Steps to Healthier Homes

- Start with People
- House as a System
- Keep It:
  - Dry
  - Pest-Free
  - Safe
  - Maintained
  - Clean
  - Ventilated
  - Contaminant-Free
- Making it Work

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Why Well Ventilated?

- Pollutants can be found in concentrations 2-5 times higher indoors than outdoors.
- Proper ventilation can reduce hazards of:
  - Volatile organic compounds
  - Moisture
  - Environmental tobacco smoke
  - Particulate matter
  - Allergens
  - Mold
  - Carbon monoxide
  - Formaldehyde

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Type of Heating Fuel

- Water Heater
  - —51% have piped gas
  - —40% have electricity
- Clothes Dryer
  - —21% have piped gas
  - —77% have electricity

From American Housing Survey – 2007

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Primary Heating Equipment

- 63% have warm air furnace
- 12% have steam or hot water system
- 12% have electric heat pump

But . . .

- 1.3 million homes (1.2%) have room heaters without flue
- 900,000 homes (0.8%) rely on stoves
- 120,000 homes (0.1%) rely on cooking stove

For their Primary Source of Heat!

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Heating Problems

- 7% were uncomfortably cold for more than 24 hours
  - 11% for renters
- 1% had inadequate heating capacity
  - 2% for renters and residents below poverty level
- 0.8% had inadequate insulation
  - 1.6% for renters
  - 1.4% for residents below poverty level

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Sources of Combustion Contaminants

- Oven as heater
- Spillage from furnace, water heater, fireplace
- Ventless heater or fireplace
- Car exhaust from attached garage

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Combustion Contaminants? Health Effects

- Carbon Monoxide
  - Fatigue, headaches, dizziness, confusion
  - The "Silent Killer"
- Nitrogen Dioxide
  - Eye, nose, and throat irritation
  - Shortness of breath

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Carbon Monoxide Limits

Agency	Situation	Maximum CO Level	Duration
Environmental Protection Agency (EPA)	Outdoor / Ambient Air	9 ppm	8 hours
		35 ppm	1 hour
Consumer Products Safety Commission / Underwriter Laboratories (UL)	Alarms for Immediate Life Threats in Residential Air	70 ppm	1 - 4 hrs
		150 ppm	10 - 50 min
		400 ppm	4 - 15 min
Canadian Department of National Health and Welfare	Air in Residences	11 ppm	8 hours
		25 ppm	1 hour
World Health Organization	Indoor Air	32 ppm	Max.

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Carbon Monoxide Alarms

- Consumer Product Safety Commission (CPSC) recommends:
  - Place near sleeping area
  - Put on every level of a home to provide extra protection
  - Do not install directly above or beside fuel-burning appliances

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Smoke alarm, CO alarm, fire extinguishers?

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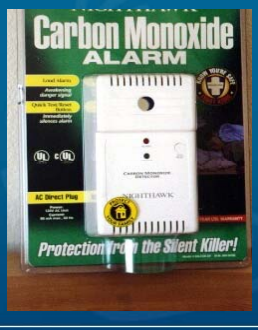
Why Ventilated: Health Effects

Approximately 500 carbon monoxide deaths plus more than 15,000 non-fire related healthcare visits per year.



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Why Ventilated: Health Effects

- Higher rates of respiratory irritation and illness in housing with poor ventilation
  - Common colds
  - Influenza
  - Pneumonia
  - Bronchitis

... and increased rates of absence from school or work

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Well-ventilated

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A Well-Ventilated Building?

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A Well-Ventilated Building Provides:

- **Local Exhaust Ventilation** to remove moisture, odors, and other pollutants at the source
- **Whole House Ventilation** for supplying fresh air to reduce contaminants by dilution
- **Control of airflow** through building so crazy airflows can't carry contaminants into and around the house

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Key Concepts

- If any portion of air leaves a house the same amount must enter
- Air like water seeks the path of least resistance
- When heated air rises
- When cooled air falls
- Air can be hot, cold, wet, dry, or polluted when it enters or exits a house

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Air Flow in Homes

- Typical homes do not have a planned supply of fresh air.
- We depend on leakage such as windows, doors, and cracks.
- This is usually not adequate.

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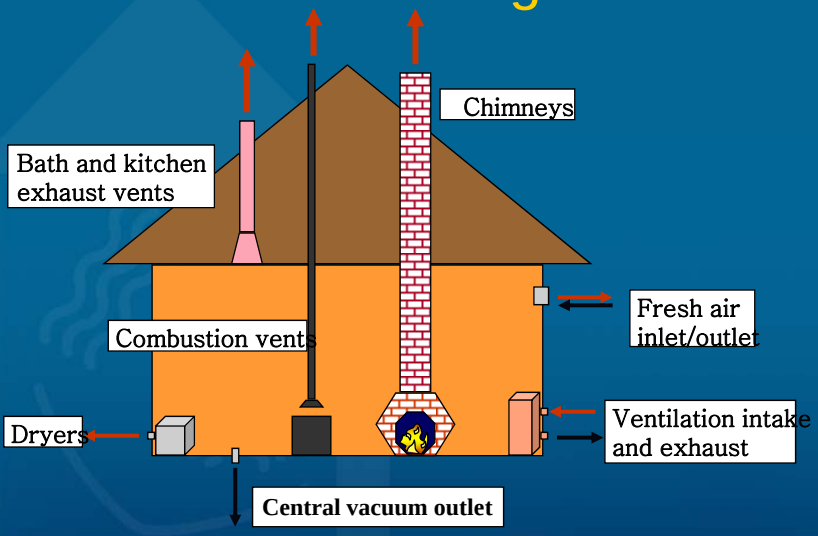
Air Flow Needs Designed Holes



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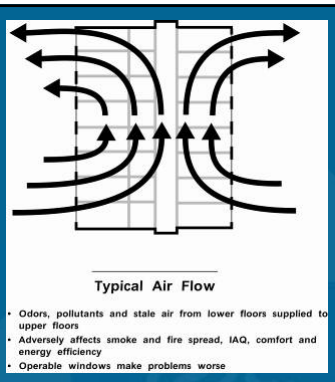

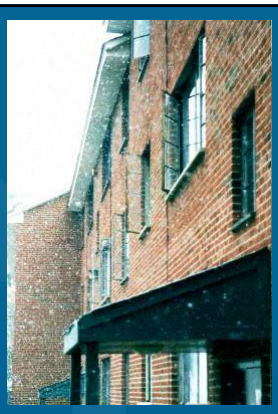

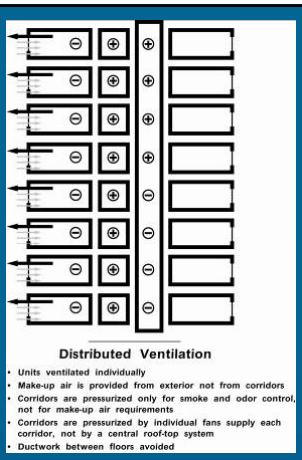

Multi-family dwellings should have planned fresh air supply because:
–Neighbors are closer together
–Stack effect- this dominates in cold weather

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What are we looking for?

- Bath, dryer, and range exhaust fans?
- Gas stove used as heater?
- Windows work?
- Smoke alarm goes off?
- Unvented gas or kerosene heaters?
- Vented hot water heater?
- Furnaces, boilers, fireplaces vented?
- Rooms without windows?
- Lingering odors?
- Stale air?
- Windows fog?

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Things that need exhaust ventilation

- Bathrooms
- Clothes dryers
- Kitchen ranges
- Boilers, furnaces, hot water heaters
- Fireplaces, wood burning stoves

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Is there an exhaust in the bathroom? Does it work?

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Testing Exhaust Fan: The Charmin Method

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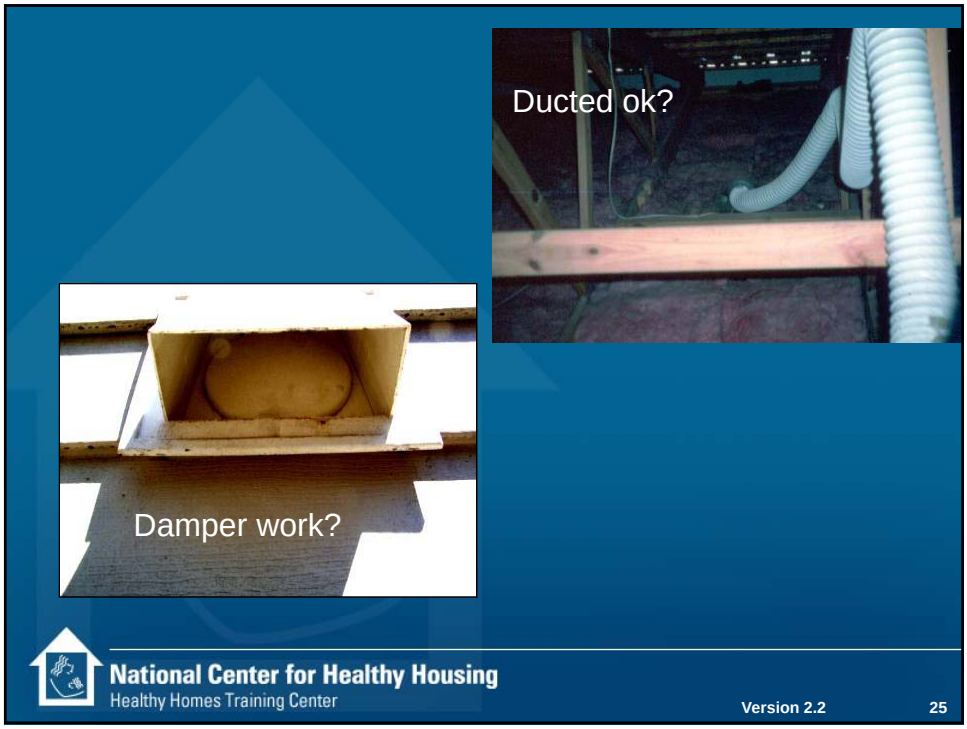
Ducted ok?
Damper work?
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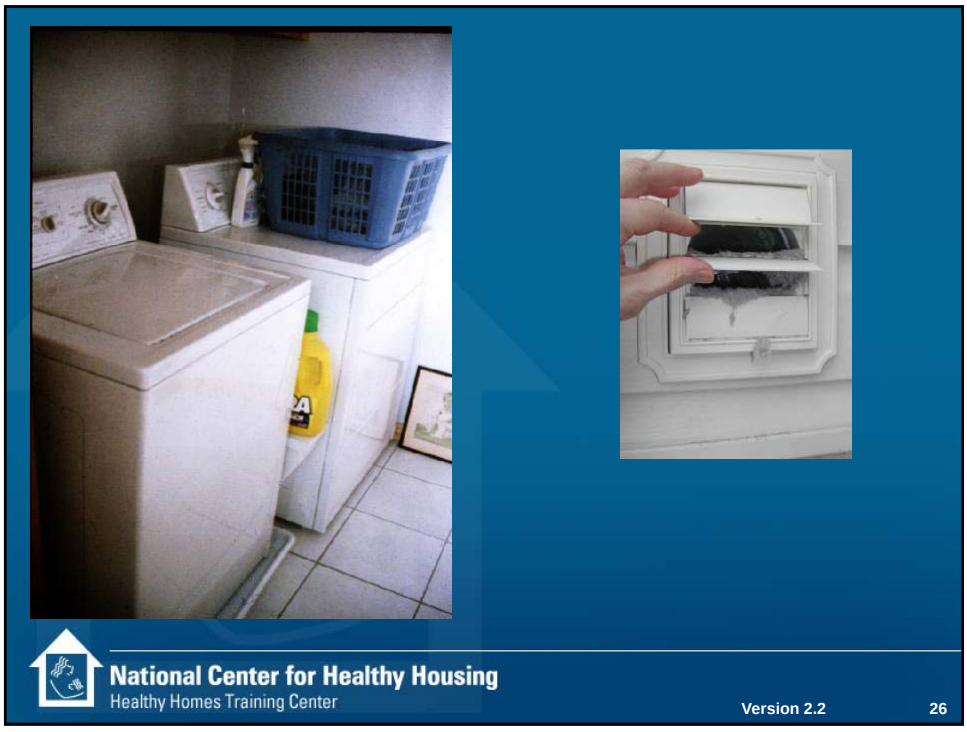
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Local Ventilation: Kitchen

- Remove moisture, odors, grease
- If gas oven or range, remove products of combustion: moisture, CO, NO_2
- Must be vented to the outside
- If it is not reasonably quiet, many people will not use it.

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Multi-family exhaust only – new construction

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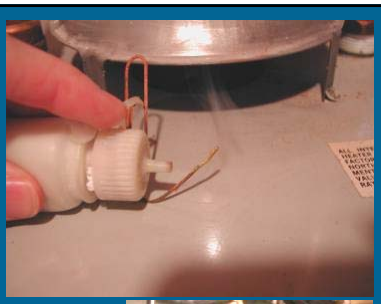

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Leaks in ducts:
▪ Cause pressure imbalance
▪ "Mine" contaminated air from garages, crawlspaces
▪ Increase energy costs
bad
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Poorly sealed filter access panel

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MERV

Minimum Efficiency Rating Value (MERV)

ASHRAE Standard 52.2 – Efficiency in collecting very small particles

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MERV Ratings

MERV	PARTICLE SIZE (μm)	TYPICAL CONTROLLED CONTAMINANT
1 – 4	>10.0	Pollen, sanding dust, textile and carpet fibers
5 – 8	3.0 – 10.0	Mold, spores, hair spray,cement dust
9 – 12	1.0 – 3.0	Legionella, lead dust, welding fumes
13 – 16	0.3 – 1.0	Bacteria, most tobacco smoke, insecticide dust, copier toner
17 - 20	≤ 0.3	Virus, combustion particles, radon progeny

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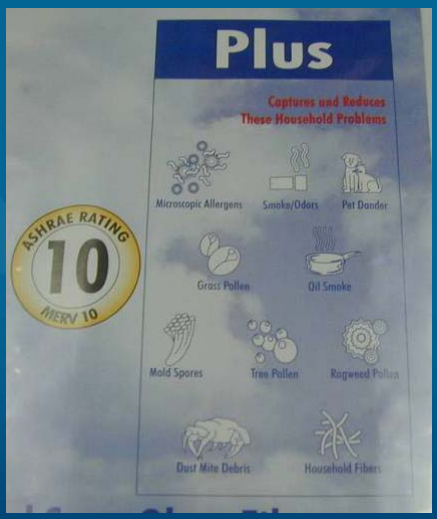
MERV 8 v. 10



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Other Rating Systems

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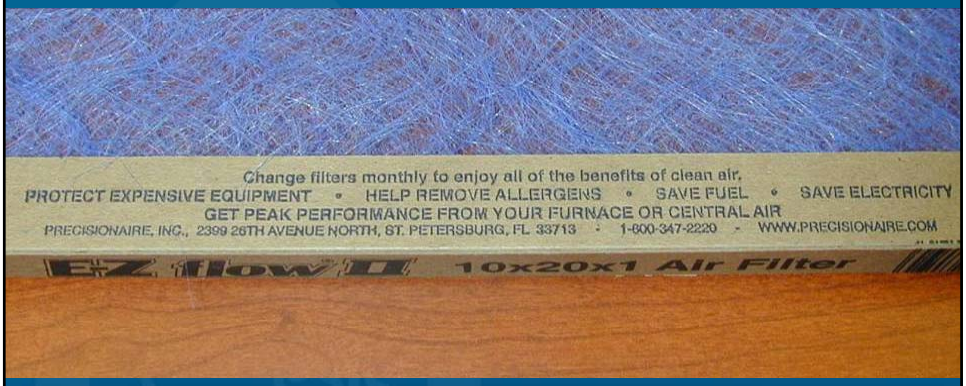
And . . .



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Code Requirements Related to Ventilation

- **403.1 Habitable spaces.**
  - Every habitable space shall have at least one openable window.
  - The total openable area of the window in every room shall be equal to at least 45 percent of the minimum glazed area required in Section 402.1.
- **403.2 Bathrooms and toilet rooms.**
  - Every bathroom and toilet room shall comply with the ventilation requirements for habitable spaces as required by Section 403.1, except that a window shall not be required in such spaces equipped with a mechanical ventilation system.
  - Air exhausted by a mechanical ventilation system from a bathroom or toilet room shall discharge to the outdoors and shall not be recirculated.

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Code Requirements Related to Ventilation

- **302.6 Exhaust vents.** Pipes, ducts, conductors, fans or blowers shall not discharge gases, steam, vapor, hot air, grease, smoke, odors or other gaseous or particulate wastes directly upon abutting or adjacent public or private property or that of another tenant.
- **403.4 Process ventilation.** Where injurious, toxic, irritating or noxious fumes, gases, dusts or mists are generated, a local exhaust ventilation system shall be provided to remove the contaminating agent at the source. Air shall be exhausted to the exterior and not be recirculated to any space.
- **403.5 Clothes dryer exhaust.** Clothes dryer exhaust systems shall be independent of all other systems and shall be exhausted in accordance with the manufacturer's instructions.
- **603.2 Removal of combustion products.** All fuel-burning equipment and appliances shall be connected to an approved chimney or vent.
  - **Exception:** Fuel-burning equipment and appliances which are labeled for unvented operation.

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Code Requirements Related to Ventilation

- **607.1 General.** Duct systems shall be maintained free of obstructions and shall be capable of performing the required function.
- **505.4 Water heating facilities.**
  - Water heating facilities shall be properly installed, maintained and capable of providing an adequate amount of water to be drawn at every required sink, lavatory, bathtub, shower and laundry facility at a temperature of not less than 110ºF (43ºC).
  - A gas-burning water heater shall not be located in any bathroom, toilet room, bedroom or other occupied room normally kept closed, unless adequate combustion air is provided.
  - An approved combination temperature and pressure-relief valve and relief valve discharge pipe shall be properly installed and maintained on water heaters.
- **603.5 Combustion air.** A supply of air for complete combustion of the fuel and for ventilation of the space containing the fuel-burning equipment shall be provided for the fuel-burning equipment.

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Key Messages

- Ventilation plays an important role in maintaining health.
- Ventilation is necessary to remove humidity and dilute or remove contaminants.
- Local exhaust ventilation removes contaminants from a point source, while whole house ventilation uses fresh air to dilute contaminants.

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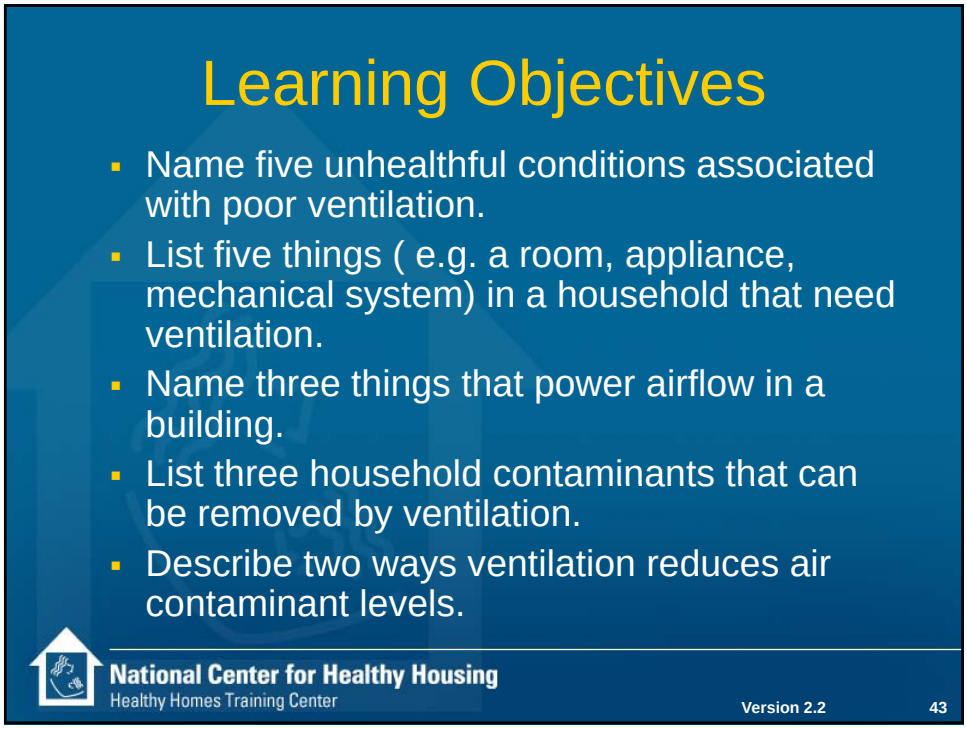
Learning Objectives
Name five unhealthful conditions associated with poor ventilation.
List five things (e.g. a room, appliance, mechanical system) in a household that need ventilation.
Name three things that power airflow in a building.
List three household contaminants that can be removed by ventilation.
Describe two ways ventilation reduces air contaminant levels.
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