
You know,
we've got to pause
and ask ourselves:
How much clean air
do we really
need?

Fire Smoke and Human Health: How we share what we know

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Pulmonary, Critical Care & Sleep Medicine
American Lung Association & American Thoracic Society

Slides courtesy of Janice Nolen, Assistant Vice President, ALA

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Why Healthy Air Matters

Health Effects of Air Pollution

Health Effects of Secondhand Smoke

Health Effects of Bad Air

- Shortness of breath & wheezing
- Asthma attacks
- Emergency Dept visits & hospitalizations
- Acute myocardial infarction & stroke
- Long-term lung & cardiovascular disease
- Lung cancer
- Premature death in seniors and infants

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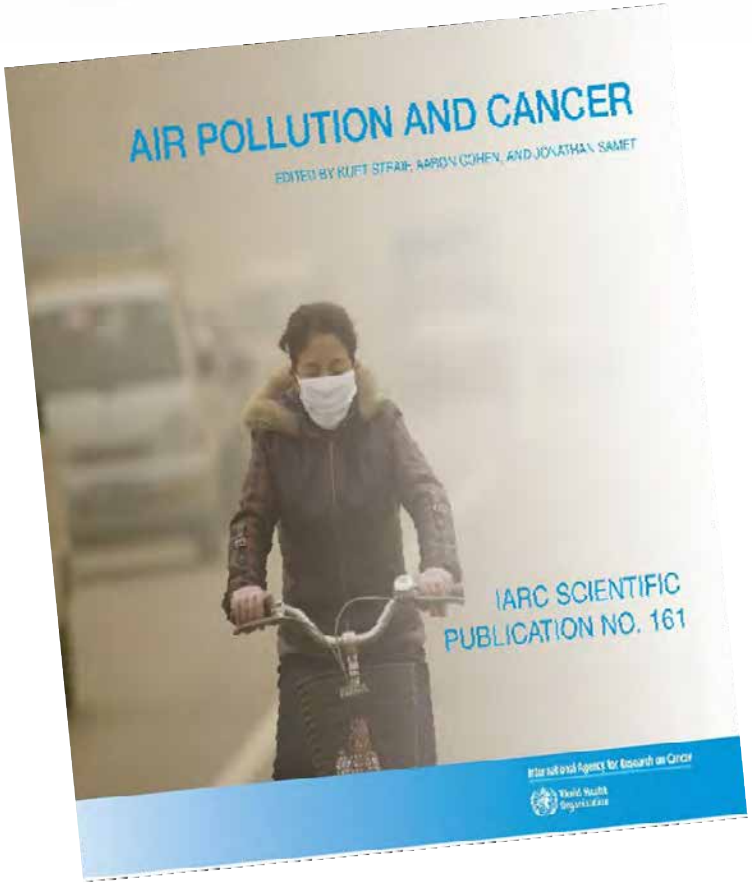
Air Pollution and PM cause Cancer



WHO's International Agency for Research on Cancer (IARC) report:

- Air pollution is a "leading environmental cause of cancer deaths"
- Particulate matter causes cancer.

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The News

In 2010-2012

nearly 5 in 10 people

in the U.S.A. lived in counties with an

F for air quality

Most common

- **Ozone (smog)**
- **Particulate matter (soot)**

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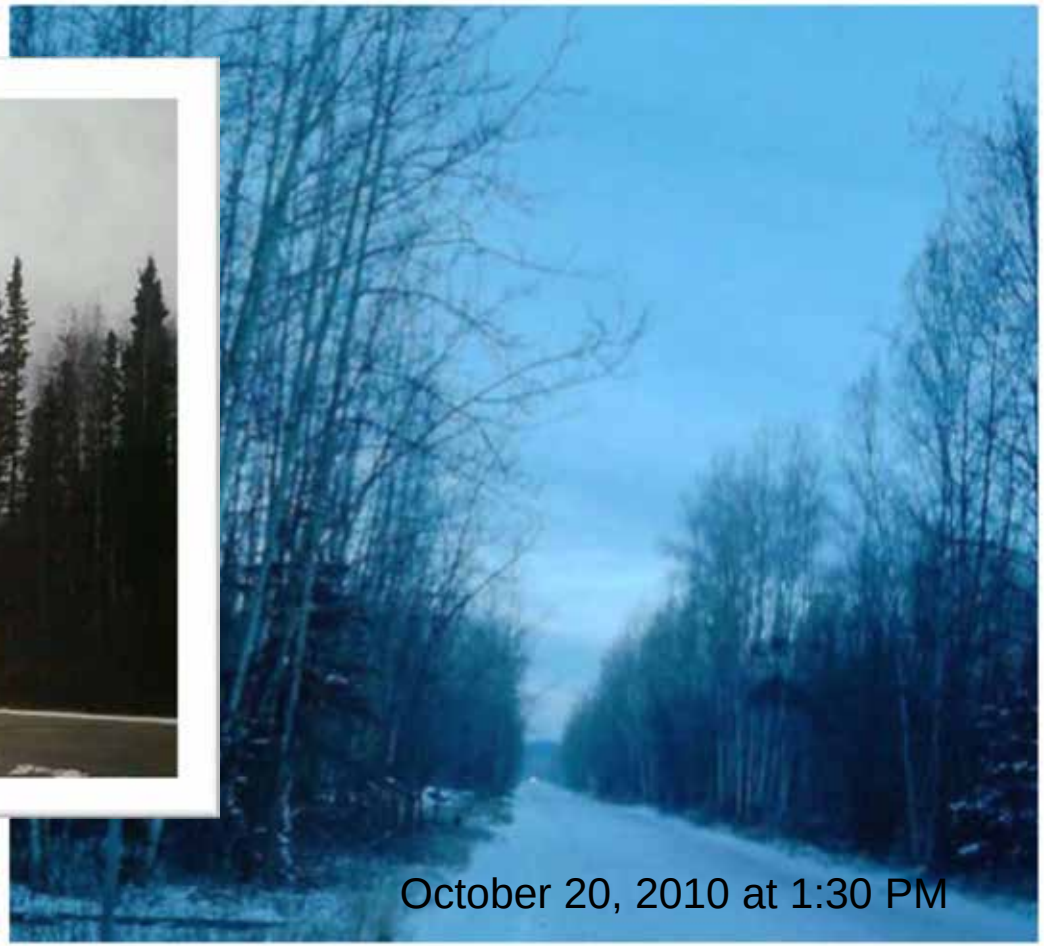
Fine Particles Reduce Visibility

Air pollution remains a problem

Fairbanks, Alaska—haze from wood-burning



China – January 2013

Outdoor Air Pollutants

Particles are microscopic

Solids and aerosols bypass the body's defenses to lodge in lungs.

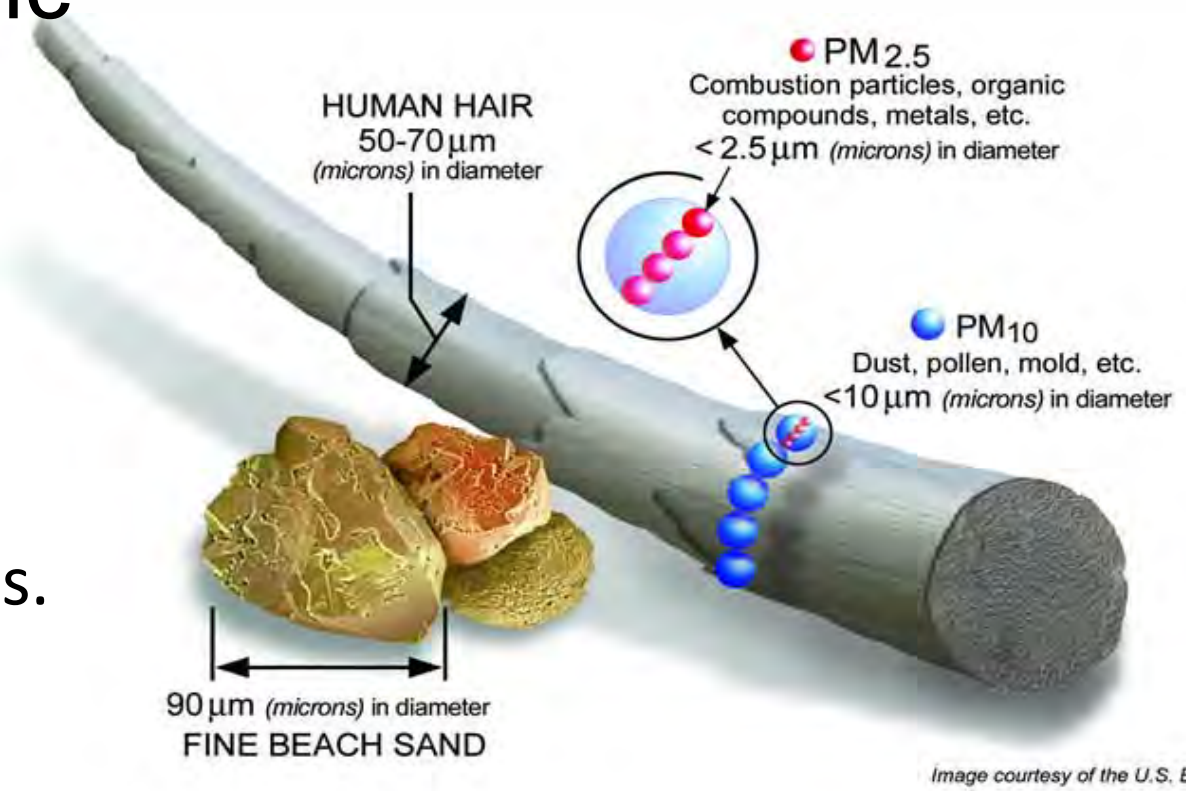


Image courtesy of the U.S. EPA

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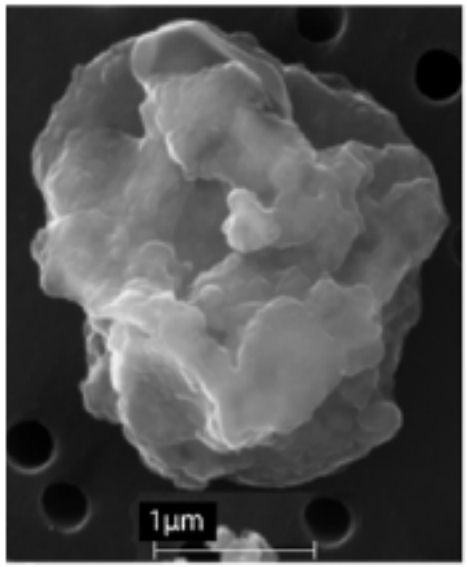
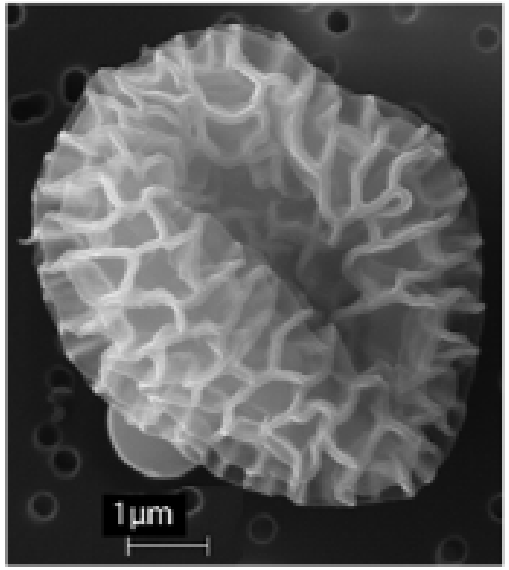
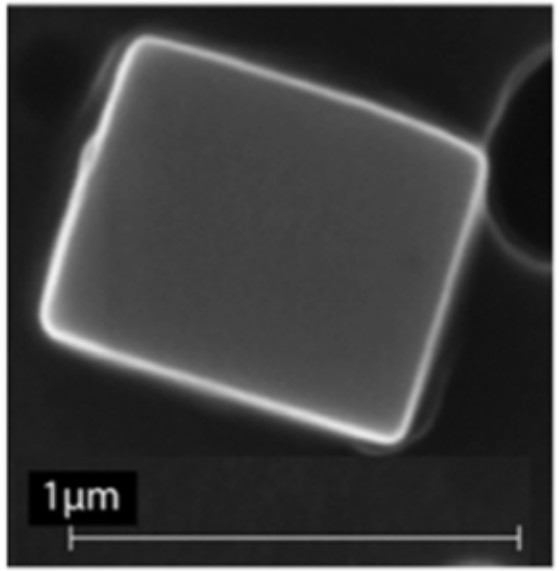
Naturally-occurring particles



Aluminum silicate particle, probably crustal



Pollen particle, partially collapsed



Salt

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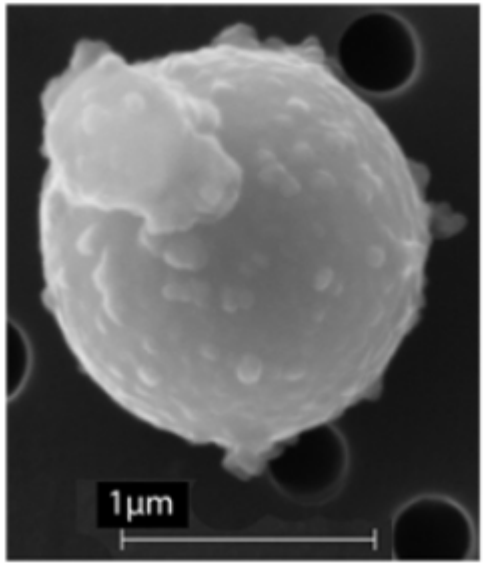
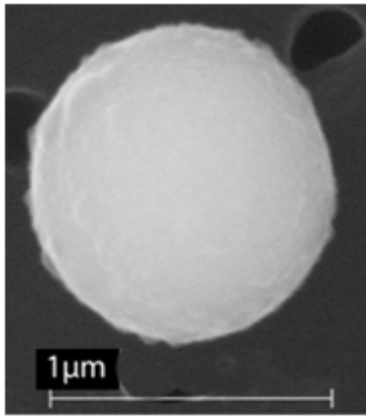
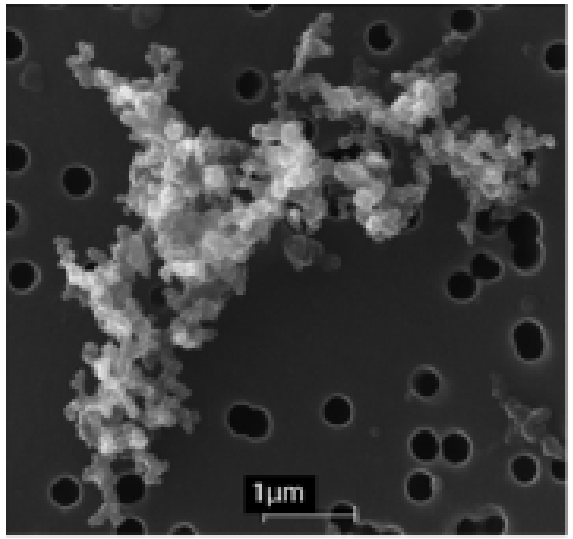
Fine particles— Human origin



Aluminum silicate fly ash from a coal-fired power plant
-EPA, 2009



Iron oxide from a steel manufacturing plant



Carbon soot from a diesel engine—has lots of tiny particles

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Types of Particulate Matter Air Pollution

2 types of particles in the air

- Primary

  Emitted directly from air pollution sources, such as diesel trucks

- Secondary

  Formed in the atmosphere from gaseous air pollutants, such as sulfur dioxide (SO_2) from power plants, that form regional sulfates

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Particulate Matter Comes From Many Sources

Wildland Fires

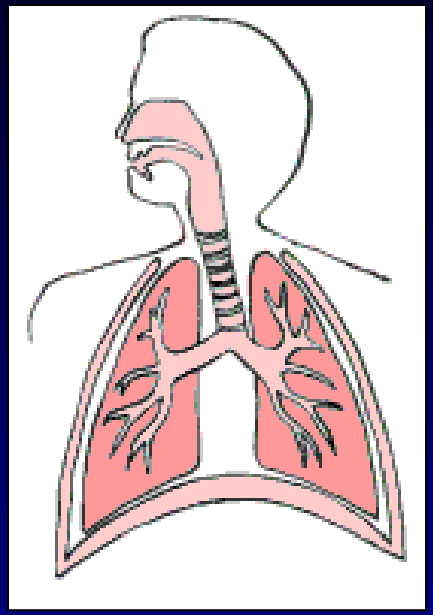
CA Climate Action Team 2009 Report: “An increase in the number, size and duration of fires will add to the air pollution that already burdens California.”

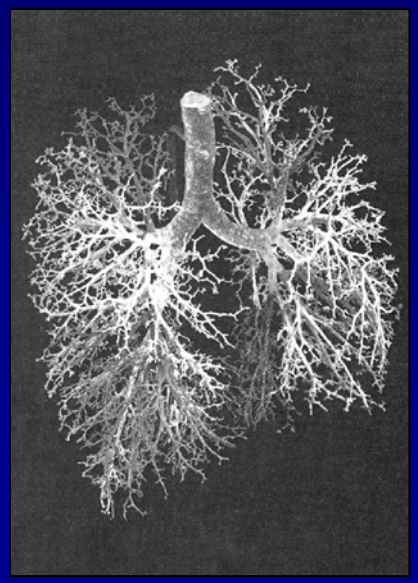
- Up to 55% increase in large wildland fires by 2050
- Up to 128% increase by 2099

Wildland fires cause increased health care utilization for respiratory illness, especially asthma.

Particle Deposition in the Lungs

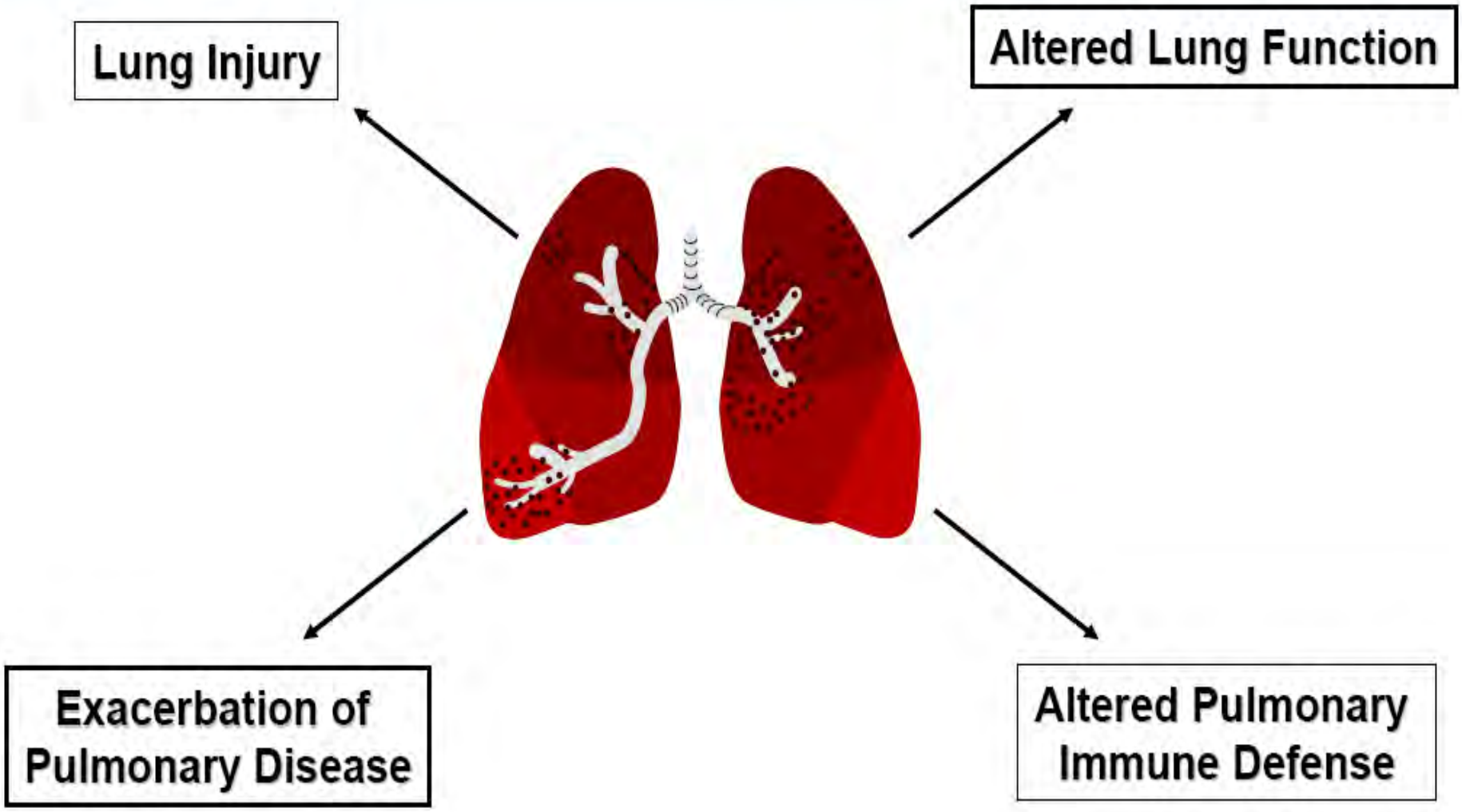
- Larger particles deposit in the upper airways (nose and throat) and are cleared out.
- Smaller particles penetrate deep into the lungs and stay there longer.





The very smallest particles (ultrafine nanoparticles) may pass through the lungs, enter the bloodstream and travel throughout the body.

Potential Effects of PM on the Pulmonary System



American Cancer Society Study (JAMA, 2002)

ORIGINAL CONTRIBUTION

Lung Cancer, Cardiopulmonary Mortality, and Long-term Exposure to Fine Particulate Air Pollution

C. Arden Pope III, PhD
Richard T. Burnett, PhD
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Eugenia E. Calle, PhD
Daniel Krewski, PhD
Kazuhiko Ito, PhD
George D. Thurston, ScD

Context Associations have been found between day-to-day particulate air pollution and increased risk of various adverse health outcomes, including cardiopulmonary mortality. However, studies of health effects of long-term particulate air pollution have been less conclusive.

Objective To assess the relationship between long-term exposure to fine particulate air pollution and all-cause, lung cancer, and cardiopulmonary mortality.

Design, Setting, and Participants Vital status and cause of death data were collected by the American Cancer Society as part of the Cancer Prevention II study, an ongoing prospective mortality study, which enrolled approximately 1.2 million adults in 1982. Participants completed a questionnaire detailing individual risk factor data (age, sex, race, weight, height, smoking history, education, marital status, diet, alcohol consumption, and occupational exposures). The risk factor data for approximately 500000 adults were linked with air pollution data for metropolitan areas throughout the United States and combined with vital status and cause of death data through December 31, 1998.

Main Outcome Measure All-cause, lung cancer, and cardiopulmonary mortality.

Results Fine particulate and sulfur oxide–related pollution were associated with all-cause, lung cancer, and cardiopulmonary mortality. Each 10-$\mu g/m^3$ elevation in fine particulate air pollution was associated with approximately a 4%, 6%, and 8% increased risk of all-cause, cardiopulmonary, and lung cancer mortality, respectively. Measures of coarse particle fraction and total suspended particles were not consistently associated with mortality.

Conclusion Long-term exposure to combustion-related fine particulate air pollution is an important environmental risk factor for cardiopulmonary and lung cancer mortality.

JAMA. 2002;287:1132-1141 www.jama.com

BASED ON SEVERAL SEVERE AIR pollution events,[1-3] a temporal correlation between extremely high concentrations of particulate and sulfur oxide air pollution and acute increases in mortality was well established by the 1970s. Subsequently, epidemiological studies published between 1989 and 1996 reported health effects at unexpectedly low concentrations of particulate air pollution.[4] The convergence of data from these studies, while controversial,[5] prompted serious reconsideration of standards and health guidelines[6-10] and

JAMA Study Conclusions

- Long-term exposure to fossil fuel combustion air pollution, especially fine particulate matter, is associated with increased annual risk of mortality
- Living in a more polluted city is associated with approximately a 20% increase in risk of dying from lung cancer
  - Roughly comparable to the cancer risk of passive smoking exposure from living with a smoker
- The risk from air pollution appears greatest in those with lower socio-economic status

People at risk

Someone in every family faces higher risk from air pollution

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Children, Teens face higher risk

Children, teens have growing lungs, spend more time outdoors, inhale more air per pound

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Older Adults face higher risk

Aging brings a gradual decline in the body's systems that makes us more vulnerable.

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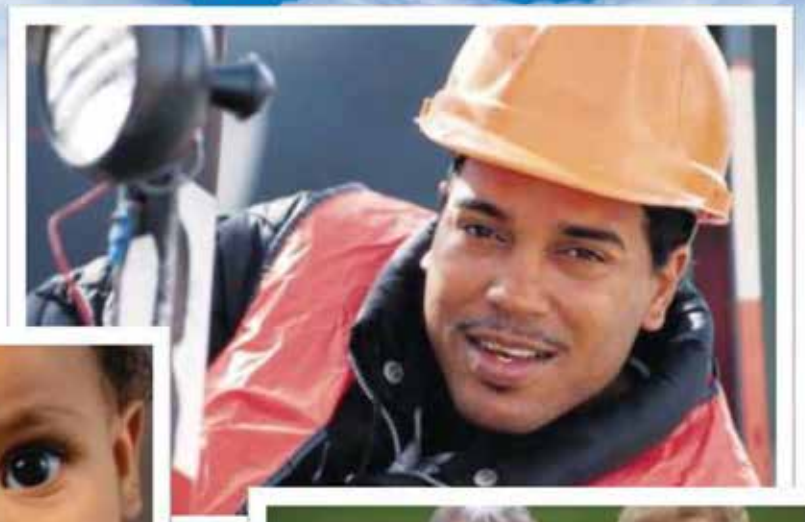
Chronic diseases mean higher risk

Having
asthma
or other lung diseases,
cardiovascular
disease or
diabetes
puts you at
higher risk.



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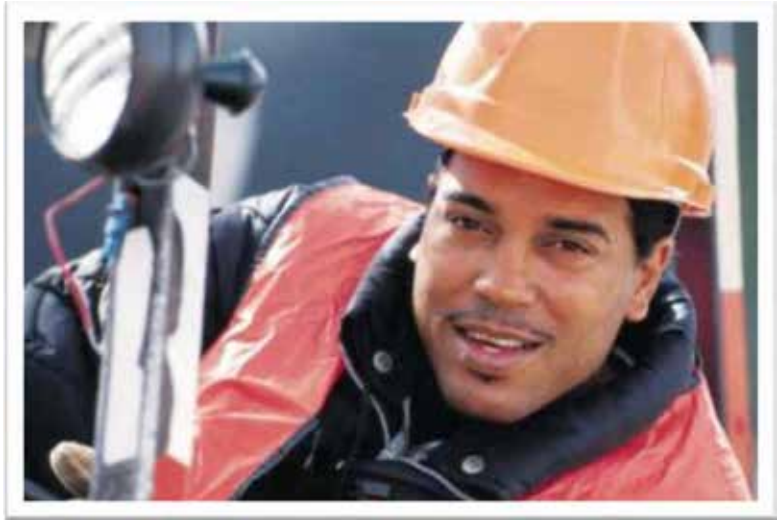
Healthy adults face higher risk

Working or exercising outdoors increases exposure, especially near highways



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Low income people face higher risk

Poorer people often live closer to sources of pollution,
may have higher incidence of disease, and less access to care.

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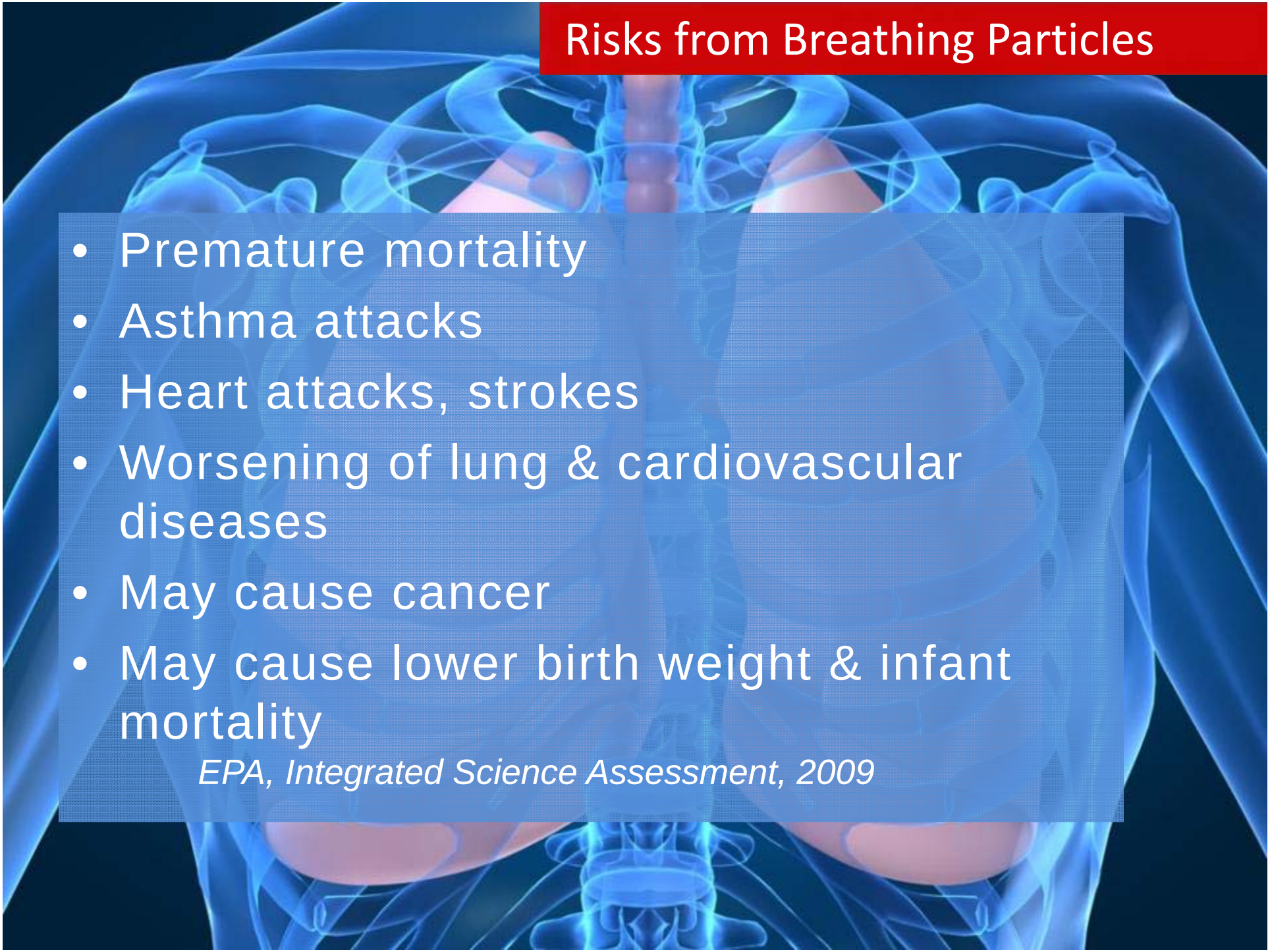


Risks from Breathing Particles

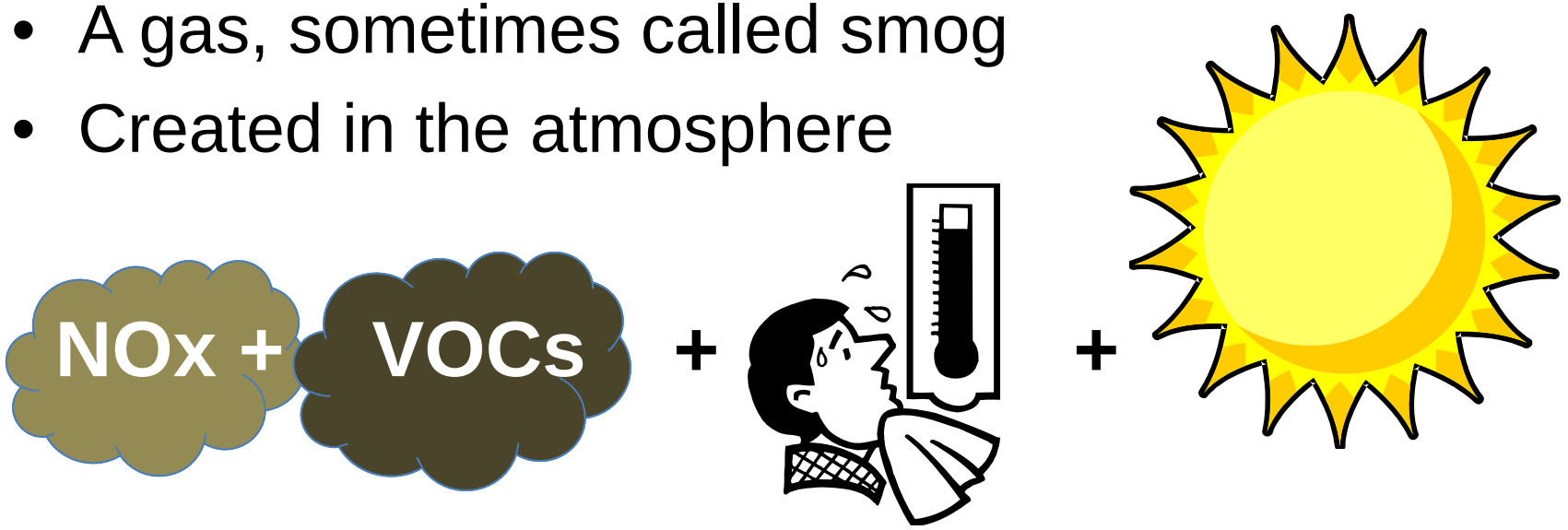
- Premature mortality
- Asthma attacks
- Heart attacks, strokes
- Worsening of lung & cardiovascular diseases
- May cause cancer
- May cause lower birth weight & infant mortality

EPA, Integrated Science Assessment, 2009

Ozone Pollution

What is ozone?

- A gas, sometimes called smog
- Created in the atmosphere



= Ozone (O_3)

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Health effects of ozone

- Chest pain, cough, throat irritation and congestion.
- It can worsen bronchitis, emphysema and asthma.
- It can reduce lung function and inflame the linings of the lungs.
- Repeated exposure may permanently scar lung tissue.

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Who is the American Lung Association?

- A national non-profit
- Founded in 1904 to fight tuberculosis
- Expanded mission to include healthy air

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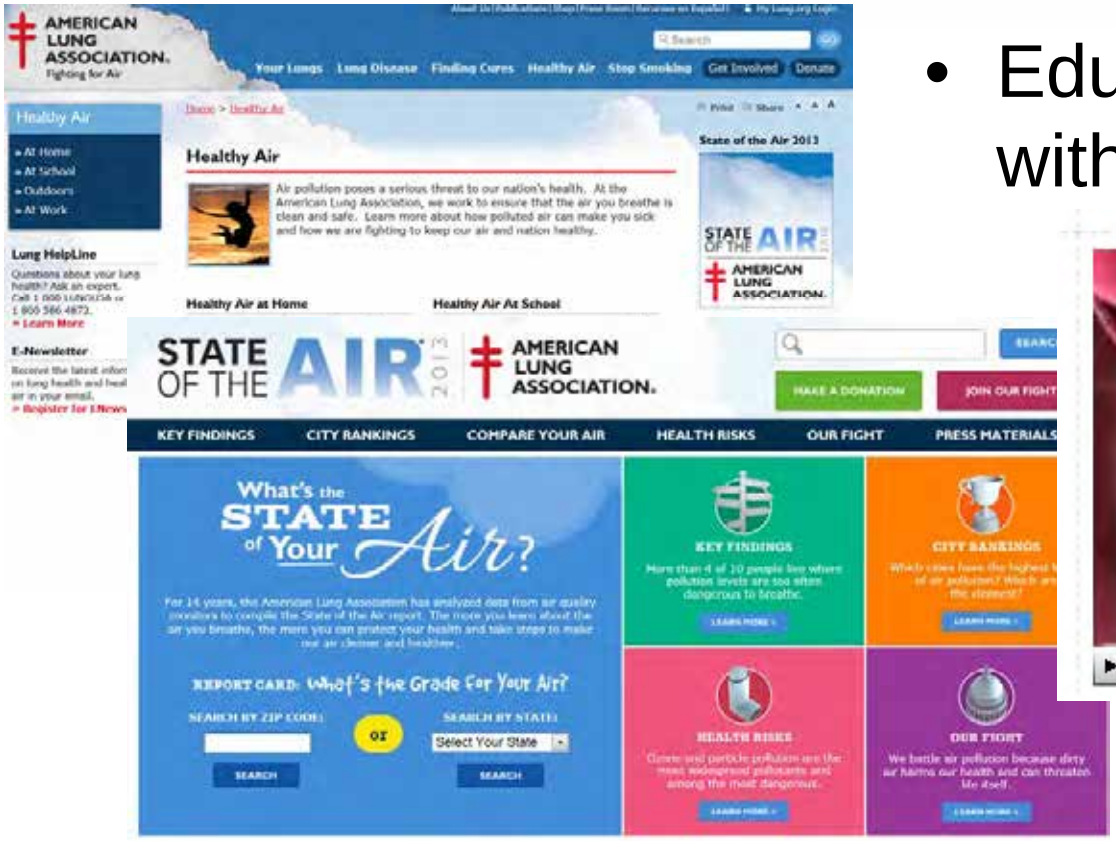
How we fight for healthy air



- Education, online & with media

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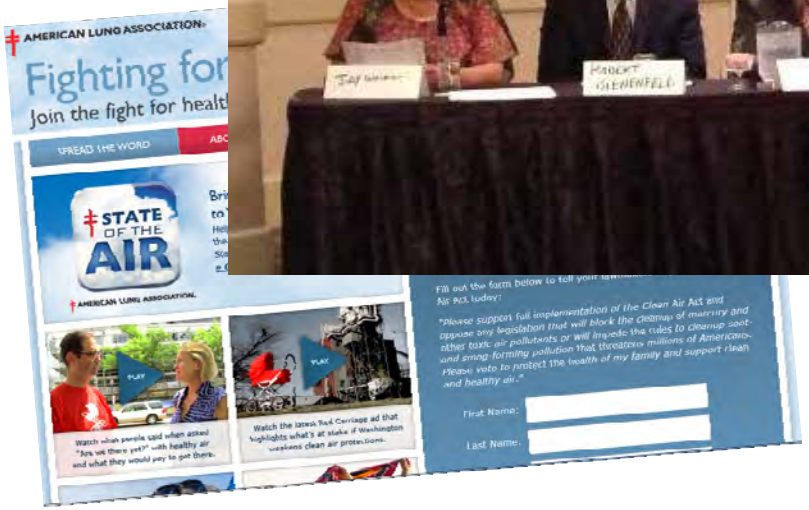
How we fight for healthy air

- Testimony, comments, letting people tell their stories



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Meet Judy, and Lucy and Ethel

- Judy avoids “bonfires, barbecues and cigarette smoke. If it smells bad or smoky, I’m gone! I can’t escape or control the pollution that lingers in our air.”
- Judy, Lucy & Ethel speak out for healthier air.

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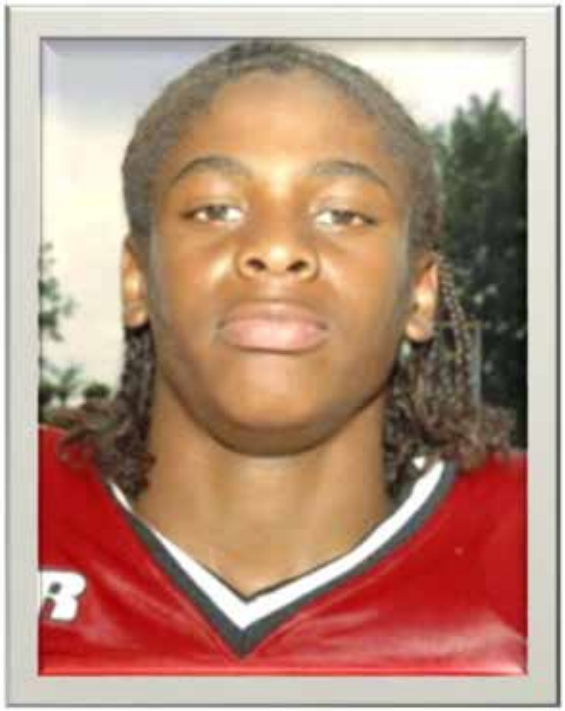
Chandra talks about her son Jovante

"My life changed forever on August 11, 2010. . .

An ambulance rushed Jovante to the hospital . . . his asthma attack had caused him to suffer anoxic brain injury."



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We tell people about the air they breathe so they can protect themselves and fight for air

STATE OF THE AIR 2014

AMERICAN LUNG ASSOCIATION®

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What about that app?

- "State of the Air" phone app **forecasts** the air quality today and tomorrow
- **Website** grades air quality in the **past** (2010-2012)
- m.stateoftheair.org is a mobile version of stateoftheair.org

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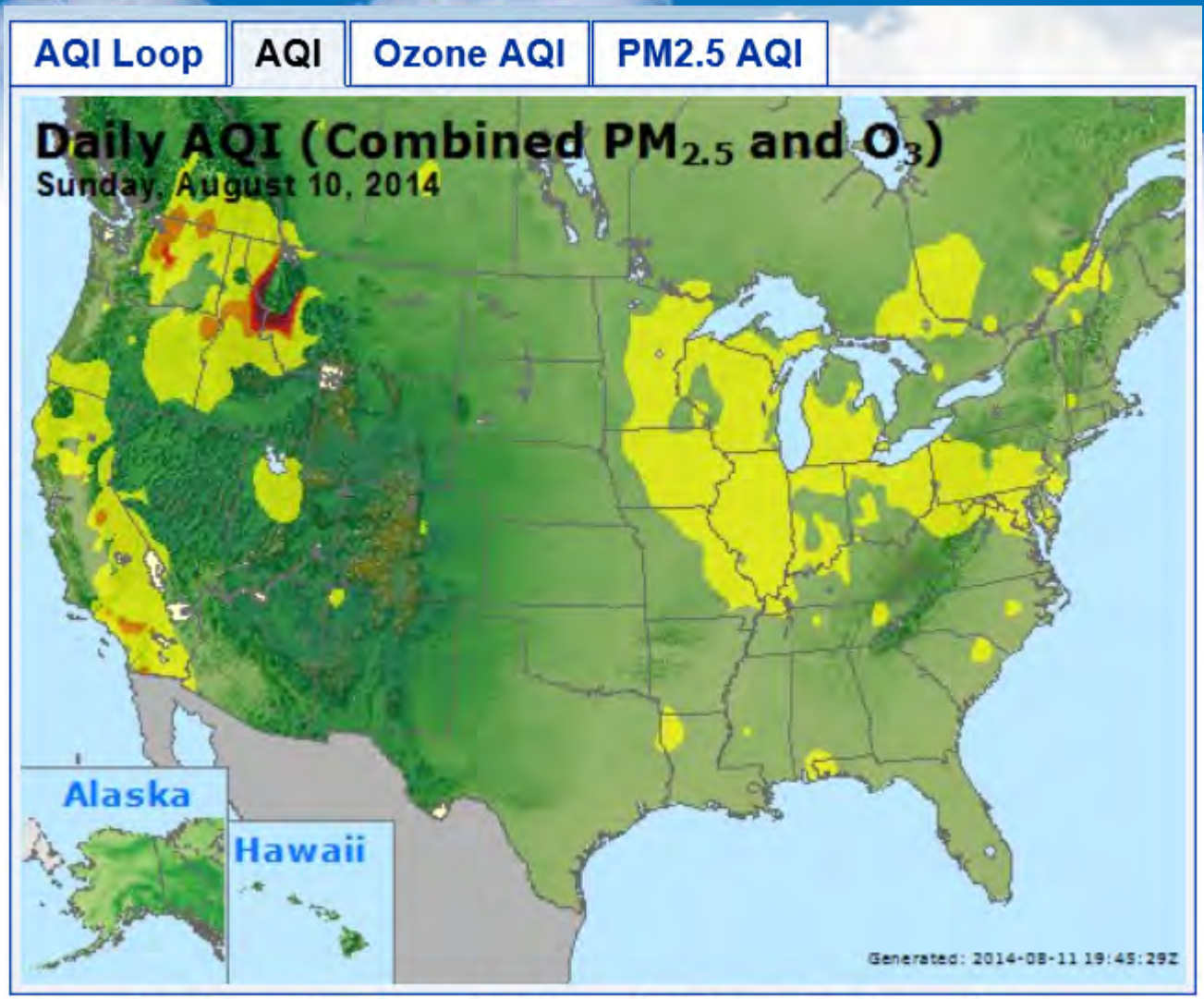
2014 on Airnow.gov



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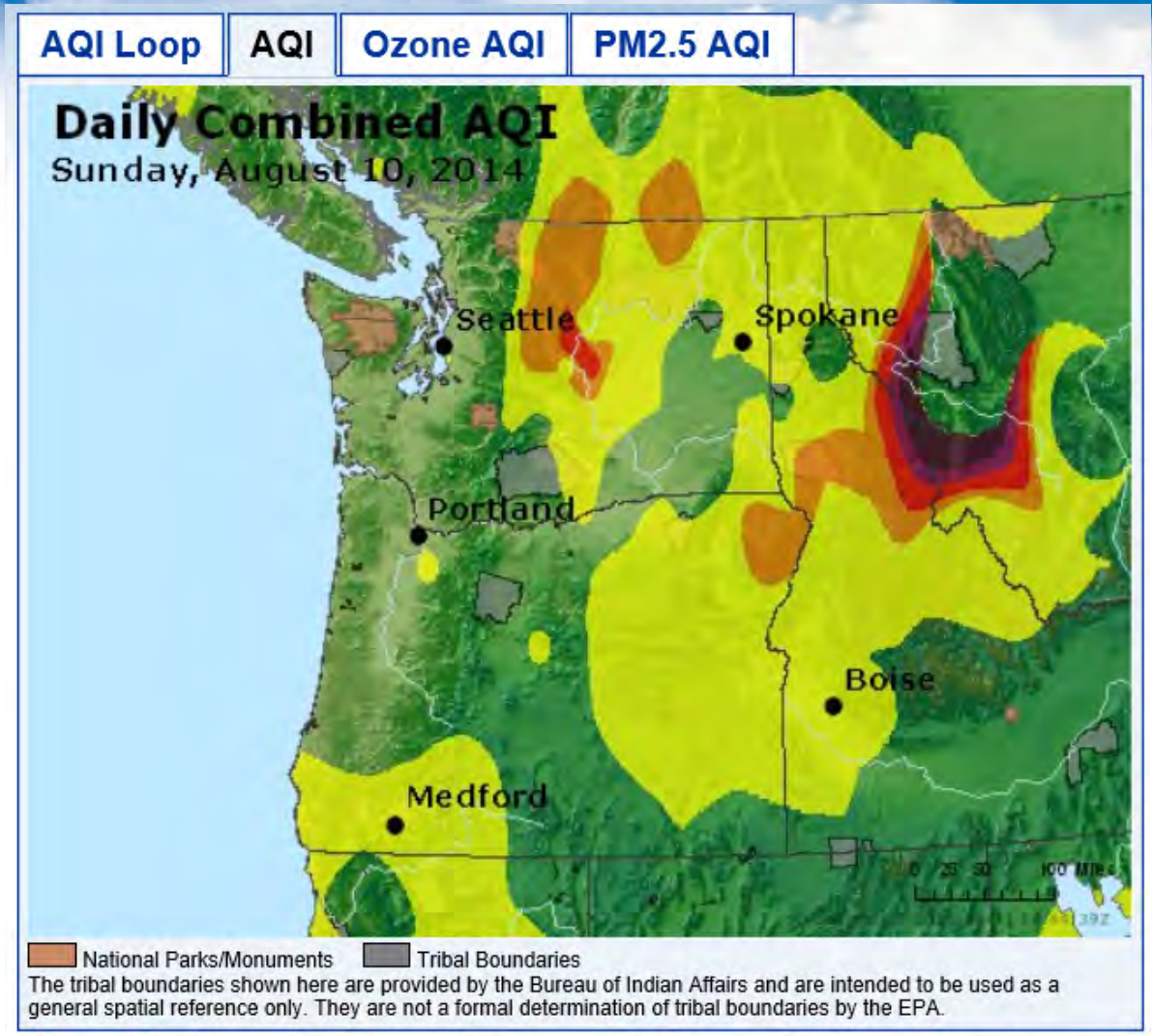
Smoke reached hazardous levels



Maroon is Hazardous, the highest range in the Air Quality Index

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What State of the Air Does


San Francisco Chronicle

Too much stuff can be a real problem

Breathing gets easier, pollution study finds

- Puts air pollution into everyday language
- Gives public local information
- Focuses attention on ozone and particle pollution

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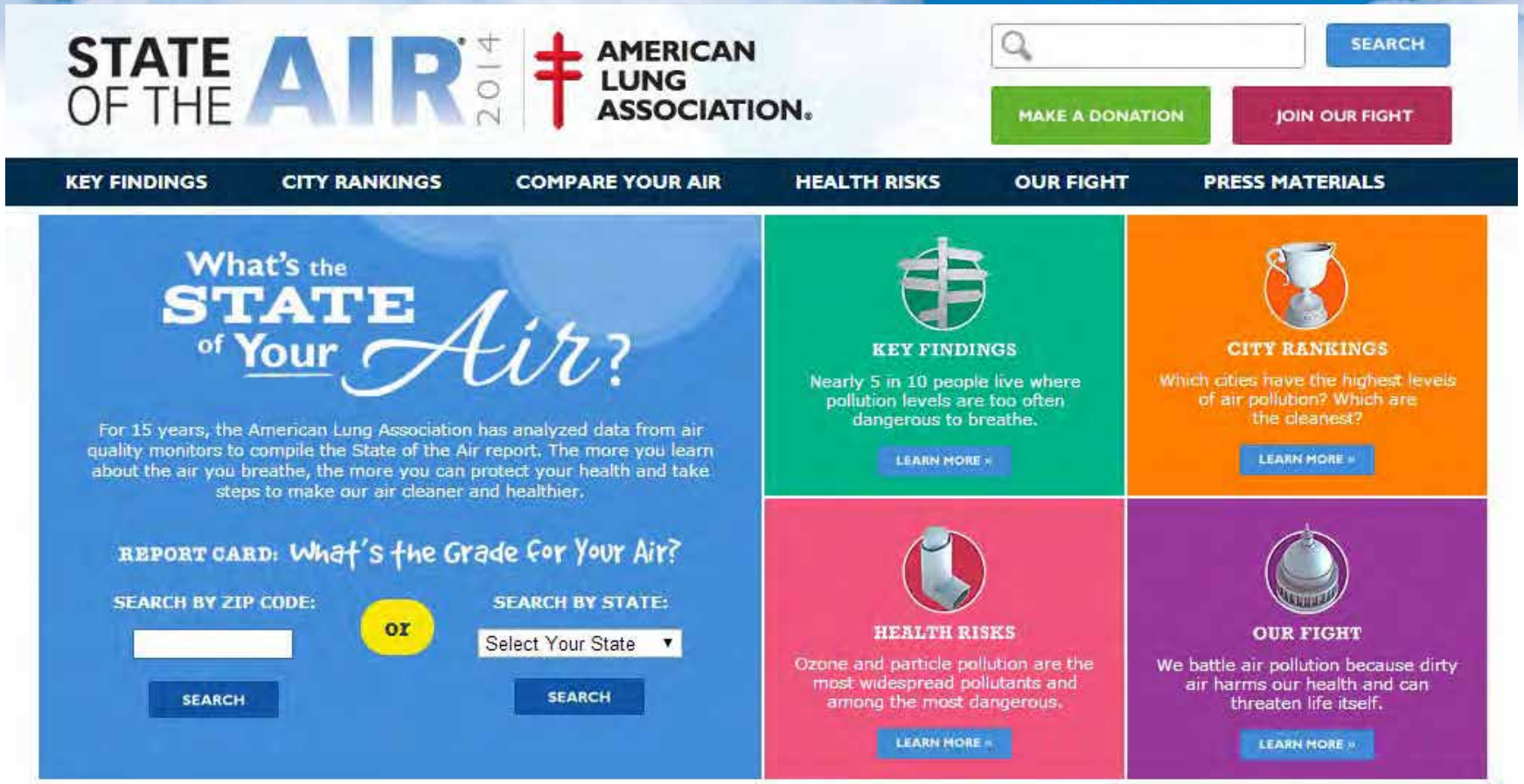
www.stateoftheair.org



www.stateoftheair.org

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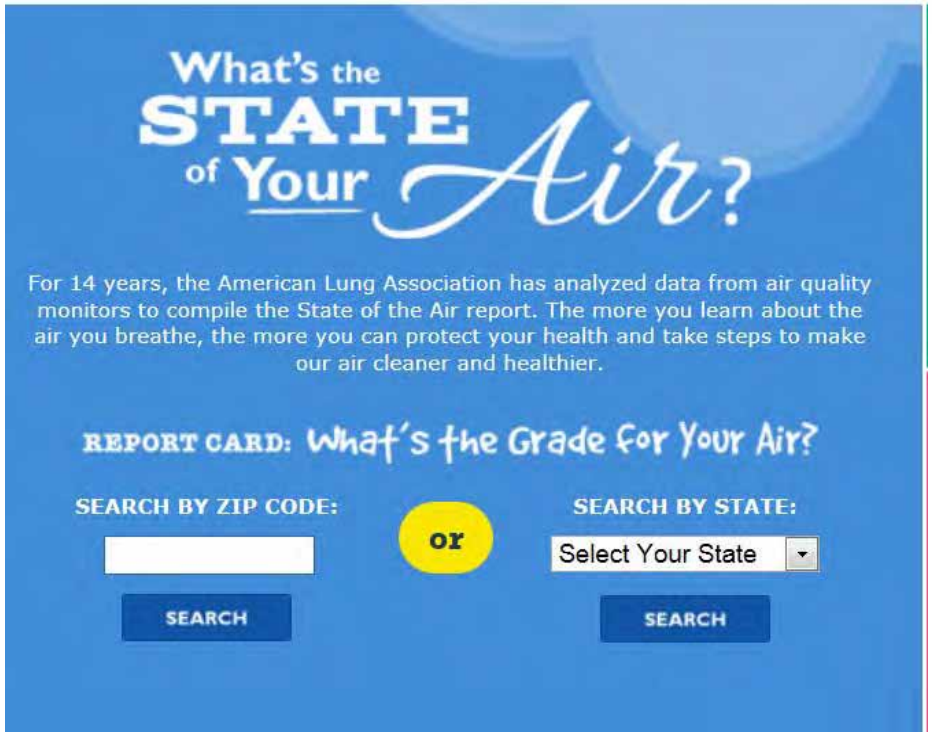
www.stateoftheair.org

How to find your grade?

- Enter your zip code or select your state.
- Zip code gets you to your county
- State gets you to all the counties, including those without monitors



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Where we get the data

Air Pollution Monitors

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www.stateoftheair.org

Most polluted/ cleanest rankings

City Rankings

CLEANEST CITIES

MOST POLLUTED CITIES

VIEW STATE MAP

COMPARE YOUR AIR

SHARE YOUR STORY

SHARE YOUR AIR

SHOP FOR AIR

DOWNLOAD REPORT

REPORT CARD: What's the Grade for Your Air?

SEARCH BY ZIP CODE

Enter Your Zip

Most Polluted Cities

Washington-Baltimore-Northern Virginia, DC-MD-VA-WV

#9 In Ozone Pollution

United States

North Atlantic Ocean

1000 km

1000 mi

Map data ©2013 Google, INEGI, MapLink - Terms of Use

Click on a city below to learn more about its ranking

BY OZONE	BY YEAR ROUND PARTICLE POLLUTION	BY SHORT-TERM PARTICLE POLLUTION
#1: Los Angeles-Long Beach-Riverside, CA	#1: Bakersfield-Delano, CA	#1: Bakersfield-Delano, CA
#2: Visalia-Porterville, CA	#1: Merced, CA	#2: Fresno-Madera, CA
#3: Bakersfield-Delano, CA	#3: Fresno-Madera, CA	#3: Hanford-Corcoran, CA
#4: Fresno-Madera, CA	#4: Hanford-Corcoran, CA	#4: Los Angeles-Long Beach-Riverside, CA
#5: Hanford-Corcoran, CA	#4: Los Angeles-Long Beach-Riverside, CA	#5: Modesto, CA
#6: Sacramento--Arden-Arcade--Yuba	#6: Modesto, CA	#6: Salt Lake City-Ogden-Clearfield,

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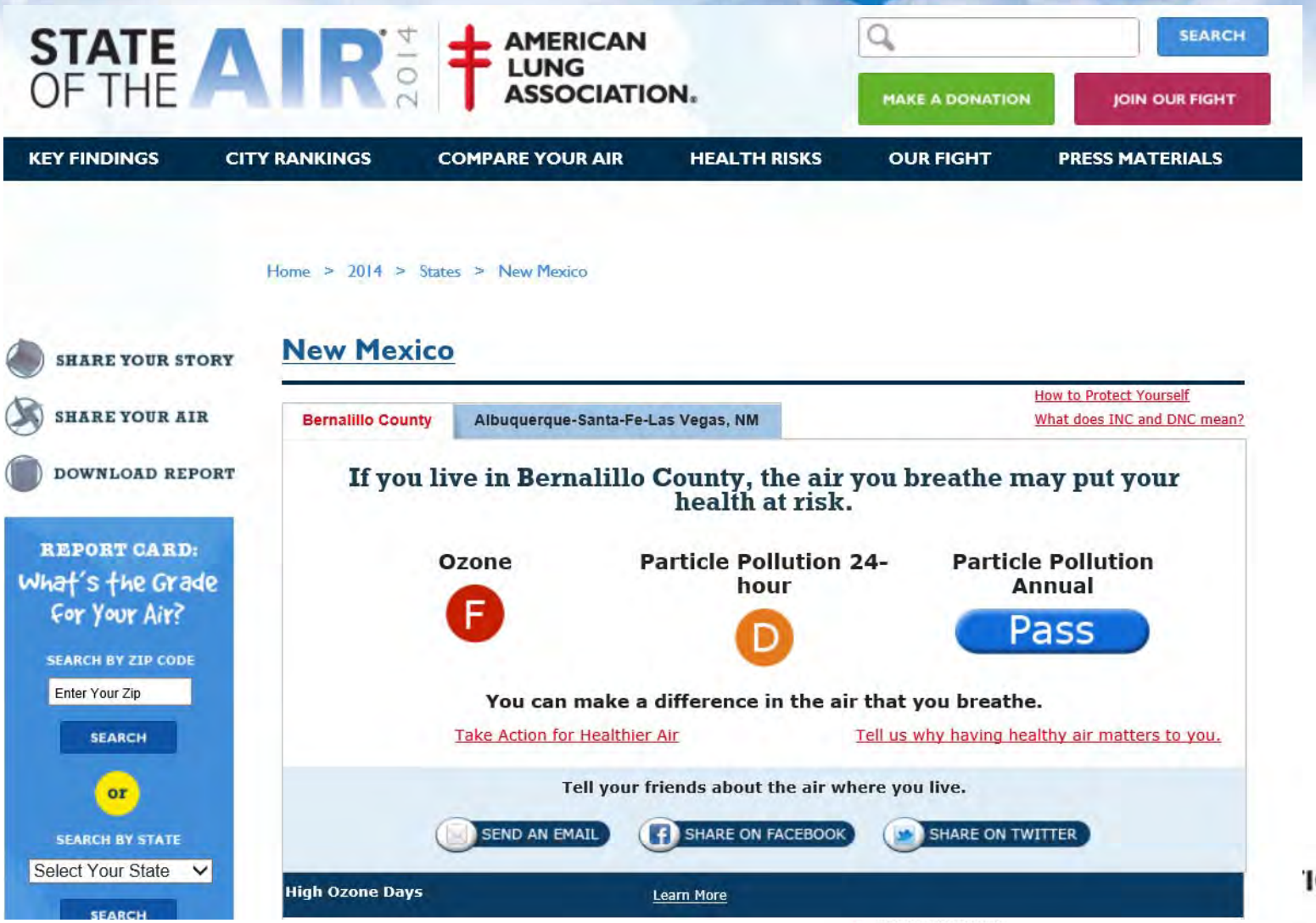
State/County Web Pages



www.stateoftheair.org

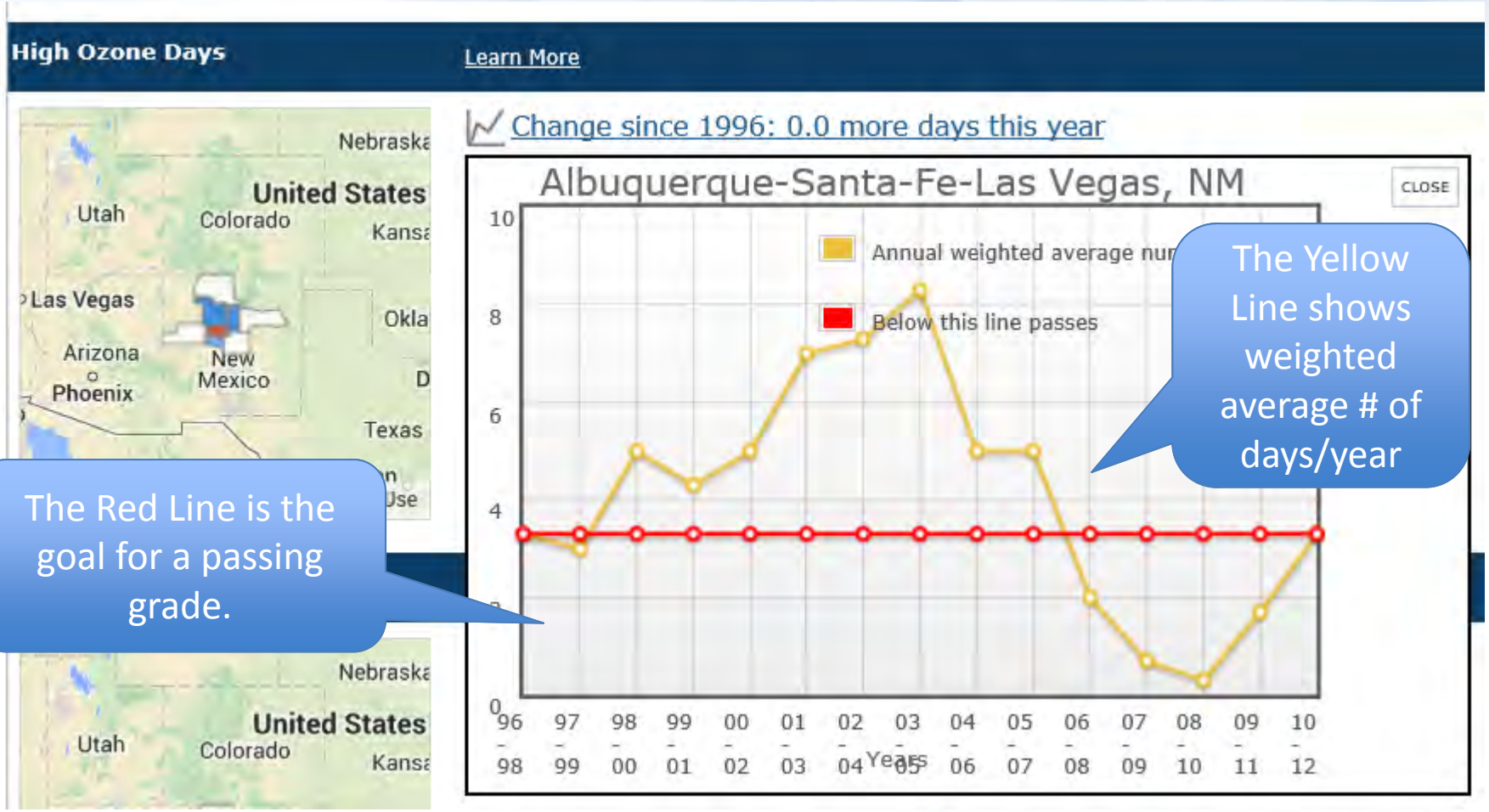
Metro area information

Metros cover multiple counties

How does your city's air rank?

www.stateoftheair.org

Trend Charts show progress



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Coming down the road . . .

Impact of a warmer climate

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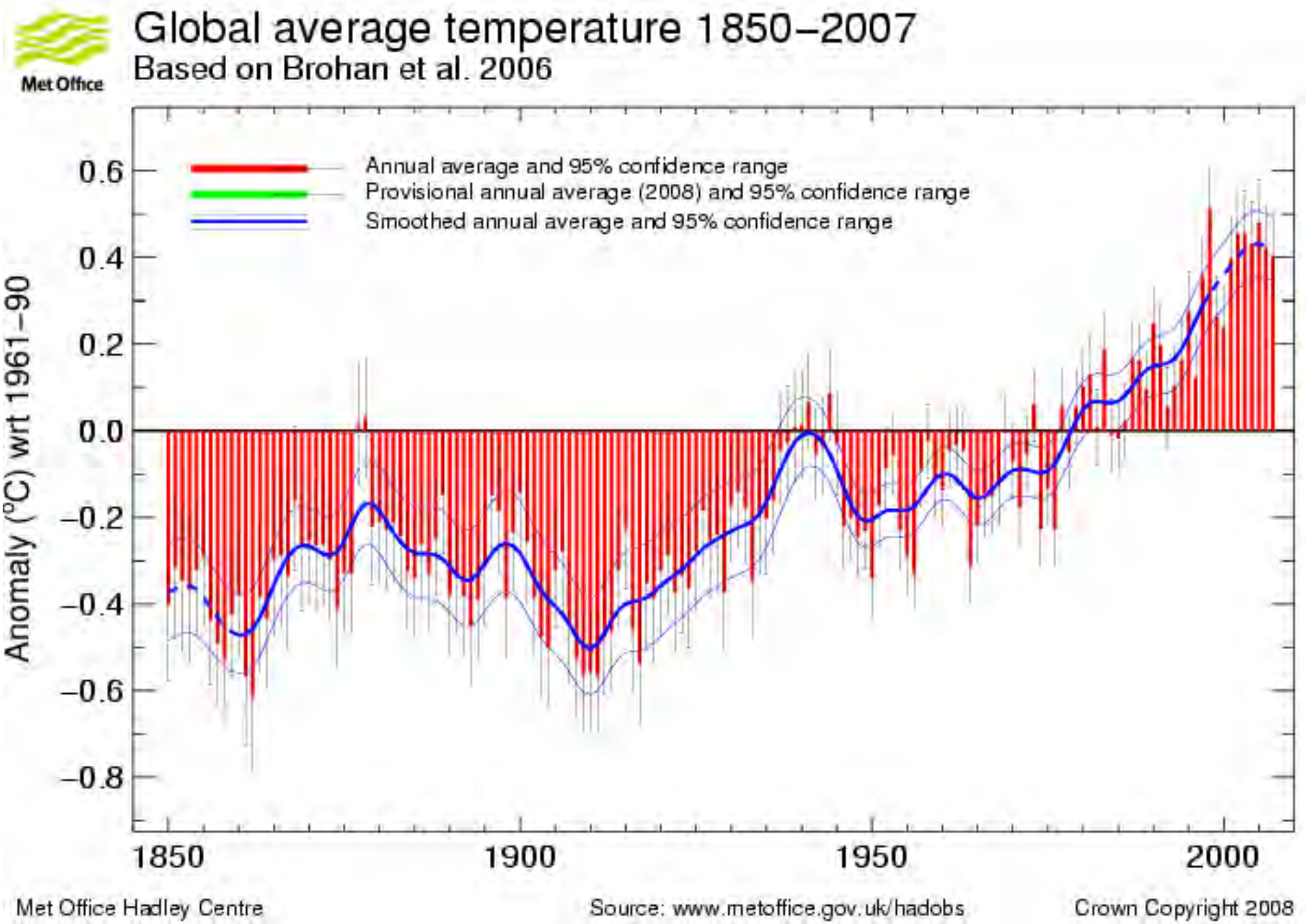


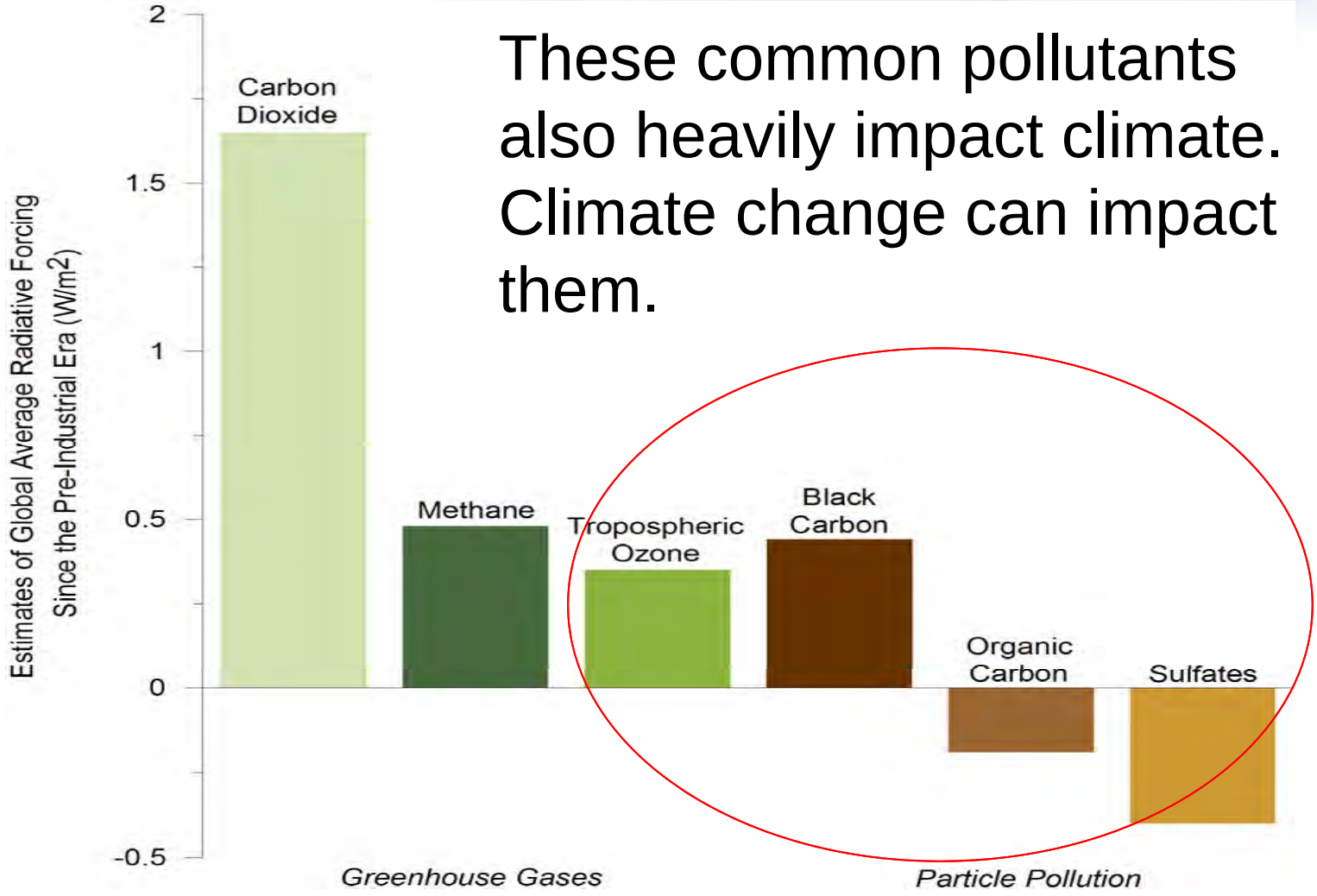
IPCC4th AR Global T increase 1.4°F

Carbon Pollution

- Primarily affects lung health through changes in climate
- Carbon pollution is the major contributor to climate change
- Coal-fired power plants are the major source of carbon pollution

Ozone changes climate

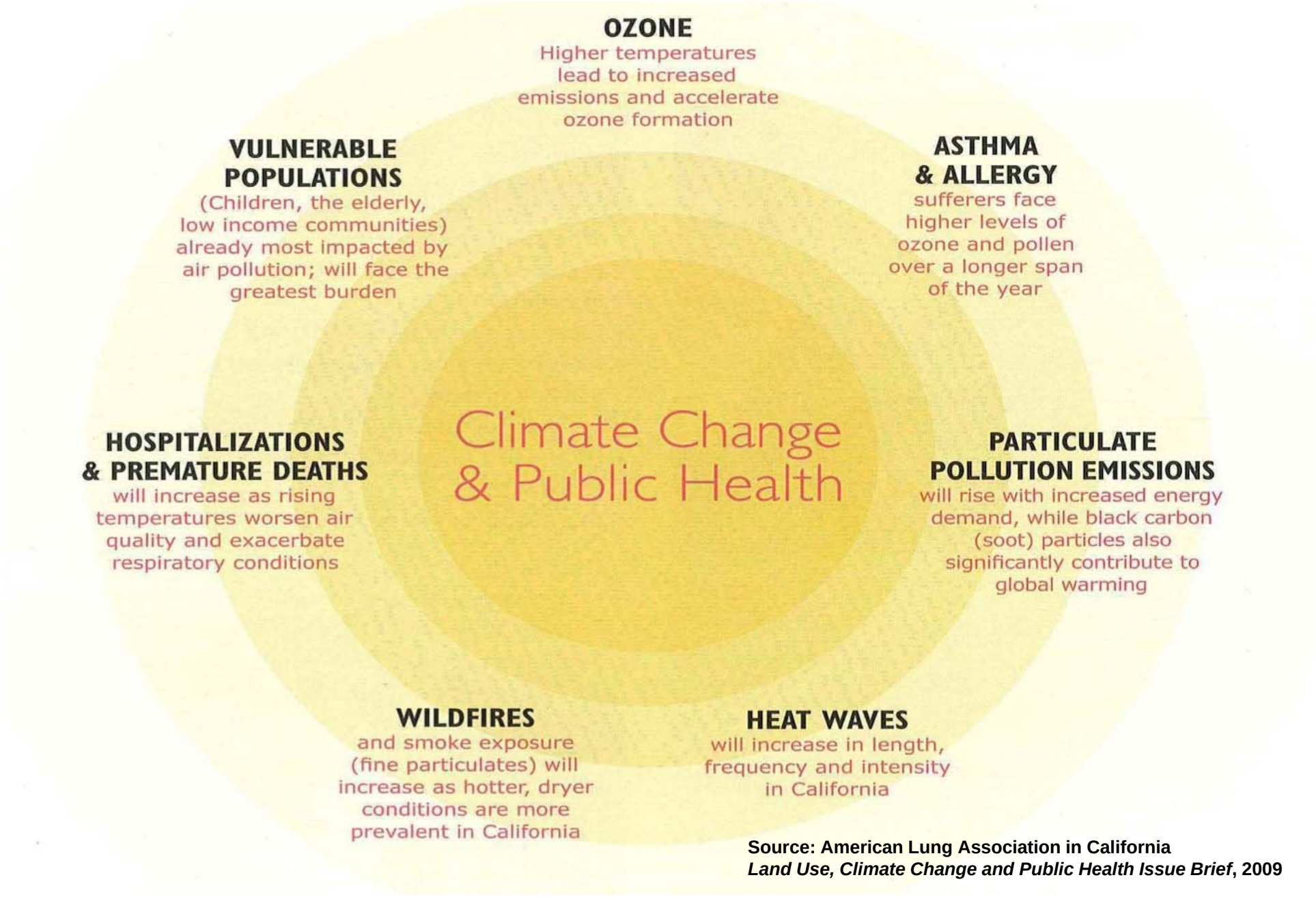
These common pollutants also heavily impact climate. Climate change can impact them.



Global Climate Change & Health

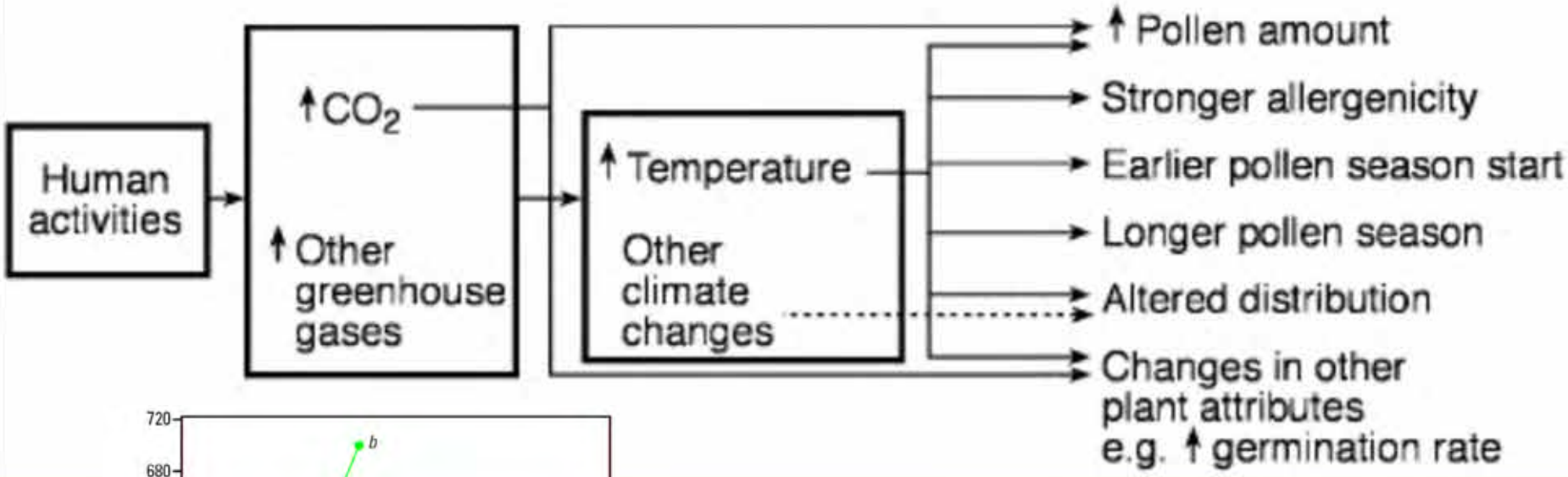
- Changing pollen releases impact asthma and allergic rhinitis (seasonal allergies)
- Heat waves cause critical care-related diseases
- Climate-driven air pollution increases exacerbations asthma and chronic obstructive pulmonary disease
- Desertification increases particulate matter (PM)
- Increasing size and frequency of wildland fires
- Climate-related changes in food and water security impact infectious respiratory disease through malnutrition (pneumonia, upper respiratory infections)

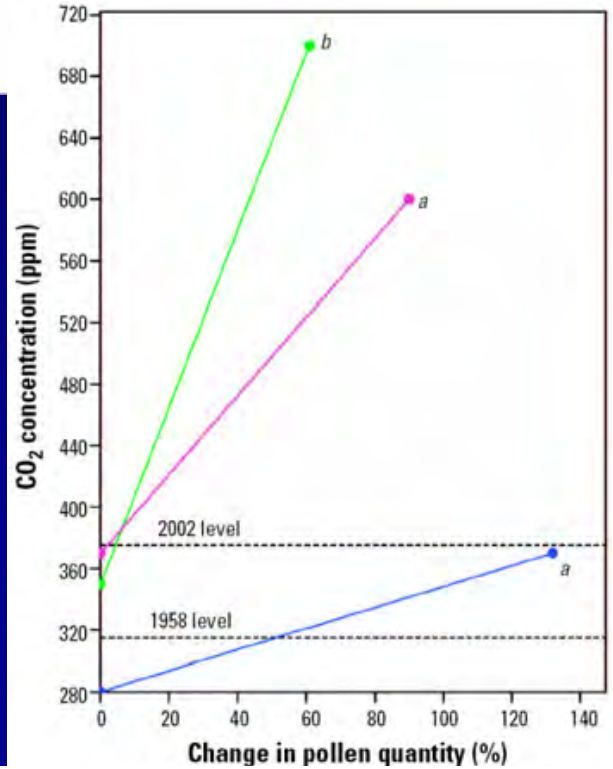
Respiratory Health Effects of Climate Change



Source: American Lung Association in California
***Land Use, Climate Change and Public Health Issue Brief*, 2009**

Impacts of Climate Change on Exposure to Pollen





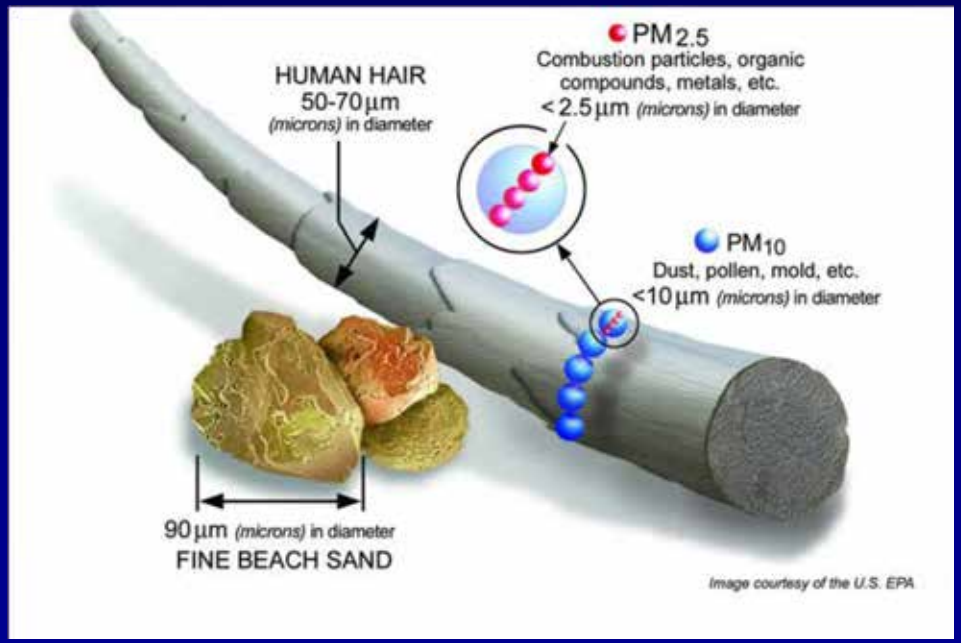
(Beggs)

August 2003 Heat Wave – France

- Mean maximum temperature exceeded seasonal norm by 11-12ºC on 9 consecutive days
- 15,000 excess deaths; 60% increase over expected
  - 32,000 throughout Europe
- Mortality 45% higher in women than in men >45 years
  - Increased in widowed, single and divorced people
- Excess mortality at hospitals (42%), home (32%) and in nursing homes (19%)
- Lack of air conditioning important
- Increased deaths due to heatstroke, hyperthermia and dehydration
  - Heart failure, chronic respiratory disease and stroke markedly contributed to mortality
  - Psychiatric disorders increased, especially depression

Dhainaut J-F et al. Critical Care 2004; 8:1-2.
Stafoggia M et al. Epidemiology 2006; 17: 315-23.

Increased emissions of fine PM during heat waves due to increased power generation for air conditioning

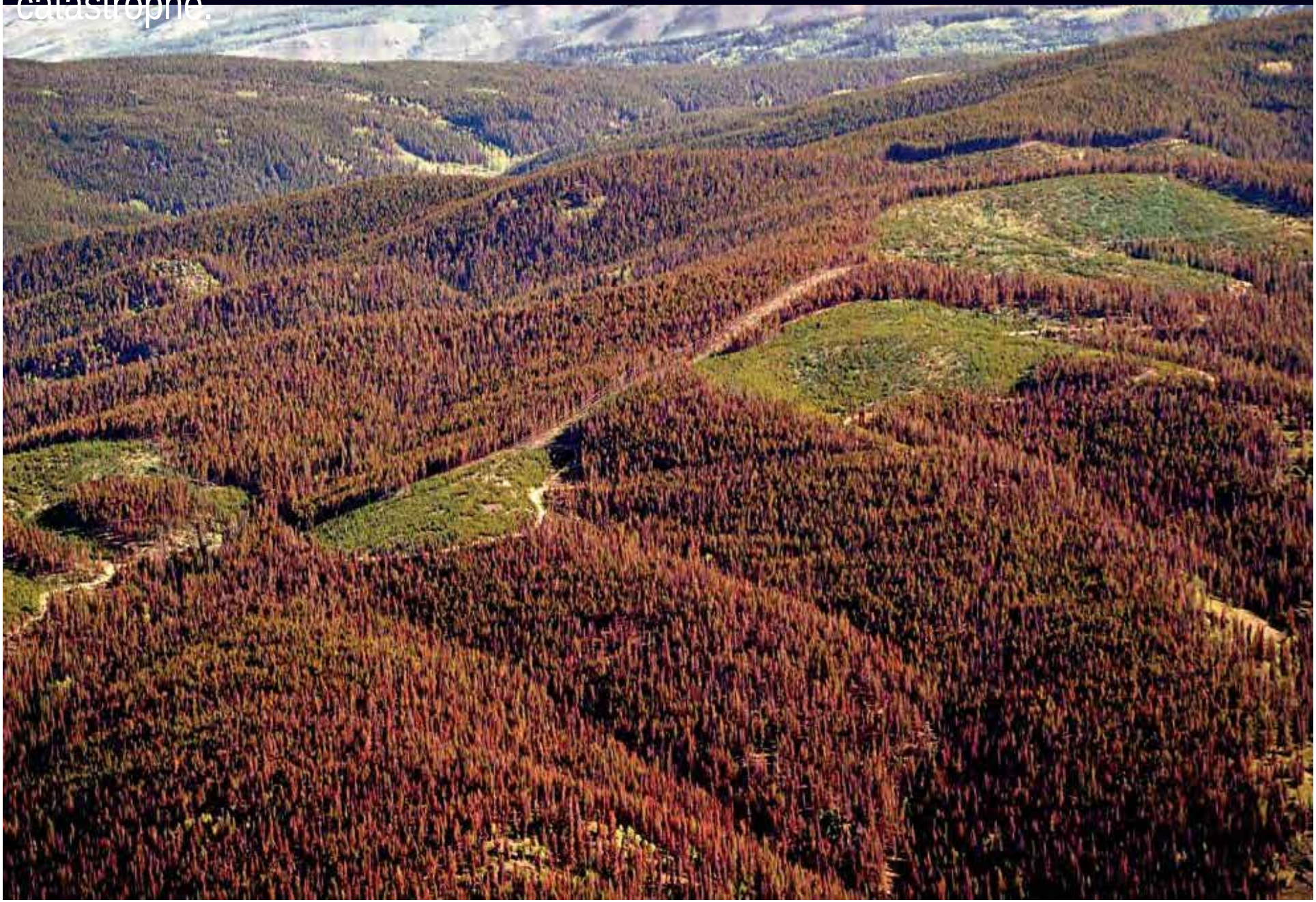


Acute Health Effects

Increased:

- Respiratory symptoms
- Bronchodilator use
- Hospitalizations for respiratory disease (pneumonia, asthma, bronchitis)
- Cardiopulmonary mortality

Cause and effect: Climate change may have caused the pine-beetle catastrophe.



High Income Countries

- Primarily residential heating
- Low concentration exposure
- Genders exposed equally
- Primarily wood
- Single type of exposure

Low/ middle Income Countries

- Primarily cooking activities
- High concentration exposure
- Women & children highly exposed
- Fuels low on the energy ladder
- Mixed exposures common
- #1 cause of COPD worldwide

Courtesy Akshay Sood, MD

Wood smoke exposure predicts COPD among smokers

	FEV_1 % predicted		Airflow Obstruction (GOLD)		Chronic Bronchitis	
Exposure variable	**PE**	**p value**	**OR**	**p value**	**OR**	**p value**
Wood smoke	-0.03	<0.001	2.0	<0.001	1.6	<0.001
Current Cigarette Smoke	-0.03	<0.001	1.3	0.02	3.5	<0.001

Data adjusted for covariates, including cigarette smoke where relevant.

Effect sizes related to wood smoke exposure generally similar to that of current cigarette smoke exposure, except for chronic bronchitis.

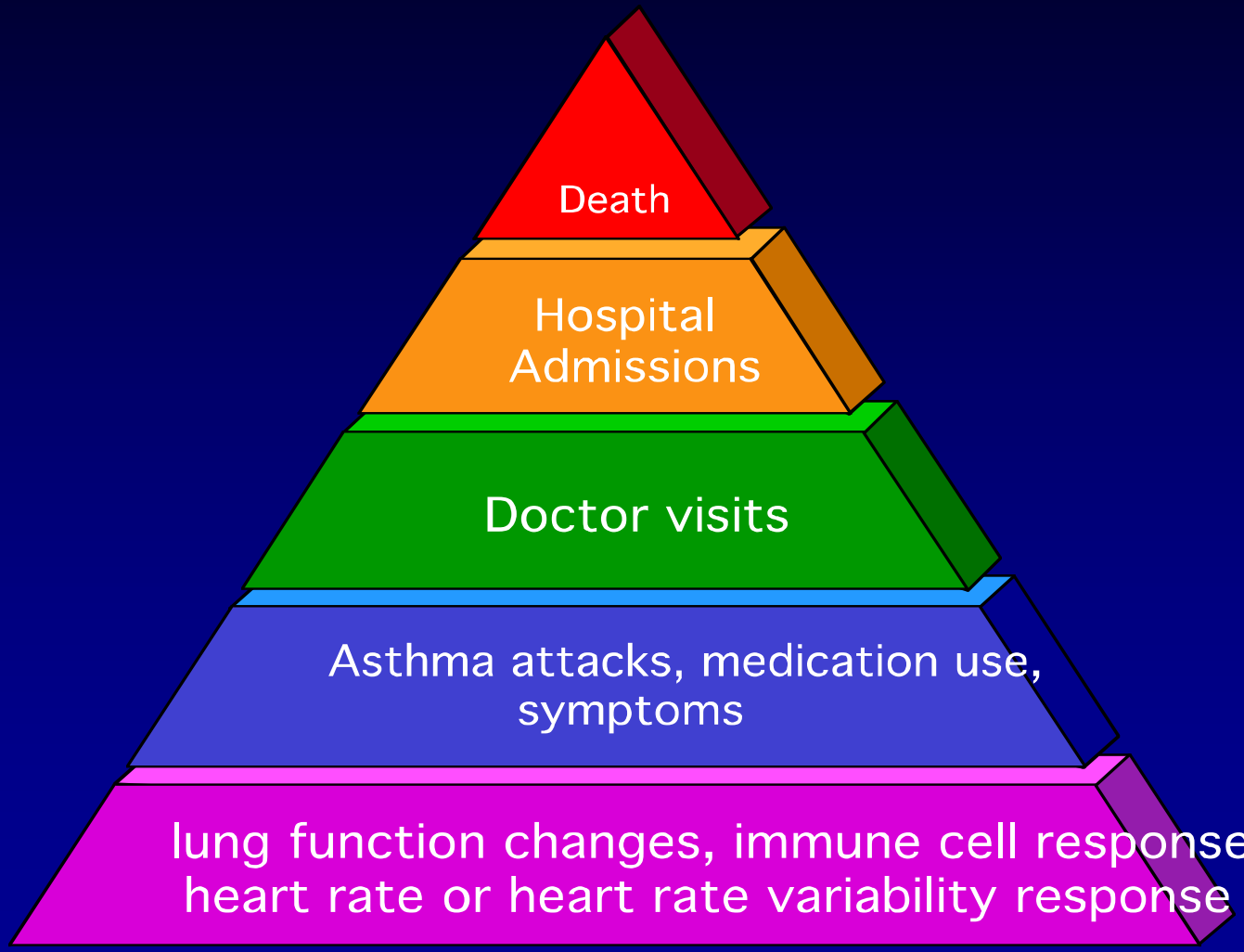
Sood et al. Am J Respi Crit Care Med 2010

Additive lung effect of exposures to cigarette smoke & wood smoke

	FEV_1 % predicted		Airflow Obstruction (GOLD)		Chronic Bronchitis	
Exposure variable	**PE**	**p value**	**OR**	**p value**	**OR**	**p value**
Current Cigarette Smoke only	-0.03	<0.001	1.3	0.13	3.9	<0.001
Wood Smoke only	-0.03	0.001	1.7	0.007	2.1	<0.001
Both Smoke	-0.06	<0.001	2.7	<0.001	5.7	<0.001

Am J Respi Crit Care Med 2010 Jul 1 Epub

Air Pollution Effects



Why do we care?

Thank you for working to clean up the air we breathe

Millions of reasons

- Over 147 million people live where the air is too often unhealthy to breathe.
- Thanks to your hard work, many will not become sick or die early from air pollution.

Thank you from all of us.

AMERICAN LUNG ASSOCIATION.
Fighting for Air

We will breathe easier when the air in every American community is clean and healthy.

We will breathe easier when people are free from the addictive grip of tobacco and the debilitating effects of lung disease.

We will breathe easier when the air in our public spaces and workplaces is clear of secondhand smoke.

We will breathe easier when children no longer battle airborne poisons or fear an asthma attack.

Until then, we are fighting for air.

AMERICAN LUNG ASSOCIATION.
Fighting for Air

www.stateoftheair.org

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