

# **Healthy Homes, Home Energy Upgrades, Partnership for Clean Indoor Air, Asthma Programs**

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EPA/WESTAR Residential Wood Smoke Workshop

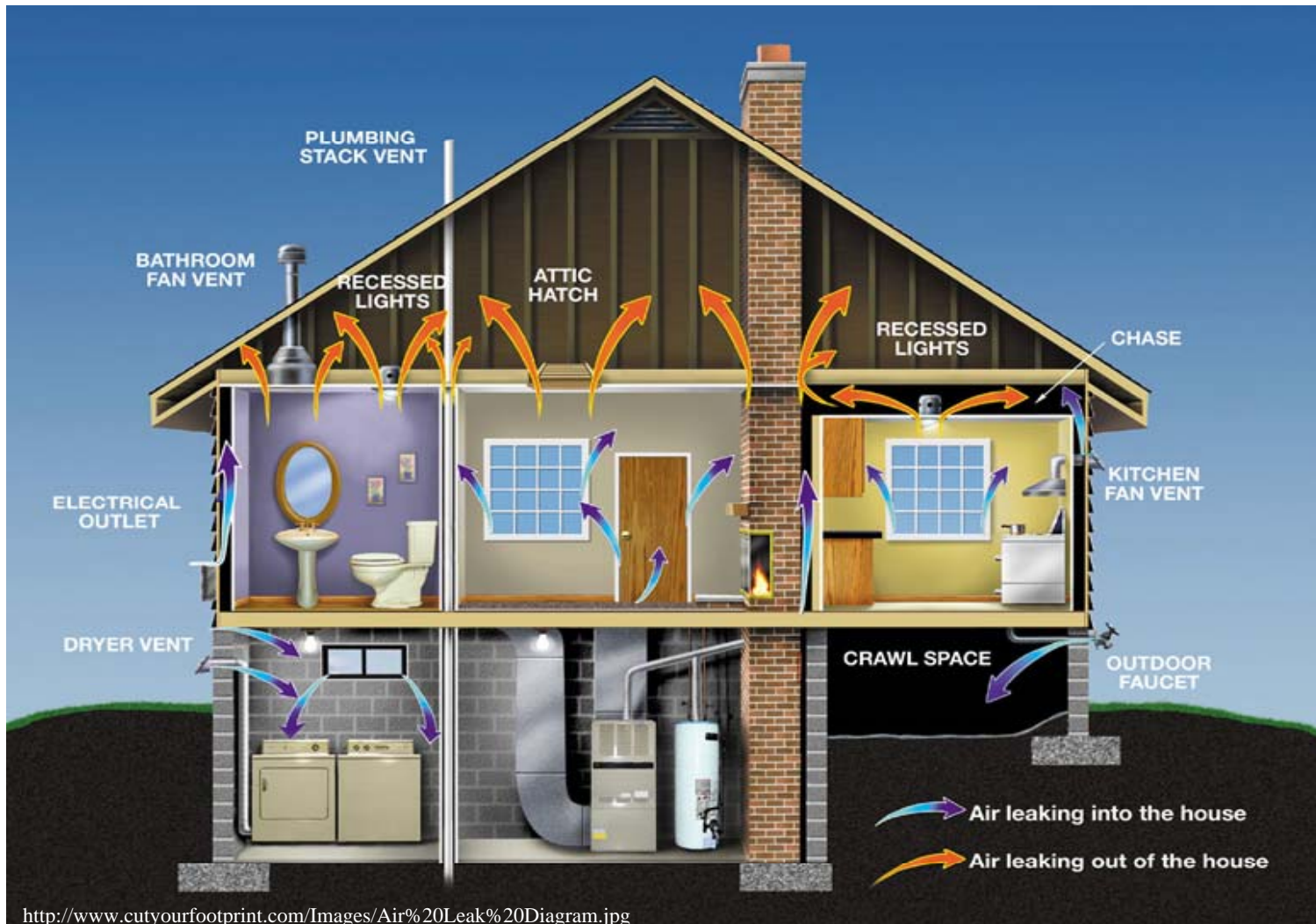
March 2, 2011

- **High Risk**
  - Chemicals (i.e.. formaldehyde, PCBs, lead), Pesticides, Biologicals (i.e.. mold)
  - Consumer products, furniture, building materials
- **High Exposure**
  - Concentrations usually 2-5x higher than outdoors
  - Up to 90% of time spent indoors (especially for children/seniors)
  - Exposure to indoor pollutants causes health effects
- **High Economic Costs**
  - \$150 - \$200B per year in lost work/school hours
- **Focus on Children's Health and Environmental Justice Issues**
  - Asthma disparities are greater in these groups
  - Ability to pay for low income households to fix indoor air problems

# What Does the Indoor Air Program [www.epa.gov/air](http://www.epa.gov/air) Do?

- **Asthma**
  - Lead Children’s Health Taskforce on asthma disparities
  - Avoid 50,000+ ER visits annually, 27% of health plans support environmental management
- **Partnership for Clean Indoor Air**
  - 300 Partner organizations/115 countries to increase the use of clean, efficient, affordable, reliable, and safe cooking technology and fuels
  - Laid the foundation for what has become a large international program
- **Promoting Healthy Environments and Families**
  - **Homes**
    - **Indoor airPLUS program** for new homes – specifications to build new homes in a safe and healthy way
    - Integrate IAQ policies, protocols and specifications into existing building related initiatives (Energy Efficiency, Green Buildings, DOE, HUD)
  - **Schools -**
    - Leader in getting schools to develop and integrate effective Indoor air quality management plans
- **Interagency Leader- IAQ, Radon, Children’s Health**

# Homes are Systems



## Weatherizing (sealing and insulating)

- Moderates temperature changes
- Helps save energy



## But...

## Sealing and tightening the home's envelope (reducing air leakage) can:

- Make existing problems worse
- Create new problems
- Problems can cause discomfort or in rare cases death



molds



animals



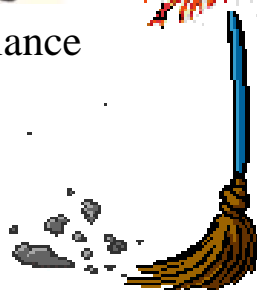
feathers



pollen



combustion appliance  
smoke



dust



cigarette smoke

- About 23M people in US have asthma (includes 7.1M children)
- Asthma accounts for 217,000 emergency room visits and 10.5M visits to the physician office per year
- Deaths in the U.S. = 3,447 people in 2007
- Asthma costs in the U.S.= \$30B in 2007



- Children
- Low-income, urban residents
- Minorities
- Those with hereditary predisposition
- Allergic individuals

- Indoor pollutants = significant contributor to asthma-related morbidity and mortality
- Prevention is an important asthma management tool

Inefficient combustion produces

- Asphyxiants
- Irritants
- PM

# Simple Asphyxiant: Nitric Oxide (NO)

- Colorless, odorless, highly reactive
- Outdoor source: fossil fuel burning
- Indoor sources: ETS, internal combustion engines, poorly vented stoves/heaters
- Limited data on health effects

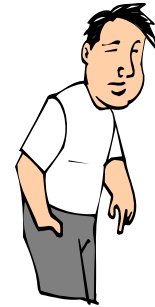


# Chemical Asphyxiant: Carbon Monoxide (CO)

- Colorless, odorless gas
- Source: incomplete burning of carbon-based fuel



- Increased respiration
- Aggravated angina (chest pain)
- Decreased: visual perception, dexterity, learning, & task performance
- Headache, fatigue, & impaired judgment
- Confusion, collapse w/exercise
- **More than 400 deaths/yr in the U.S. due to unintentional CO poisoning**



# Home Combustion Appliances

- Ranges, stoves
- Clothes dryers
- Room heaters, space heaters
- Fireplaces
- Water heaters
- Hibachis, barbeques, charcoal grills



- Reddish brown gas; sharp, biting odor
- Source: By-product of burning fossil fuels, Kerosene heaters, un-vented gas stoves and heaters, environmental tobacco smoke
- Health effects: Shortness of breath, irritation of lungs, eyes, nose, throat; respiratory infections in children
- Average indoor level ½ that of outdoors



- Chemical, fiber or metal components
- Health effects depend on particle size and composition
  - Inhalable range = diam. 10 microns or less
  - Respirable range = diam. 2.5 microns or less
- Health Effects: Irritation of lungs, eyes, nose, throat, may increase respiratory symptoms in people with chronic lung disease or heart problems
- Some chemicals attached to PM may be carcinogenic

# PM: Environmental Tobacco Smoke (ETS)



- Complex mixture of >4,000 compounds
  - 50 known carcinogens
  - respiratory irritants
  - reproductive toxicants



# Indoor Air Pollutant Reduction

**Source Control**

**Ventilation**

**Air Filtration**

# Reduce Exposure to Combustion Gaseous Pollutants

- Keep gas appliances properly adjusted
- Consider vented space heater
- Use proper fuel in heaters/furnaces
- Install & use exhaust fan vented to outside
- Choose properly sized wood stoves certified to meet EPA emission standards
- Have trained professional inspect, clean, & tune up central heating systems annually
- Fix identified problems promptly
- Don't idle car in garage



- Create a balance between high energy efficiency home and health
- Relevant IED Programs (to name a few!):
  - Partnership for Clean Indoor Air
  - Asthma Program
  - Indoor Air Plus

## Mission

- To reduce exposure to indoor air pollution from household energy use
- To improve the health, livelihood, and quality of life, particularly for women and children.
  
- Almost 400 public and private organizations working in 115 countries
- Four essential elements for sustainable household energy and health programs in developing countries:
  - Meeting Social and Behavioral Needs
  - Developing Local Markets
  - Improving Technology Design & Performance
  - Monitoring Impacts of Interventions

[www.PCIAonline.org](http://www.PCIAonline.org)



## Program Goals:

Reduce exposure to indoor asthma triggers and improve the quality of life for 6.5 million people by 2012.

## Program components:

- Community Outreach and Education
- National Public Awareness Campaigns
- Science Support

[www.epa.gov/asthma](http://www.epa.gov/asthma)

# Indoor airPLUS Program

A new opportunity for leading  
builders to create better environments  
inside and out



[www.epa.gov/indoorairplus](http://www.epa.gov/indoorairplus)



***Coming soon!***

## ***EPA's "Healthy Indoor Environment Protocols for Home Energy Retrofits"***

- Use with DOE Wx assistance programs (WAPs)
- Recommendations for weatherization and home performance contractors
  - Practical
  - Actionable
  - Affordable



<http://www.epa.gov/iaq/homes/retrofits.html>

EPA is coordinating with other federal agencies

- **Ventilation Study**

- Planned multi-year, multi-phase research study
- Intended to improve indoor air quality (IAQ) and energy performance of the U.S. housing stock
- Inform the setting of ventilation standards to
  - manage the health risks associated with indoor air pollutant exposures
  - maintain or improve new home energy efficiency

- Indoor air pollution impacts health
- Source control is most effective in achieving risk reduction
- Increased use of efficient combustion appliances indoors
  - Energy efficiency
  - Less impact on the environment via reduced fuel usage and reduced outdoor air pollution
  - Reduced risk of health impacts from exposure to combustion pollutants indoors



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[\*www.epa.gov/iaq\*](http://www.epa.gov/iaq)

# Thank You

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# Back Up Slides



[www.epa.gov/air](http://www.epa.gov/air)

# Weatherization Impacts on Indoor Air Quality

- The house is a system; air sealing and insulating can **change how a house operates**
- Sealing and tightening the home's envelope (reducing air leakage) can:
  - **Make existing problems worse**
  - **Create new problems**
  - **Problems can cause discomfort or may be lethal**

## **Weatherization Impacts on IAQ** - Continued

- **Stack-effect** altered and **reduced make-up air**
- **Spillage/Back-drafting** of combustion products (e.g., carbon monoxide) from atmospherically vented furnaces, hot water heaters, wood stoves and fireplaces
- **Reduced natural ventilation impacts:**
  - Increased moisture/mold, other biologicals
  - Increased chemical pollutant levels
  - Increased odors
  - Effects of gas leaks magnified
  - Less fresh air for occupants

# Determining the Right Amount of Ventilation

- **Test In-Test Out: Blower-door testing**
  - Before alterations to establish leakage of envelope and target sealing upgrades
  - After energy upgrades to ensure adequate ventilation for indoor air quality
- **Establish “Minimum Ventilation Requirement” (MVR or “Building Tightness Limit,” BTL)**
- **Compute MVR with ASHRAE 62-1989 or ASHRAE 62.2 (latest version)**

# Targeting Air Sealing

- **Sealing/weather stripping conducted**
- **Target for blower door reading** usually between pre-weatherization test result and calculated MVR
- State programs often determine the target test result differently
- **Test atmospherically vented combustion appliances/equipment for spillage/back-drafting**

## Additional Resources

- **EPA's Indoor Air Quality Web site:**  
[www.epa.gov/iaq](http://www.epa.gov/iaq)
- **EPA's Climate Change:**  
[www.epa.gov/climatechange/](http://www.epa.gov/climatechange/)
- **ENERGY STAR Home Improvement:**  
[www.energystar.gov/homeimprovement](http://www.energystar.gov/homeimprovement)
- **EPA's Ventilation for Homes Web page:**  
[www.epa.gov/iaq/homes/hip-ventilation.html](http://www.epa.gov/iaq/homes/hip-ventilation.html)
- **EPA's The Inside Story: A Guide to Indoor Air Quality:**



[www.epa.gov/air](http://www.epa.gov/air)



# Energy Efficiency, Weatherization and Ventilation

- **Weatherizing (sealing and insulating)**
  - Moderates temperature changes
  - Helps save energy
- **Ventilation**
  - Circulates air in a home
  - Helps reduce indoor pollutants and helps control moisture



**Weatherizing without maintaining proper ventilation can negatively affect indoor air quality**



## Proper ventilation must be included in a weatherization plan

Residential indoor air quality

[www.epa.gov/iaq/homes/index.html](http://www.epa.gov/iaq/homes/index.html)

Ventilation and remodeling

[www.epa.gov/iaq/homes/hip-front.html](http://www.epa.gov/iaq/homes/hip-front.html)

Ventilation for homes

[www.epa.gov/iaq/homes/hip-ventilation.html](http://www.epa.gov/iaq/homes/hip-ventilation.html)



## Control moisture and limit mold growth

- Vent appliances that produce moisture to the outside
- Fix moisture problems & dry materials and furnishings within **48 hours** to prevent mold growth

[www.epa.gov/iaq/mold](http://www.epa.gov/iaq/mold)

## Build new homes with the Indoor airPLUS label

- Use Indoor airPLUS guidance to improve indoor air quality and save energy

~~Indoor airPLUS specifications cover insulation and ventilation~~

[www.epa.gov/indoorairplus](http://www.epa.gov/indoorairplus)

Is it possible to tighten buildings & increase energy efficiency, yet maintain good indoor air quality? (Yes)

Primary means to control indoor pollutants

1. Source reduction (lower emitting products/materials)
2. Ventilation
3. Filtration/air cleaning technologies

BUT, we need more research...



# Ventilation

- Poor Ventilation Can Lead to High Humidity
- High Humidity = Good Conditions for Mold Growth
- Contaminates Can Accumulate without Good Ventilation



# A Growing Problem & Critical Priority: RADON

- **Leading cause of environmental cancer mortality**
- **21,000 Lung Cancer Deaths/Year, leading cause for non-smokers**
- **The poor have virtually no way to reduce their risk**
- **While proud of our results – the problem has grown: currently 8 million American houses with high levels**
- **Aggressively ramping up effort to reverse trend:**
  - Assistant-Secretary level initiative with 8 federal agencies (HHS, HUD, DOE, USDA, DoD, GSA, DOI, VA)
  - Joint EPA/industry/state initiative to engage NGOs (public health, environmental, housing advocates)

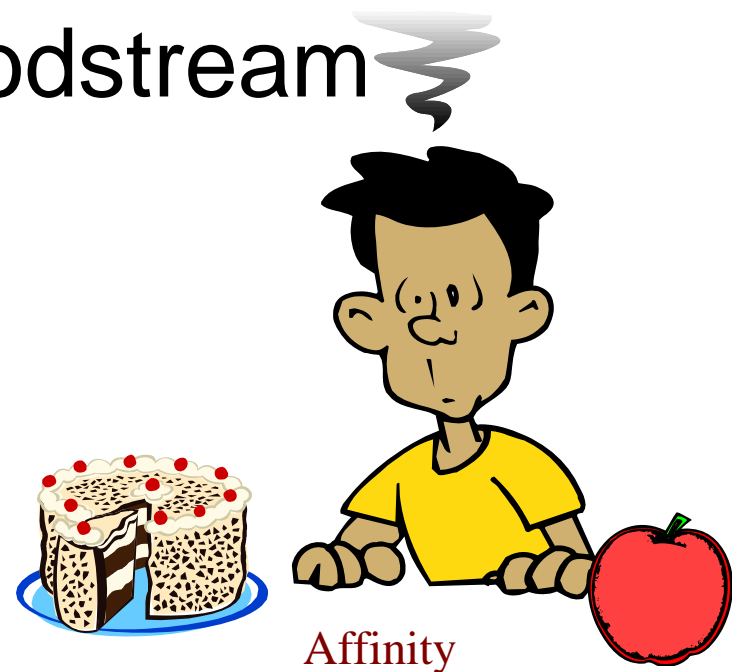


# Radiation Protection

- **Revise out-of-date uranium rules to reflect scientific and technological advances**
  - Health and Environmental Protection Standards for Uranium and Thorium Mill Tailings (40 CFR 192)
  - Revise NESHAP for active uranium mills (40 CFR 61, Subpart W)
- **Revise Environmental Standards for Nuclear Power Operations (40 CFR 190)**
- **Finalize *Radiogenic Cancer Risk Models and Projections for the U.S. Population* (the “Blue Book”)**
  - Provides scientific basis for estimating radiogenic cancer risks to the U.S. population from defined doses of radiation
  - Forms scientific basis for radiation rules and Federal Guidance

# CO: Relevant Body Chemistry

- CO + Hemoglobin =  
carboxyhemoglobin (COHb)
- COHb = less O<sub>2</sub> in bloodstream



Affinity

EPA funded National Academy of Sciences Institute of Medicine Climate Change Study:

**“The Effect of Climate Change on Indoor Air Quality and Public Health”**

- Panel is gathering information on topics including:
  - occupant health, allergen exposure, infectious disease transmission, and research and data collection related to climate change, indoor environments, public health issues, etc.
  - **indoor air quality, adaptation and mitigation strategies for buildings, green architecture, etc.**

For more information or to submit comments:

<http://www8.nationalacademies.org/cp/projectview.aspx?key=49138>

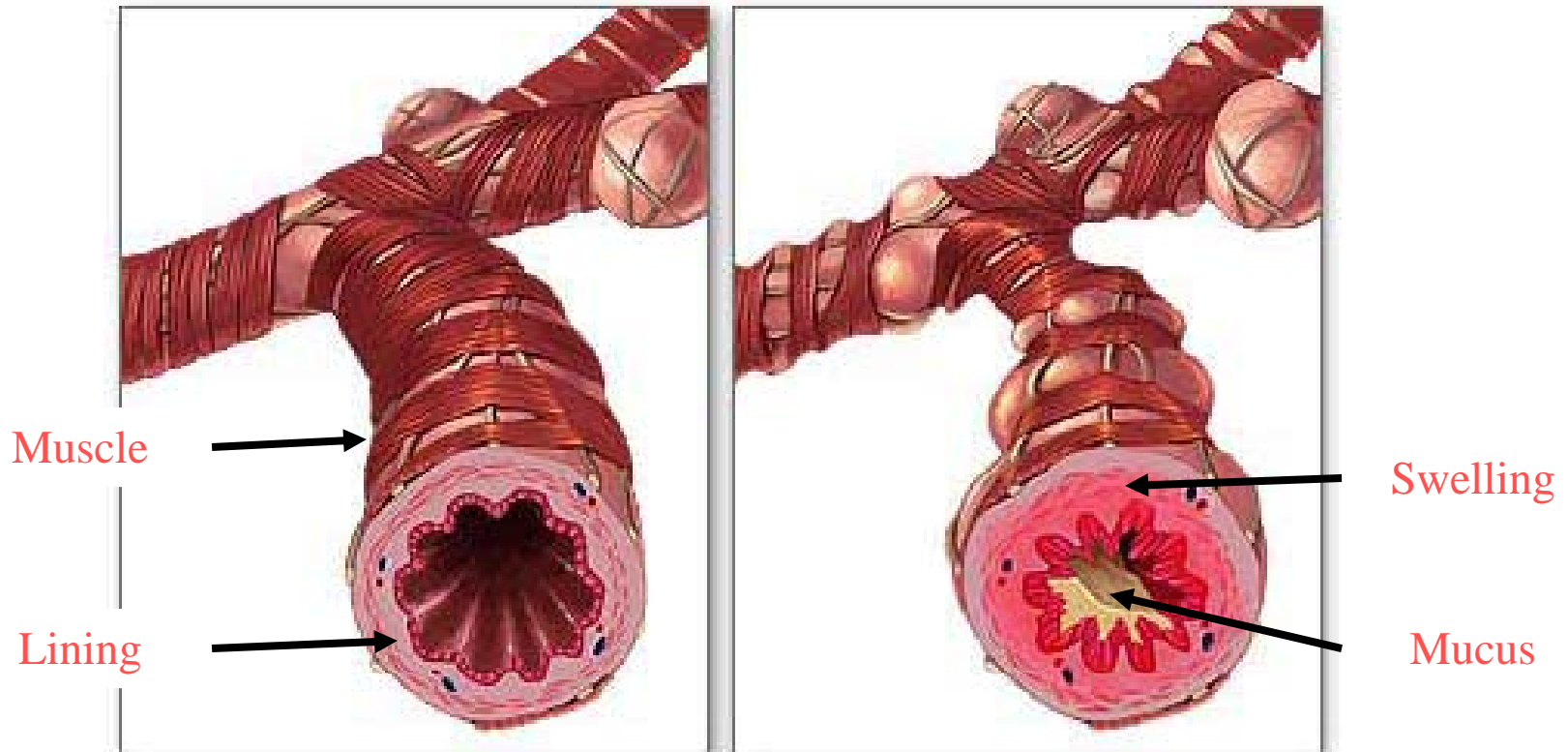
## Indoor Air



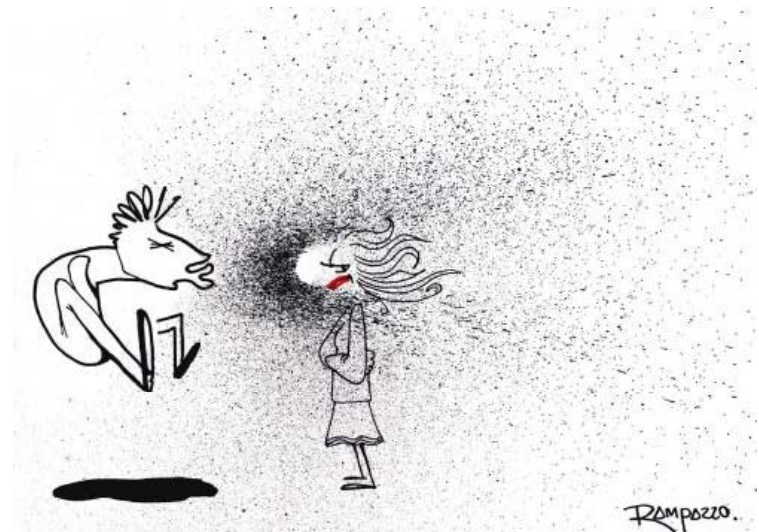
## Airways Narrow

Normal Airway

Airway in Person  
with Asthma

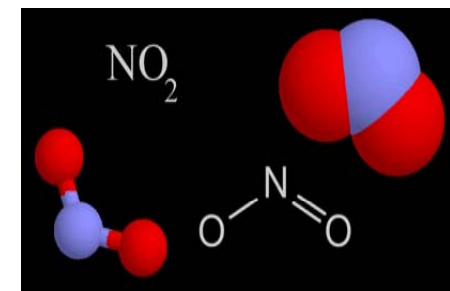


- Allergies and asthma are not the same
- Both are diseases involving the immune system
- Allergies can trigger asthma attacks or episodes



## Chemical Pollutants

- CO
- NO<sub>2</sub>, NO<sub>x</sub>
- SO<sub>2</sub>, SO<sub>x</sub>
- PM
  - Environmental Tobacco Smoke (ETS)
- Plasticizers
- Formaldehyde
- Fragrances
- Pesticides
- Ozone
- VOCs

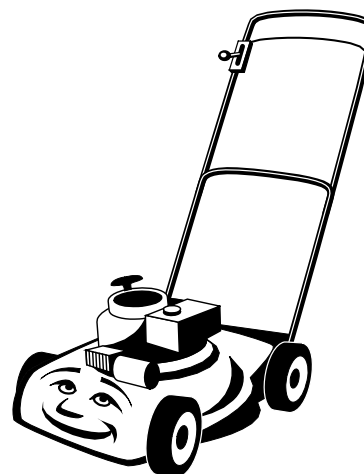
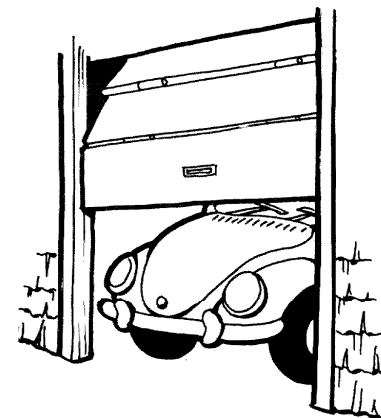


- Chronic inflammatory disorder of airways
- Characterized by:
  - Recurrent episodes of airflow limitation
- Usually reversible spontaneously, or with appropriate treatment

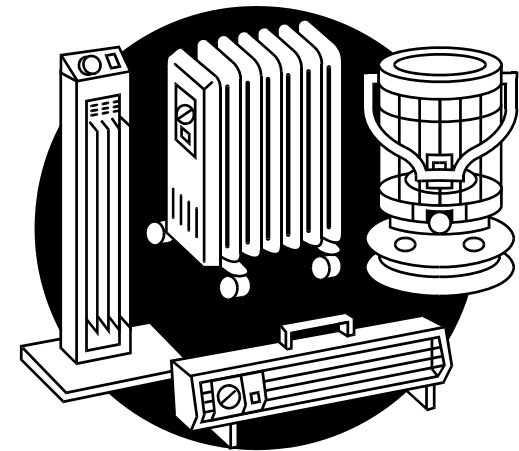
- Asthma is the most common chronic condition of childhood
- Asthma is the third-ranking cause of hospitalization among children under 15.
- 12.8M missed school days in 2003



- Cars
- Lawn mowers, weed trimmers
- Chain saws
- Generators
- Power washers
- Snow blowers



More than **400** deaths/yr  
in the U.S. due to  
unintentional CO poisoning



- ETS exposure causes health effects in children
- 43 % of U.S. children exposed to ETS in their own homes
- 150,000 - 300,000 cases/year of bronchitis and pneumonia in children
- Estimated 750,000 cases/year middle ear infections in children



# Reduce Gaseous Pollutants: Preventing CO Deaths

- Don't idle car in garage or near air intake vents
- Have combustion appliances checked once a year
- Do not rely on smoke detectors [are not protective]
- Do not rely completely on CO detectors [vary in sensitivity & accuracy]

- Choose not to smoke around children, especially infants & toddlers, or those with asthma
- Choose not to smoke in your home or permit others to do so
- If you must smoke, choose to smoke outside

