




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

Why Healthy Air Matters



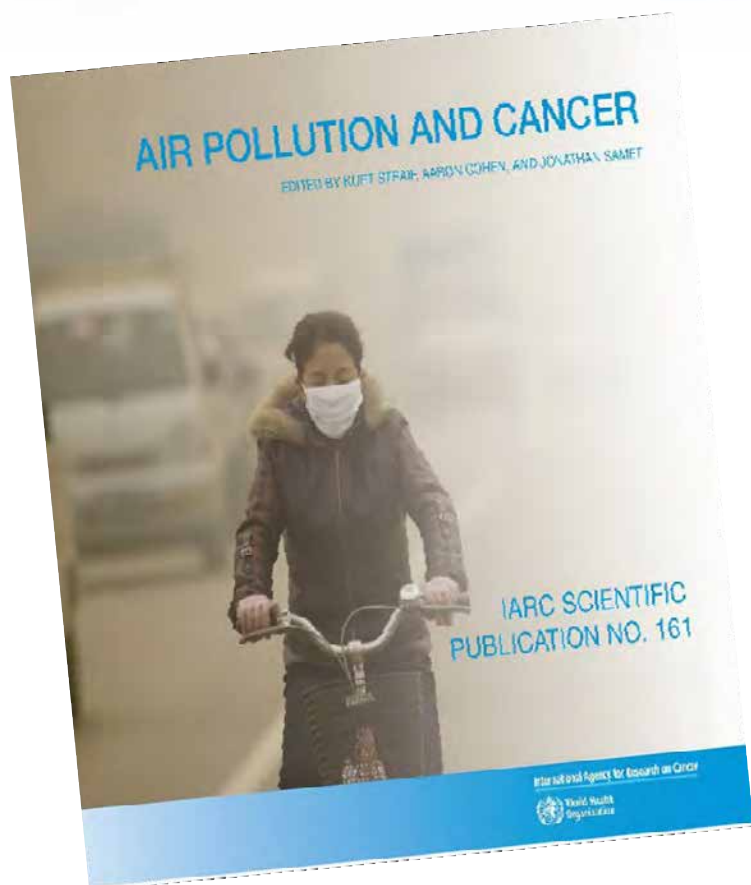
Health Effects of Air Pollution

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

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.

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)

Fine Particles Reduce Visibility



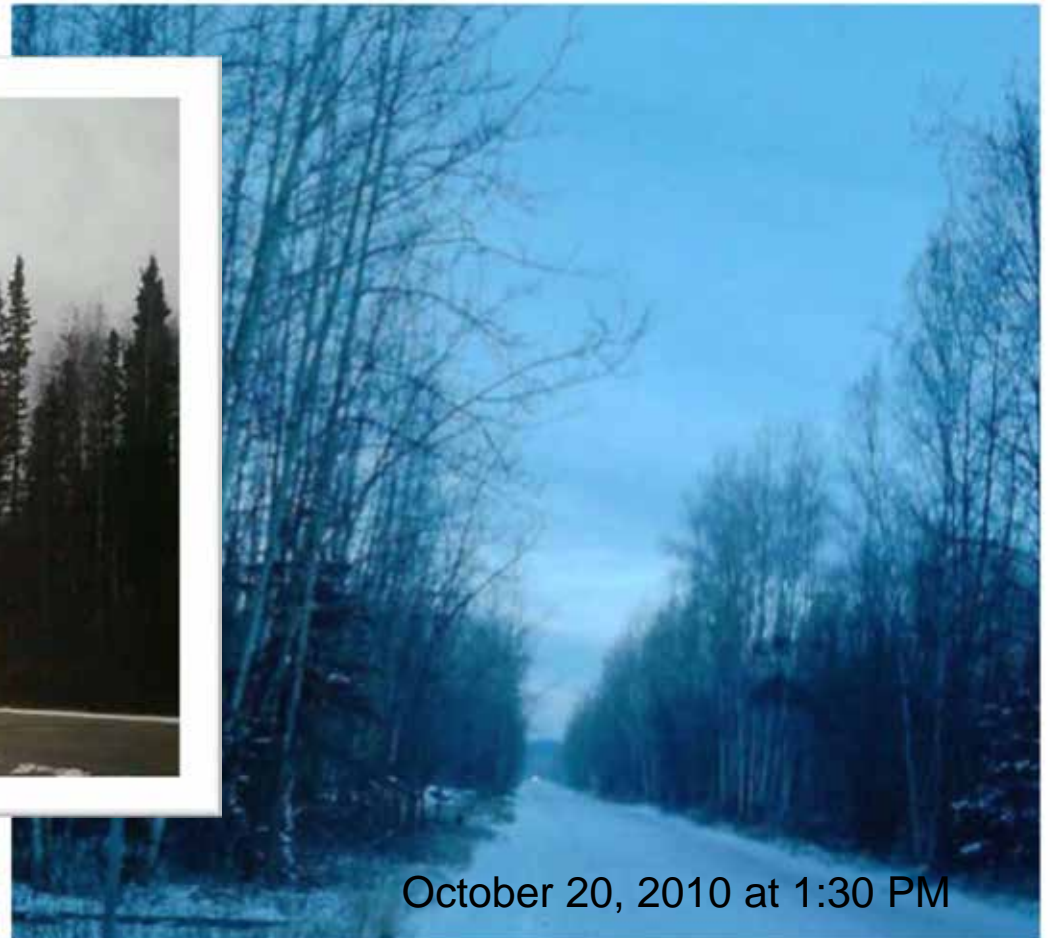
Air pollution remains a problem

Fairbanks, Alaska—haze from wood-burning

November 3, 2010 at 11 AM



October 20, 2010 at 1:30 PM



China – January 2013



Associated Press

Outdoor Air Pollutants

Particles are
microscopic

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

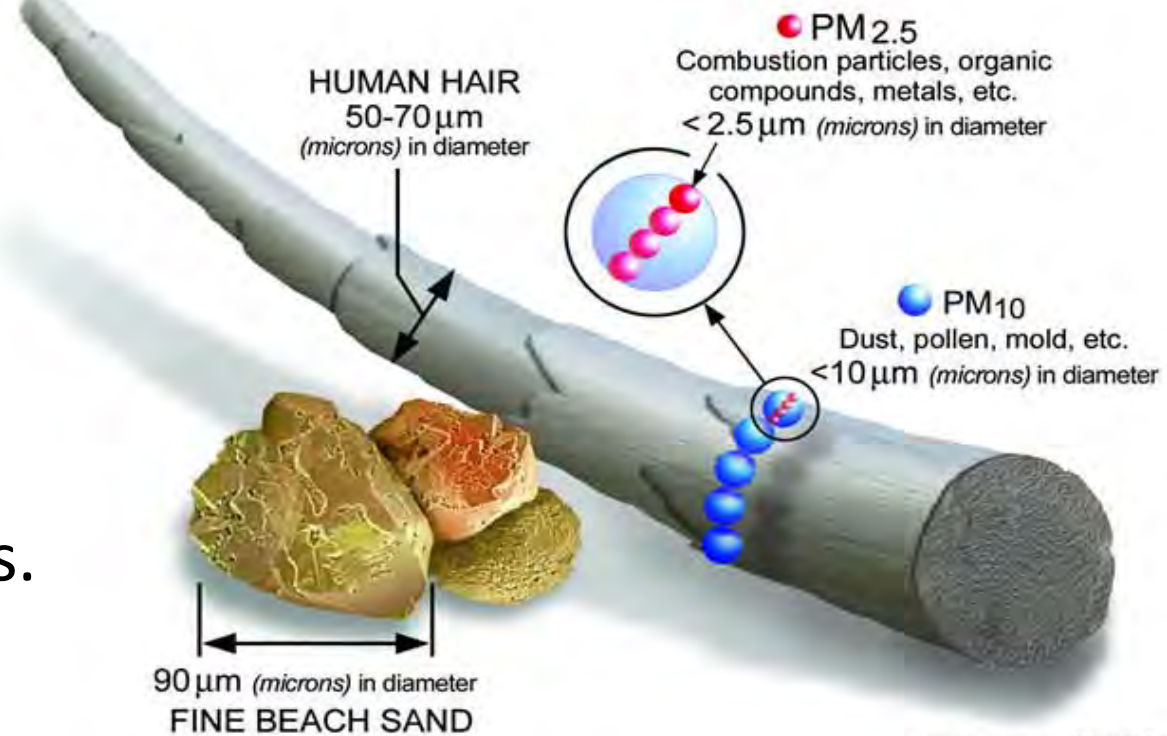
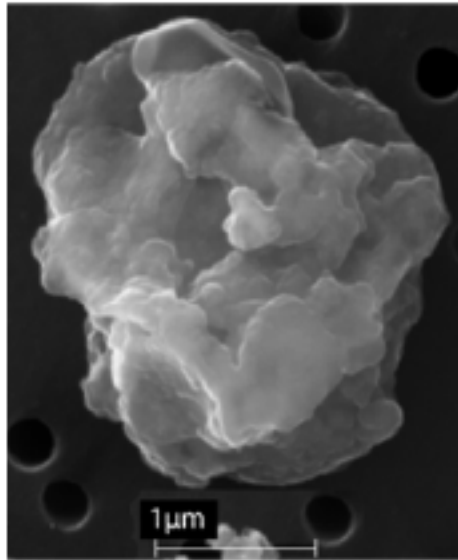


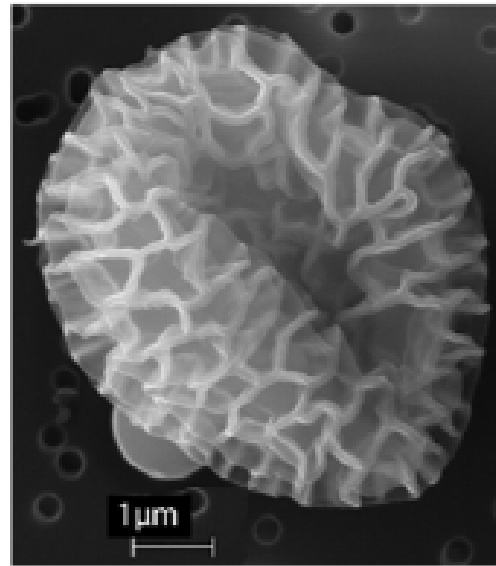
Image courtesy of the U.S. EPA

Particle pollution

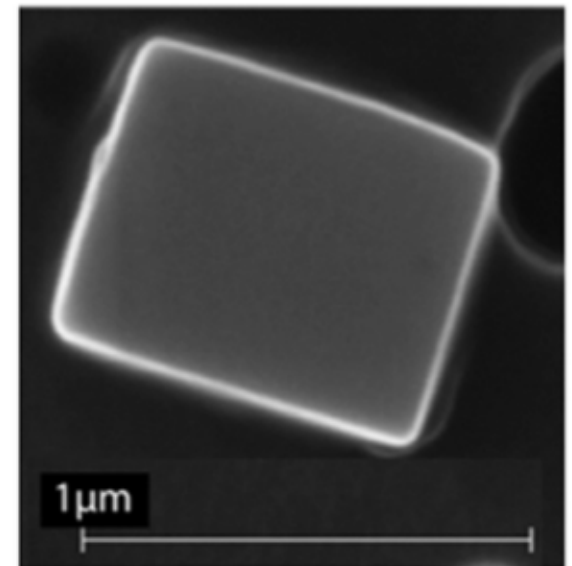
Naturally-occurring particles



Aluminum silicate
particle, probably
crystal



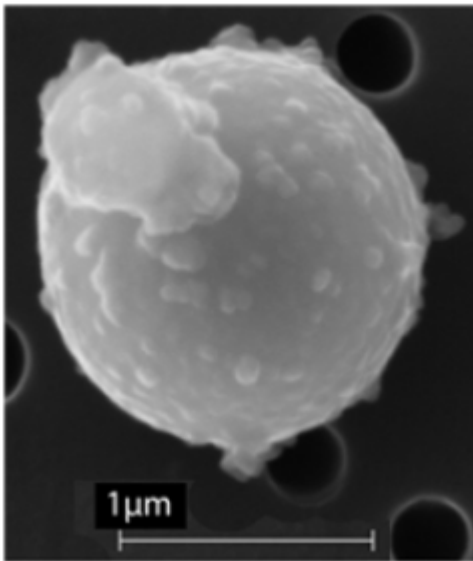
Pollen particle,
partially collapsed



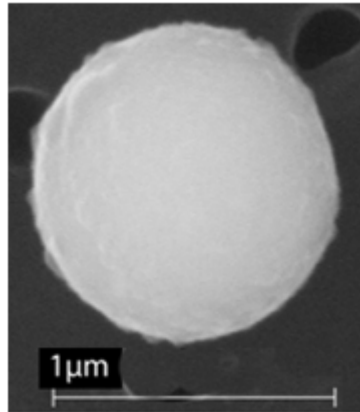
Salt

Particle pollution

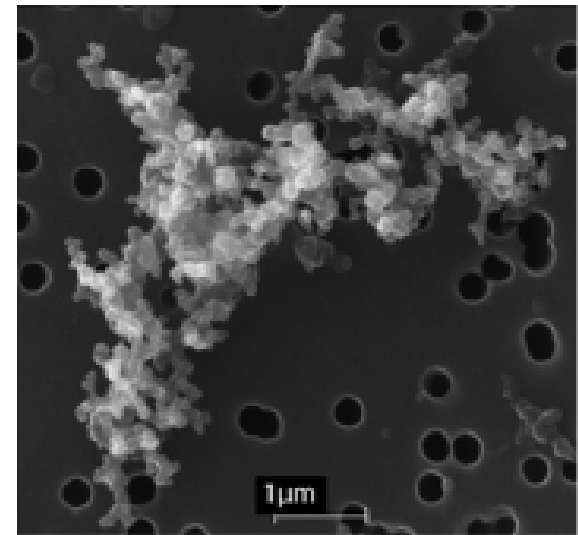
Fine particles— Human origin



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



Types of Particulate Matter Air Pollution

2 types of particles in the air

- Primary

Emitted directly from air pollution sources, such as diesel trucks

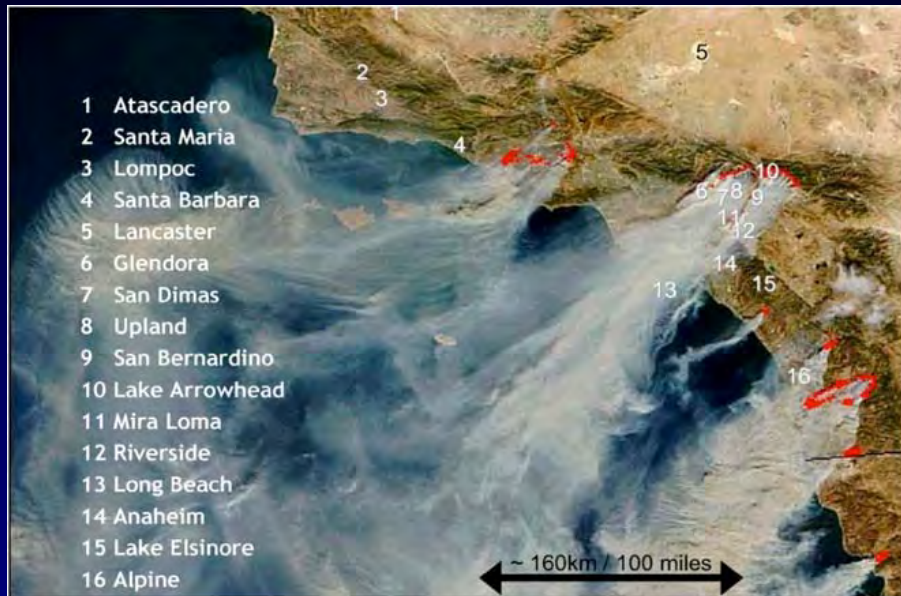
- Secondary

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

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.”

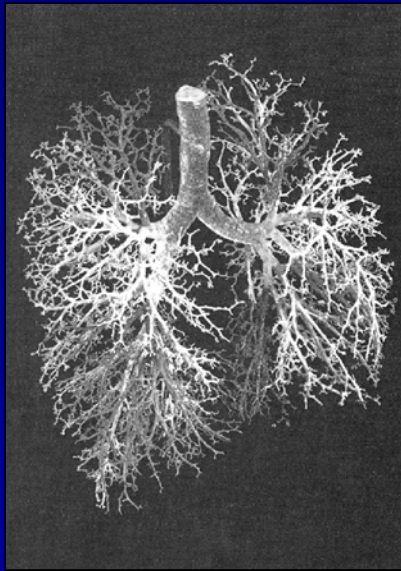
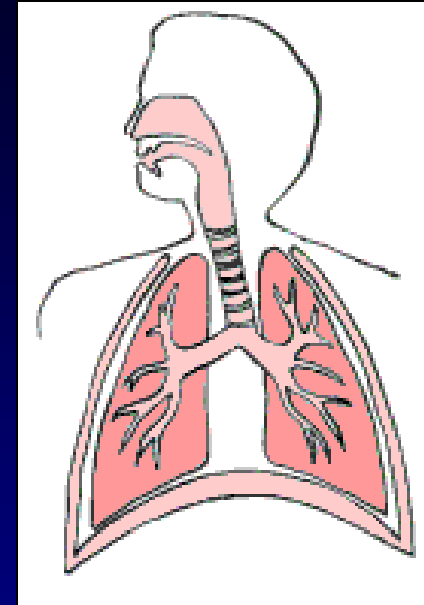
- Up to 55% increase in large wildland fires by 2050
- Up to 128% increase by 2099

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



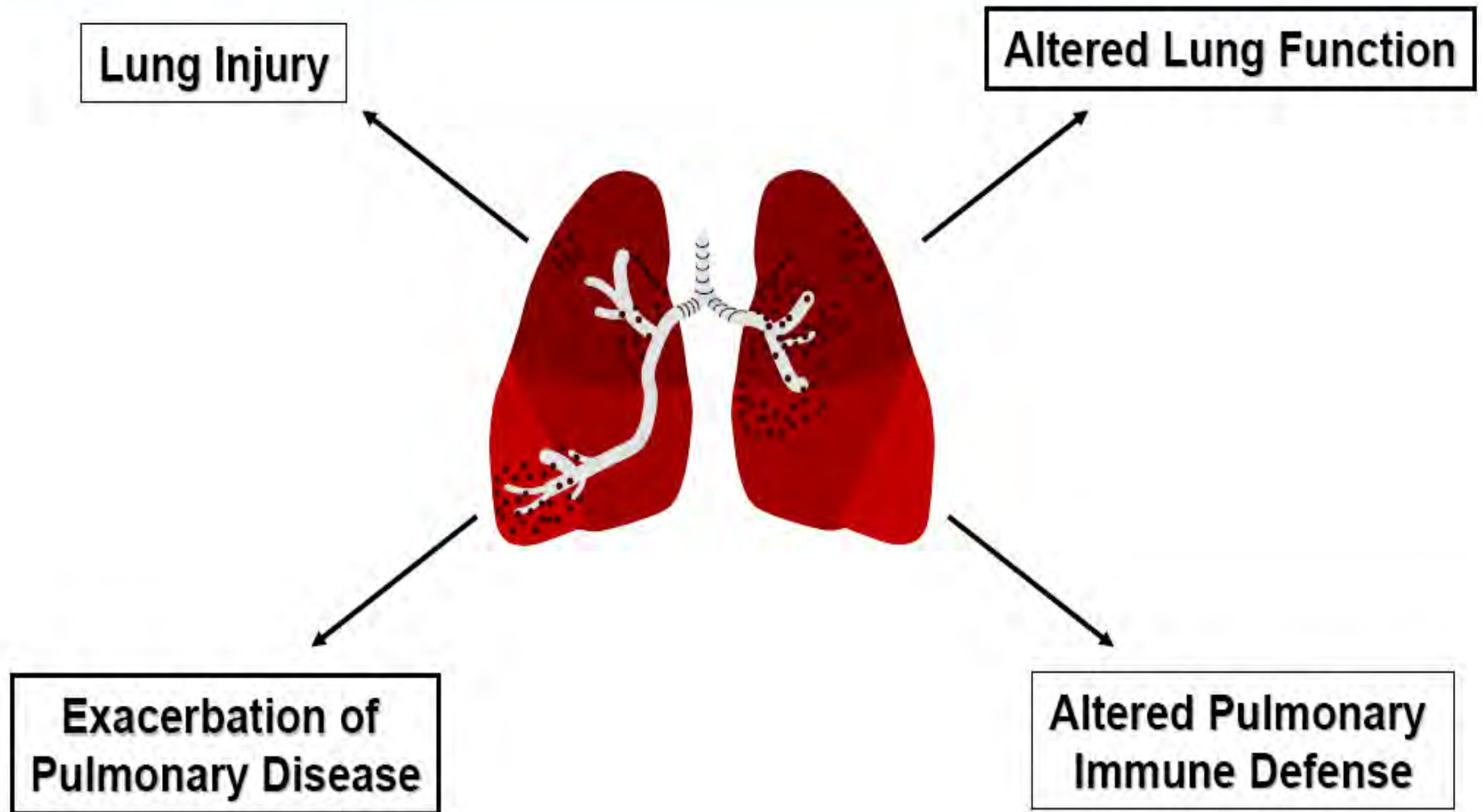
Particle Deposition in the Lungs

- 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

Michael J. Thun, MD

Eugenia E. Calle, PhD

Daniel Krewski, PhD

Kazuhiko Ito, PhD

George D. Thurston, ScD

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 guidelines⁶⁻¹⁰ and

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 500,000 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- $\mu\text{g}/\text{m}^3$ 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

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



Children, Teens face higher risk



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

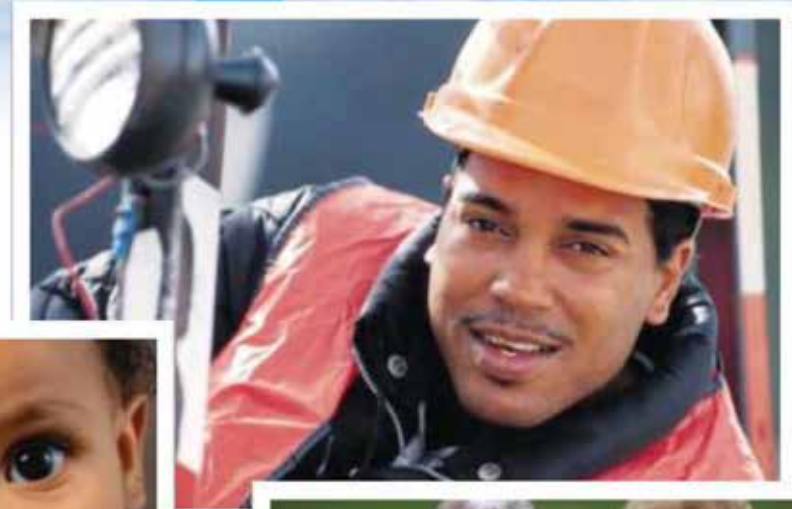
Older Adults face higher risk

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



Chronic diseases mean higher risk

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



Healthy adults face higher risk

Working or exercising outdoors increases exposure, especially near highways



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.



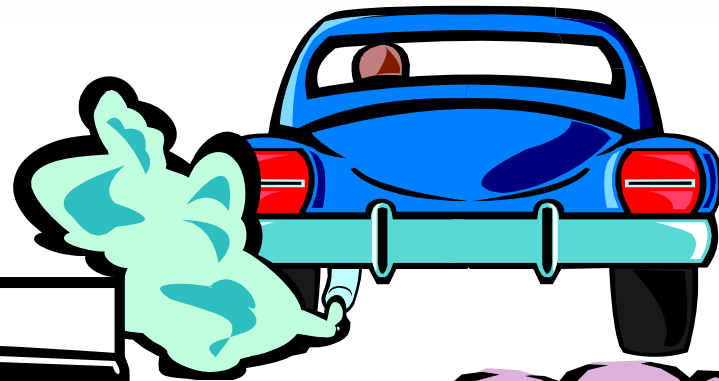
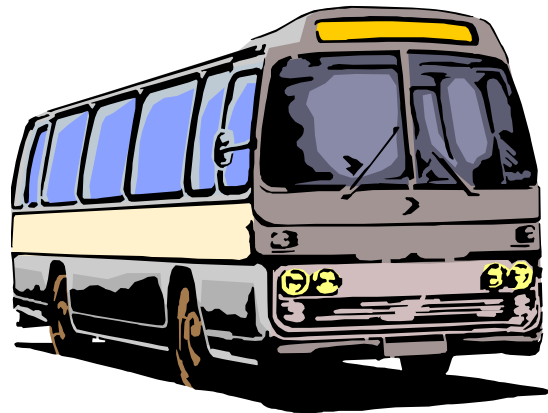


Risks from Breathing Particles

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

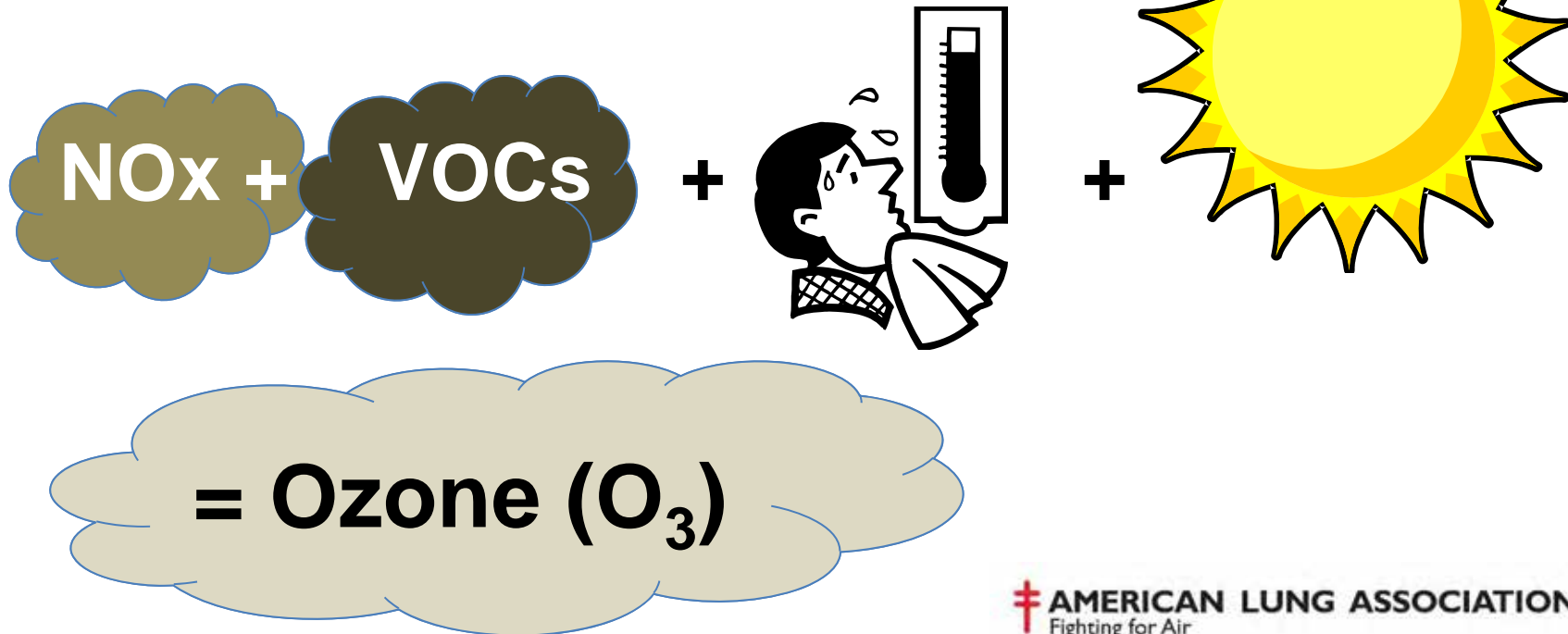
EPA, Integrated Science Assessment, 2009

Ozone Pollution



What is ozone?

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





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.

Who is the American Lung Association?



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

How we fight for healthy air

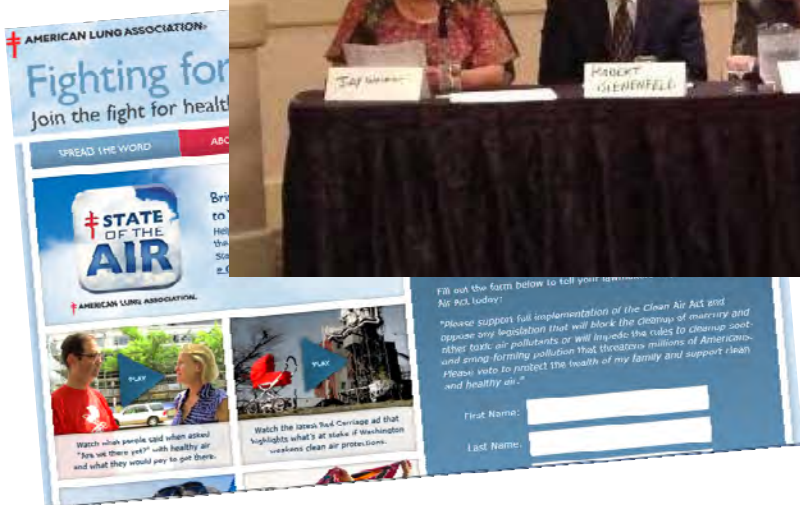
- Education, online & with media

The screenshot displays the American Lung Association's website for the 'State of the Air 2013' report. The header includes the organization's logo and navigation links such as 'Your Lungs', 'Lung Disease', 'Finding Cures', 'Healthy Air', 'Stop Smoking', 'Get Involved', and 'Donate'. A search bar is located in the top right. The main content area features a 'Healthy Air' section with a sub-header 'Healthy Air' and a paragraph stating: 'Air pollution poses a serious threat to our nation's health. At the American Lung Association, we work to ensure that the air you breathe is clean and safe. Learn more about how polluted air can make you sick and how we are fighting to keep our air and nation healthy.' Below this is a 'STATE OF THE AIR 2013' graphic. A navigation bar lists categories: 'KEY FINDINGS', 'CITY RANKINGS', 'COMPARE YOUR AIR', 'HEALTH RISKS', 'OUR FIGHT', and 'PRESS MATERIALS'. The main content is divided into four colored boxes: 1. 'What's the STATE of Your Air?' (blue) with a search form for 'REPORT CARD: What's the Grade For Your Air?' by ZIP code or state. 2. 'KEY FINDINGS' (green) with the text 'More than 4 of 10 people live where pollution levels are so high, dangerous to breathe.' 3. 'CITY RANKINGS' (orange) with the text 'Which cities have the highest levels of air pollution? Which are the cleanest?'. 4. 'HEALTH RISKS' (pink) with the text 'Ozone and particle pollution are the most widespread pollutants and among the most dangerous.' A fifth box, 'OUR FIGHT' (purple), contains the text 'We battle air pollution because dirty air harms our health and can threaten life itself.' Buttons for 'LEARN MORE' are present in each box. A 'MAKE A DONATION' and 'JOIN OUR FIGHT' button are also visible.



How we fight for healthy air

- Testimony, comments, letting people tell their stories



Meet Judy, and Lucy and Ethel

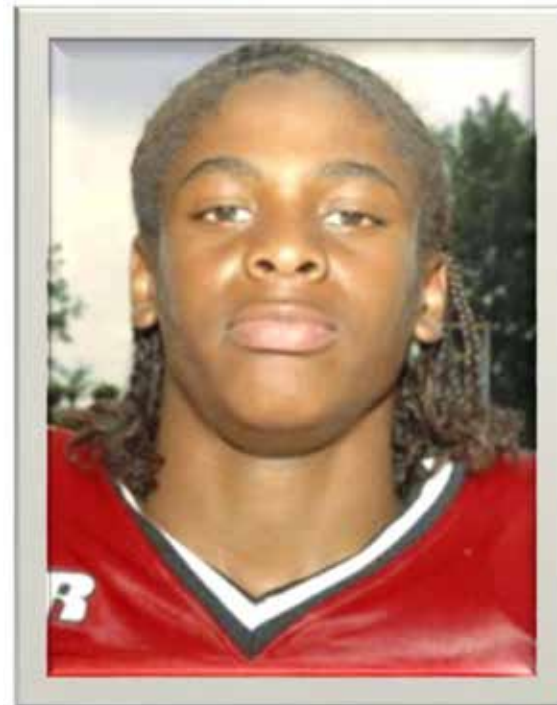
- Judy avoids “bonfires, barbecues and cigarette smoke. If it smells bad or smoky, I’m gone! I can’t escape or control the pollution that lingers in our air.”
- Judy, Lucy & Ethel speak out for healthier air.



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.”



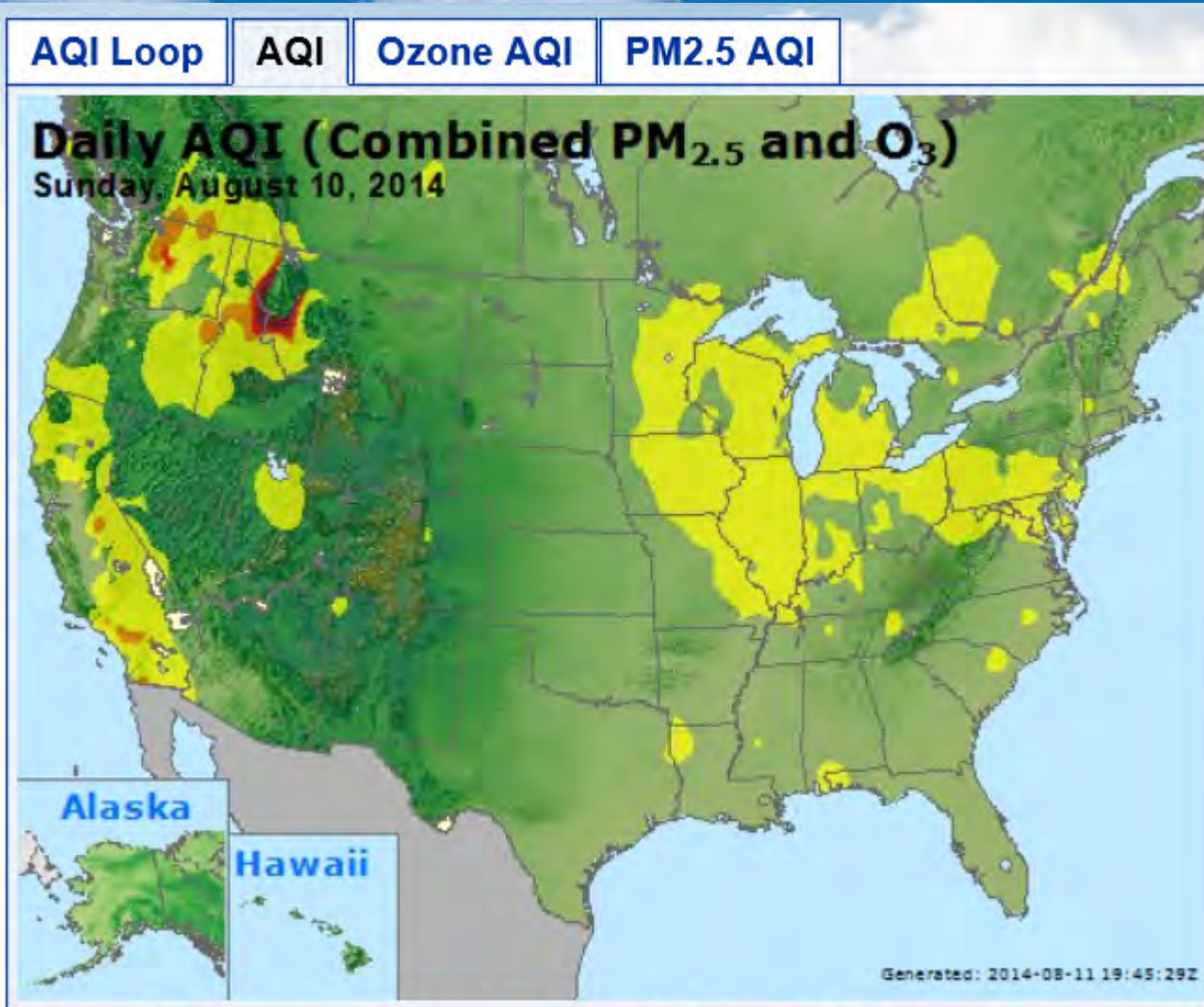
We tell people about the air they breathe so they can protect themselves and fight for air



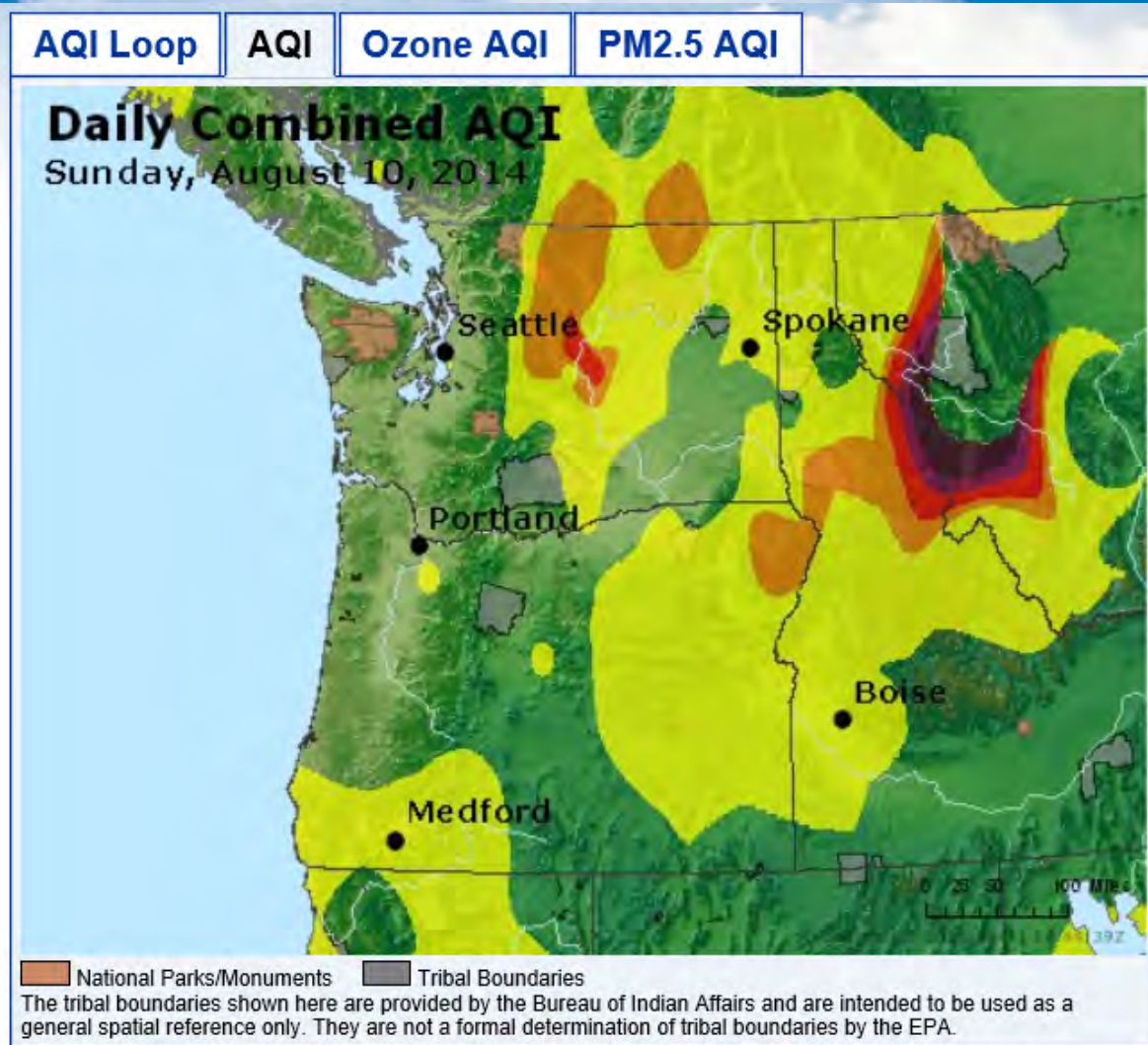
What about that app?

- “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





Smoke reached hazardous levels



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



ICAN LUNG ASSOCIATION.
for Air

What State of the Air Does



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

STATE OF THE AIR 2014

AMERICAN LUNG ASSOCIATION.

SEARCH

MAKE A DONATION

JOIN OUR FIGHT

KEY FINDINGS

CITY RANKINGS

COMPARE YOUR AIR

HEALTH RISKS

OUR FIGHT

PRESS MATERIALS

What's the STATE of Your Air?

For 15 years, the American Lung Association has analyzed data from air quality monitors to compile the State of the Air report. The more you learn about the air you breathe, the more you can protect your health and take steps to make our air cleaner and healthier.

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

SEARCH BY ZIP CODE:

SEARCH

OR

SEARCH BY STATE:

Select Your State ▼

SEARCH



KEY FINDINGS

Nearly 5 in 10 people live where pollution levels are too often dangerous to breathe.

LEARN MORE »



CITY RANKINGS

Which cities have the highest levels of air pollution? Which are the cleanest?

LEARN MORE »



HEALTH RISKS

Ozone and particle pollution are the most widespread pollutants and among the most dangerous.

LEARN MORE »



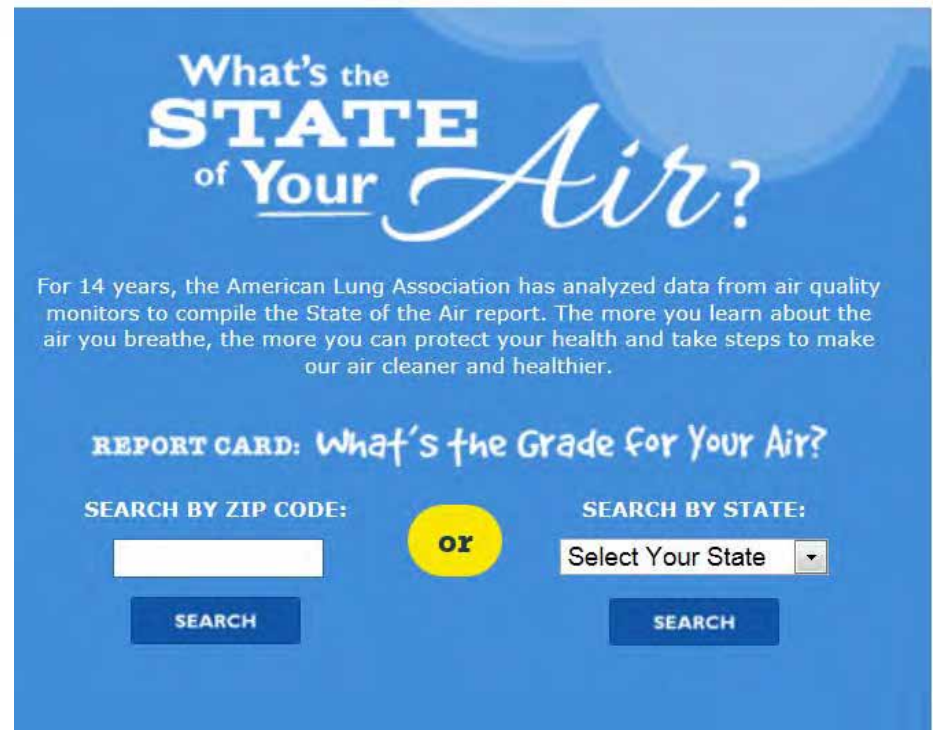
OUR FIGHT

We battle air pollution because dirty air harms our health and can threaten life itself.

LEARN MORE »

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



The screenshot shows the homepage of the 'What's the State of Your Air?' website. The header features the title 'What's the STATE of Your Air?' with 'STATE' in bold and 'Air?' in a script font. Below the title is a paragraph: 'For 14 years, the American Lung Association has analyzed data from air quality monitors to compile the State of the Air report. The more you learn about the air you breathe, the more you can protect your health and take steps to make our air cleaner and healthier.' The main content area is titled 'REPORT CARD: What's the Grade for Your Air?'. It offers two search options: 'SEARCH BY ZIP CODE:' with a text input field and a 'SEARCH' button, and 'SEARCH BY STATE:' with a dropdown menu labeled 'Select Your State' and a 'SEARCH' button. A yellow circle with the word 'OR' is positioned between the two search options.

Where we get the data

Air Pollution Monitors



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



Click on a city below to learn more about its ranking

BY OZONE

- #1: [Los Angeles-Long Beach-Riverside, CA](#)
- #2: [Visalia-Porterville, CA](#)
- #3: [Bakersfield-Delano, CA](#)
- #4: [Fresno-Madera, CA](#)
- #5: [Hanford-Corcoran, CA](#)
- #6: [Sacramento-Arden-Arcade-Yuba](#)

BY YEAR ROUND PARTICLE POLLUTION

- #1: [Bakersfield-Delano, CA](#)
- #1: [Merced, CA](#)
- #3: [Fresno-Madera, CA](#)
- #4: [Hanford-Corcoran, CA](#)
- #4: [Los Angeles-Long Beach-Riverside, CA](#)
- #6: [Modesto, CA](#)

BY SHORT-TERM PARTICLE POLLUTION

- #1: [Bakersfield-Delano, CA](#)
- #2: [Fresno-Madera, CA](#)
- #3: [Hanford-Corcoran, CA](#)
- #4: [Los Angeles-Long Beach-Riverside, CA](#)
- #5: [Modesto, CA](#)
- #6: [Salt Lake City-Ogden-Clearfield](#)

State/County Web Pages

The screenshot shows the 'State of the Air 2014' website for Bernalillo County, New Mexico. The header includes the 'STATE OF THE AIR 2014' logo, the 'AMERICAN LUNG ASSOCIATION' logo, a search bar, and buttons for 'MAKE A DONATION' and 'JOIN OUR FIGHT'. A navigation bar contains links for 'KEY FINDINGS', 'CITY RANKINGS', 'COMPARE YOUR AIR', 'HEALTH RISKS', 'OUR FIGHT', and 'PRESS MATERIALS'. The breadcrumb trail reads 'Home > 2014 > States > New Mexico'. On the left, there are links for 'SHARE YOUR STORY', 'SHARE YOUR AIR', and 'DOWNLOAD REPORT', along with a 'REPORT CARD' section for searching by zip code or state. The main content area is titled 'New Mexico' and shows 'Bernalillo County' selected. It displays air quality grades: Ozone (F), Particle Pollution 24-hour (D), and Particle Pollution Annual (Pass). A call to action states 'You can make a difference in the air that you breathe.' and provides links for 'Take Action for Healthier Air' and 'Tell us why having healthy air matters to you.'. Social sharing options for email, Facebook, and Twitter are available. At the bottom, there is a 'High Ozone Days' section with a 'Learn More' link. The 'ION' logo is in the bottom right corner.

STATE OF THE AIR 2014 AMERICAN LUNG ASSOCIATION

SEARCH

MAKE A DONATION JOIN OUR FIGHT

KEY FINDINGS CITY RANKINGS COMPARE YOUR AIR HEALTH RISKS OUR FIGHT PRESS MATERIALS

Home > 2014 > States > New Mexico

New Mexico

Bernalillo County Albuquerque-Santa-Fe-Las Vegas, NM

[How to Protect Yourself](#)
[What does INC and DNC mean?](#)

If you live in Bernalillo County, the air you breathe may put your health at risk.

Ozone F	Particle Pollution 24-hour D	Particle Pollution Annual Pass
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You can make a difference in the air that you breathe.

[Take Action for Healthier Air](#) [Tell us why having healthy air matters to you.](#)

Tell your friends about the air where you live.

[SEND AN EMAIL](#) [SHARE ON FACEBOOK](#) [SHARE ON TWITTER](#)

High Ozone Days [Learn More](#)

ION

Metro area information

The screenshot shows the 'State of the Air 2014' website for New Mexico. The main heading is 'New Mexico'. Below it, there are two tabs: 'Bernalillo County' and 'Albuquerque-Santa-Fe-Las Vegas, NM'. The main content area features a call to action: 'The air you breathe needs your support. You can make a difference in the air that you breathe.' Below this, there are three statistics: 'Ranked 84 for high ozone days out of 277 metropolitan areas', 'Ranked 32 for 24-hour particle pollution out of 277 metropolitan areas', and 'Ranked 14 for cleanest metropolitan areas in the country for annual particle pollution'. A callout box points to these statistics with the text 'How does your city's air rank?'. There are also social media sharing buttons and a 'Compare Your Air' section at the bottom.

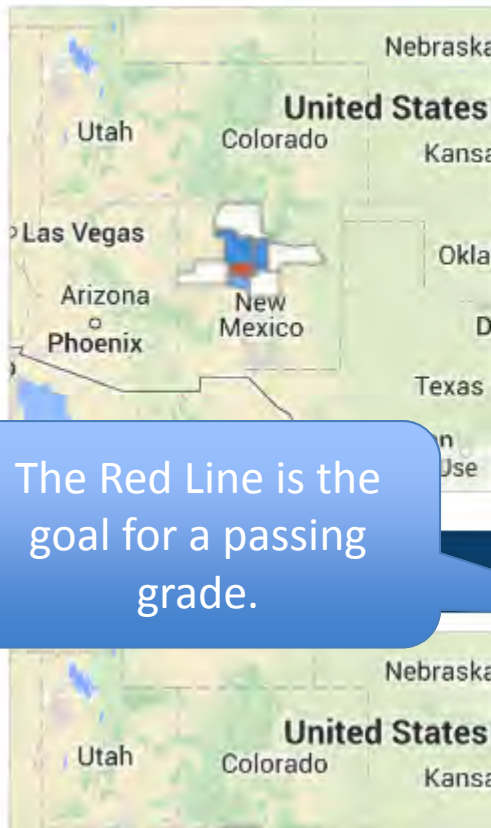
Metros cover multiple counties

How does your city's air rank?

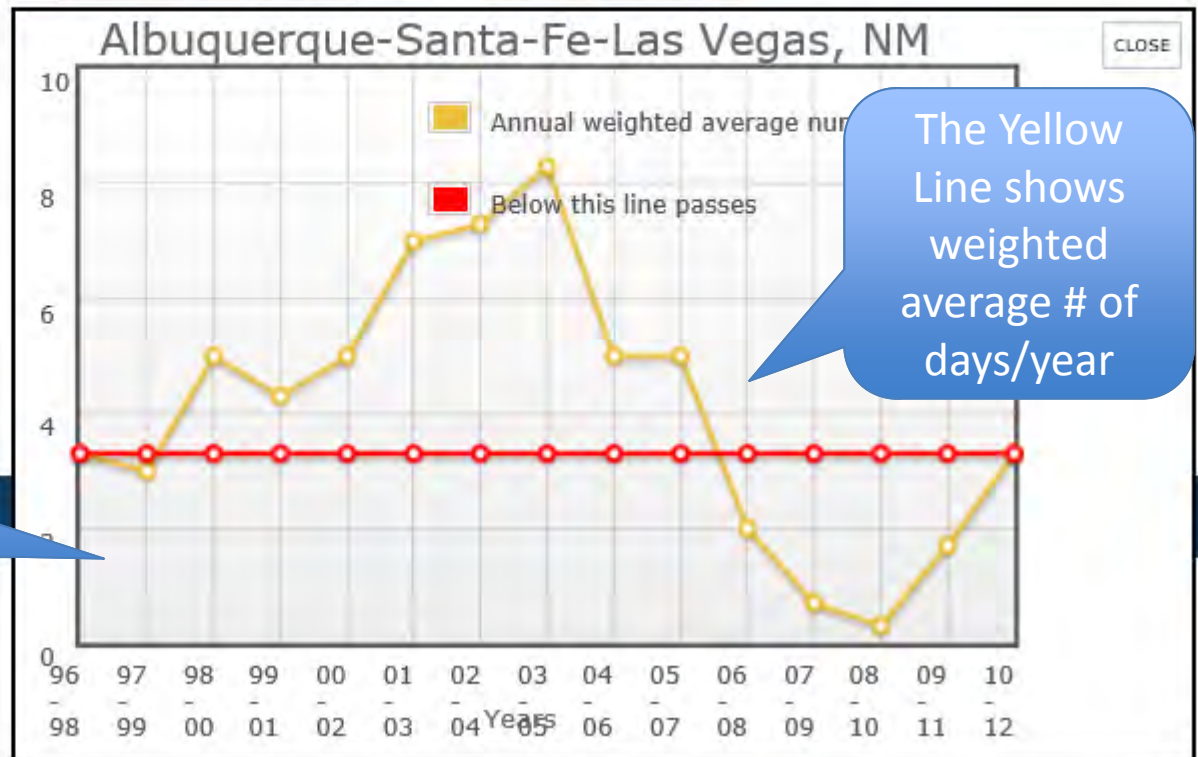
Trend Charts show progress

High Ozone Days

[Learn More](#)



Change since 1996: 0.0 more days this year



The Red Line is the goal for a passing grade.

The Yellow Line shows weighted average # of days/year

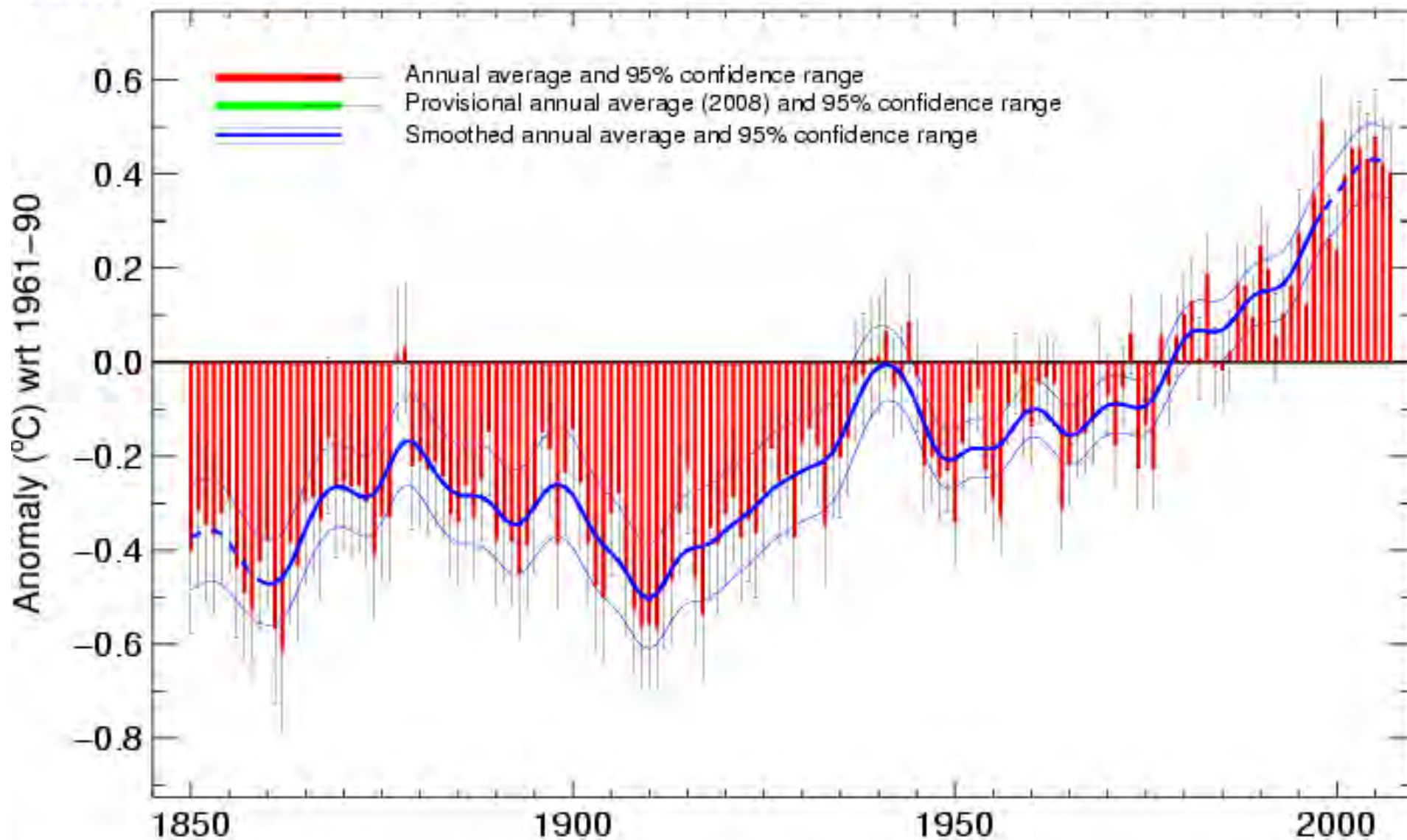
Coming down the road . . .

Impact of a warmer climate



Global average temperature 1850–2007

Based on Brohan et al. 2006



Met Office Hadley Centre

Source: www.metoffice.gov.uk/hadobs

Crown Copyright 2008

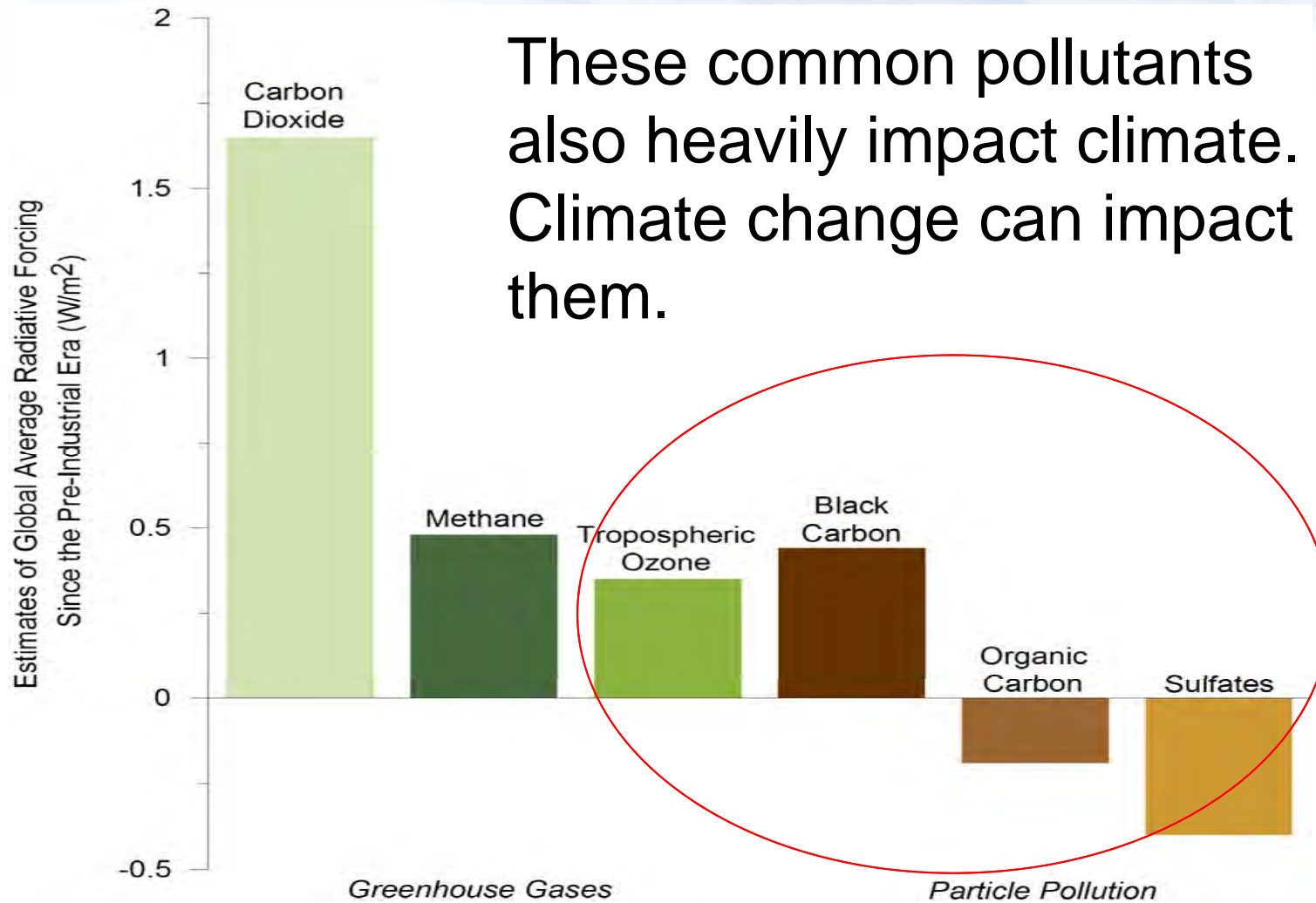
IPCC4th AR Global T increase 1.4°F

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

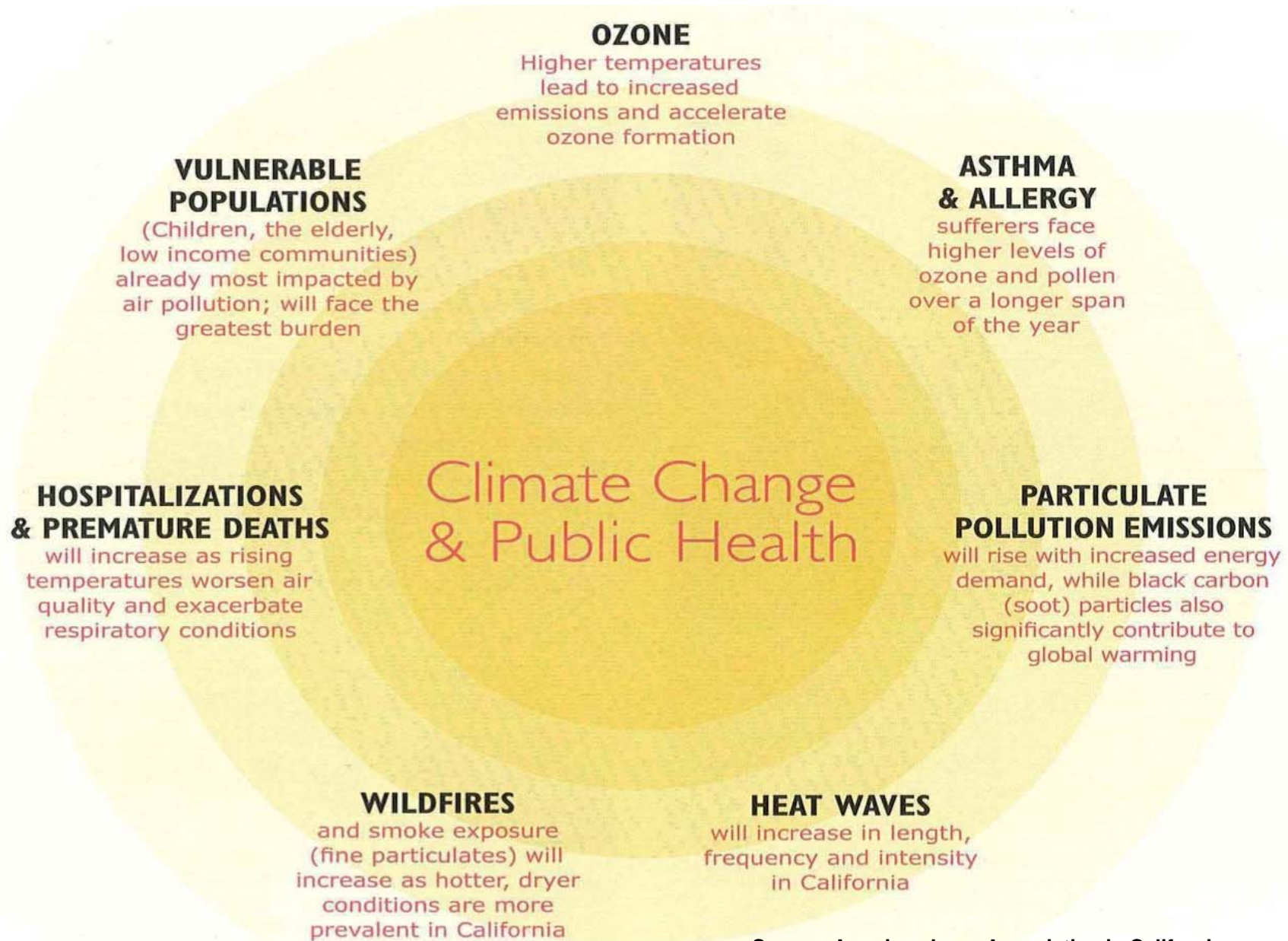
Ozone changes climate



Global Climate Change & Health

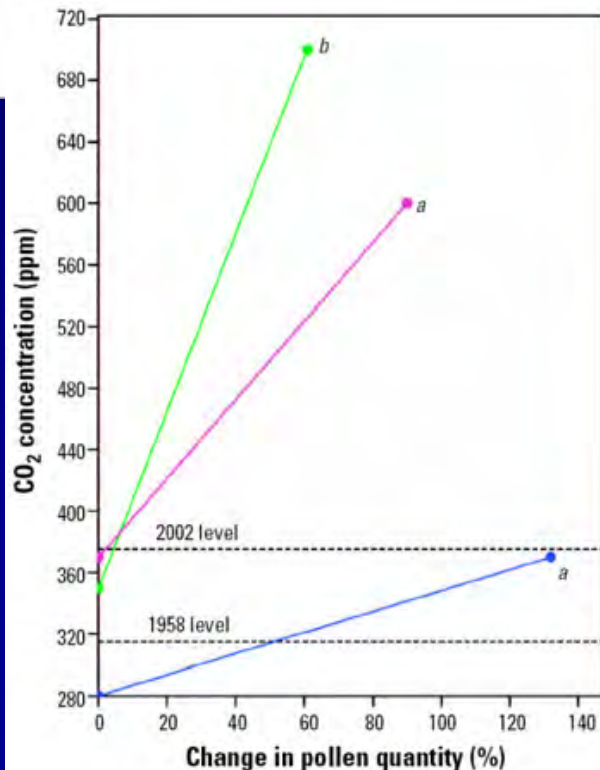
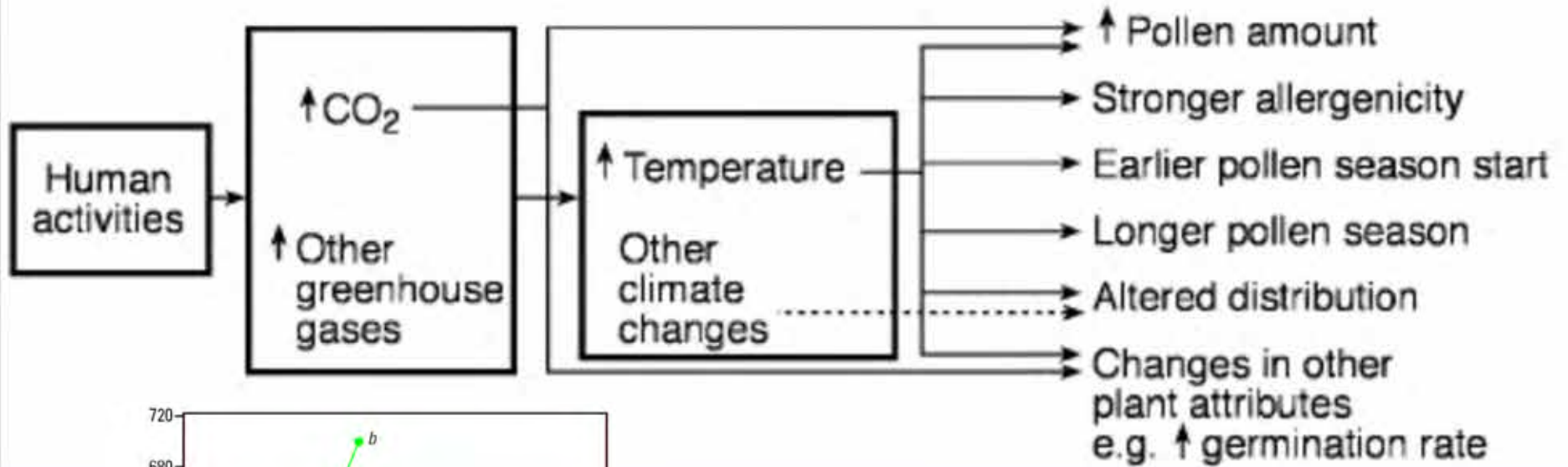
- Changing pollen releases impact asthma and allergic rhinitis (seasonal allergies)
- Heat waves cause critical care-related diseases
- Climate-driven air pollution increases exacerbations asthma and chronic obstructive pulmonary disease
- Desertification increases particulate matter (PM)
- **Increasing 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)



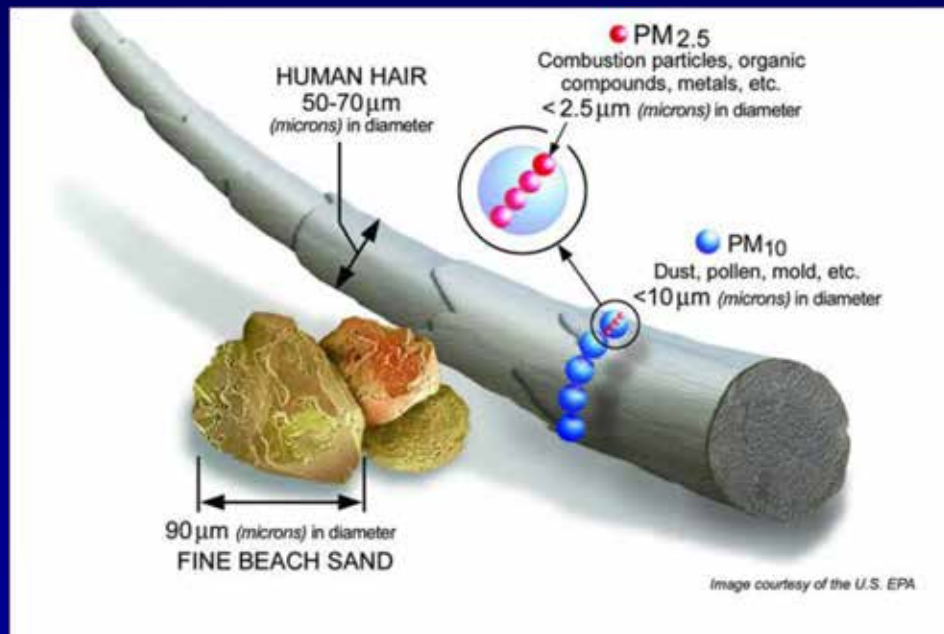
August 2003 Heat Wave – France

- Mean maximum temperature exceeded seasonal norm by 11-12°C 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

Exposure variable	FEV ₁ % predicted		Airflow Obstruction (GOLD)		Chronic Bronchitis	
	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

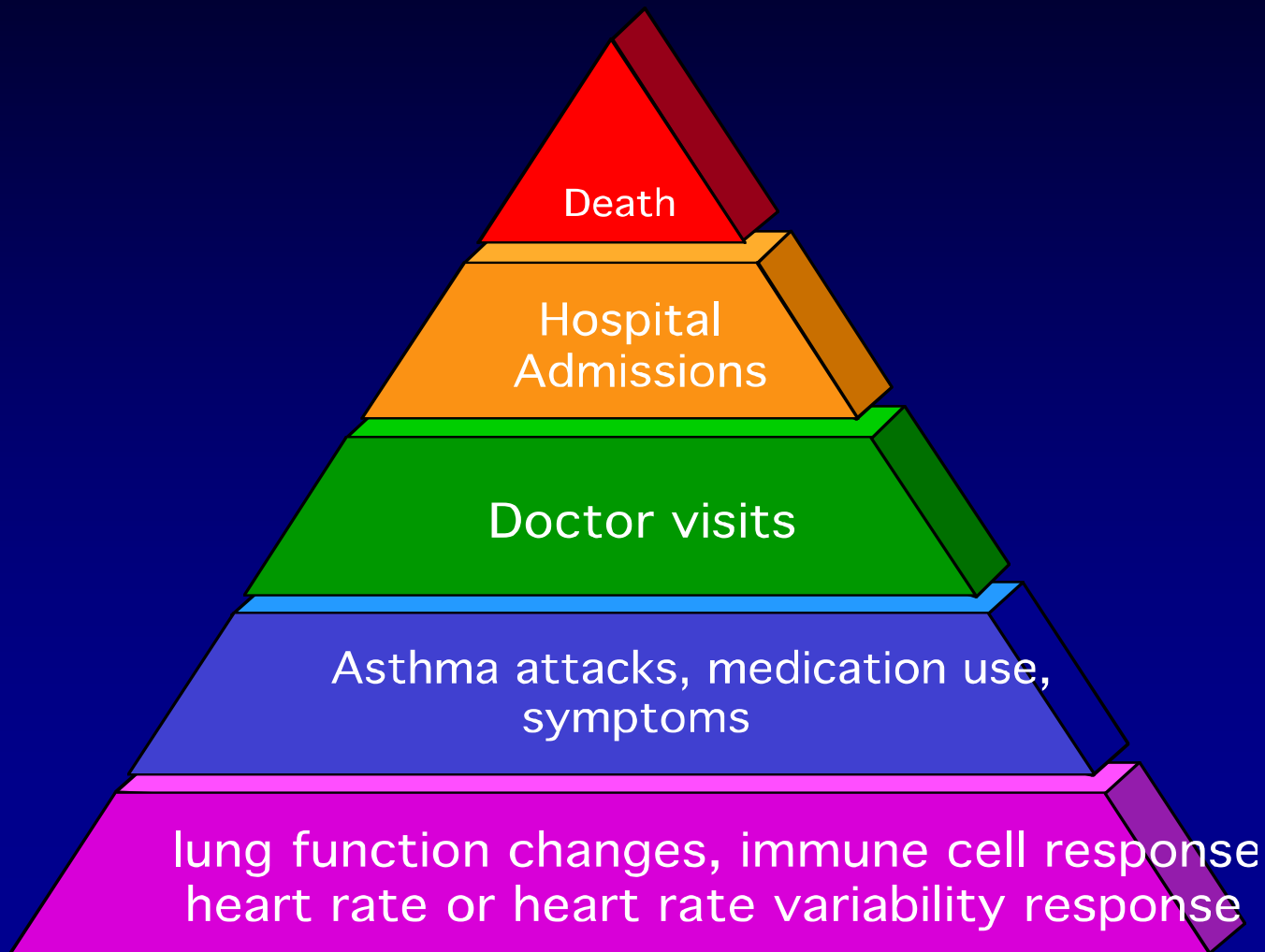
Data adjusted for covariates, including cigarette smoke where relevant.

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

Additive lung effect of exposures to cigarette smoke & wood smoke

Exposure variable	FEV ₁ % predicted		Airflow Obstruction (GOLD)		Chronic Bronchitis	
	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

Air Pollution Effects



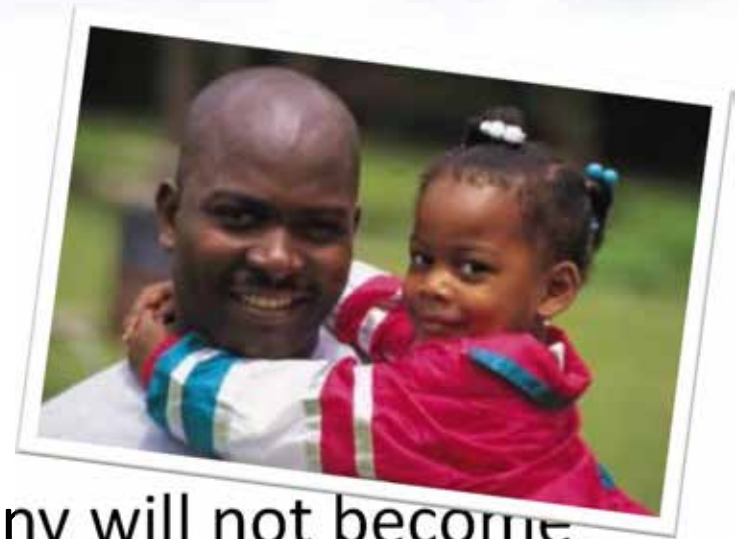
Why do we care?


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.





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.



www.stateoftheair.org

**What's the State
of Your Air?**

 AMERICAN LUNG ASSOCIATION

**STATE
OF THE AIR** 2011