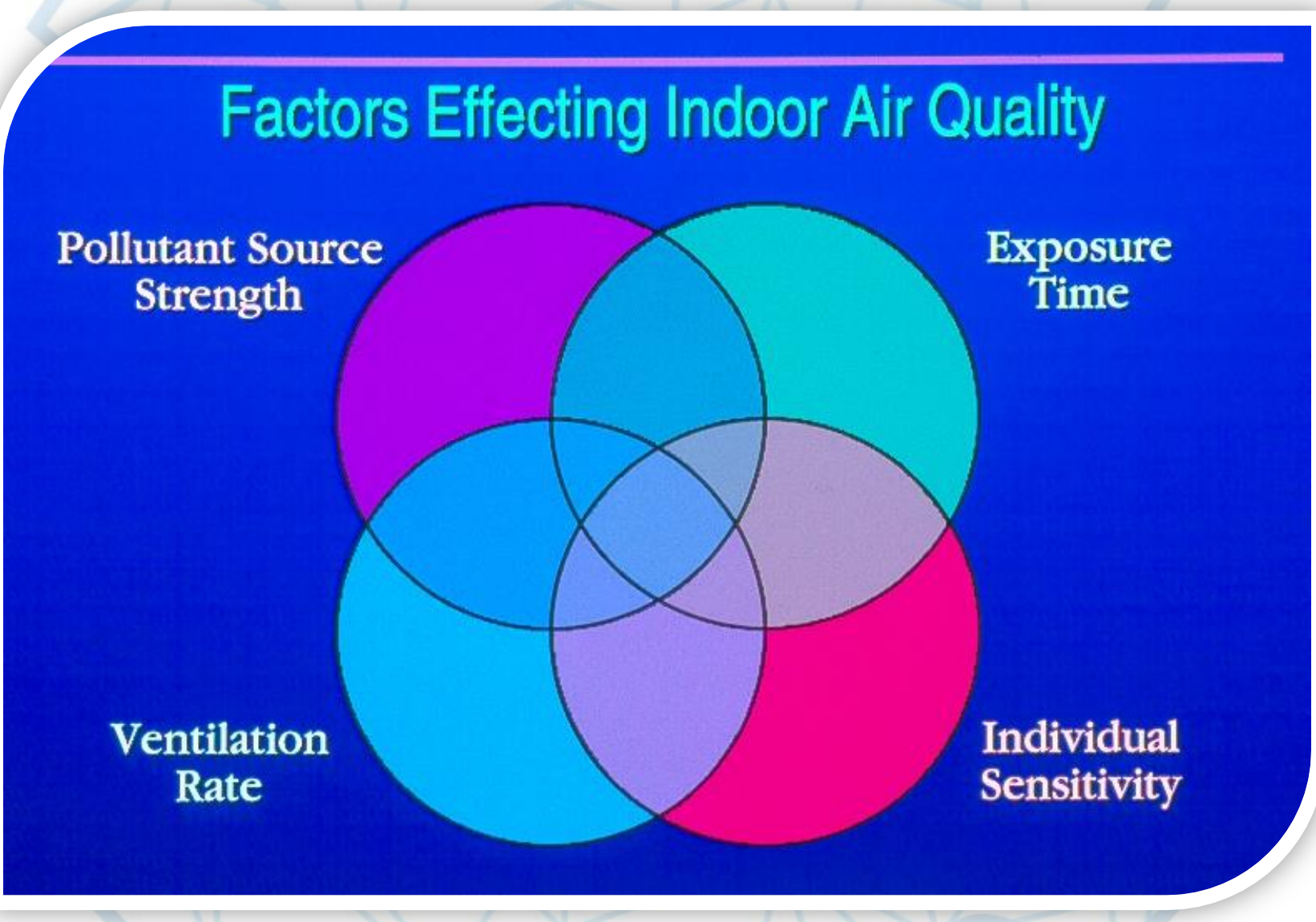
- Healthcare associated infections (HAIs) kill more people in this country than *AIDS, breast cancer and auto accidents combined*.

CDC
CENTERS FOR DISEASE CONTROL AND PREVENTION

- **CRSs**

*Healthcare associated infections (HAIs) (Nosocomial infections or hospital-acquired infections


Indoor
Air Quality
90% of our lives spent indoors
2-5x More pollution indoors than outdoors
Common Indoor Air Pollutants
Airborne particles
from diesel exhaust, dust, smoke and other sources
Indoor formaldehyde
from building materials, furniture, cooking, and smoking
Household odors & gases
from activities such as painting, cooking, and smoking
Ozone
from outdoor air (ground level ozone is harmful to breathe)
O3
Carbon Dioxide
from people exhaling and cooking
50 Years, BASF has been developing solutions for Clean Air
www.catalysts.basf.com/iaq


Factors Effecting Indoor Air Quality
Pollutant Source Strength
Exposure Time
Ventilation Rate
Individual Sensitivity

INDOOR AIR CONTAMINANTS

- Volatile Organic Compounds
- Carbon Monoxide, Combustion Products
- Particulates
- Fibers: asbestos, fibrous glass
- Radon
- Allergens: pollen, dust mites, cat, dog, cockroach
- Microbial Organisms: viruses, bacteria, fungi
- Sewer Gas

SICK BUILDING SYNDROME

Building occupants experience acute health and comfort effects that appear to be linked to time spent in building, but no specific illness or cause can be identified.

- Symptoms Include:

Irritation and dryness of eyes, nose, throat

Sneezing, stuffy/runny nose

Fatigue or lethargy

Headache, dizziness

Nausea

Irritability, forgetfulness

BUILDING–RELATED ILLNESS

Symptoms of diagnosable illness are identified and can be attributed directly to airborne contamination in building

- Examples Include:

  Asthma
  Legionnaires' Disease
  Humidifier fever
  Respiratory allergies
  Carbon monoxide poisoning

OVER 50% OF IAQ PROBLEMS RESULT FROM INADEQUATE VENTILATION:

- Ineffective Dilution of Contaminants
- Inadequate Removal of Contaminants
- Induction of Pollutants from Outdoors
- Distribution of Pollutants by HVAC
- Generation of Contaminants in HVAC

FUNGAL FOOD IN BUILDINGS

- Cellulose based products
  - Ceiling tiles
  - Kraft paper insulation backing
  - Sheet rock paper facing
- Wood
- Dirt
  - Pollen, other molds
  - Dust, insect droppings

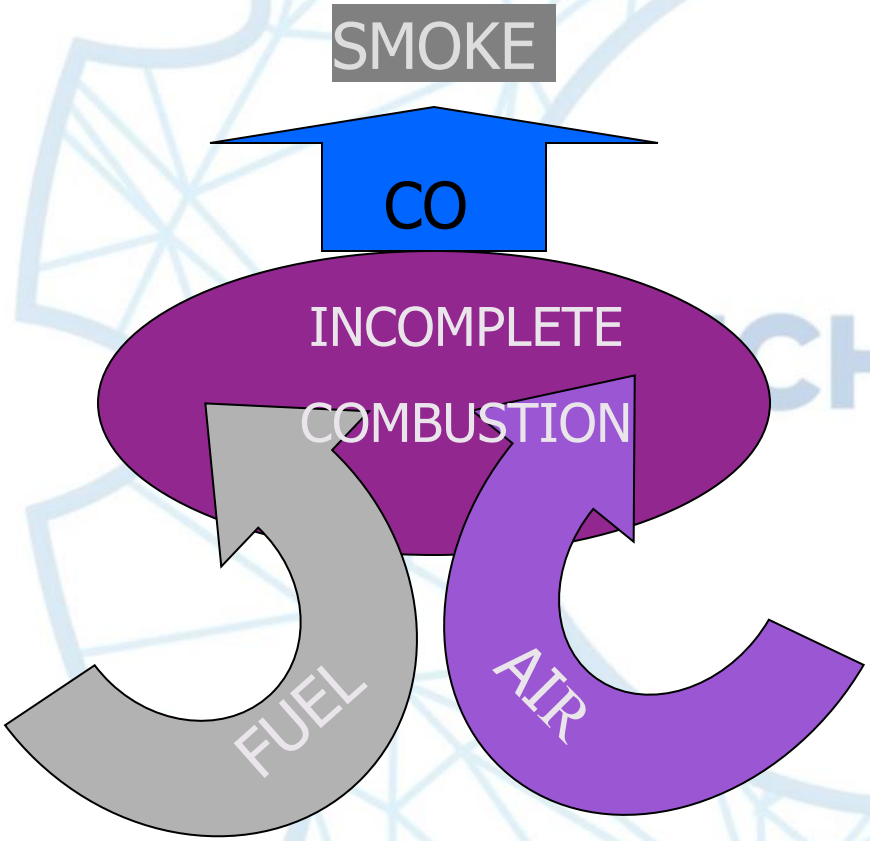
MOLD GROWTH ON BUILDING MATERIALS

Mold Growth on OSB

Dust mites 320X 30-60 microns

Bacteria 5500X .4-10 microns

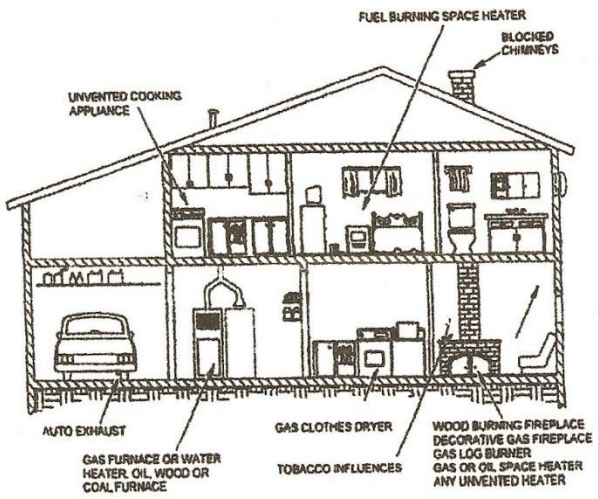
HOW IS CO PRODUCED?



FUEL RICH MIXTURE

- Carbon monoxide is produced by the incomplete combustion of fuels.
- It occurs when there is not enough oxygen mixed with fuel. This is commonly referred to as a "fuel rich mixture".
- All fuel burning appliances have the potential to produce CO in varying concentrations.
- CO can result from improperly vented or malfunctioning combustion sources such as boilers and hot water heaters.

WHAT ARE SOME OF THE COMMON SOURCES OF CO?



- Unvented Cooking Appliances
- Wood-burning Fireplace
- Blocked Chimney
- Water Heater
- Gas Refrigerator
- Gas Clothes Dryer
- Attached Garage
- Barbecue Grill
- Pool/spa Heaters
- Tobacco Smoke
- Ceiling Mounted Unit Heater
- Fuel-burning Space Heaters

IAQ POLLUTANTS AND SOURCES

CLEANING, MAINTENANCE & PERSONAL PRODUCTS

VOLATILE ORGANIC COMPOUNDS

Cleaning Products

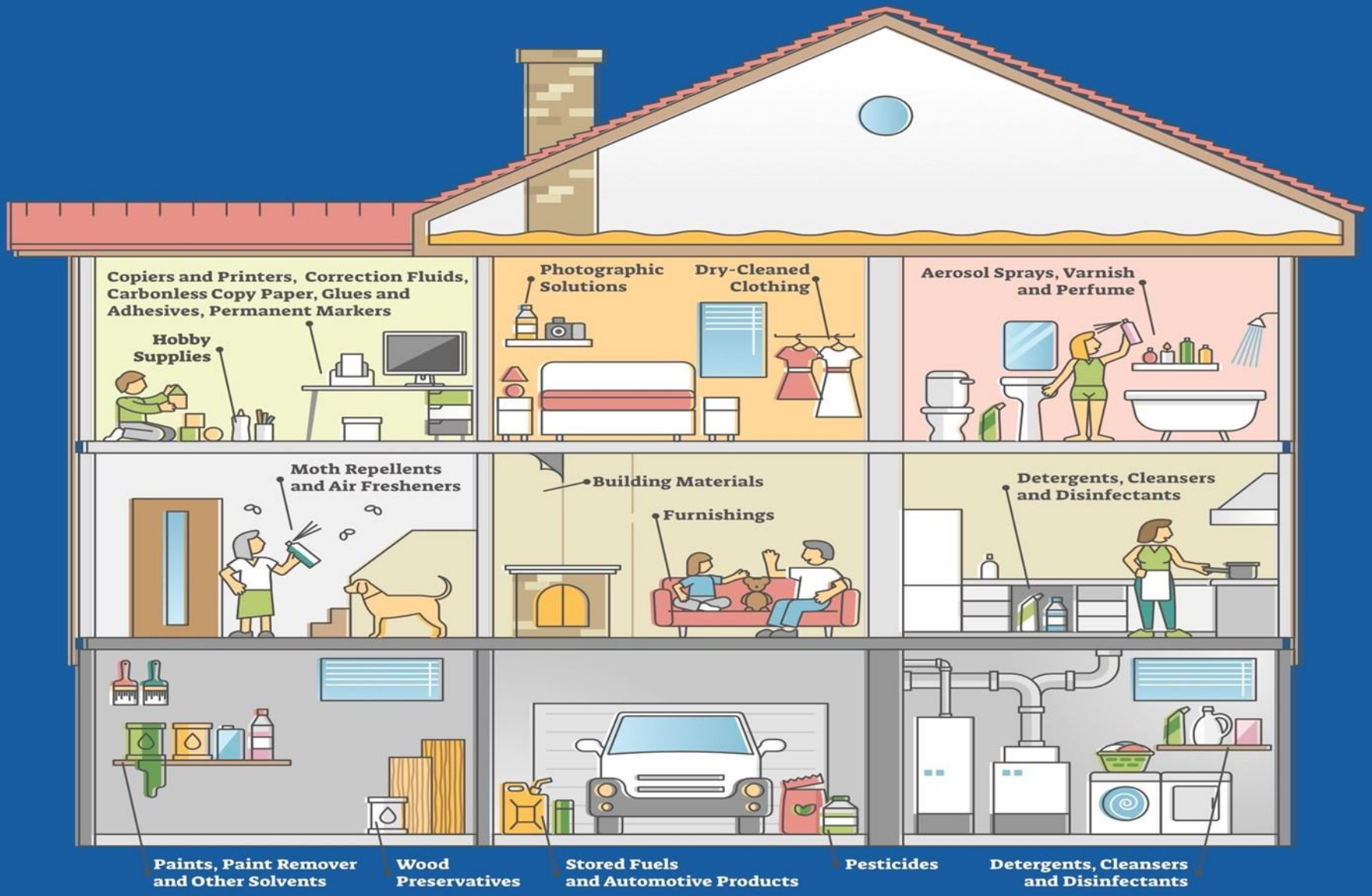
- Improper storage of supplies
- Inadequate ventilation of storage area

Occupant Generated

- Perfumes, colognes, lotions
- Air fresheners, candles

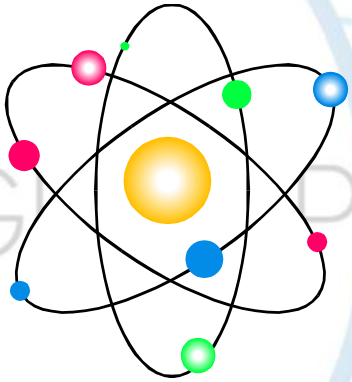
SOURCES OF VOCs

VOLATILE ORGANIC COMPOUNDS



RADON AND SOIL GAS

- Base Rates Cover Most Houses
- Ventilation Can Make Bad Problem Worse
- Problem Locations Need Remediation
- Radon Resistant Designs Available



PESTICIDES

Include Insecticides, Rodenticides, Fungicides, Disinfectants, Termiticides

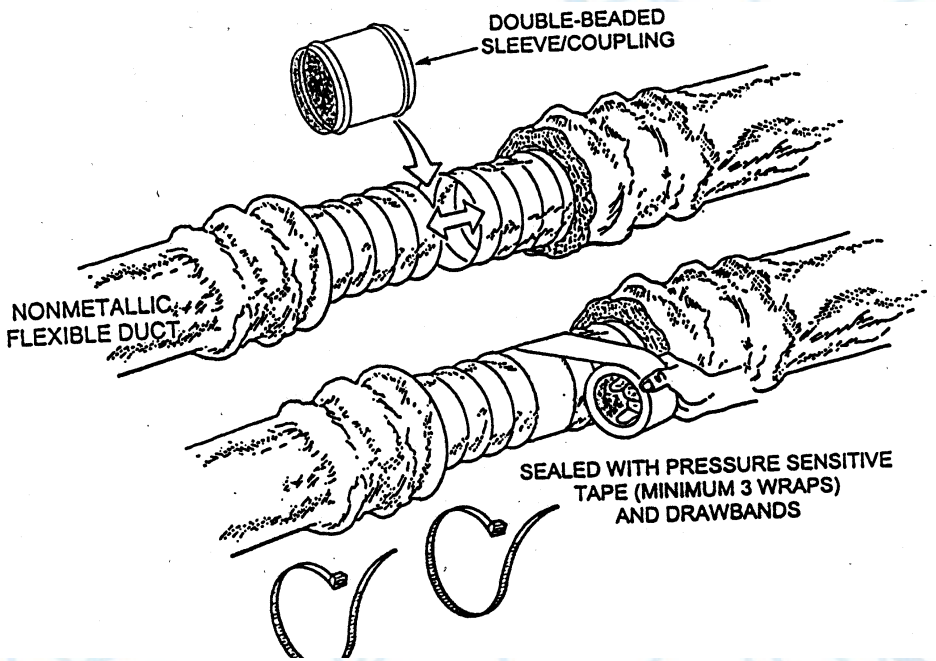
- Inherently toxic
- Direct exposure from use
- Exposure from outdoor "drift"
- EPA found measurable airborne levels of up to 12 pesticides in many homes and buildings

IAQ POLLUTANTS AND SOURCES

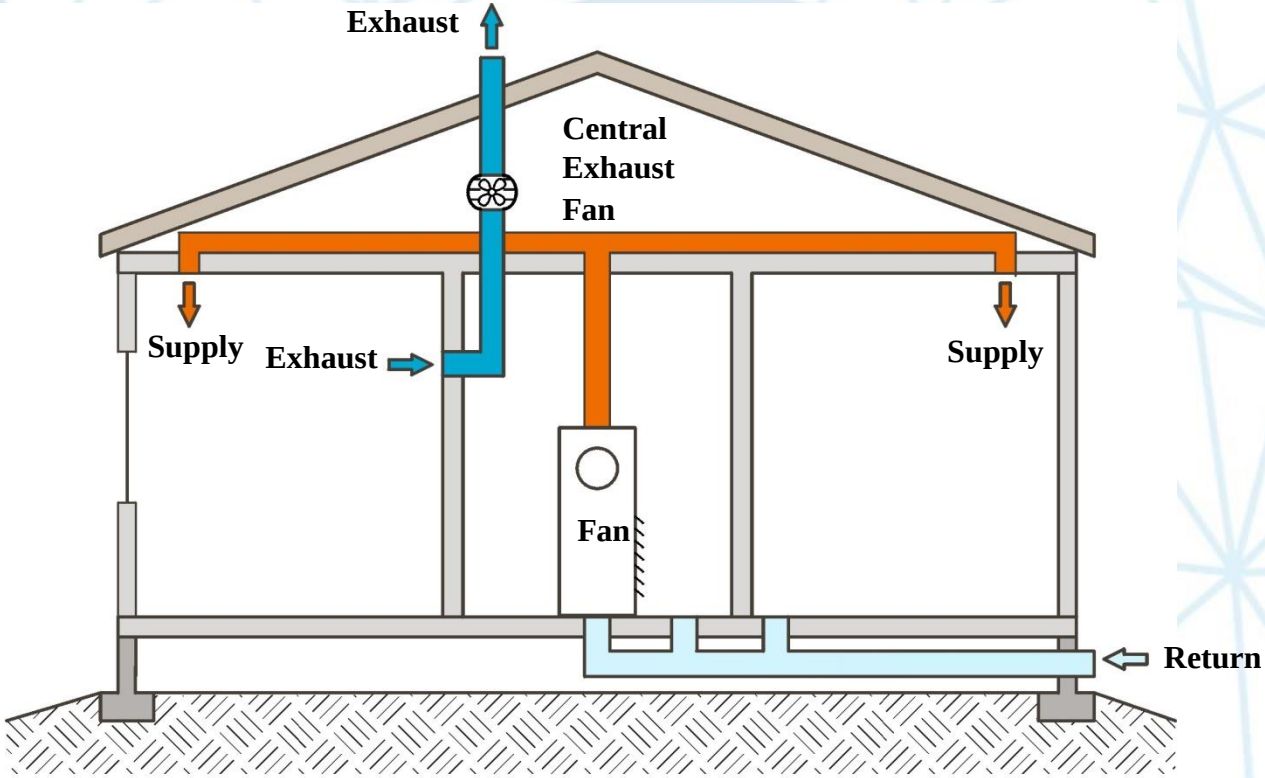
- Particulates
- Fiber glass fibers
- Asbestos fibers

Duct Sealing

- Prevent Negative Pressure



Control Ventilation



Controlled ventilation system for a house in a cooling climate.

Ventilation

- Bathroom (8 ACH*)
- Kitchen fans (15 ACH*)
- Laundry (6 ACH*)
- Ventilate to the outside
  - Not to attic
  - Not to crawl space
- Use humidity or time controls

*Home Ventilating Institute (HVI)

Indoor Air Quality

5 Things You Need to Know

Air pollution is **one of the top 5 factors** causing chronic disease according to the World Health Organization [along with unhealthy diet, physical inactivity, tobacco use, harmful alcohol use][1]

Almost 90% of our time is spent indoors and almost 70% in our homes [indoors: 87%, at home: 69%][2]

We consume **nearly 8 times** as much air by volume as food and **4 times** as much air as water. [air: 31 lbs., water 8 lbs., food 4 lbs.][3]

Indoor air often **contains 2x–5x as much pollution** as is typical in outdoor air, and as much as 100x.[4]

High-performance homes constructed today **let in significantly less fresh air** than those in older, less efficient homes [about ¼ the natural infiltration].[5]


Thank you