FGBC FLORIDA GREEN BUILDING COALITION

A Green Florida for a Blue Planet

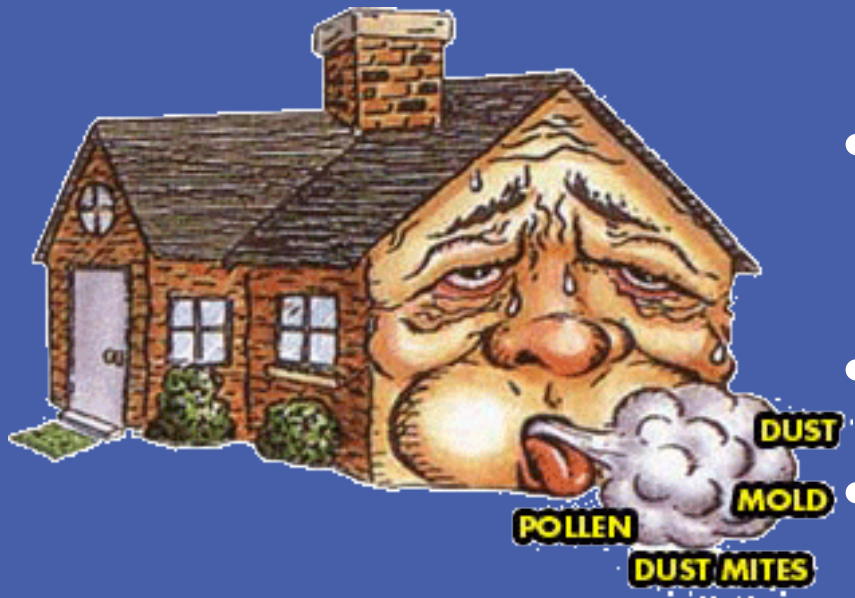
Chapter 7

Indoor Air Quality

Learning Objectives

1. Describe issues and considerations that impact indoor environmental quality.
2. Identify the primary steps builders and remodelers can take to create and maintain a healthy indoor environment.
3. Explain ways to eliminate pollutants in a building.
4. Describe ways that occupant separation from pollutant sources may be accomplished.
5. Describe filtration methods used to remove pollutants from the air that enters a home.

Indoor Air Quality Goals



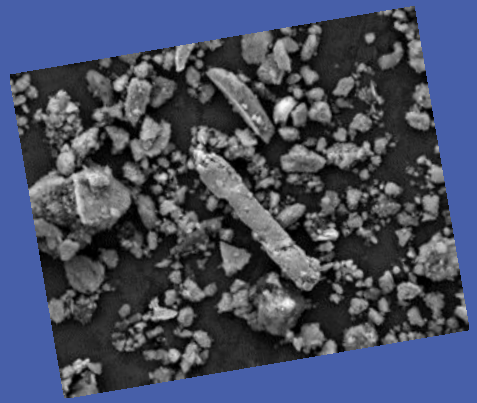
- Planning and design to promote healthy IAQ
- Design for proper ventilation and filtration
- Reduce indoor pollutants
- Separate indoor air from hazardous materials
- Prevent mold

Behavior Patterns Affect IAQ

Common Pollutants

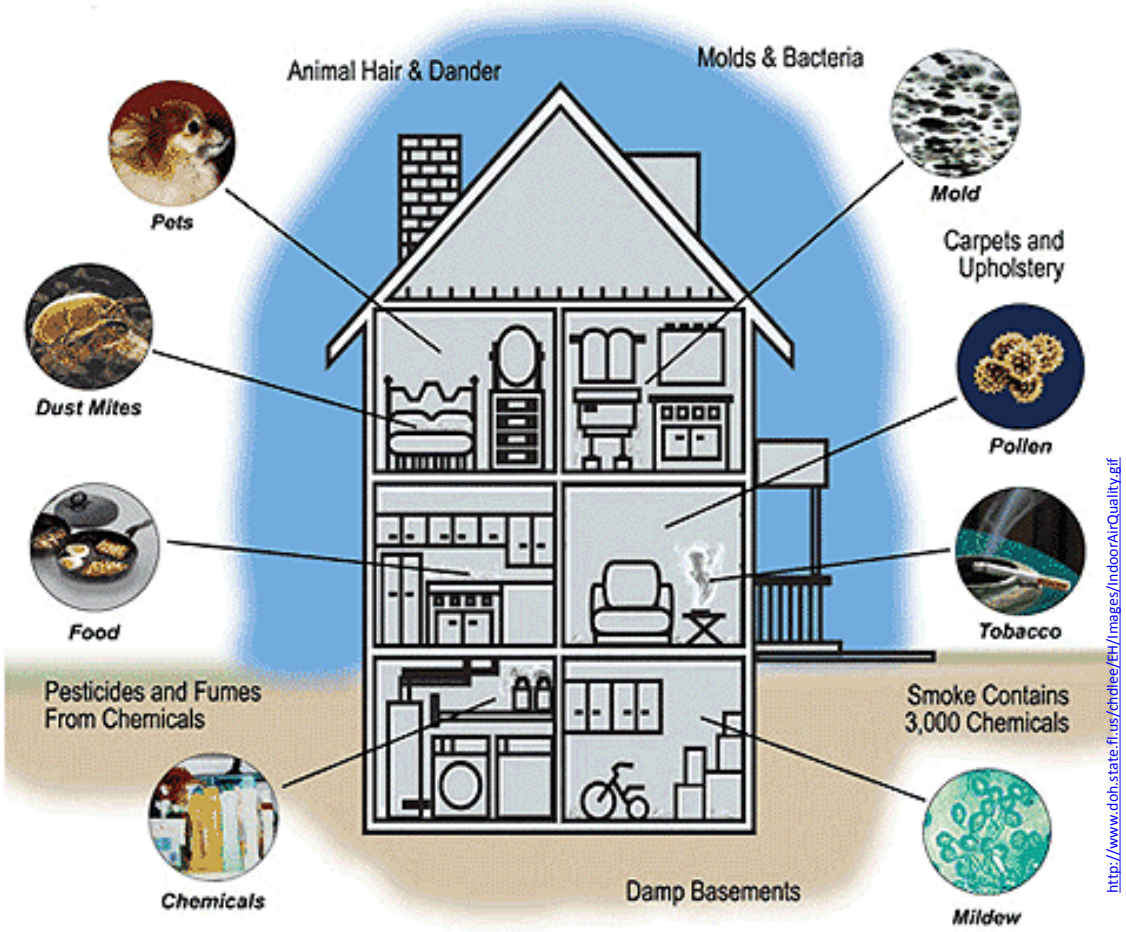
- Carbon monoxide
- Carbon dioxide
- Tobacco Smoke
- Volatile Organic Compounds (VOC's)
- Formaldehyde
- Inhalable Particles
- Mold
- Radon

CO



CO_2

Common Pollutant Sources



http://www.doh.state.fl.us/chdlee/EH/Images/IndoorAirQuality.gif

Combustion Gasses

Carbon Monoxide

- Colorless, odorless and tasteless gas
- Result of incomplete combustion
- Health effects = fatigue, headaches , dizziness…. DEATH

Volatile Organic Compounds

V – Volatile

O – Organic

C – Compounds

Most are carcinogens

- Organic compounds that evaporate at room temperature
- Common in building products
- Health effects = respiratory problems, eye irritation

Common VOC Sources

- Paints/sealants
- Adhesives
- Glues
- Solvents
- Carpets
- Furniture
- Aerosols
- Insulation
- Dry Cleaning
- Upholstery

Mold

Mold is everywhere

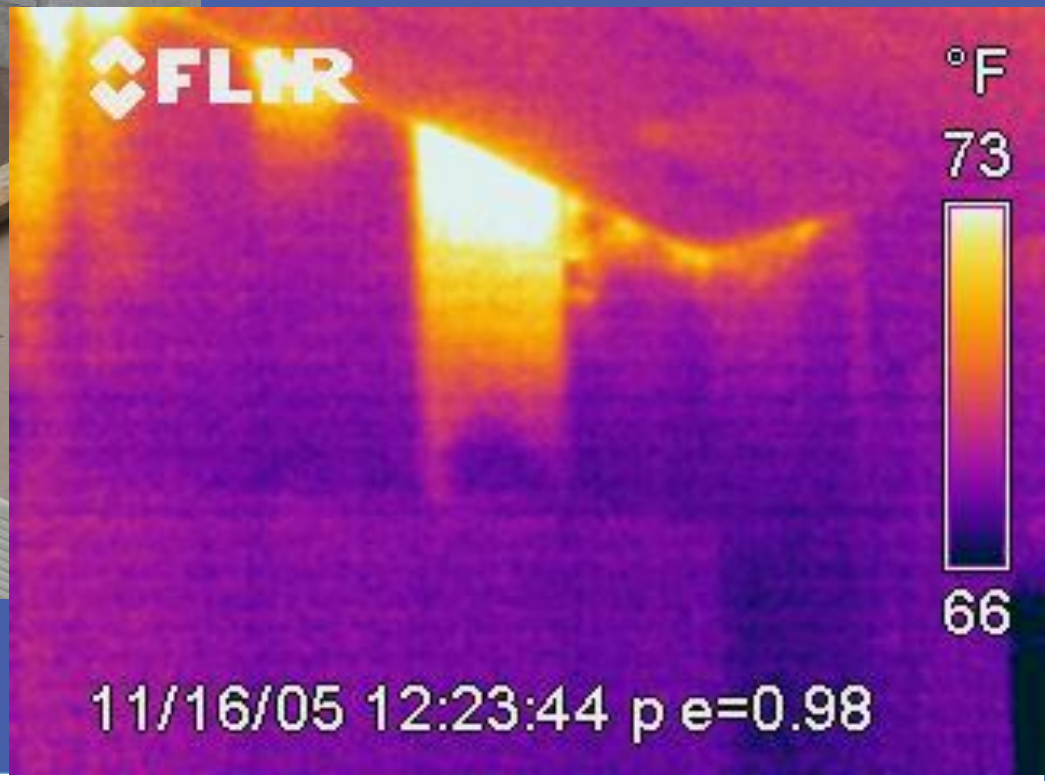
Mold needs 4 criteria to grow

- Time (24-48 hrs)
- Moisture
- Organic Food source
- Proper temperature

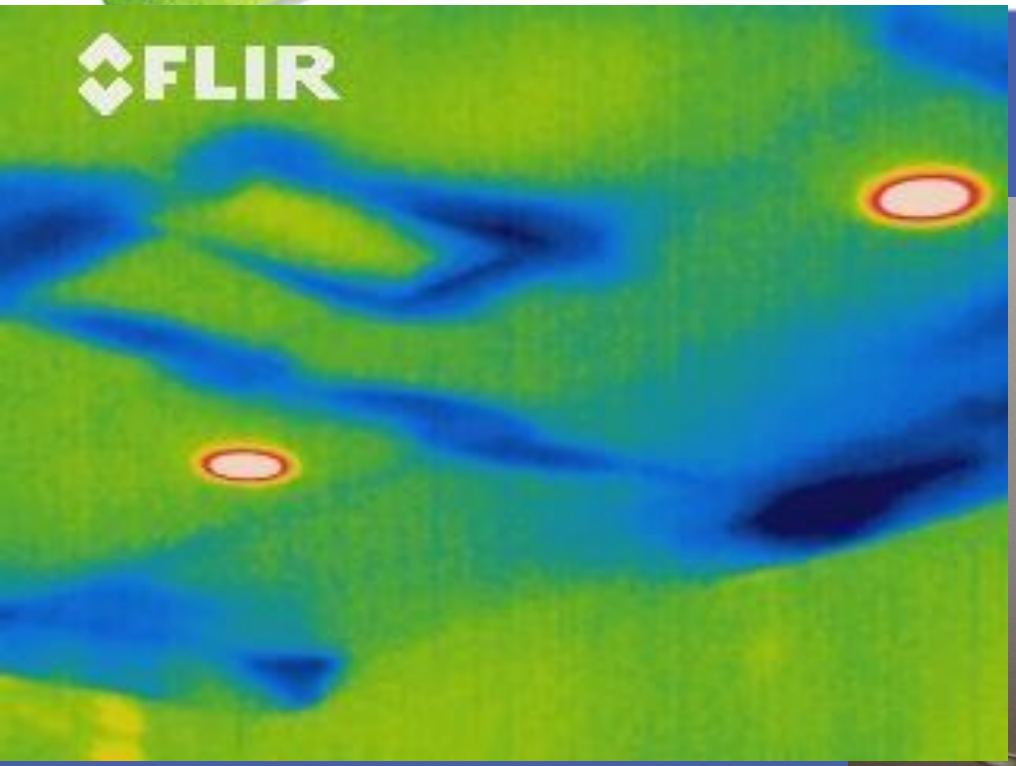
Food sources for mold

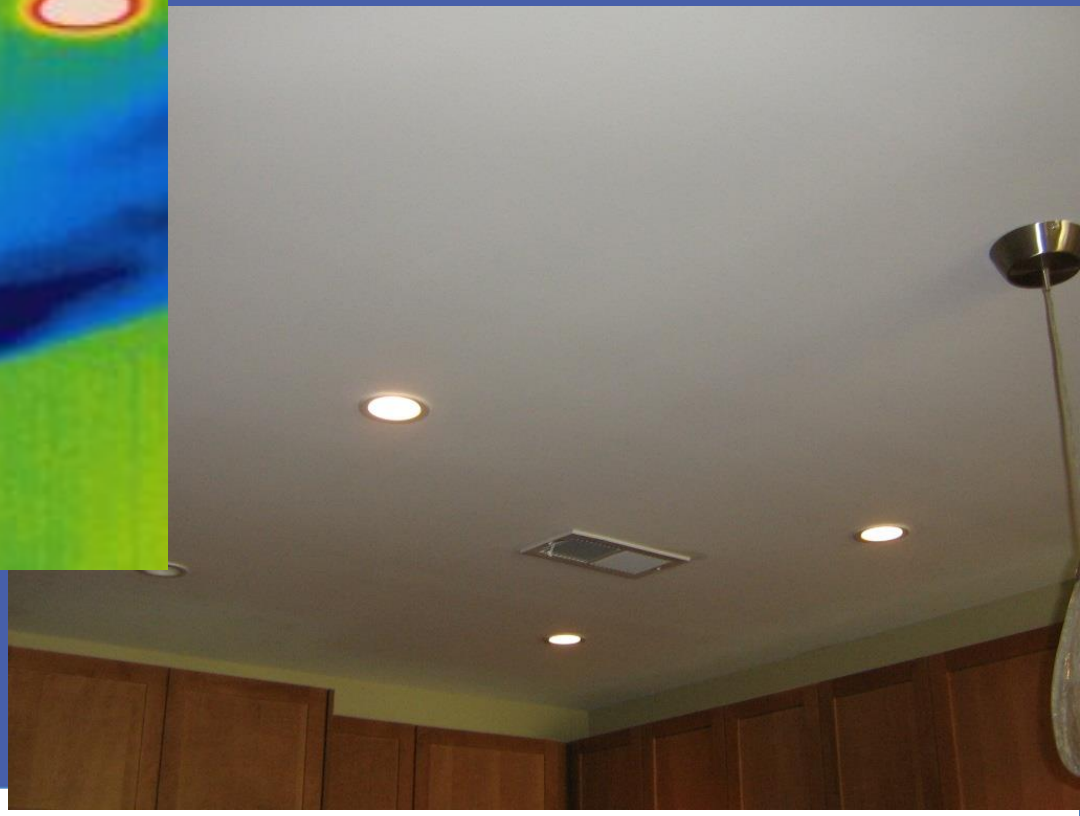
- Drywall
- Wood
- Paints
- Wall Coverings
- Carpet & Pad

Mold



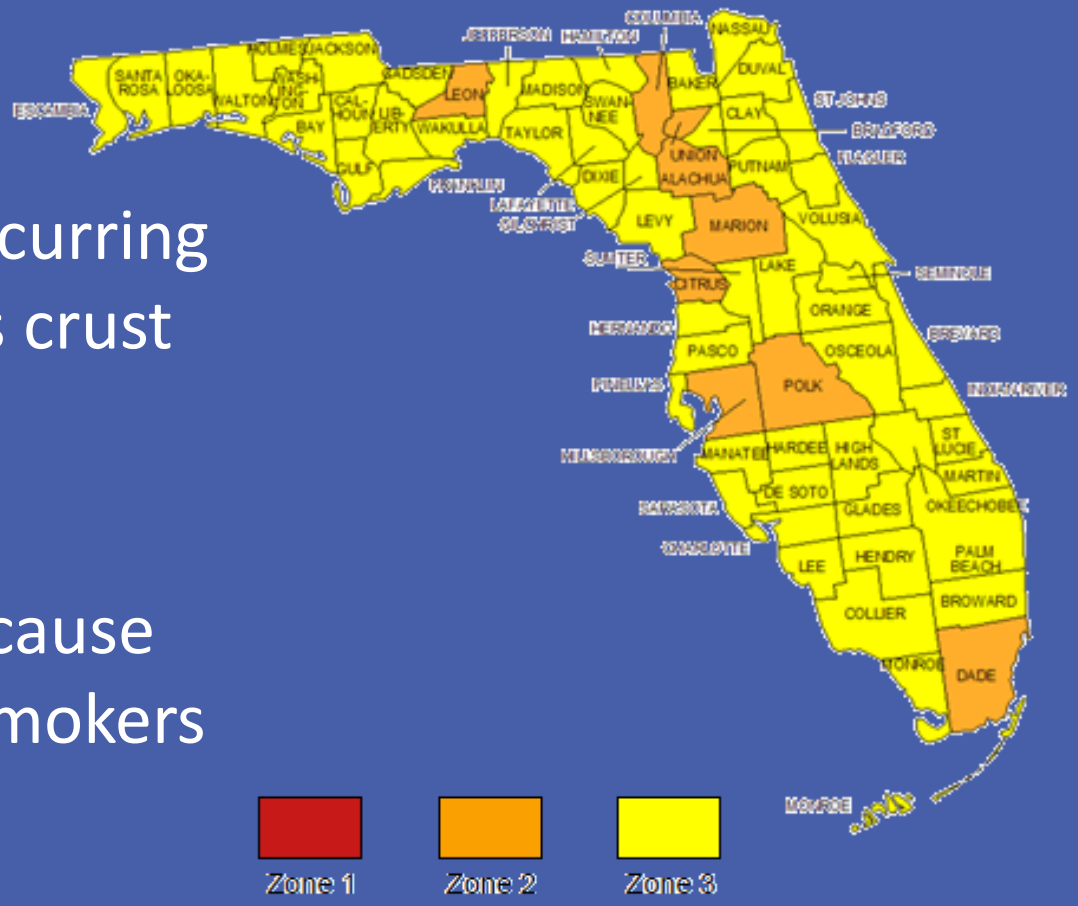
Mold



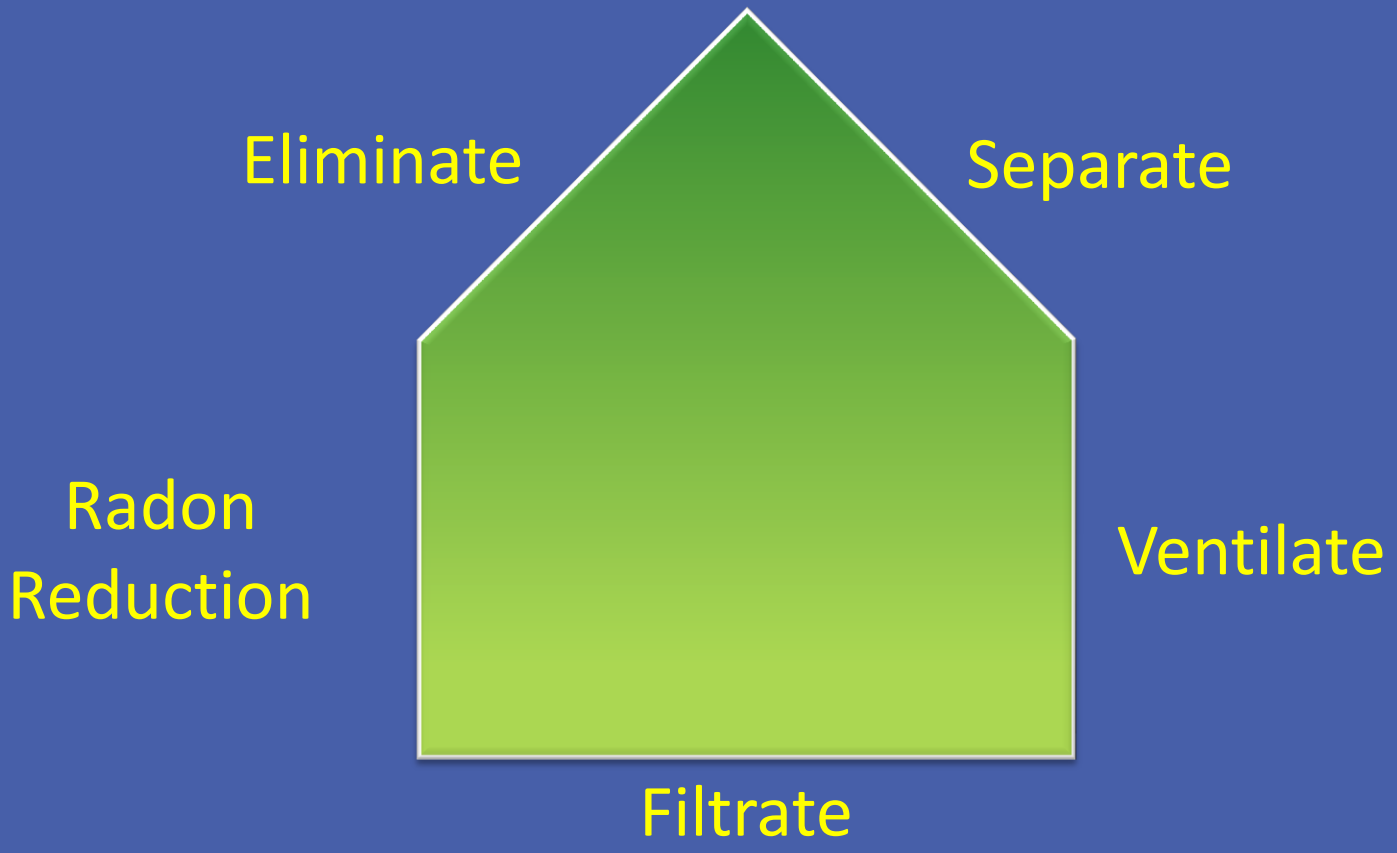


Radon Gas

- Radon is a naturally occurring gas found in the earth's crust
- Concentrations vary depending on location
- Believed to be leading cause of lung cancer in non-smokers

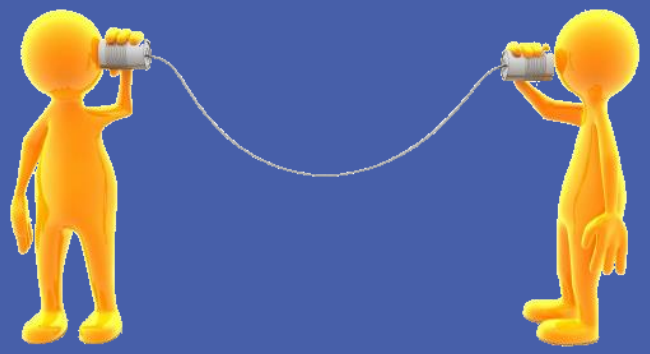


Air Quality Improvement Strategies



Eliminate

- Most effective of all strategies
- Simplest of all strategies
- Hardest to police
  - Requires communication between contractor and subcontractors and installers



Three ways:

- Construction methods
- Material selection
- Owner education

Construction Contaminant Controls

- Seal and protect ductwork during construction

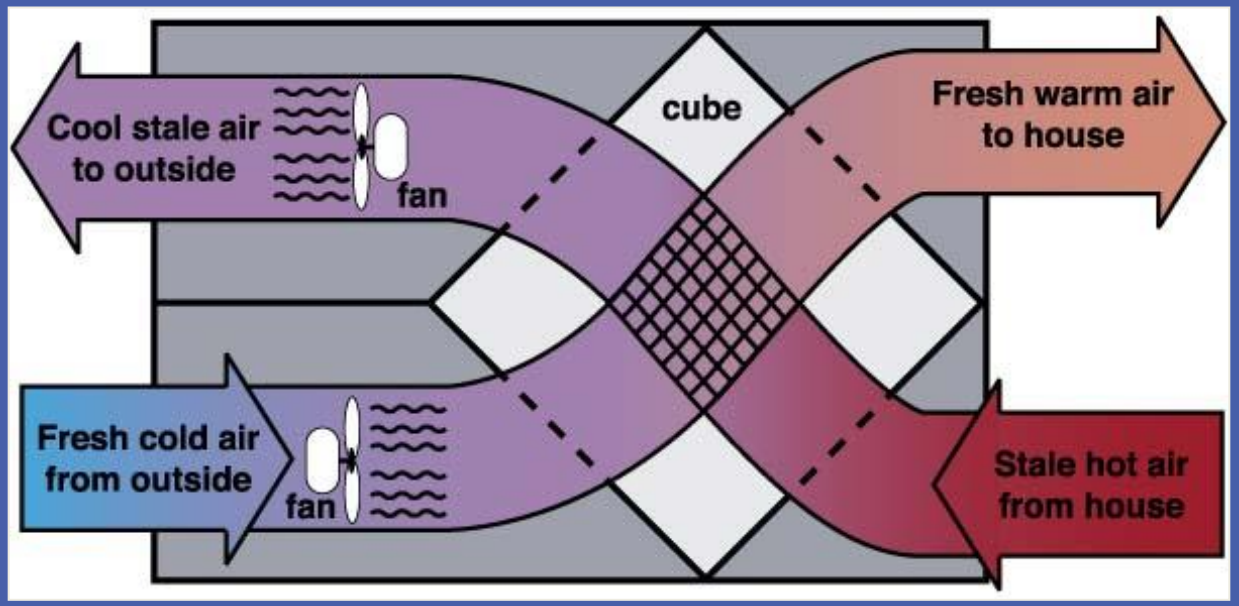
- Protect stored materials from moisture

Construction Contaminant Controls

- Protect building interior from outdoor contaminants

- Prohibit smoking inside the building

HRVs and ERVs



- Incoming and outgoing airflows pass through different sides of the cube.
- ERVs also allow the exchange of moisture.

Healthy Materials

- Low-VOC or No-VOC paints and sealers
- Low VOC Adhesives
- Formaldehyde free products
- Healthy flooring
- Healthy Insulation

VOC Limits

Paints & Coatings
VOC Limits
Green Seal GS-11 r3

Interior Paints, Coatings, & Primers	VOC weight (g/L minus water)
Flats	50
Non-Flats	100

Healthy Flooring

Flooring System	Certification
Carpet	Carpet and Rug Institute's Green Label Plus Program
Carpet Cushion	Carpet and Rug Institute's Green Label Program
Hard Surface Flooring	FloorScore Certification
Tile, Masonry, Terrazzo, Cut Stone, And Solid Wood Flooring without Sealants	Qualifies

Adhesive VOC Limits

Architectural Applications	VOC Limit (g/L less water)	Specialty Applications	VO (g/L l
Indoor carpet adhesives	50	PVC welding	
Carpet pad adhesives	50	CPVC welding	
Wood flooring adhesives	100	ABS welding	
Rubber floor adhesives	60	Plastic cement welding	
Subfloor adhesives	50	Adhesive primer for plastic	
Ceramic tile adhesives	65	Contact adhesive	
VCT and asphalt adhesives	50	Special purpose contact adhesive	
Drywall and panel adhesives	50	Structural wood member adhesive	
Cove base adhesives	50	Sheet applied rubber lining operations	
Multipurpose construction adhesives	70	Top and trim adhesive	
Structural glazing adhesives	100		

ns	VOC Limit (g/L less water)	Sealants	VO (g/L l
	30	Architectural	
	50	Roadway	250
	50	Other	420
	30		
	80		

	VOC Limit (g/L less water)		
	250		
Architectural, porous	775		
Other	750		

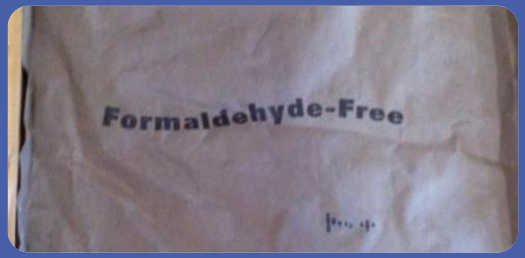
SCAQMD rule 1168 2005, South Coast Air Qu

GREENGUARD® Indoor Air Quality Certified

AQMD

Healthy Insulation

- Insulation should be VOC and Formaldehyde free
- Insulation should be permeable to prevent mold growth



Separate

- Keep hazardous substances separate from living areas
- Create barriers between hazardous substances and living areas

Garages

- Dirtiest room of a home
  - Car Exhaust
  - Gasoline
  - Pesticides
  - Paints
  - Solvents
  - Cleaners

Detached Garage

- Most effective way to separate
- Not always an option
  - Design limitations
  - Site restrictions

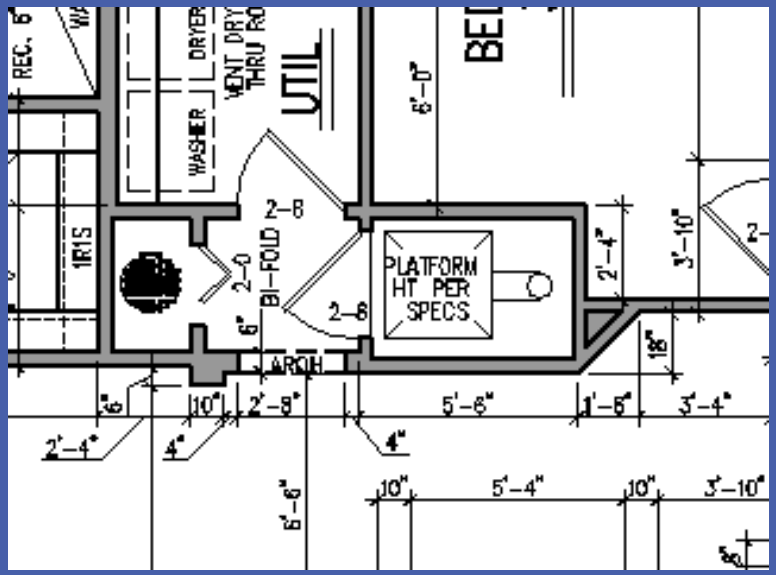
Air Sealed Garage

Create an air barrier between garage and living area

- Seal bottom plate to floor
- Seal all penetrations
- Use exterior door with gasket
- Use automatic closer on door
- Gasket attic access
- Keep air handlers out of garage

Air Handler Placement

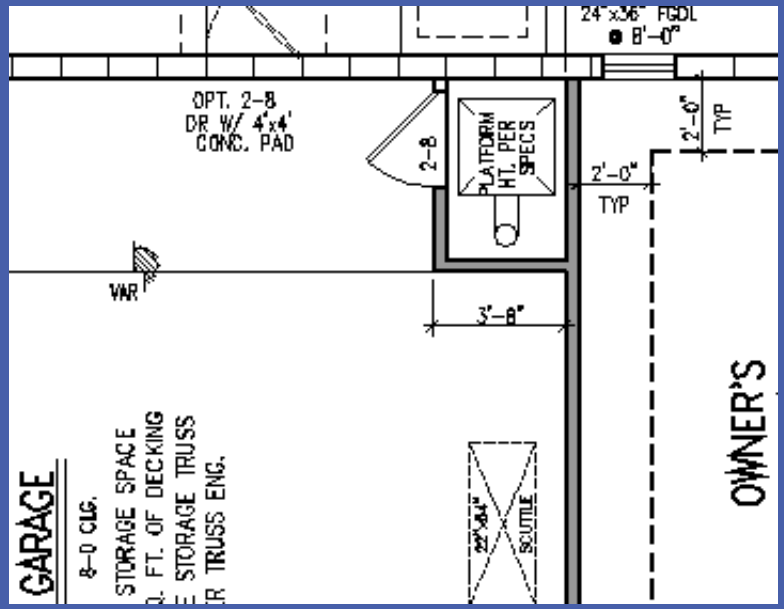
Keep air handler separate from garage



Interior closet

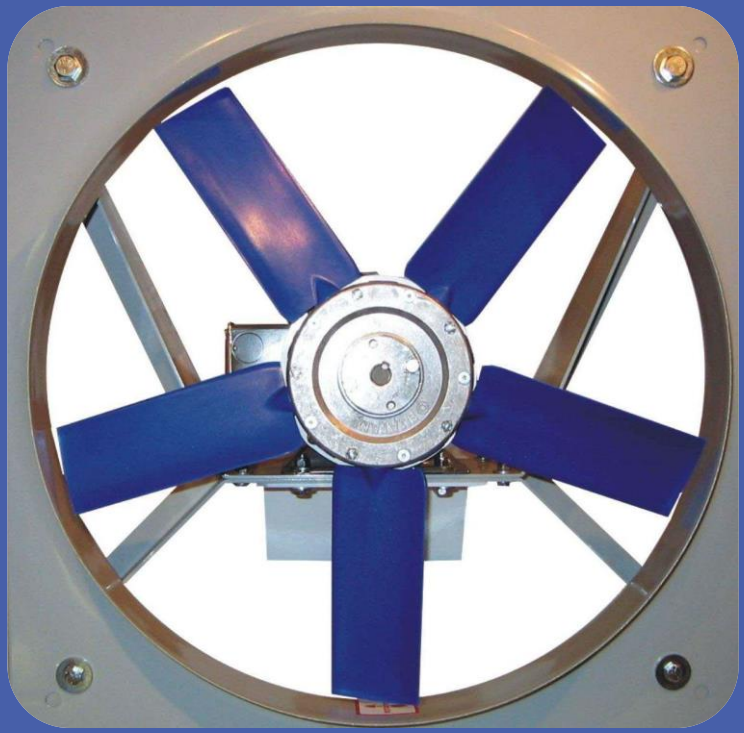
Air sealed garage closet

- Sealed bottom plate
- Sealed exterior door
- Insulated walls



Ventilate

- Homes are being built tighter with fewer envelope leaks
- Helps to control moisture in the air
- For indoor air to remain healthy, outdoor air should be utilized



Why Ventilate

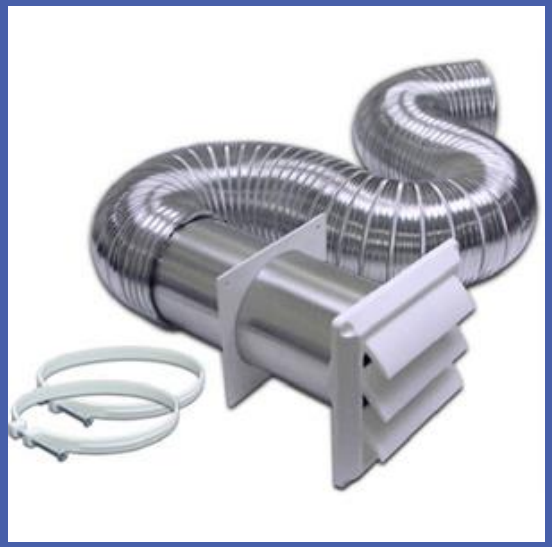
To Remove pollutants

- People and pets
  - Carbon Dioxide, Water Vapor, Body Odor
- Building Pollutants
  - VOC's, combustion gasses, radon, water vapor
- Activity pollutants
  - VOC's, water vapor, odors

CO_2

Exhaust Ventilation

- Located near pollutant
  - Remove moisture and odors
- Bath fans
  - Timer/humidistat controls
  - > 50 CFM < 1 sone
  - Energy Star
- Kitchen range hood
  - Vented to outdoors
- Dryer vents
- All of these create negative pressure in home



Supply Ventilation

- Outside air intake into the HVAC return duct
  - Mechanical damper closes when air handler isn't running
  - Damper can be closed if outside air is polluted
  - Keep intake 10' from exhaust vents, 2' from roof or ground

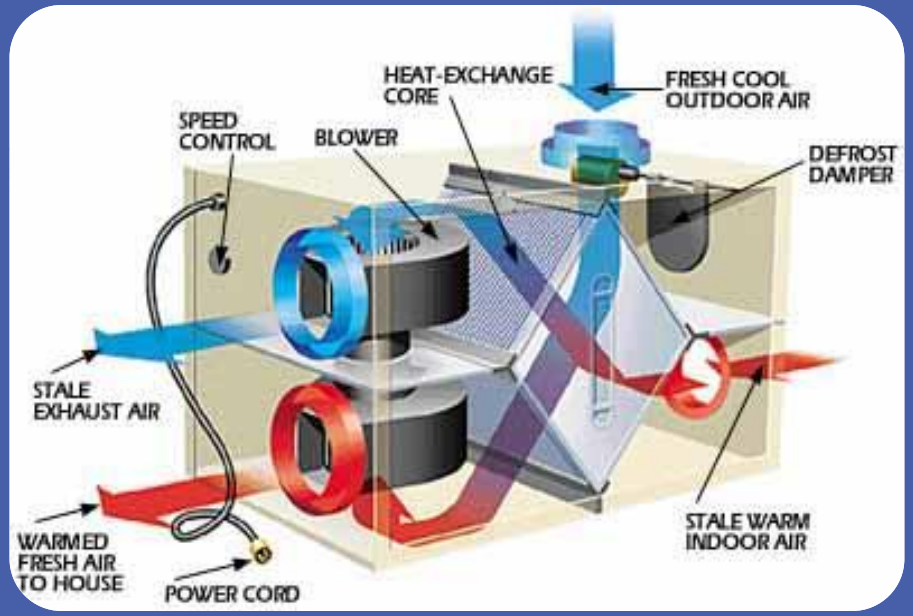
Balanced Ventilation

Energy Recovery Ventilators

- Condition Air for both temperature and humidity
- Suitable for hot humid locations

Heat Recovery Ventilators

- Same as ERV but only condition for temperature
- Most suitable for dry cold locations



Ventilation Rate

- ASHRAE 62.2 Minimum ventilation rates
- Depend on home size and number of occupants

Minimum Ventilation Requirements CFM

Conditioned Floor Area	Number of Bedrooms				
	0 – 1	2 – 3	4 – 5	6 – 7	> 7
➢ 1500	30	45	60	75	90
1501 – 3000	45	60	75	90	105
3001 – 4500	60	75	90	105	120
4501 – 6000	75	90	105	120	135
6001 – 7500	90	105	120	135	150
>7500	105	120	135	150	165
ASHRAE 62.2					

Filtrate

- Filters remove contaminants from the air
- The higher the MERV rating the smaller the particles it can filter

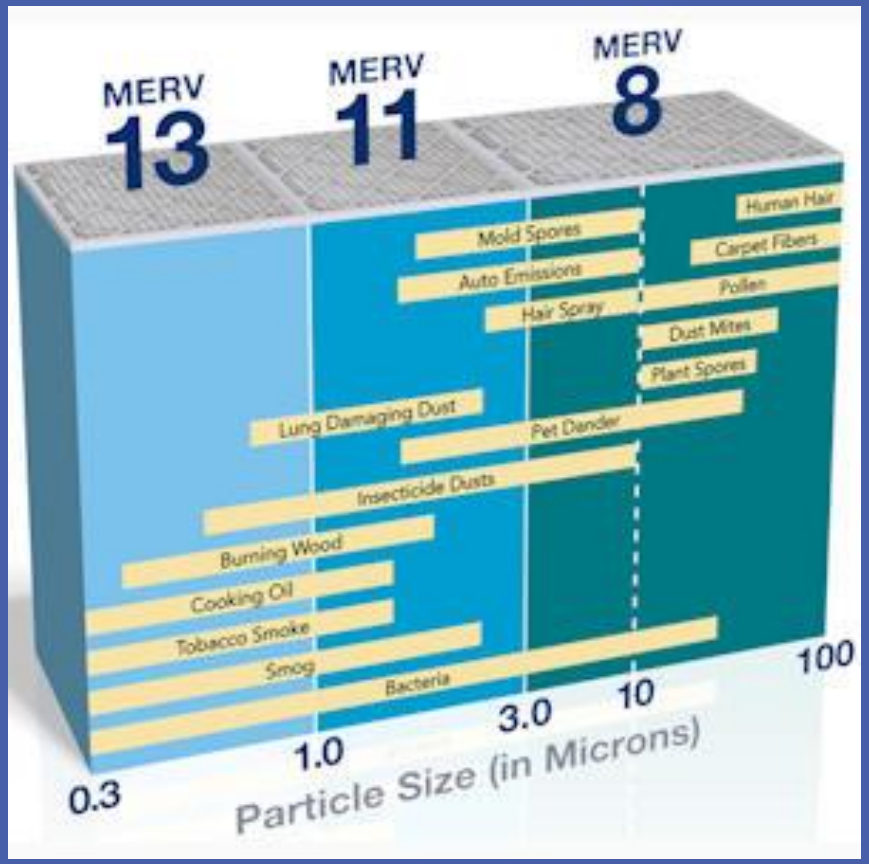
Filtrate

M – Minimum

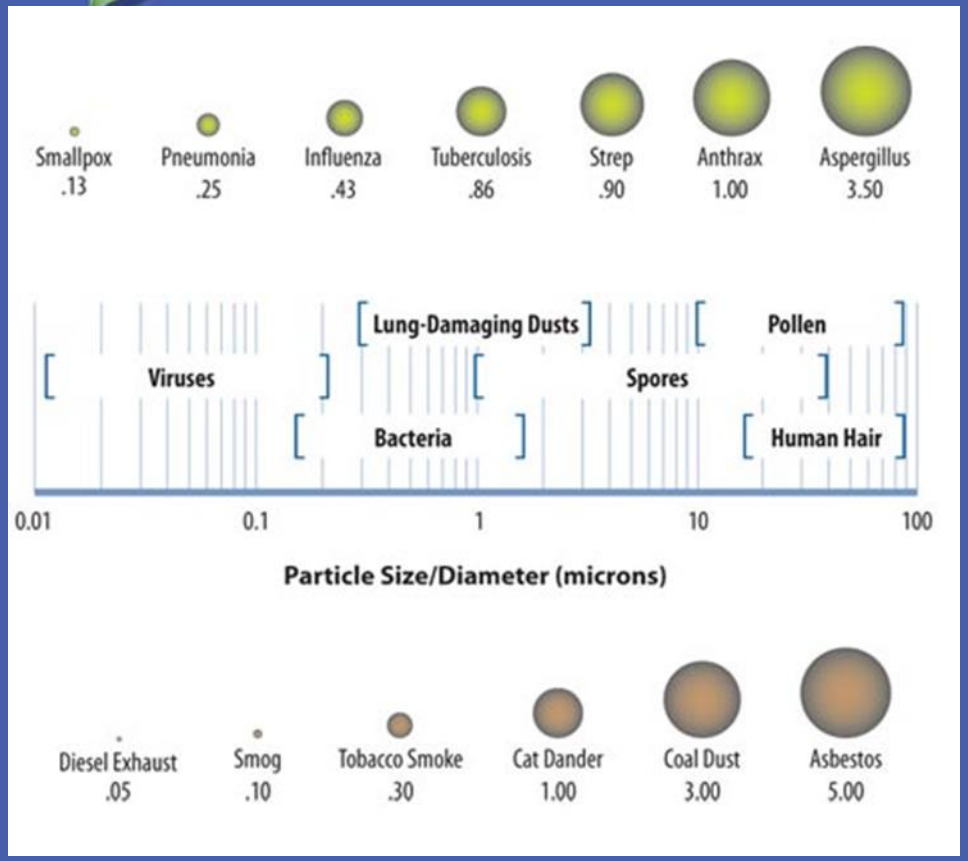
E – Efficiency

R – Reporting

V – Value



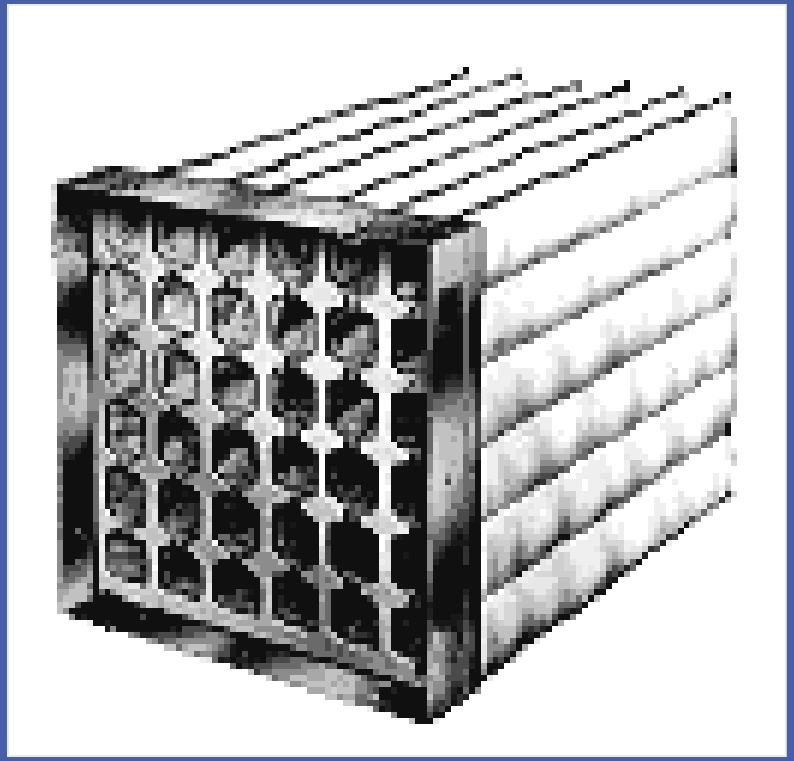
Particle Sizes



- MERV 4
  - 3-10 micron < 20%
- MERV 8
  - 3-10 micron 85%
- MERV 10
  - 1-3 micron 65%
- MERV 12
  - 1-3 microns 90%

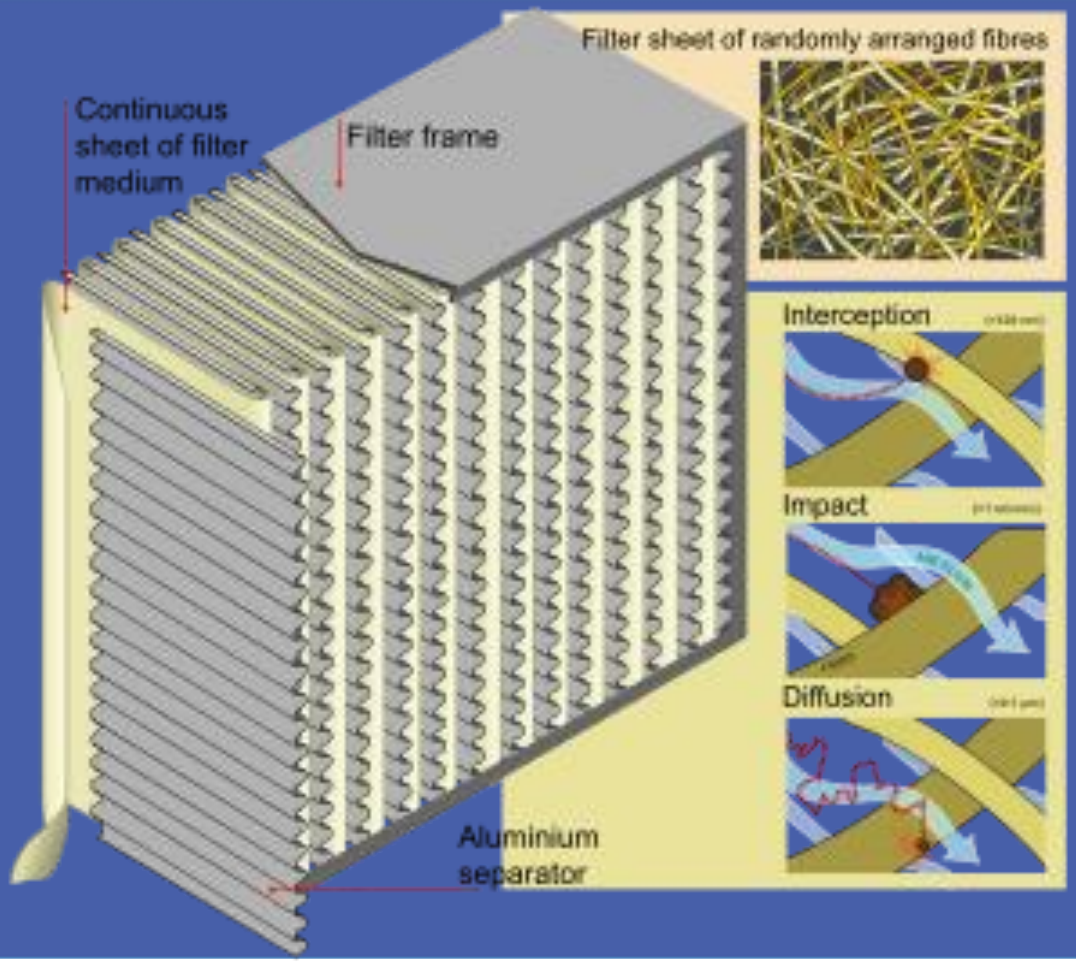
HEPA Filters

- **HEPA** - **H**igh **E**fficiency **P**articulate **A**ir filters
- Removes micron-sized particles
- Real world installations do not always achieve performance limits measured in laboratories.



HEPA Filters

- Consist of fine fibers
- Alter the airflow streamlines
  - Airflow slips around the fiber.
  - Particulate matter cannot change direction so rapidly so they impact the fiber.
  - Most particulates will not re-enter in the airstream.



Electrostatic Air Cleaners

Electrostatic Precipitators

- Use electrostatic attraction to trap charged particles:
  - They draw air through an ionization section.
  - Particles obtain an electrical charge.
  - The charged particles then accumulate on a series of flat plates, called a collector, that is oppositely charged.

Ion Generators

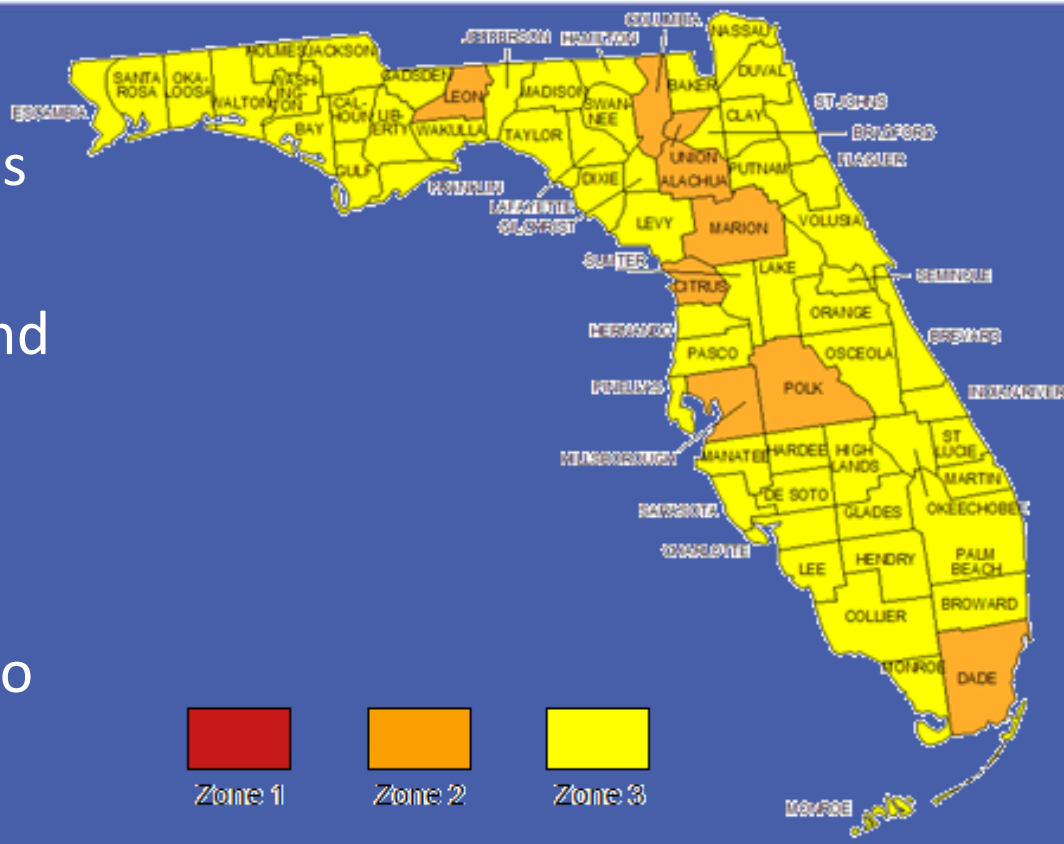
- Also called ionizers:
  - They disperse charged ions into the air.
  - Ions attach to airborne particles.
  - Charged particles attach and settle faster.

Ultraviolet

- Use UV light technology to destroy pollutants
- Air must be exposed for a minimum amount of time.
  - If too quickly, then the effectiveness is reduced.
- Three types:
  - Ultraviolet germicidal irradiation (UVGI) cleaners
  - Photo catalytic oxidation (PCO) cleaners
  - Ozone generators

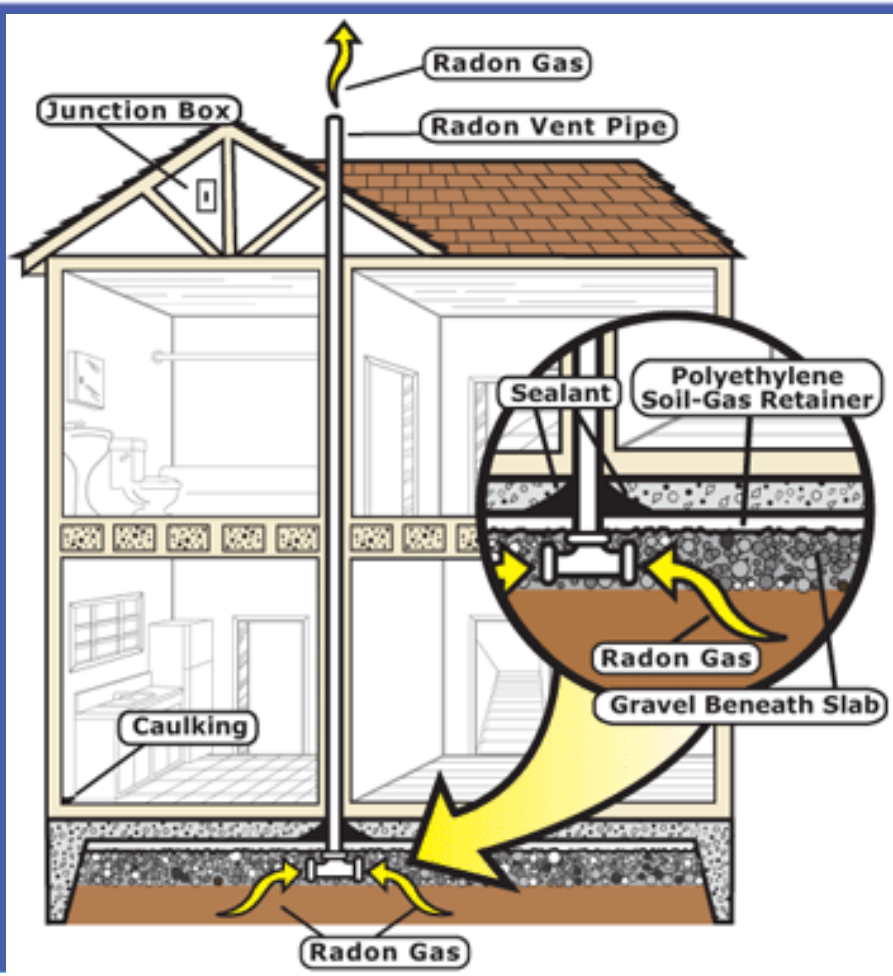
Radon Reduction Techniques

- Radon is a colorless odorless radioactive gas
- Present in almost all soils and rocks
- Concentrations vary greatly
- Lung cancer can result from long term exposure at low to medium concentrations



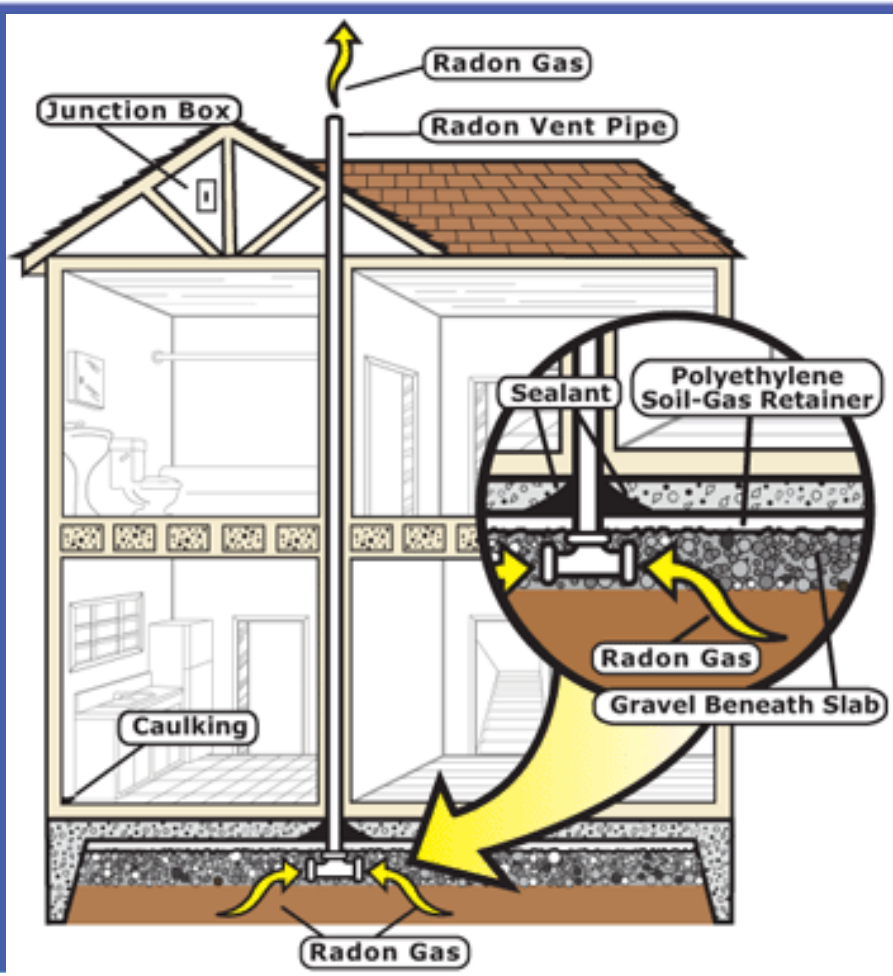
Radon Resistant Construction

- Gas permeable layer under slab
  - 4”-6” gravel
  - “T” in gas permeable layer
- Vapor barrier
  - 6 mil lapped and taped
  - Taped to penetrations

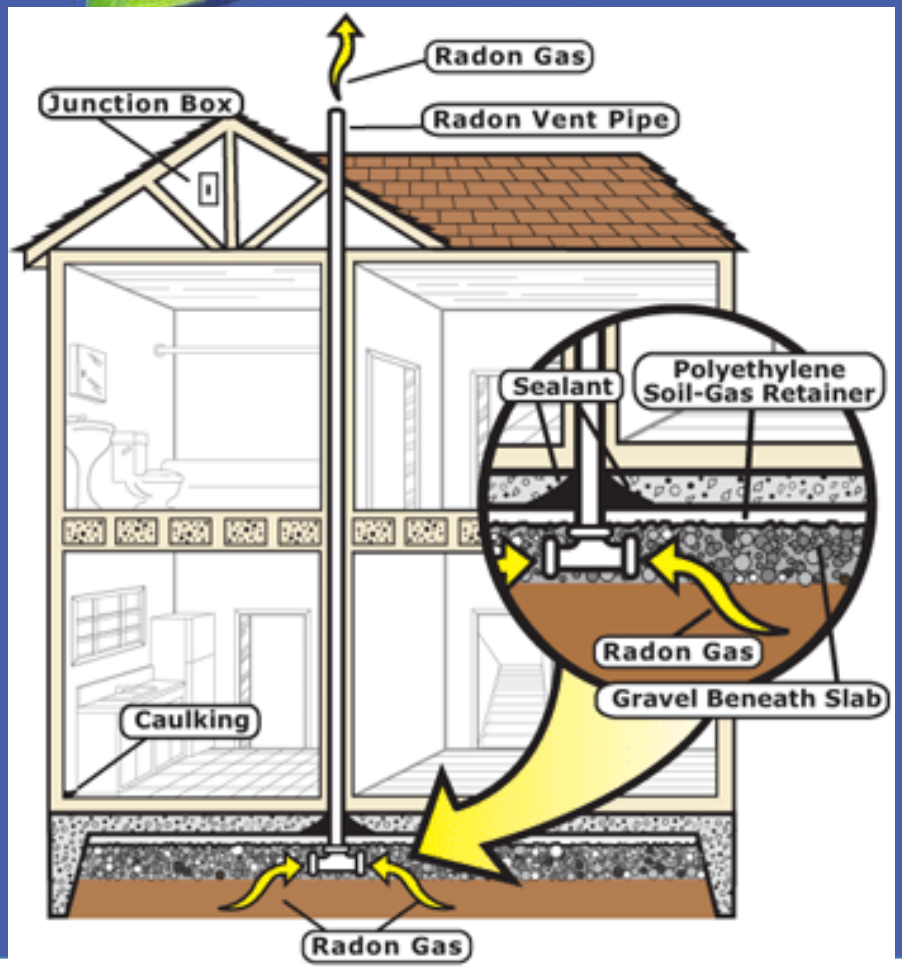


Radon Resistant Construction

- Vertical Vent Pipe to the "T"
  - 3" or 4" dia
  - 12" above roof
  - 10' from any opening
- Seal slab construction joints and penetrations
  - Elastomeric sealer
  - Polyurethane caulk



Radon Resistant Construction



- Electrical junction box in attic
  - For future fan if needed.

Indoor Air Quality Review

1. What are some of the issues and considerations that impact indoor environmental quality?
2. What are the principle concepts for improving IAQ?
3. Name one mitigation approach for each of the principle concepts of IAQ.
4. The _____the MERV filter rating the _____ the particle it can filter.

Resources

- EPA Indoor Air Plus
  - www.epa.gov/iaplus01
- EPA Indoor Air Quality
  - www.epa.gov/iaq/
- GreenGuard
  - www.greenguard.org
- Green Seal
  - www.greenseal.org
- Carpet & Rug Institute
  - www.carpet-rug.org
- EPA Radon
  - www.epa.gov/radon
- EPA Build Radon Out
  - www.epa.gov/radon/pdfs/buildradonout.pdf.